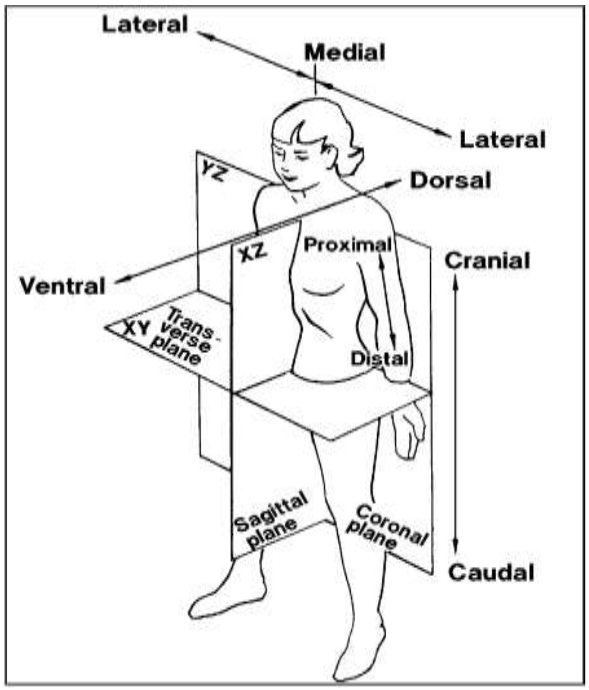
Introduction

Anatomy: Anatomy is the study of the structures of the body.

Gross anatomy: deals with those structures that can be seen without a microscope.

The anatomical position: For descriptive purposes the body is always imagined to be in the anatomical position, standing erect, arms by sides, palms of hands facing forwards.

Terms:

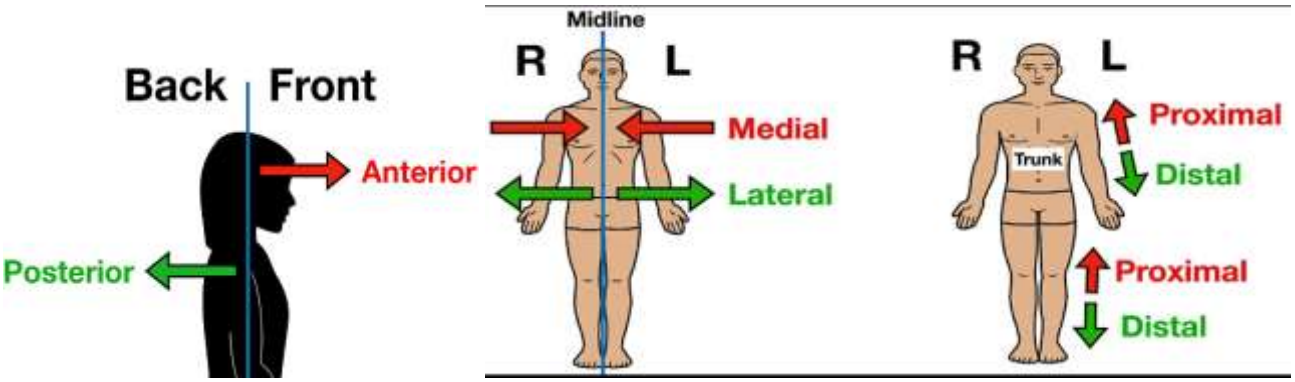


Median Sagittal Plane: This is a vertical plane passing through the center of the body, dividing it into equal right and left halves.

A structure situated nearer to the median plane of the body than another is said to be **medial** to the other. Similarly, a structure that lies farther away from the median plane than another is said to be **lateral** to the other.

Coronal Planes: are imaginary vertical planes at right angles to the median plane. divides the body into anterior and posterior parts.

Horizontal, or Transverse, Planes: These planes are at right angles to both the median and the coronal planes. Divides the body into superior and inferior.

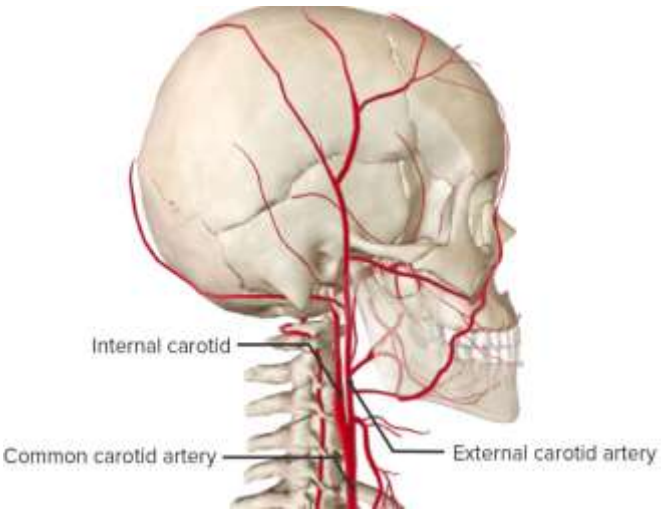


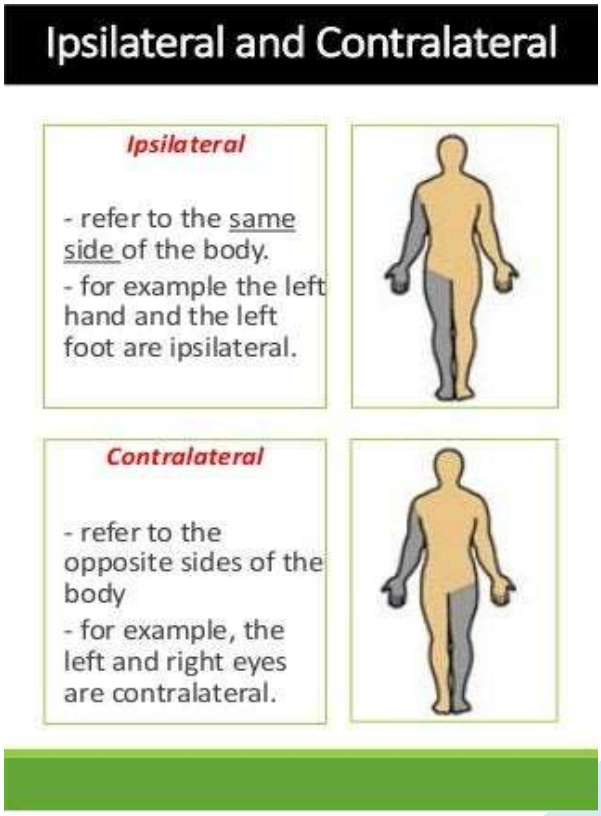
The terms **anterior and posterior** are used to indicate the front and back of the body, respectively.

Proximal and distal are terms generally applied to positions close to or away from the body, respectively. For example, the wrist is proximal to the finger but distal to the elbow.

The terms **superficial and deep** represent the relative distances of structures from the surface of the body.

The terms **superior and inferior** represent levels relatively high or low with reference to the upper and lower ends of the body.

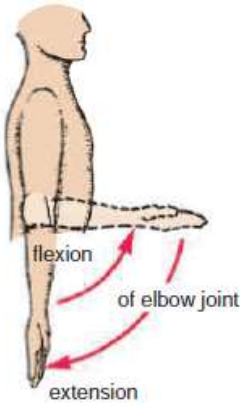


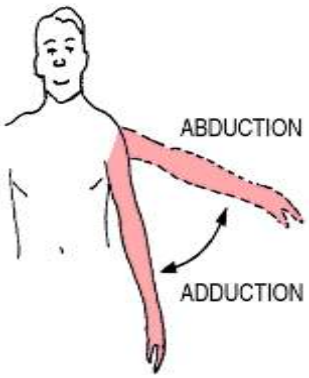


The terms **internal and external** are used to describe the relative distance of a structure from the center of an organ or cavity; for example, the internal carotid artery is found inside the cranial cavity and the external carotid artery is found outside the cranial cavity.

The term **ipsilateral** refers to the same side of the body; for example, the left hand and the left foot are ipsilateral.

Contralateral refers to opposite sides of the body; for example, the left hand and the right foot are contralateral.





The **supine position** of the body is lying on the back.

The **prone position** is lying face downward.

Flexion is a movement that takes place in a sagittal plane. For example, flexion of the elbow joint approximates the anterior surface of the forearm to the anterior surface of the arm.

Extension means straightening the joint and usually takes place in a posterior direction.

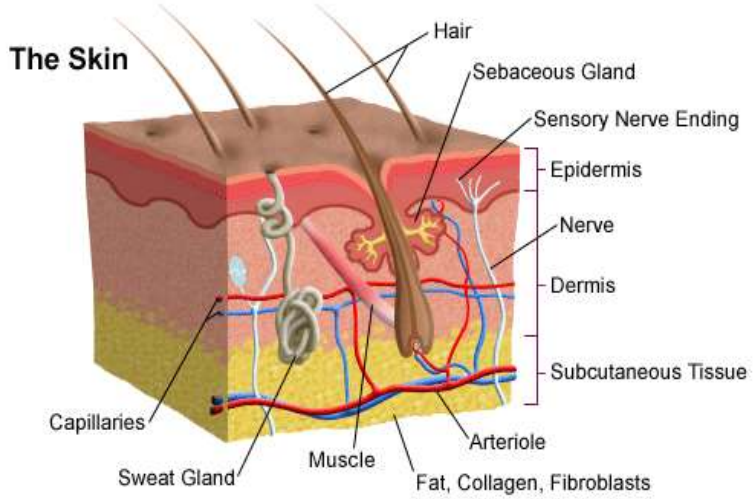
Abduction is a movement of a limb away from the midline of the body in the coronal plane.

Adduction is a movement of a limb toward the body in the coronal plane.

Skin: The skin is the body's largest organ, covering the entire body

The skin is divided into two parts: the superficial part, the **epidermis**; and the deep part, the **dermis**.

The epidermis: is a stratified epithelium whose cells become flattened as they mature and rise to the surface. On the **palms of the hands** and the **soles of the feet**, the epidermis is extremely thick, to withstand the wear and tear that occurs in these regions. In other areas of the body, for example, on the anterior surface of the **arm and forearm**, it is thin.



The dermis: is composed of **dense connective tissue** containing many **blood vessels, lymphatic vessels, and nerves.** It shows considerable variation in thickness in different parts of the body, tending to be thinner on the anterior than on the posterior surface. It is thinner in women than in men.

The appendages of the skin: are the **nails, hair follicles, sebaceous glands, and sweat glands**.

The nails: are keratinized plates on the dorsal surfaces of the tips of the fingers and toes.

Hairs: grow out of follicles, which are invaginations of the epidermis into the dermis.

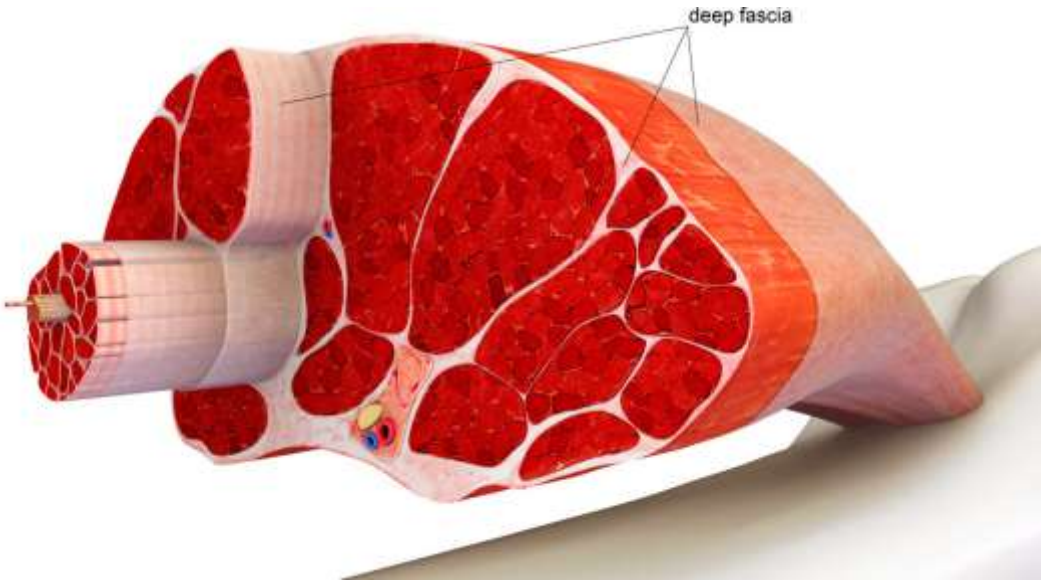
Sebaceous glands: pour their secretion, the sebum, onto the shafts of the hairs as they pass up through the necks of the follicles.

Sweat glands: are distributed over the surface of the body, except on the red margins of the lips, the nail beds. These glands extend through the full thickness of the dermis, and their extremities may lie in the superficial fascia.

Fasciae

The **fasciae** of the body can be divided into two types— **superficial and deep**—and lie between the skin and the underlying muscles and bones.

The **superficial fascia**, or **subcutaneous tissue**, is a mixture of loose areolar and adipose tissue that unites the dermis of the skin to the underlying deep fascia. The subcutaneous tissue houses larger blood vessels and nerves. This layer is important in the regulation of the temperature of the skin itself and the body. The size of this layer varies throughout the body and from person to person.



The **deep fascia** is a membranous layer of connective tissue that invests the muscles and other deep structures. In the neck, it forms well-defined layers that may play an important role in determining the path taken by pathogenic organisms during the spread of infection.

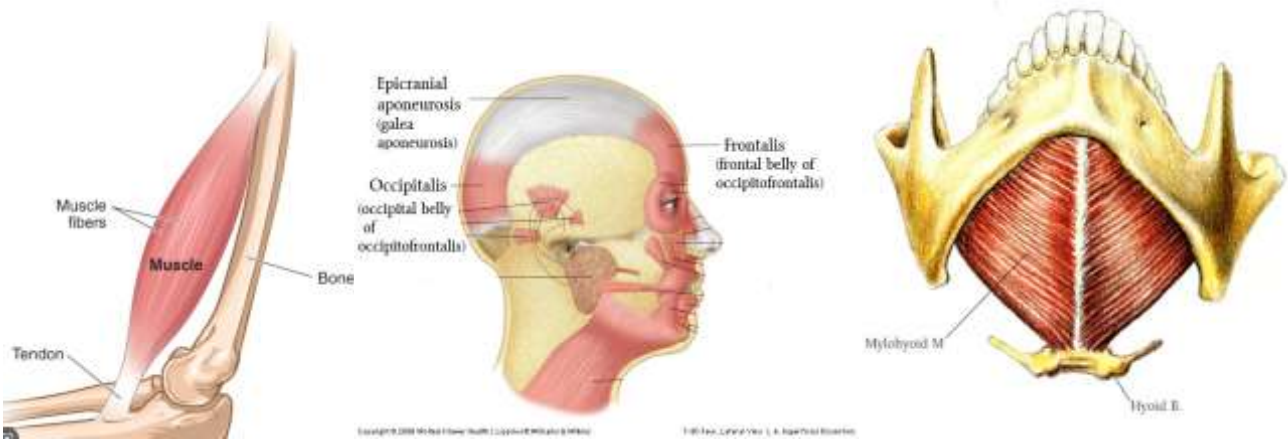
Lecture (2) The Muscles

The three types of muscles are skeletal, smooth, and cardiac.

Skeletal muscles:

Skeletal Muscles are those which attach to bones and have the main function of contracting to facilitate movement of our skeletons. They are also sometimes known as **striated muscles** due to their appearance. Skeletal muscles are also sometimes called **voluntary muscles**, because we have direct control over them through nervous impulses from our brains sending messages to the muscle.

It has 2 attachment or more. The attachment that moves less is referred to as the origin and the one that moves the most the insertion. The red part of the muscle is referred to as its belly. The end of muscle is attached to bone, cartilage or ligament by cord of fibrous tissue called **tendons**.



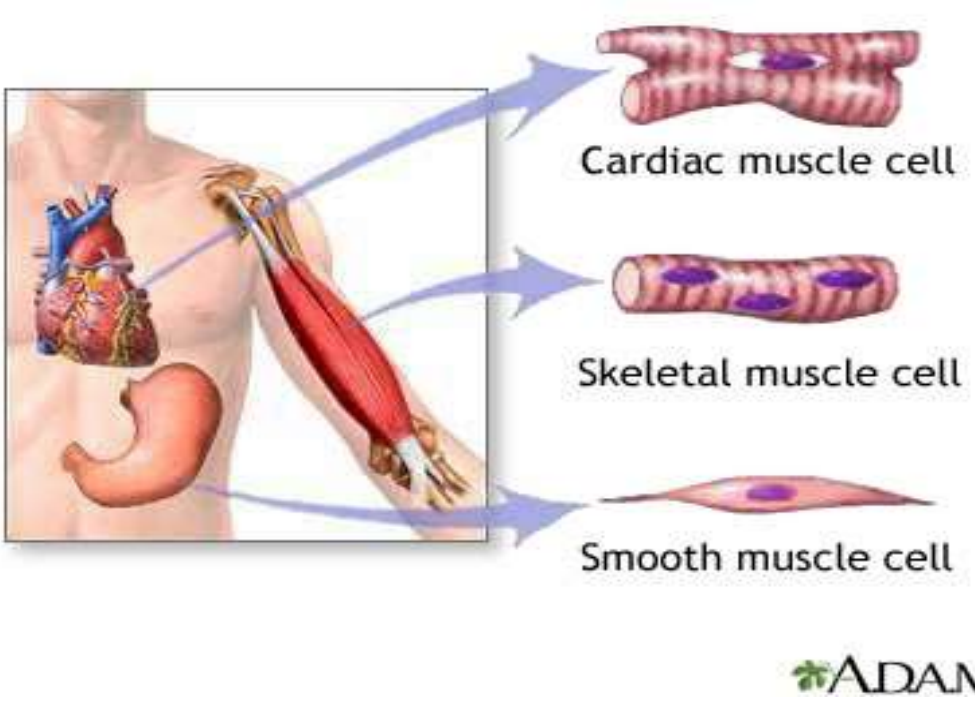
Flattened muscles (ex: Occipitofrontalis muscle) are attached by a thin strong sheet of fibrous tissue called an **aponeurosis.**

A **raphe** is an interdigitation of the tendinous ends of fibers of flat muscles. Ex: connection between right and left mylohyoid muscle.

Smooth muscle

Consist of **long spindle-shaped** cells closely arranged in bundles. Smooth muscle is also sometimes known as **Involuntary muscle** due to our inability to control

its movements, or **Unstriated.** Smooth muscle is found in the walls of hollow organs such as the **Stomach, Oesophagus, Bronchi** and in the walls of **blood vessels**. This muscle type is stimulated by involuntary neurogenic impulses and has **slow, rhythmical contractions** used in controlling internal organs, for example, moving food along the **Oesophagus** or contracting **blood vessels** during **Vasoconstriction**.

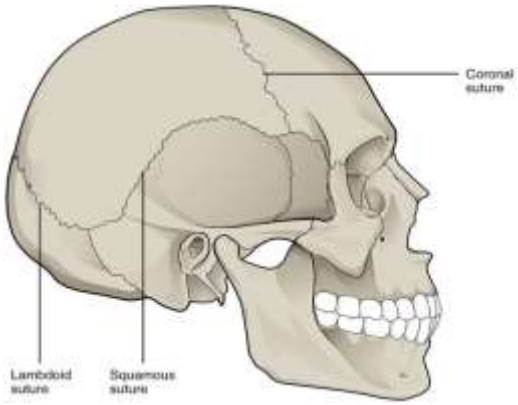


Cardiac muscle (heart muscle)

This type of muscle is found just in the walls of the **heart.** It has similarities with **skeletal muscles** in that it is **striated** and with **smooth muscles** in that its contractions are not under conscious control. However, this type of muscle is highly specialized. It is under the control of the autonomic nervous system.

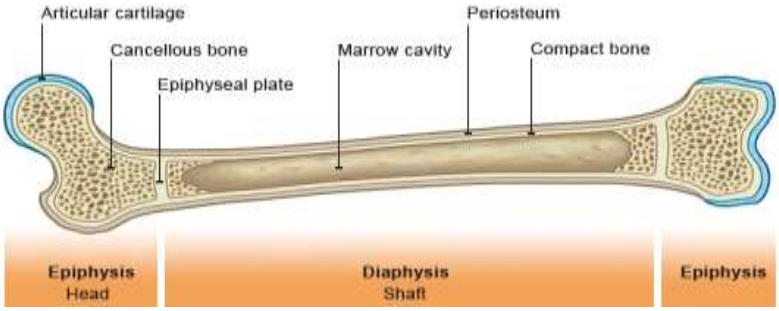
Joint – definition, types and function:

Joint: a site where 2 or more bones come together, whether or not movement occurs between them. They are classified according to the tissues that lie between the bones.

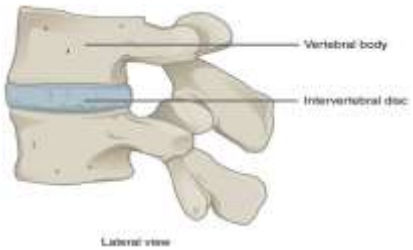


1/ fibrous joints: the articulating surfaces of bones are joined by fibrous tissue. And thus, very little movement is possible. Example. Sutures of vault of skull.

2/ cartilaginous joints: can be divided into 2 types:

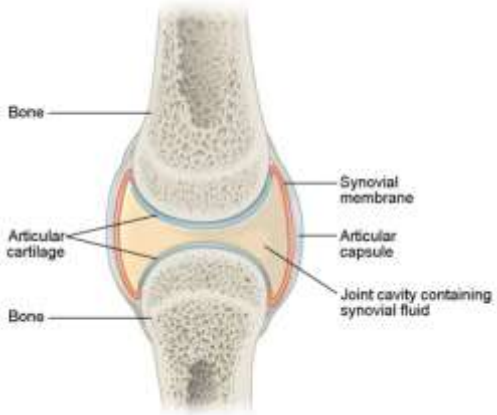


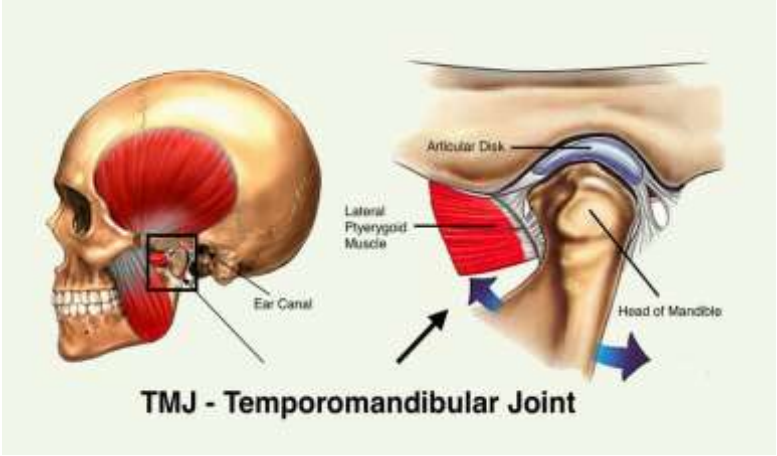
a- **Primary cartilaginous joints:** Is one in which the bones are united by a plate or bar of hyaline cartilage. Ex: union between epiphysis and diaphysis in a growing bone and no movement is possible.



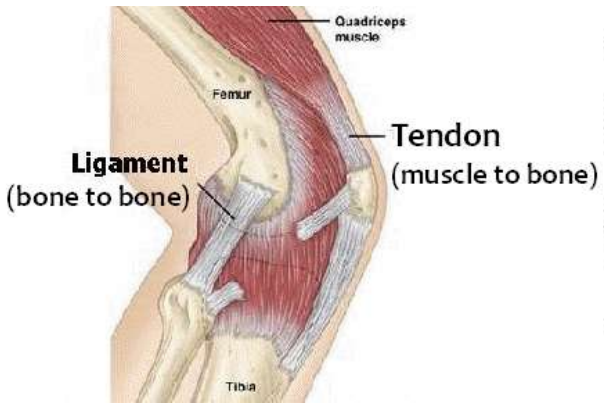
b- **Secondary cartilaginous joint:** Is one in which the bones are united by a plate of fibrocartilage, and the articular surfaces of bones are covered by a thin layer of hyaline cartilage. Ex; are the joints between the vertebral bodies, a small amount of movement is possible.

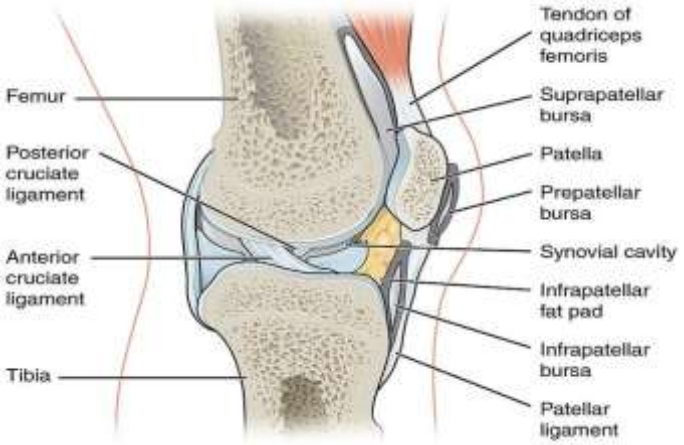
3/ Synovial joints:





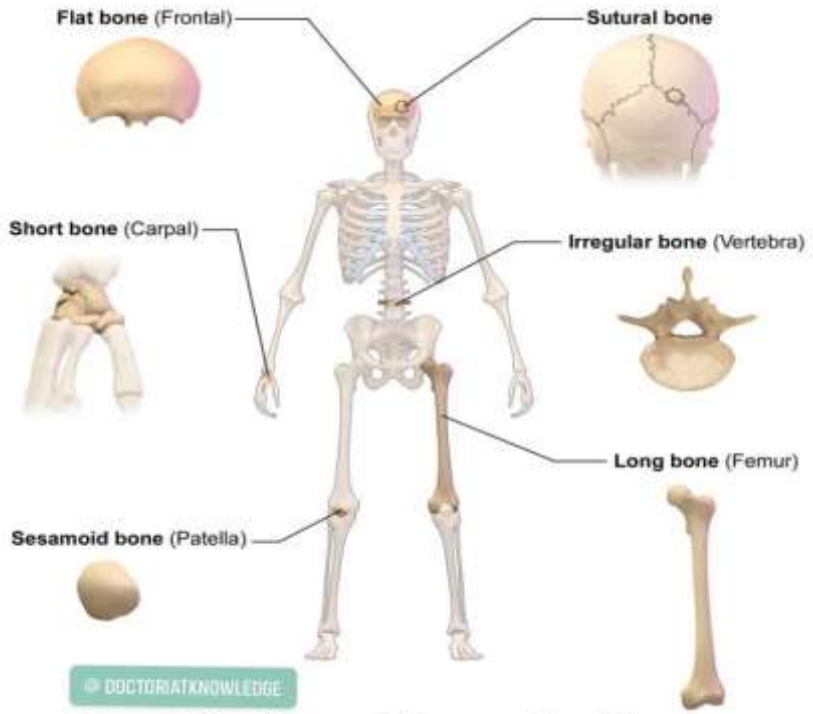
The articular surfaces of the bones are covered by a thin layer of **hyaline cartilage** separated by a joint cavity. This arrangement permits a **great degree of freedom of movement**. The cavity of the joint is lined by **synovial membrane**, which extends from the margins of one **articular surface** to those of the other. The synovial membrane is protected on the outside by a tough **fibrous membrane** referred to as the **capsule** of the joint. The articular surfaces are lubricated by a viscous fluid called **synovial fluid**, which is produced by the **synovial membrane**. In certain synovial joints, **discs** of **fibrocartilage** are interposed between the articular surfaces of the bones. These are referred to as **articular discs**. **Ex. Tempromandibular joint.**





Ligament: is a cord or band of connective tissue uniting two structures, commonly found in association with joints.

Bursae: A bursa is a lubricating device consisting of a closed fibrous sac lined with a delicate smooth membrane. Its walls are separated by a film of viscous fluid. Bursae are found wherever tendons rub against bones, ligaments, or other tendons. They are commonly found close to joints where the skin rubs against underlying bony structures, for example, the prepatellar bursa.

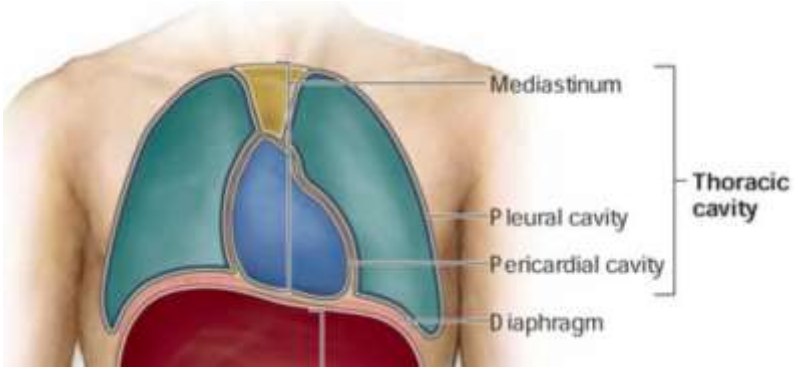


Classification of Bones by Shape

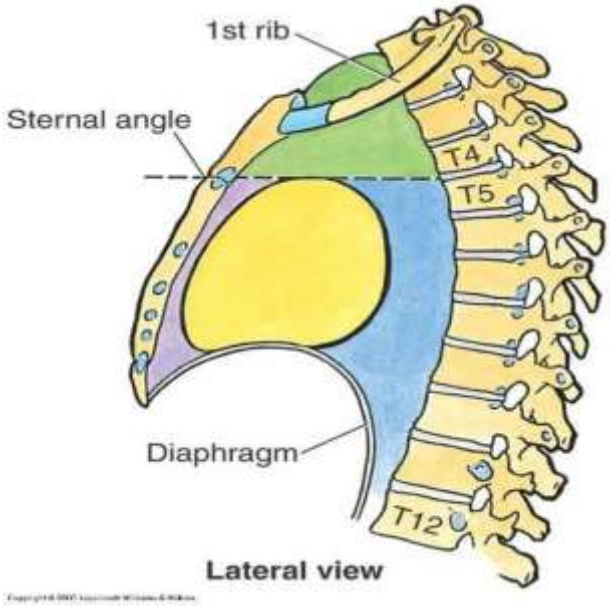
Bone Classification:

Bones may be classified on the basis of their general shape. These shapes include **long bones,** as found in the arms and legs, **short bones,** as in the wrist and ankle, **flat bones,** like those forming the skull, and **irregular bones,** such as the vertebrae. **Sesamoid bones** are also described as a separate category, for example patella.

Lecture (3) Cardiovascular system:



The cavity of the thorax can be divided into a **median partition**, called the **mediastinum**, and the laterally placed **pleurae and lungs**.

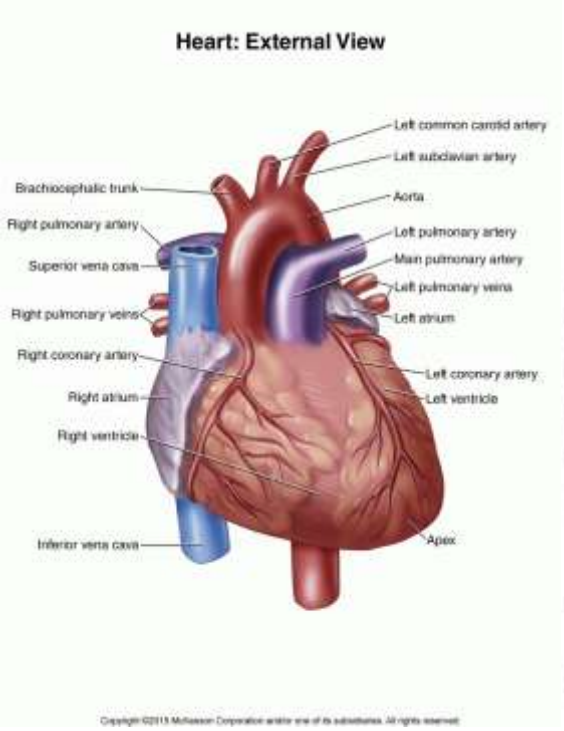


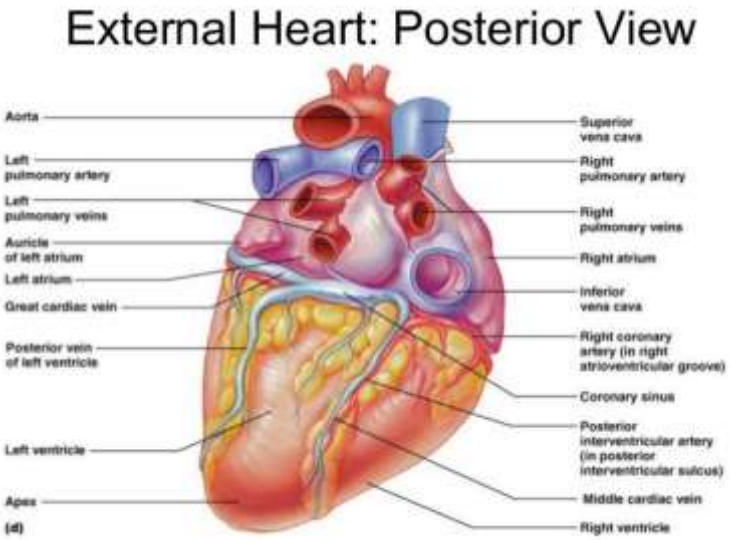
Mediastinum:

The mediastinum: lies between the **right and left pleura and lungs**. It extends from the **sternum** in front to the **vertebral column** behind, and from the **root of the neck** superiorly to the **diaphragm** inferiorly, and contains all the thoracic viscera except the lungs. It is divided into **superior and inferior** mediastinum by an imaginary plane passing from the **sternal angle anteriorly** to the **lower border of the body of the 4th thoracic vertebra posteriorly**.

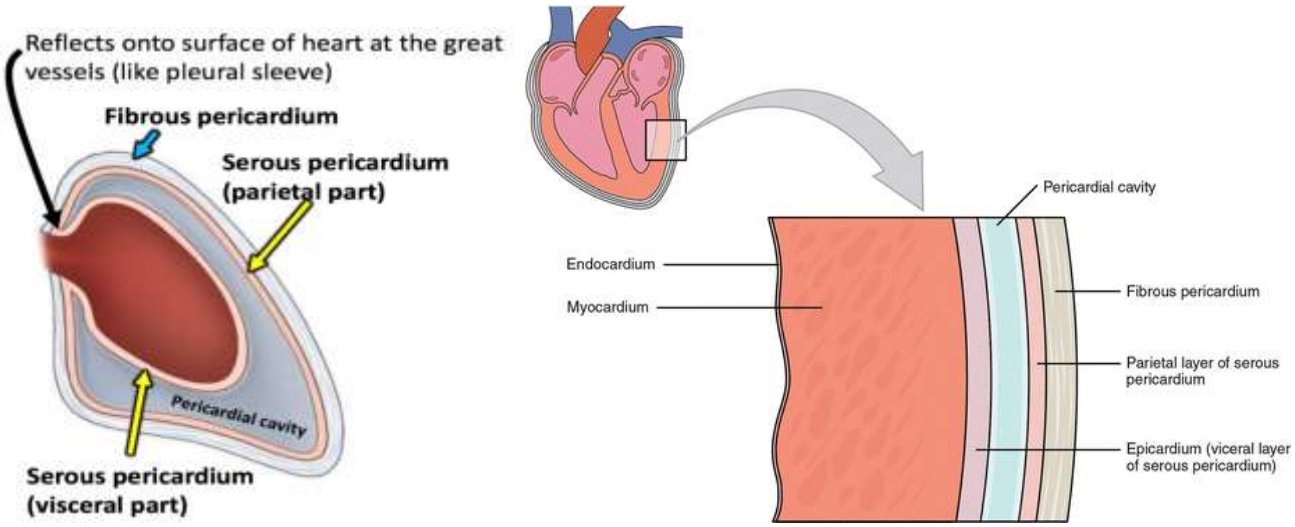
The inferior mediastinum is further subdivided into the **anterior mediastinum**, which is a space between the **pericardium and the sternum**; the **middle mediastinum**, which consists of the **pericardium and heart**; and the **posterior mediastinum**, which lies between the **pericardium and the vertebral column**.

The **superior mediastinum** is bounded in front by the **manubrium** and behind by the **first four thoracic vertebrae**. The **Inferior Mediastinum** is bounded in front by the **body of the sternum** and behind by the **lower eight thoracic vertebrae.**

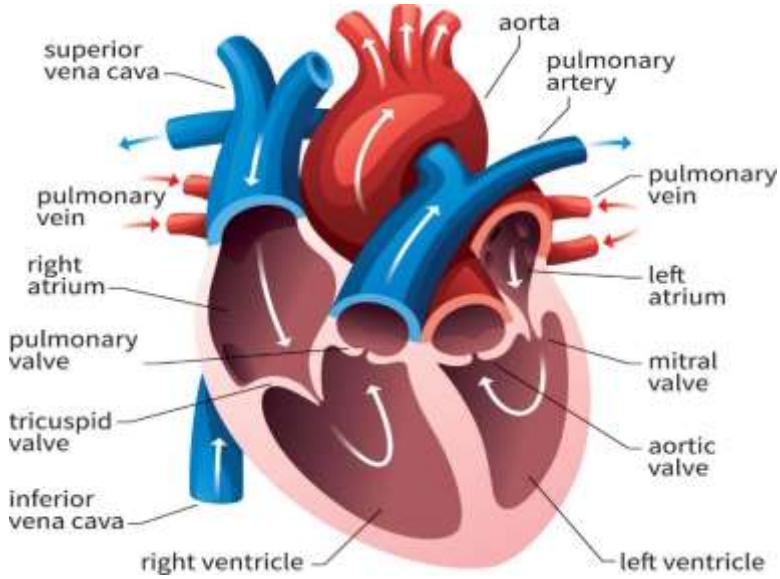




The Heart: The heart is a muscular organ about the size of a fist, pyramidal in shape. The base directed posterio-superiorly and the apex directed downward forward and slightly to the left. The heart located between the lungs and just behind the sternum. The heart has 4 chambers. The upper chambers are called the left and right atria, and the lower chambers are called the left and right ventricles. The left ventricle is the thickest, largest and strongest chamber.



Pericardium: Pericardium is a double layered membrane which covers the heart. the outermost fibrous pericardium and the inner serous pericardium. The serous pericardium, in turn, is divided into two layers, the *parietal pericardium*, which is fused to the fibrous pericardium, and the *visceral pericardium*, which is fused and cover the heart. Between parietal and visceral pericardial layers there is a potential space called the pericardial cavity. It is normally lubricated by a film of pericardial fluid.



The Heart Valves:

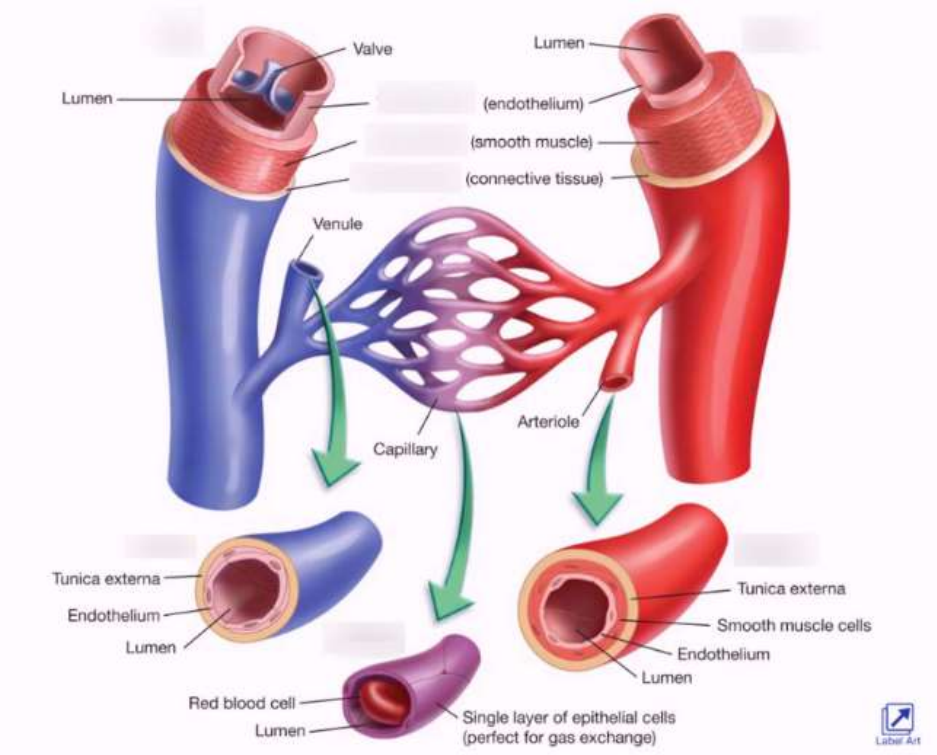
1/ The tricuspid valve regulates blood flow from right atrium to right ventricle.

2/ The pulmonary valve controls blood flow from the right ventricle into the pulmonary trunk and arteries, which carry blood to the lungs.

3/ The mitral valve lets oxygen-rich blood pass from the left atrium into the left ventricle.

4/ The aortic valve opens the way for oxygen-rich blood to pass from the left ventricle into the aorta, where it is delivered to the rest of the body.

Blood vessels



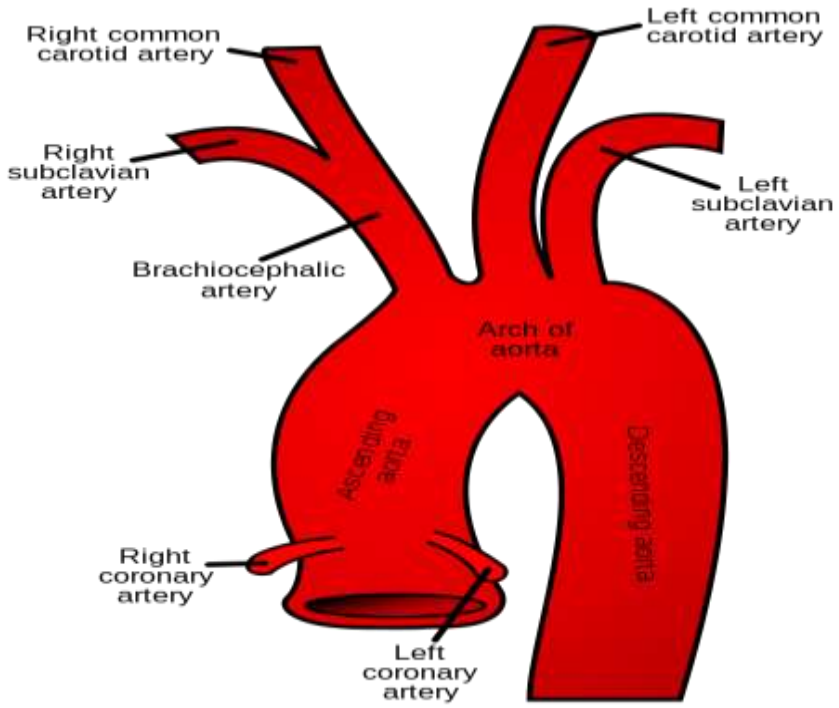
Definition: A tube through which the blood circulates in the body. Blood vessels include a network of **arteries, arterioles, capillaries, venules, and veins**. The arteries carry blood away from the heart to the **cells, tissues and organs**. The arteries branch into **arterioles** (smaller arteries) that carry blood to the **capillaries**, which are minute vessels that permeate tissues. Blood is then carried to the **venules** (small veins), which join together to form **veins** [many of them possess valves], which return blood to the heart.

Major blood vessels arise from the heart:

1/ Pulmonary Arteries [right and left] – arises from pulmonary trunk, carries de-oxygenated blood from the right ventricle to the lungs.

2/ Four Pulmonary veins– connected to the left atrium, carries oxygenated blood from the lungs to the left atrium.

3/ Venae Cavae: [superior and inferior]- connected to the right atrium, transport de-oxygenated blood from various regions of the body to the heart.



4/ The aorta: is the largest artery in the body, arises from the left ventricle of the heart, forms an arch, then extends down to the abdomen, where it branches off into two smaller arteries. aorta carries and distributes oxygen rich blood to all parts of the body.

For description aorta divided into 3 parts: ascending aorta, arch of aorta and descending aorta.

Branches of Ascending aorta: right coronary artery and left coronary artery.

Coronary Arteries - carry oxygenated and nutrient filled blood to the heart muscle.

Branches of arch of aorta:

1- Brachiocephalic Artery: branches…a-right common carotid artery b- right subclavian artery.
2- Left common Carotid Arteries.
3- Left Subclavian Arteries

Brachiocephalic Artery - carries oxygenated blood from the aorta to the head, neck and arm regions.

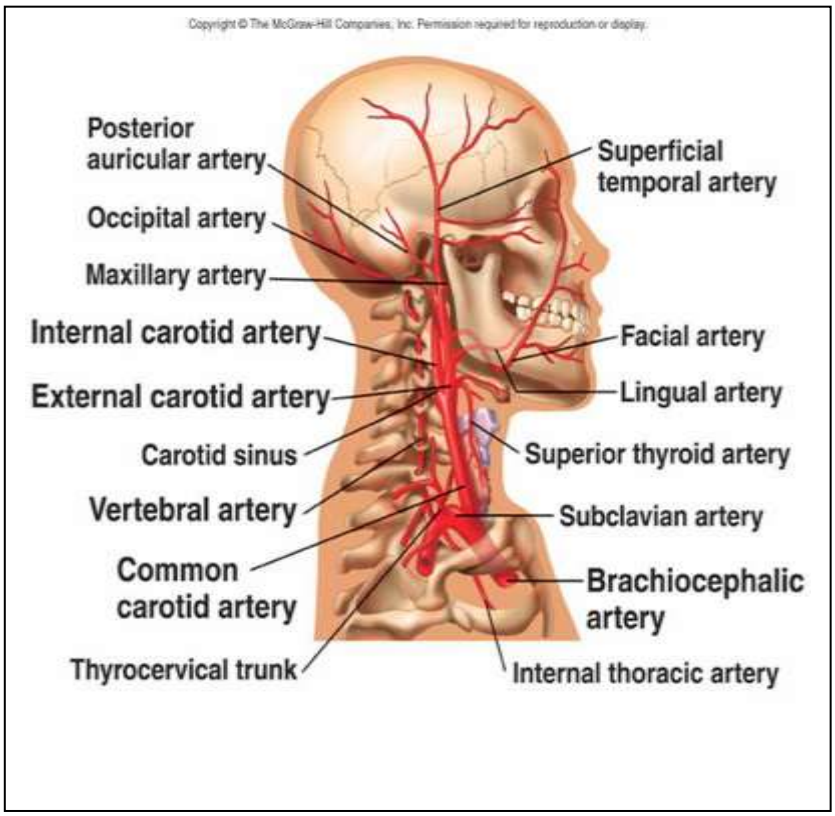
Common Carotid Arteries - supply oxygenated blood to the head and neck regions.

Subclavian Arteries - supply oxygenated blood to the arms.

External carotid artery: is a major artery of the head and neck. It arises from the common carotid artery when it bifurcates into the external and internal carotid artery.

Branches of external carotid artery: From inferior to superior:

1- Superior thyroid artery.
2- Ascending pharyngeal artery.
3- Lingual artery.
4- Facial artery.
5- Occipital artery.
6- Posterior auricular artery.
7- Maxillary artery.
8- Superficial temporal artery.



Lecture. [4] Nervous system [part 1]

Anatomically nervous system divided into 2 main parts

1/ central nervous system [brain and spinal cord]. the two parts are protected by bones [skull and vertebral column].

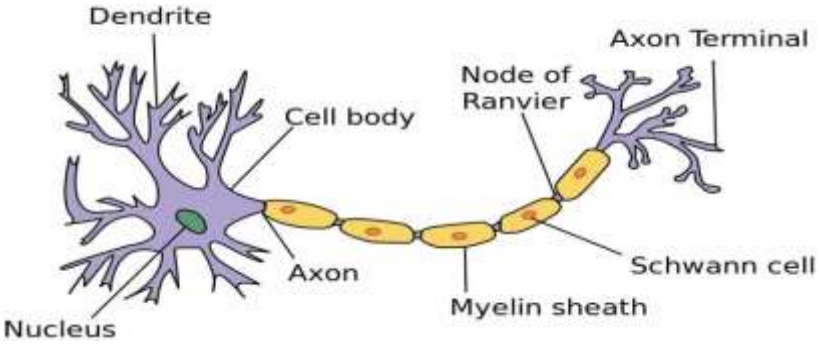
2/peripheral nervous system [12 pairs of cranial nerves and 31 pairs of spinal nerves and their associated ganglia]

Functionally, the nervous system can be further divided into:

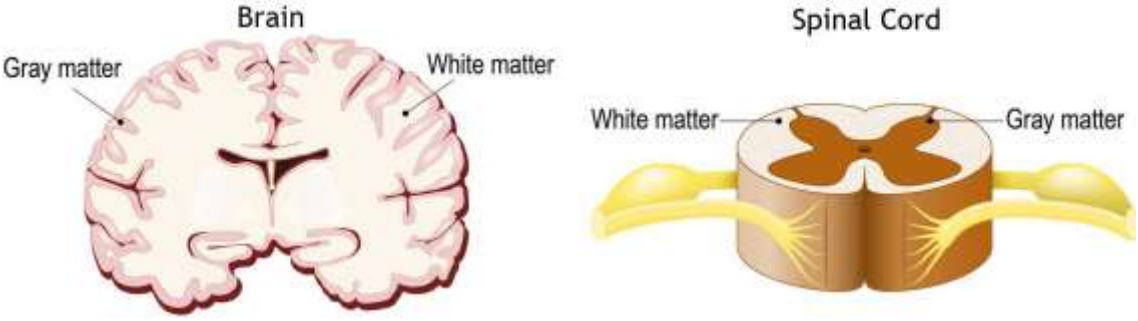
1/the somatic nervous system, which controls voluntary activities

2/ the autonomic nervous system, which controls involuntary activities.

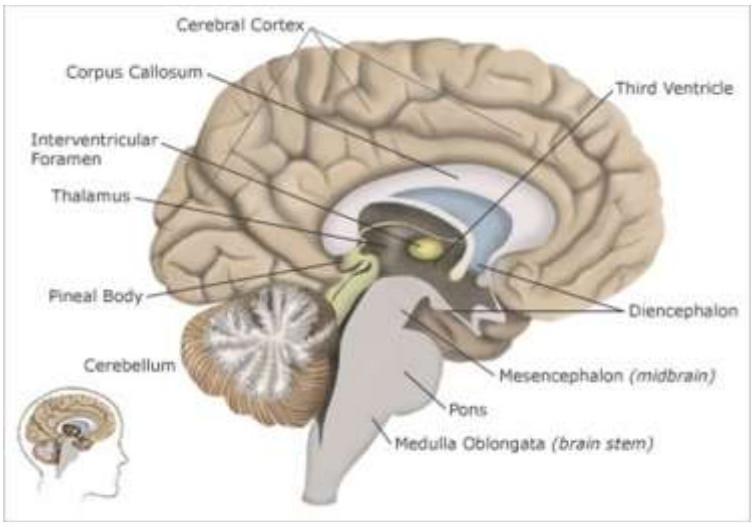
Central Nervous System: is composed of large numbers of **nerve cells** and their processes, supported by specialized tissue called **neuroglia**. **Neuron** is the term given to the nerve cell and all its processes. The nerve cell has two types of processes, called **dendrites** and an **axon**.



The interior of the central nervous system is organized into **gray and white matter**. **Gray matter** consists of nerve cells embedded in **neuroglia**. **White matter** consists of nerve fibers **(axons)** embedded in **neuroglia.**



Brain: which consist of:



1. Cerebrum 2. Cerebellum 3. Midbrain 4. Pons

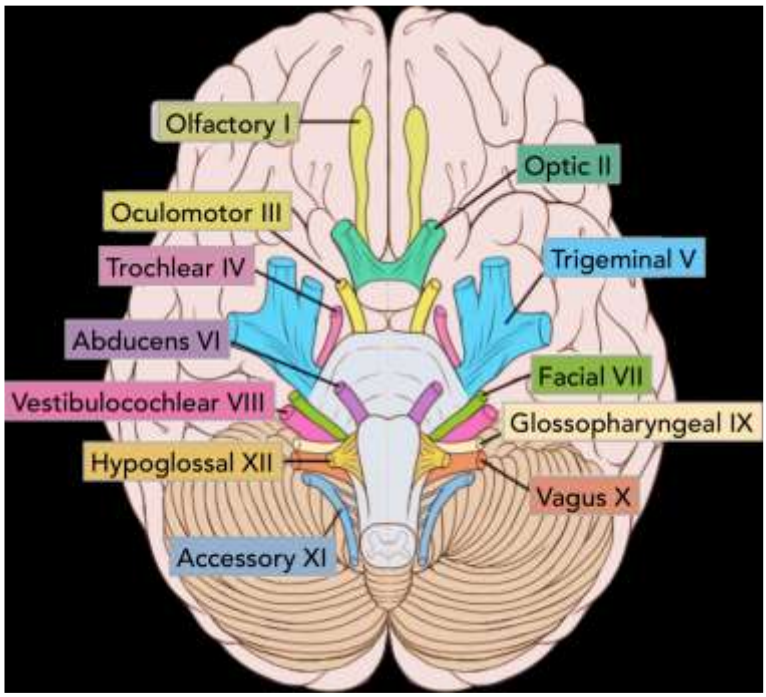
5. Medulla oblongata 6. diencephalon [thalamus and hypothalamus].

Peripheral nervous system

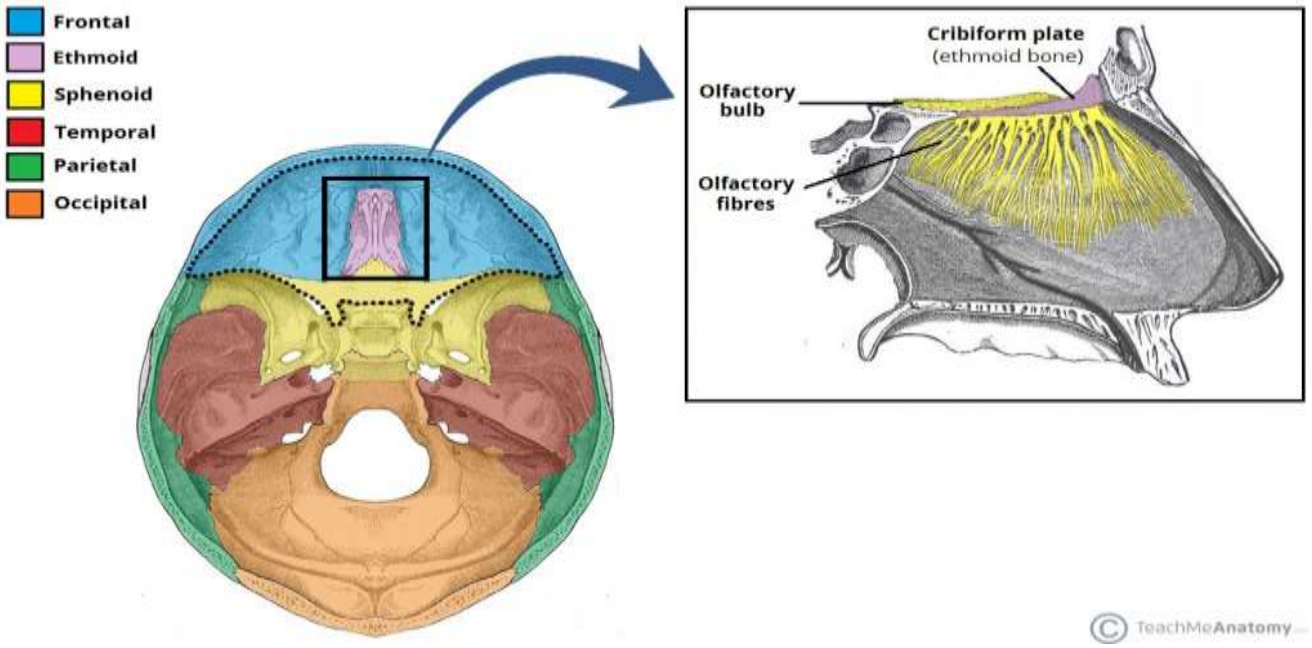
1/ cranial nerves: leaves the brain and pass through foramina in skull. All nerves are distributed in the head and neck except the Xth [vagus] which supplies structures in the thorax and abdomen.

The cranial nerves are named as follows:

I. Olfactory
II. Optic
III. Oculomotor
IV. Trochlear
V. Trigeminal
VI. Abducent
VII. Facial
VIII. Vestibulocochlear
IX. Glossopharyngeal
X. Vagus
XI. Accessory
XII. Hypoglossal

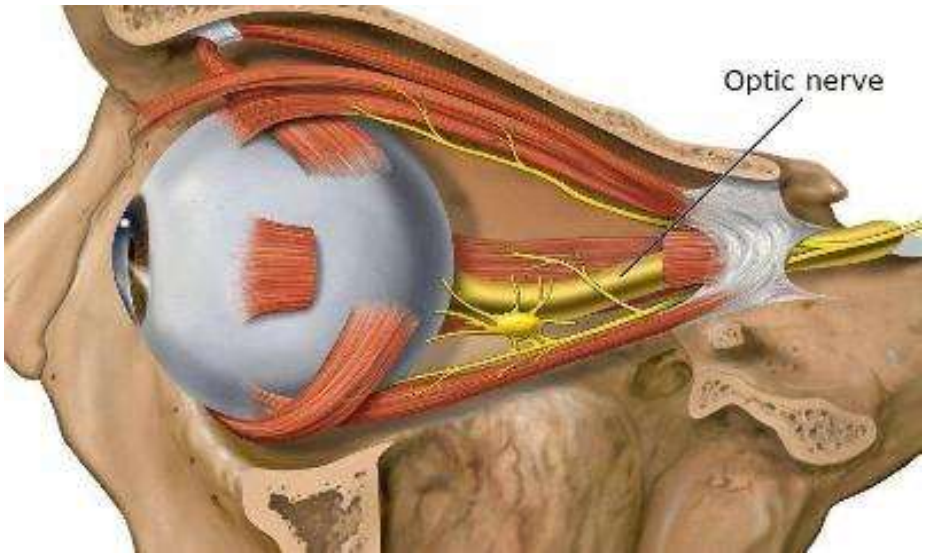


CN I [sensory] is the Olfactory nerve:

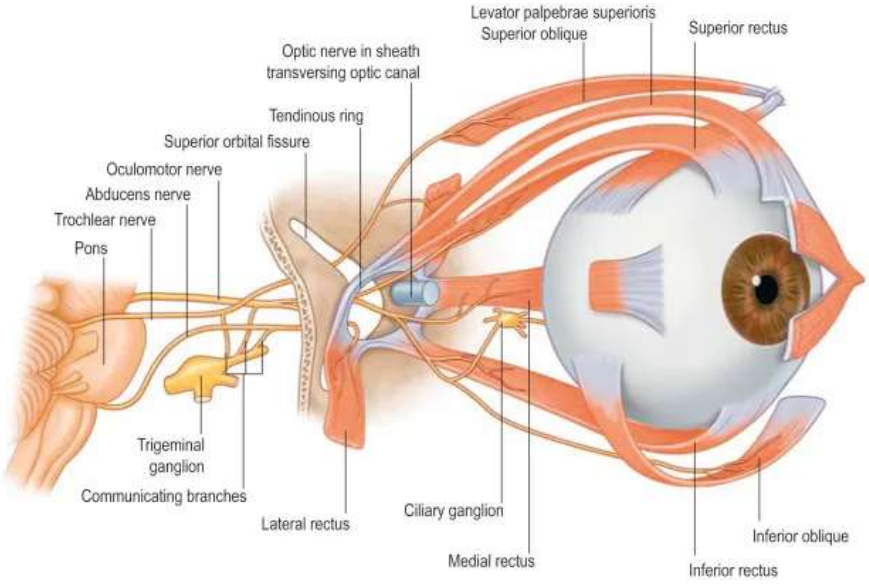


The Olfactory nerves arise from olfactory nerve cells in the olfactory mucous membrane. The olfactory mucous membrane is situated in the upper part of the nasal cavity. Bundles of these olfactory nerve fibers pass through the openings of the cribriform plate of the ethmoid.

CN II [sensory] is the Optic nerve:



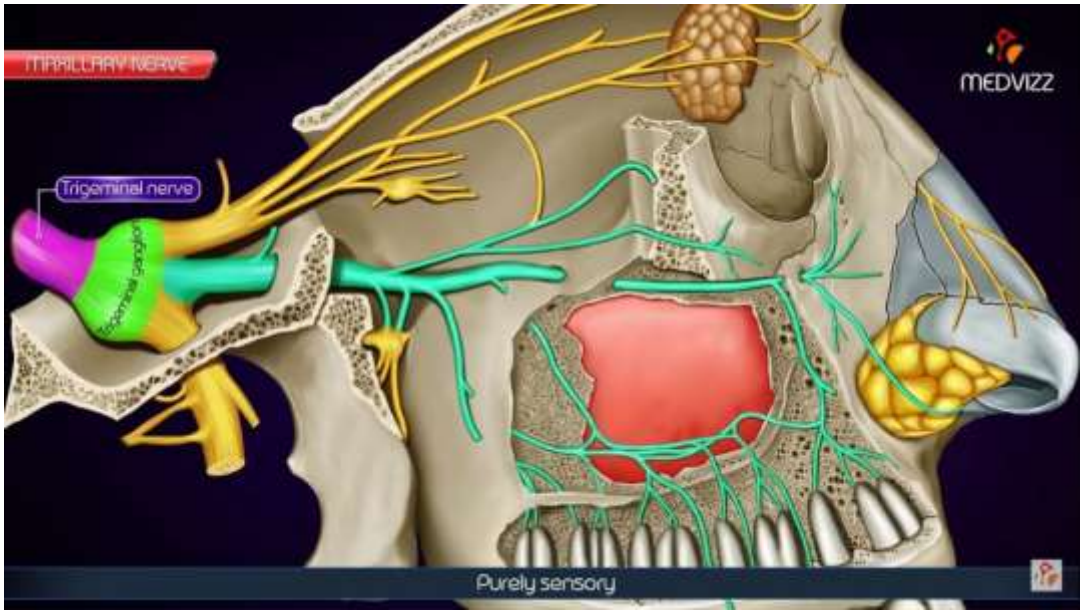
The optic nerve emerges from the back of the eyeball and leaves the orbital cavity through the **optic canal** to enter the cranial cavity.



CN III oculomotor, IV trochlear, and VI abducens are[motor]

These are the nerves that move the eye. They enter the orbital cavity through **superior orbital fissure.**

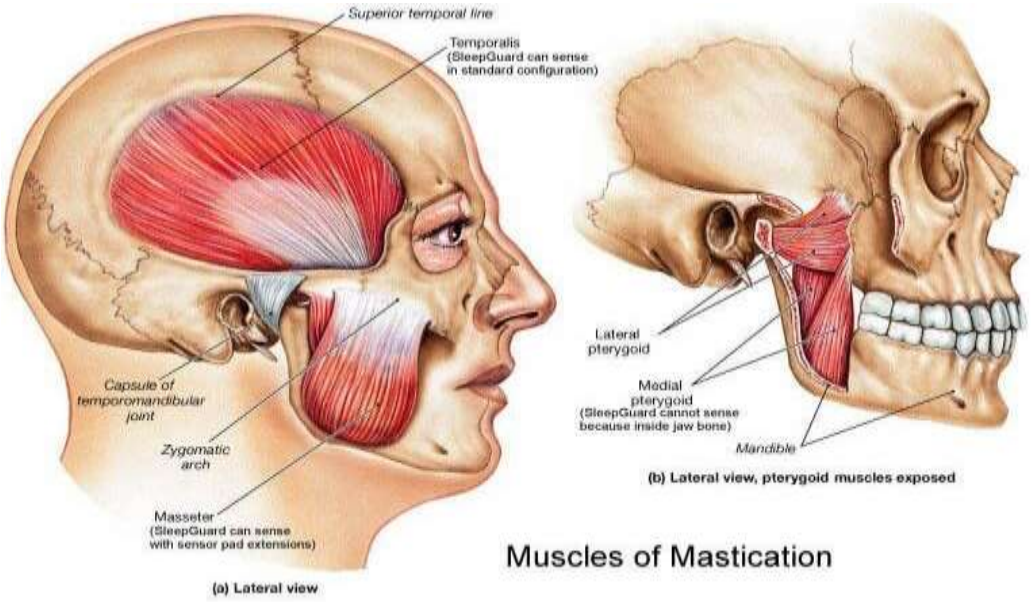
CN V [mixed] is the trigeminal nerve:



The trigeminal nerve is the largest cranial nerve. It leaves the anterior aspect of the pons as a **small motor root** and a **large sensory root**, and it passes forward, the large sensory root expands to form the **trigeminal ganglion**. The **ophthalmic (V1),**

maxillary (V2), and mandibular (V3) nerves arise from the anterior border of the ganglion.

a. **Ophthalmic nerve (V1)** is purely sensory arises from the trigeminal ganglion and leaves the skull through the **superior orbital fissure.**
b. **Maxillary Nerve (V2)** is purely sensory arises from the trigeminal ganglion and leaves the skull through the **foramen rotundum**.
c. **Mandibular Nerve (V3)** is both motor and sensory leaves the skull through the **foramen ovale.**



masticatory muscles: all receive innervation from the motor root of the trigeminal nerve via its mandibular division; includes masseter muscle, temporalis muscle, lateral pterygoid muscle, and medial pterygoid muscle.

CN VII [mixed] is the facial nerve:

Has motor and sensory roots. It passes with the vestibulocochlear nerve and enter the **internal acoustic meatus** in the **temporal bone.** The nerve emerges from the temporal bone through the **stylomastoid foramen.**

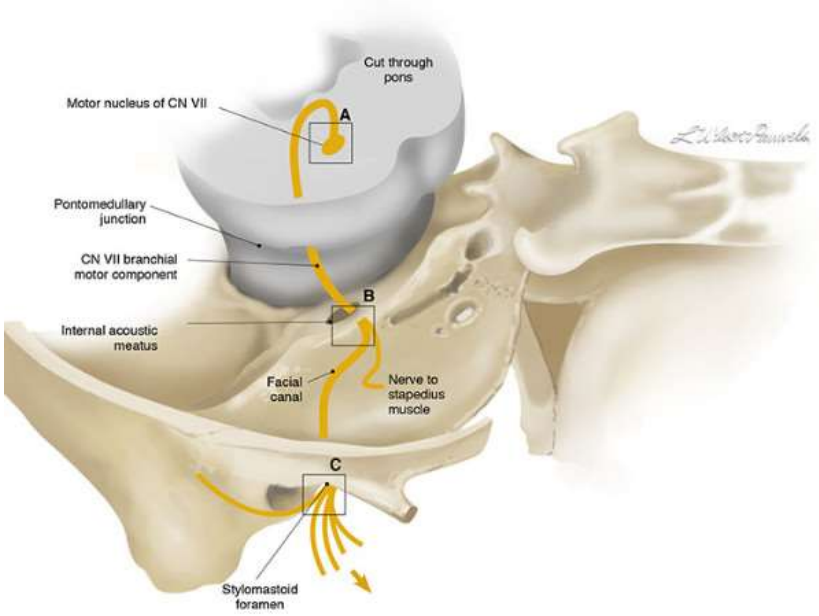
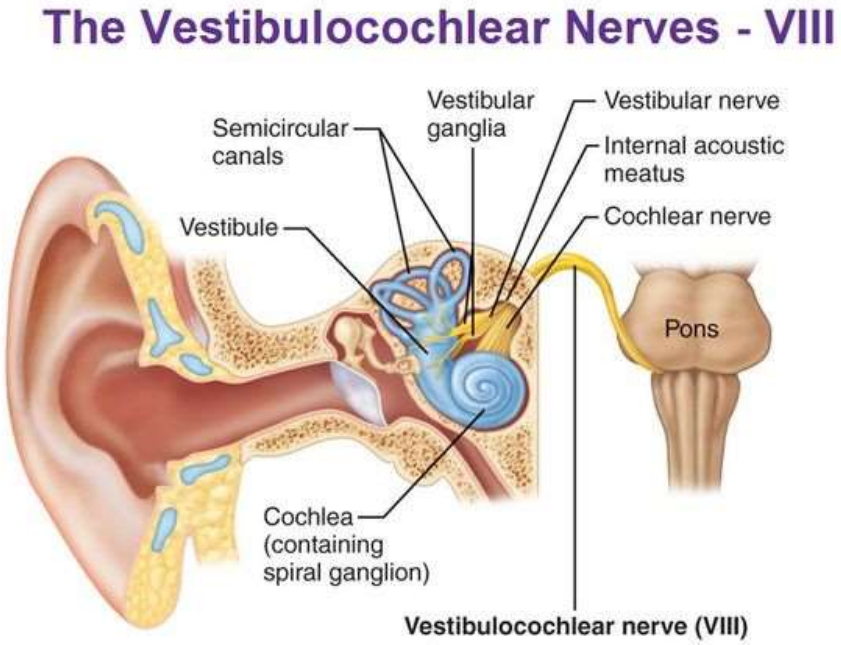


Figure VII–13 Lower Motor Neuron Lesions (LMNLs) affecting the branchial motor axons in **A**, pons, **B**, internal acoustic meatus, and **C**, styloid mastoid foramen (brainstem is elevated)



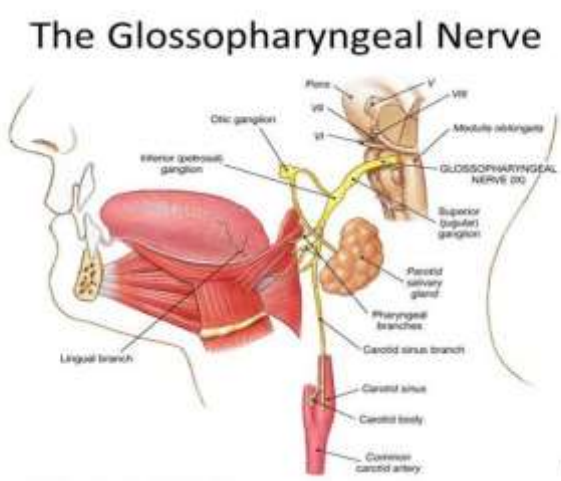
CN VIII [sensory] is the vestibulocochlear nerve:

The vestibulocochlear nerve is a sensory nerve that consists of two sets of fibers: **vestibular and cochlear**. They leave the anterior surface of the brain and cross the posterior cranial fossa and enter the internal acoustic meatus with the facial nerve.

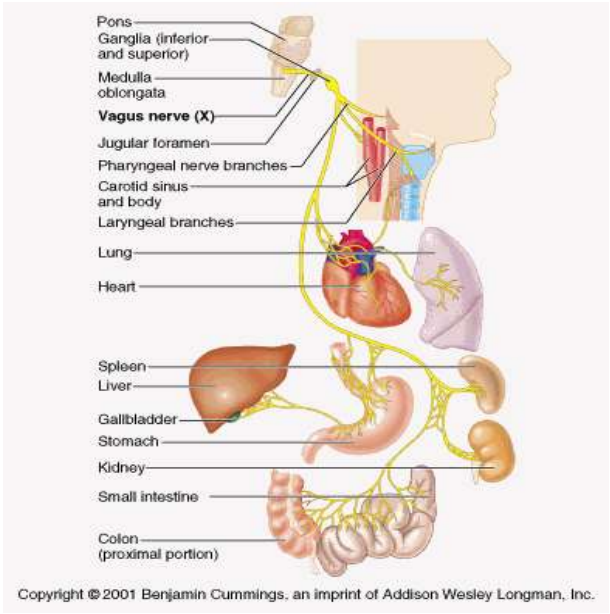
Nervous system [part 2]

CN IX [mixed] is the glossopharyngeal nerve:

The glossopharyngeal nerve is a motor and sensory nerve. It emerges from the anterior surface of the brain. It passes laterally in the posterior cranial fossa and leaves the skull by passing through the jugular foramen.

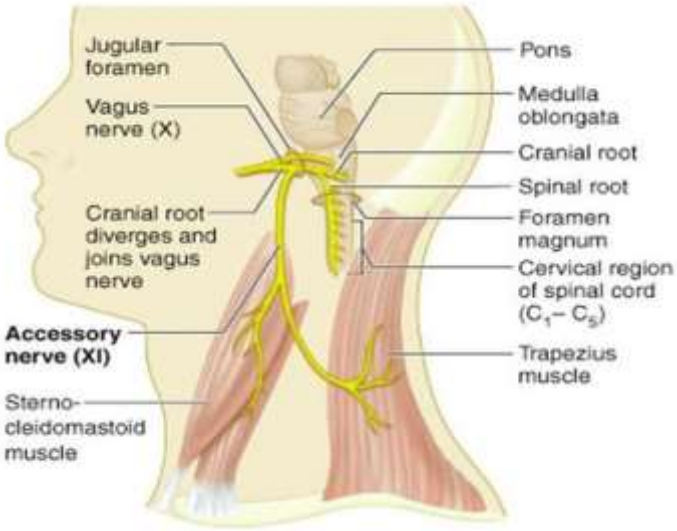


CN X [mixed] is the vagus nerve:



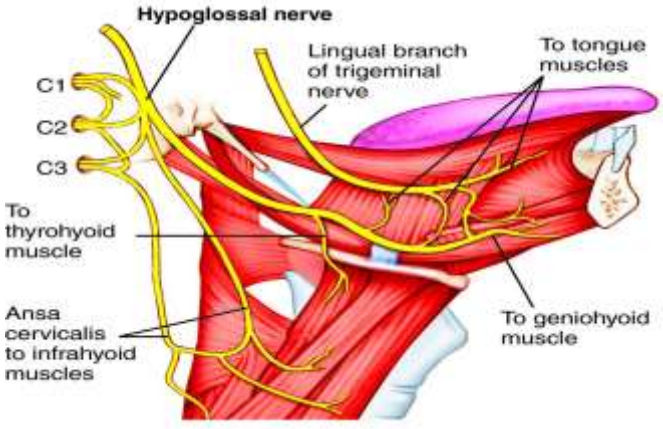
The vagus nerve is composed of motor and sensory fibers. It emerges from the anterior surface of the brain. The nerve passes laterally through the posterior cranial fossa and leaves the skull through the jugular foramen.

CN XI [motor] is the accessory nerve:



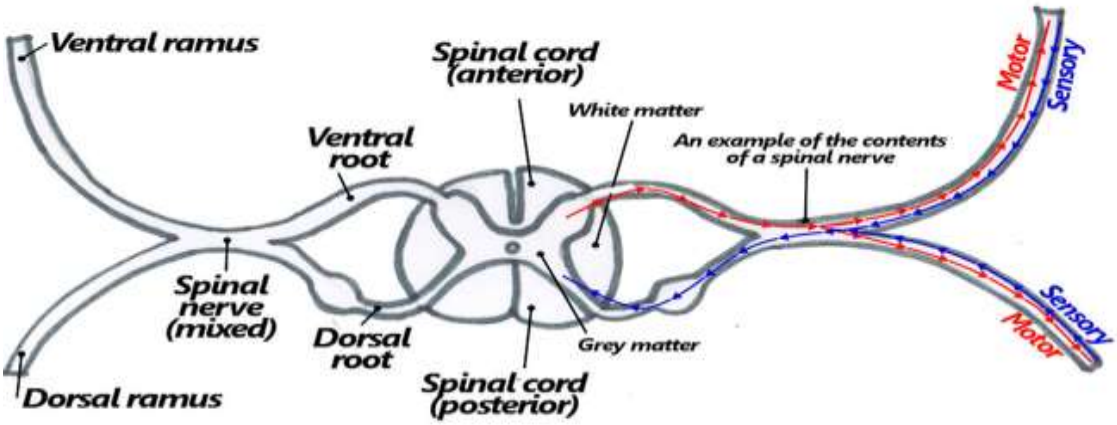
Is a **motor nerve**. It consists of a **cranial root** and a **spinal root.** The cranial root emerges from **the medulla oblongata**. The spinal root arises from the **spinal cord**. The spinal root enters the skull through the **foramen magnum** and joins the cranial root. The two roots unite and leave the skull through the jugular foramen. The roots then separate. The cranial root joins the **vagus nerve** and is distributed in its branches to the **muscles**.

CN XII [motor] is the hypoglossal nerve:



The hypoglossal nerve is a motor nerve. It emerges on the anterior surface of the medulla oblongata, crosses the posterior cranial fossa, and leaves the skull through the hypoglossal canal.

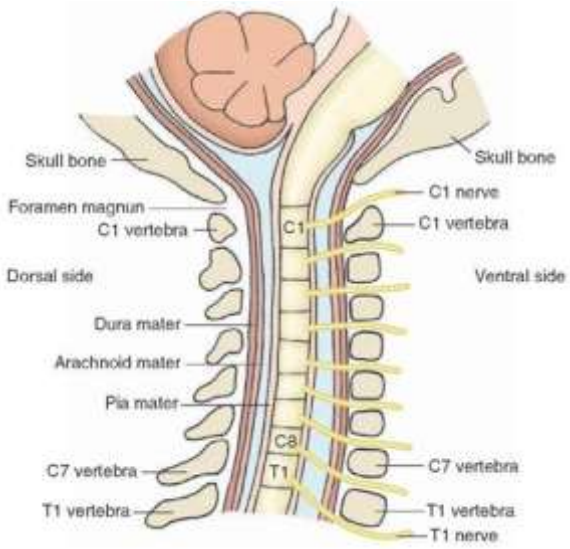
2/spinal-nerves:

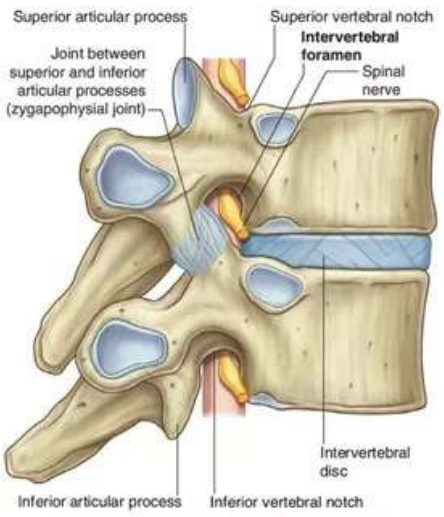


The term spinal nerve generally refers to a **mixed spinal nerve**, which carries **motor, sensory, and autonomic** signals between the **spinal cord** and the **body**.

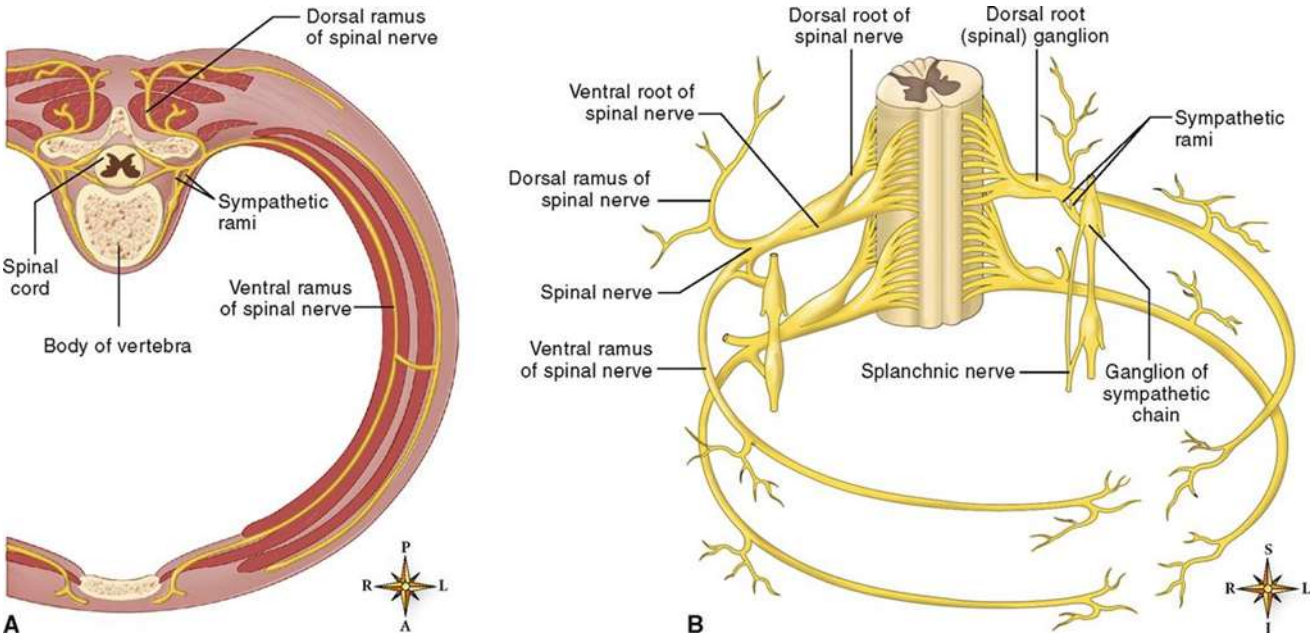
Each spinal nerve is formed by the combination of nerve fibers from the **dorsal and ventral roots** of the spinal cord. The dorsal roots carry **sensory axons**, while the ventral roots carry **motor axons**.

Humans have 31 pairs of spinal nerves: 8 cervical spinal nerve pairs (C1-C8), 12 thoracic pairs (T1-T12), 5 lumbar pairs (L1-L5), 5 sacral pairs (S1-S5), and 1 coccygeal pair. The spinal nerves are part of the peripheral nervous system (PNS).



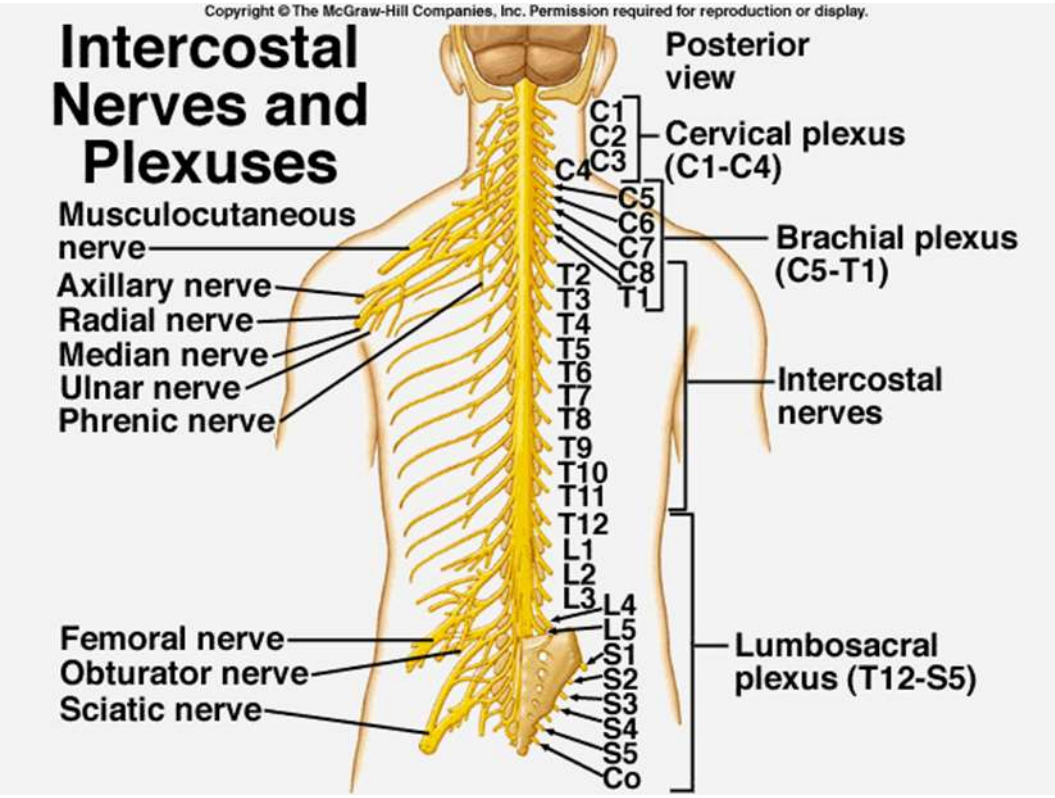


The spinal nerve emerges from the vertebral column through an opening **(intervertebral foramen)** between adjacent vertebrae. This is true for all spinal nerves except for the first spinal nerve pair, which emerges between the **occipital bone and the atlas (the first vertebra).** Thus, the cervical nerves are numbered by the vertebra below, except C8, which exists below C7 and above T1. The thoracic, lumbar, and sacral nerves are then numbered by the vertebra above.



At each intervertebral foramen, the anterior and posterior roots unite to form a spinal nerve. Here, the motor and sensory fibers become mixed together, so that a spinal nerve is made up of a mixture of motor and sensory fibers. On emerging from the foramen, the spinal nerve divides into a **large anterior ramus** and a **smaller posterior ramus**. The posterior ramus passes posteriorly around the **vertebral column** to supply the **muscles and skin of the back**. The anterior ramus continues anteriorly to supply the **muscles and skin** over the **anterolateral body wall** and all the **muscles and skin** of the **limbs**.

Plexuses:



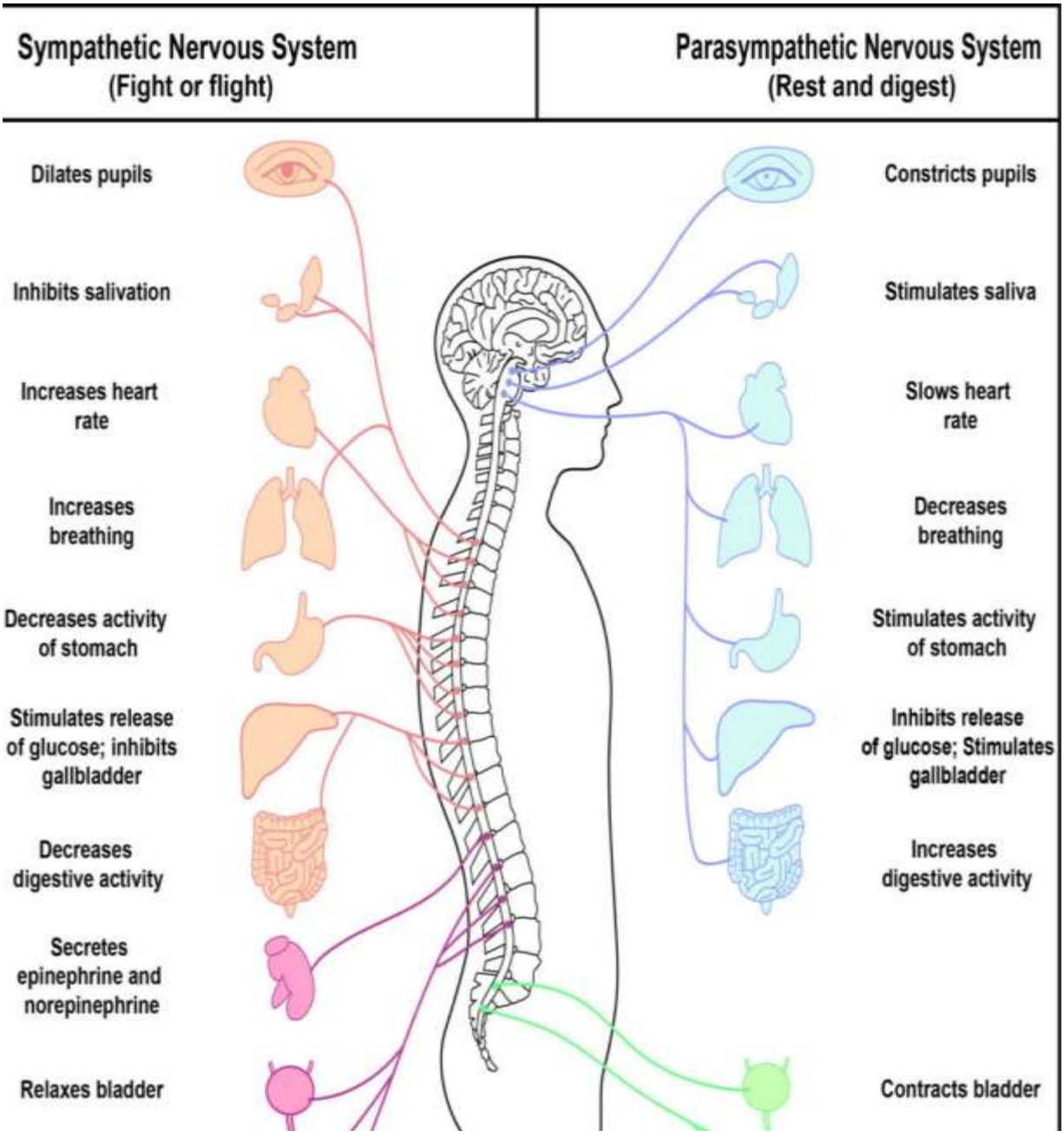
At the root of the limbs, the **anterior rami** join one another to form complicated nerve plexuses. The **cervical** and **brachial plexuses** are found at the **root of the upper limbs**, and the **lumbar** and **sacral plexuses** are found at the **root of the lower limbs**.

Autonomic nervous system:

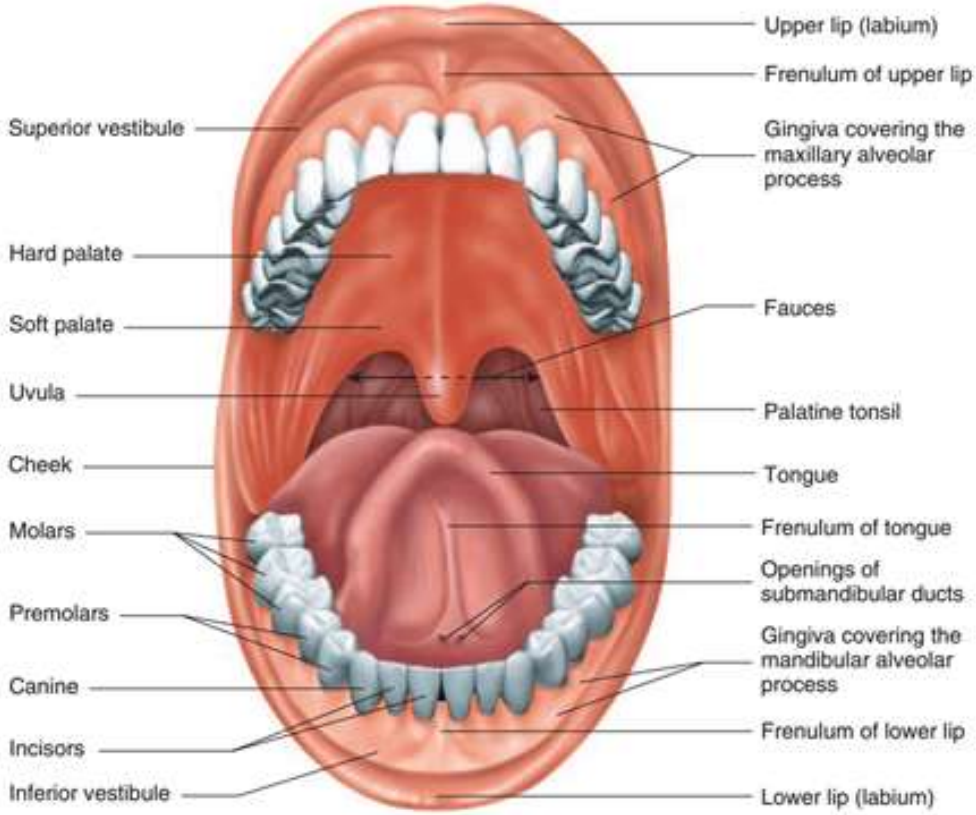
The autonomic nervous system is the part of the nervous system concerned with the innervation of involuntary structures such as the **heart, smooth muscle, and glands** throughout the body. The autonomic system may be divided into two parts—the sympathetic and the parasympathetic. The activities of the sympathetic part of the autonomic system prepare the body for an emergency. It **accelerates the heart rate, causes constriction of the peripheral blood vessels, and raises the blood pressure.** The sympathetic part of the autonomic system brings about a redistribution of the blood so that it leaves the areas of the **skin and intestine** and

becomes available to the **brain, heart, and skeletal muscle**. At the same time, **it inhibits peristalsis of the intestinal tract and closes the sphincters.**

The activities of the parasympathetic part of the autonomic system aim at conserving and restoring energy. They **slow the heart rate, increase peristalsis of the intestine and glandular activity, and open the sphincters.**



The Digestive system:

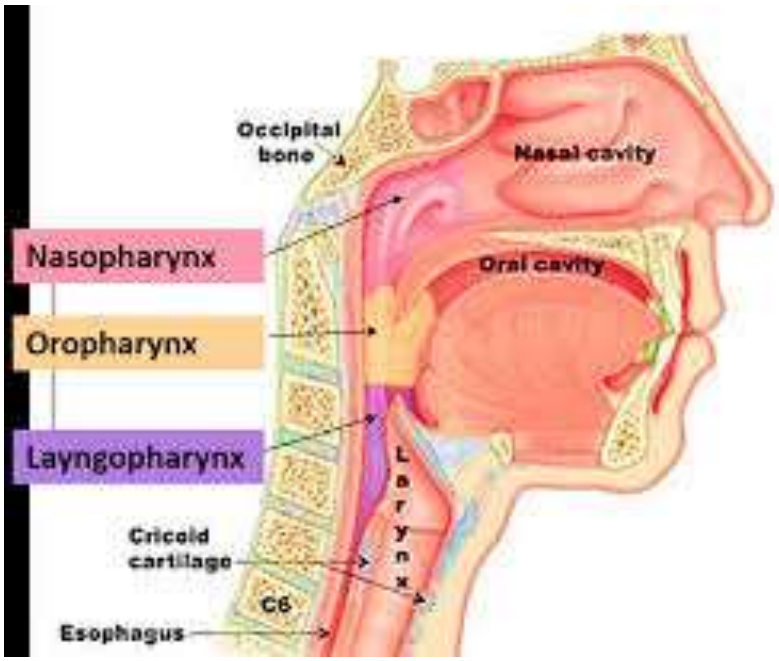


The cavity of the mouth consists of two parts: an outer, smaller portion, **the vestibule**, and an inner, larger part, the **mouth cavity proper**.

The **Vestibule** bounded externally by the **lips and cheeks**; internally by the **gums and teeth**. It communicates with the surface of the body by the orifice of the mouth. It receives the secretion from the **parotid salivary glands**, and communicates, when the jaws are closed, with the mouth cavity proper by an aperture on either side behind the **wisdom teeth**.

The **Mouth Cavity Proper** is bounded laterally and in front by the **alveolar arches** with their contained teeth; behind, it communicates with the **pharynx** by a constricted aperture termed the **oropharyngeal isthmus**. It is roofed in by the **hard and soft palates**, while the greater part of the floor is formed by the **tongue,** the remainder by the mucous membrane from the

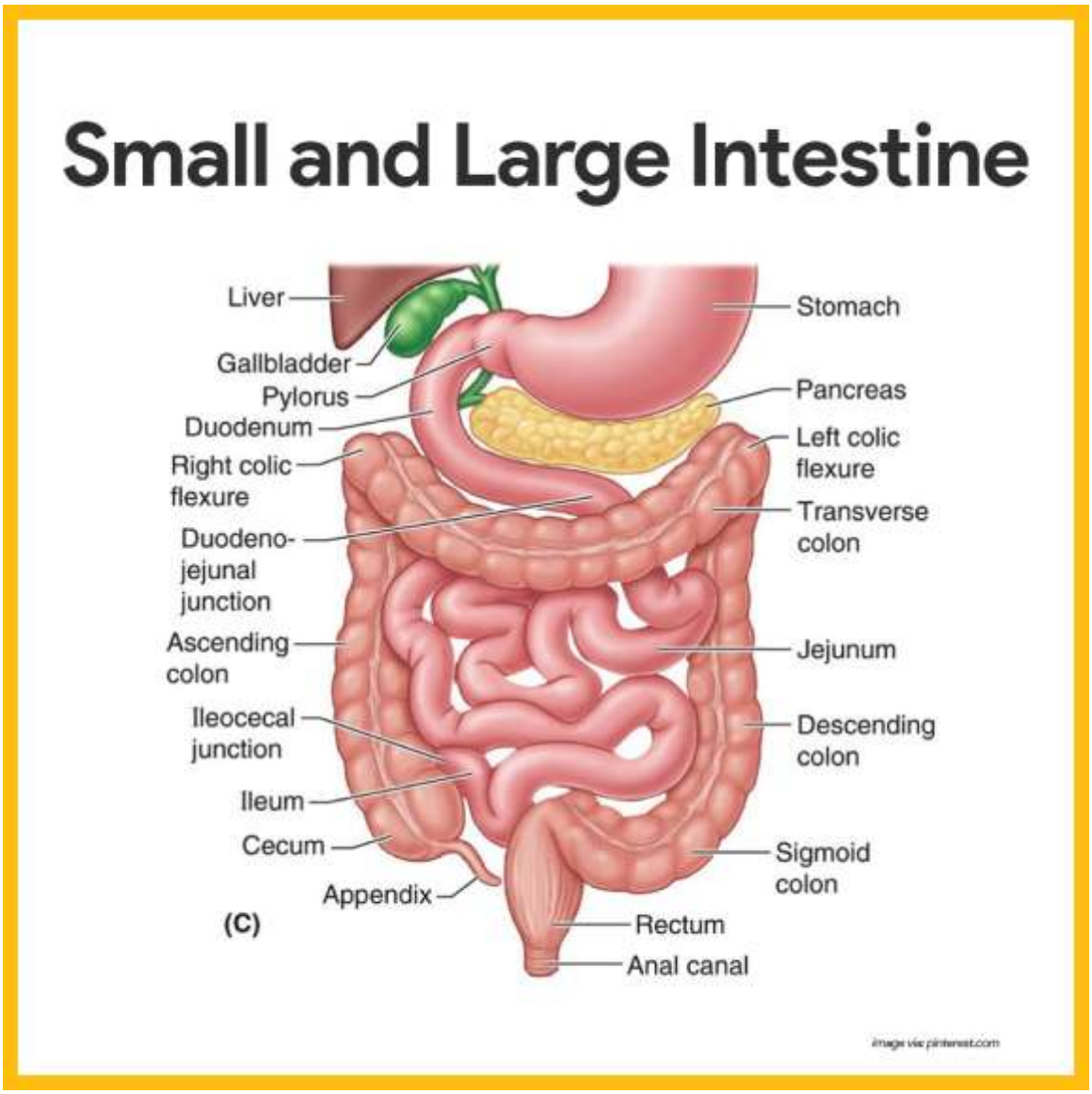
sides and under surface of the tongue to the gum lining the inner aspect of the mandible. It receives the secretion from the **submandibular and sublingual salivary glands.**



The pharynx is that part of the digestive tube which is placed behind the nasal cavities, mouth, and larynx. It is conical in form, with the base upward, and the apex downward, extending from the under surface of the skull to the level of the cricoid cartilage in front, and that of the sixth cervical vertebra behind.

The esophagus is a muscular canal, about 23 to 25 cm. long, extending from the pharynx to the stomach. It begins in the neck at the lower border of the cricoid cartilage, opposite the sixth cervical vertebra, descends along the front of the vertebral column, passes through the diaphragm, and, entering the abdomen, ends at the cardiac orifice of the stomach.

The stomach is the most dilated part of the digestive tube, and is situated between the end of the esophagus and the beginning of the small intestine. It has anterior and posterior surfaces, greater and lesser curvatures.



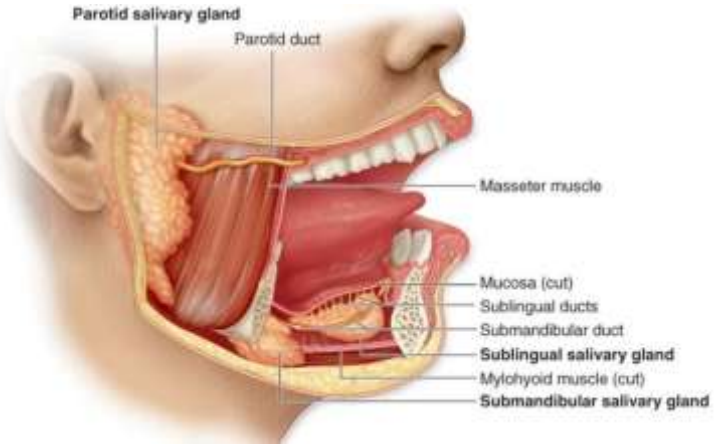
The small intestine is a convoluted tube, where it ends in the large intestine. It is about 7 meters long. It is contained in the central and lower part of the abdominal cavity. The small intestine divided into three portions: the duodenum, the jejunum, and the ileum.

Large intestine:

the colon consists of four sections: the ascending colon, the transverse colon, the descending colon, and the sigmoid colon. The cecum, colon, rectum and anal canal make up the large intestine.

Accessory organs of digestive system:

Salivary Glands: **There are three pairs of salivary glands:**

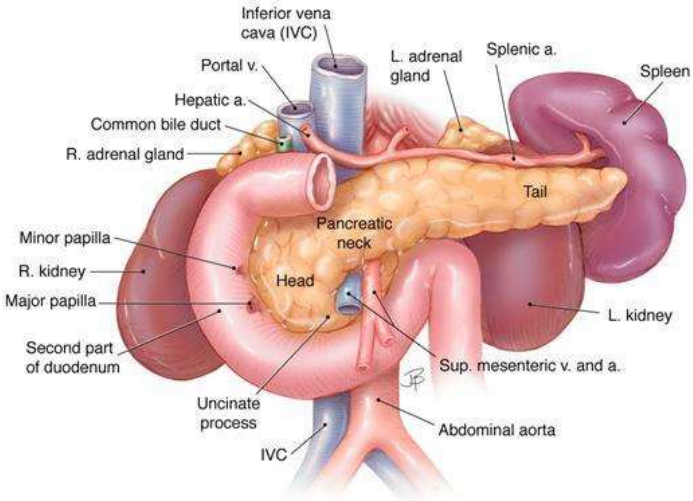


parotid glands (the largest of the salivary glands is located one in each cheek between the ear and the lower jaw)

submandibular glands (also called submaxillary glands on the floor of the mouth)

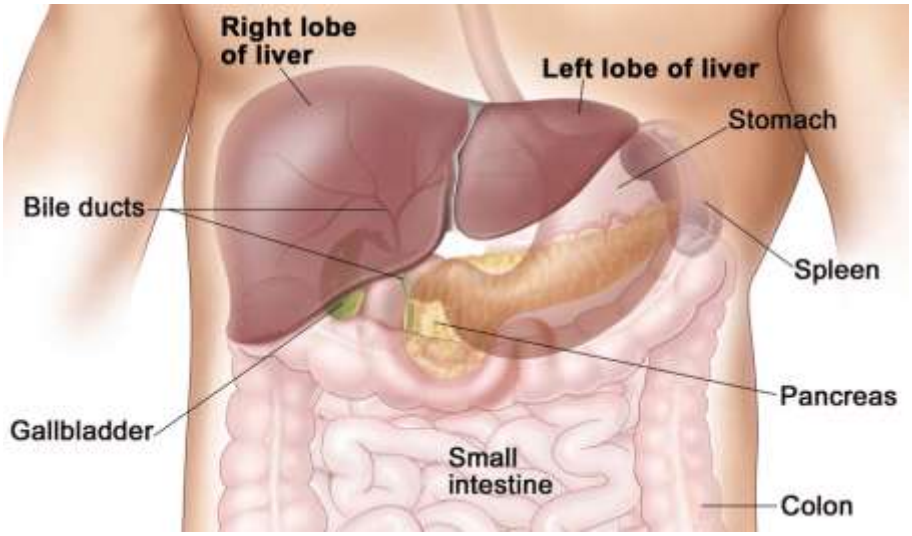
sublingual glands (in front of the **submandibular glands** under the **tongue**)

Pancreas



A carrot-shaped gland located behind and under the stomach, the pancreas acts both as **an endocrine gland** and **an exocrine gland**. pancreas has **head, body, and tail**. The head lies near the duodenum and the tail extends to the hilum of the spleen.

Liver

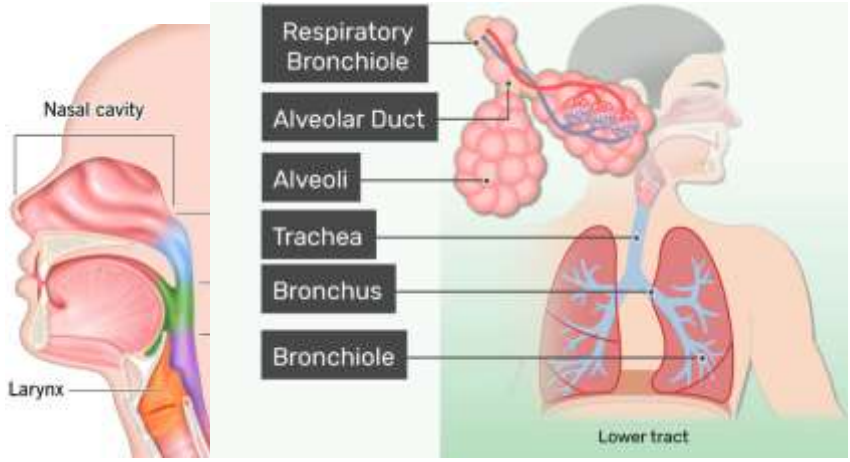


It is the largest gland of the human body , located in the upper right portion of the abdominal cavity, beneath the diaphragm, and on the top of the **stomach, right kidney, and intestines.**

Gallbladder

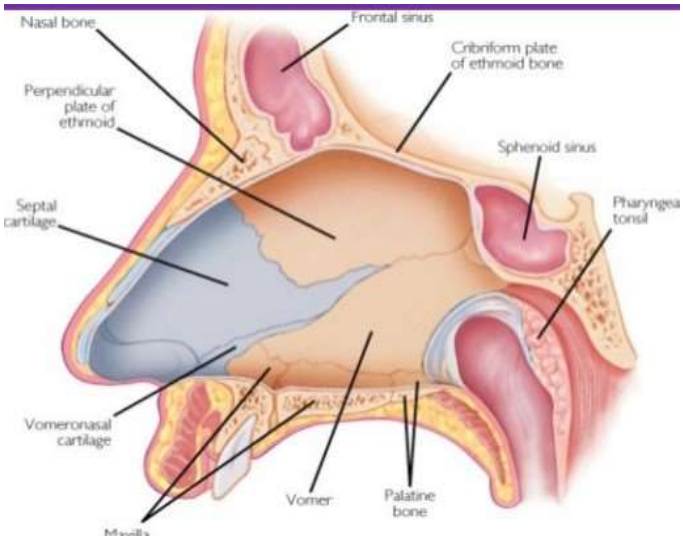
The gallbladder is a small organ located just below the liver. It is about 3 inches long and shaped like a hollow balloon. Its main function is to store bile produced by the liver.

Respiratory system

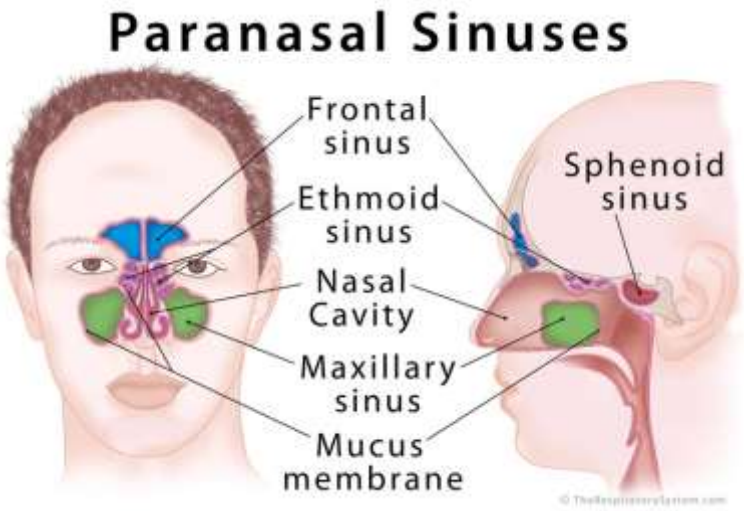


Anatomically, respiratory tract is divided into **upper** (**nose, pharynx and larynx**) and **lower respiratory tract** (**trachea, bronchi, bronchioles, alveolar duct and alveoli**).

NOSE: The external portion is supported by a framework of **bone and cartilage** covered with **skin** and lined with **mucous membrane**. **External nares** opening to exterior.

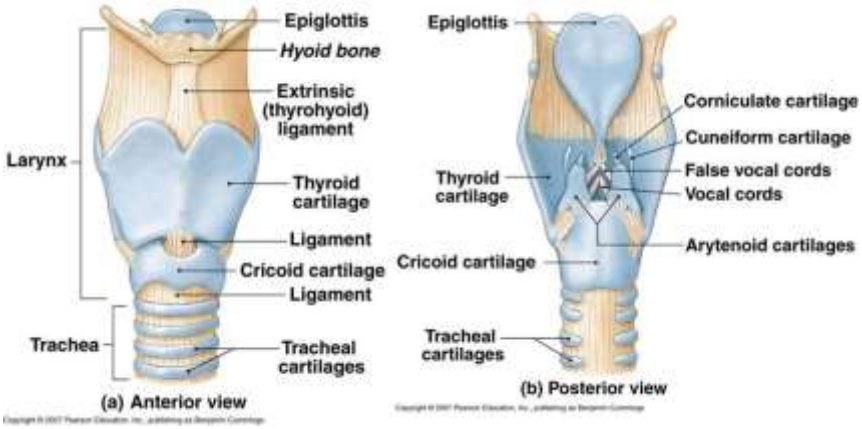


NASAL CAVITY: The internal portion is a large cavity in the skull, communicating with the **pharynx posteriorly** [**Internal nares** opening to **pharynx**]. It divided medially by the **nasal septum**.



PARANASAL SINUSES: Four bones of the skull contain paired air spaces called the paranasal sinuses - **frontal, ethmoidal, sphenoidal, maxillary**. Add resonance to voice. Communicate with the nasal cavity by ducts.

PHARYNX: is a funnel-shaped tube about 13 cm long that starts at the internal nares and extends to the level of the cricoid cartilage. Pharynx is divided into three regions – Nasopharynx - uppermost portion – Oropharynx - middle portion – Laryngopharynx - lowermost portion



LARNYX : Commonly called the voice box, is an organ in the neck involved in **breathing, sound production**, and **protecting the trachea against food aspiration**. It is about **5 cm** long.

Cartilages of larynx: • Nine cartilages form a framework of the larynx.

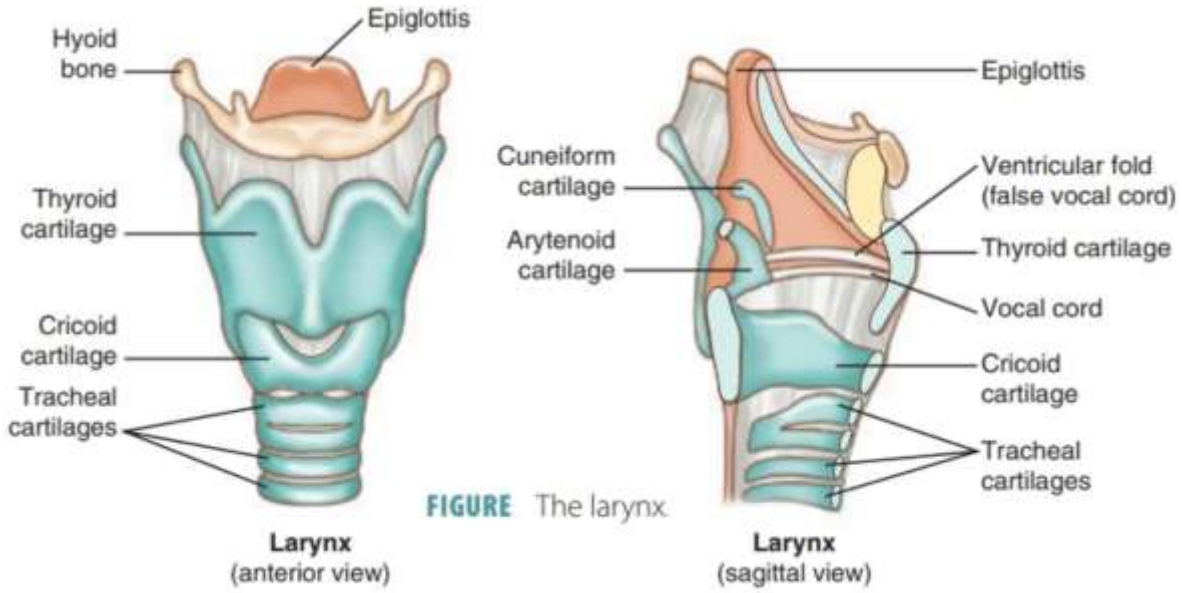
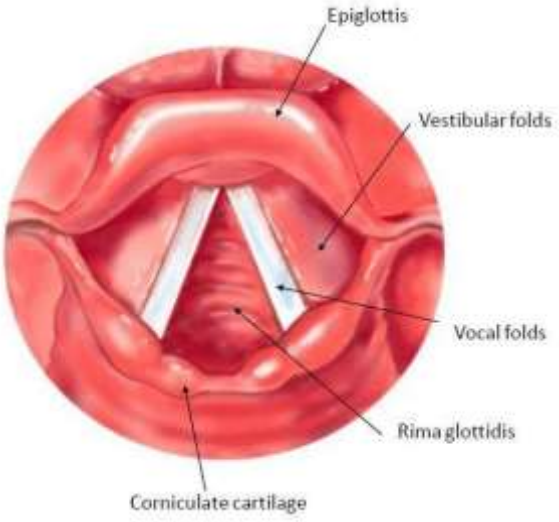


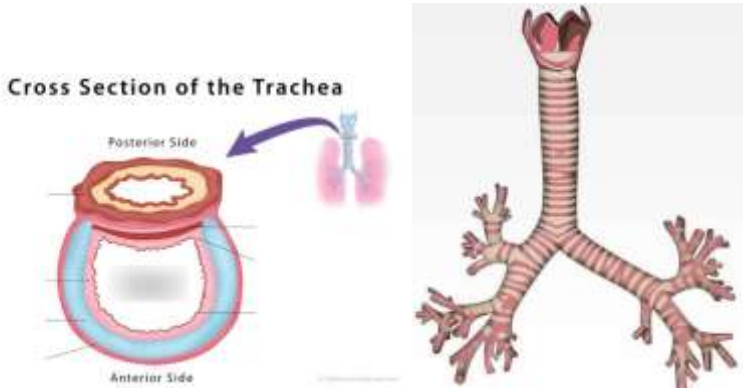
FIGURE The larynx

3 unpaired cartilages – **Thyroid cartilage – Cricoid cartilage – Epiglottis**

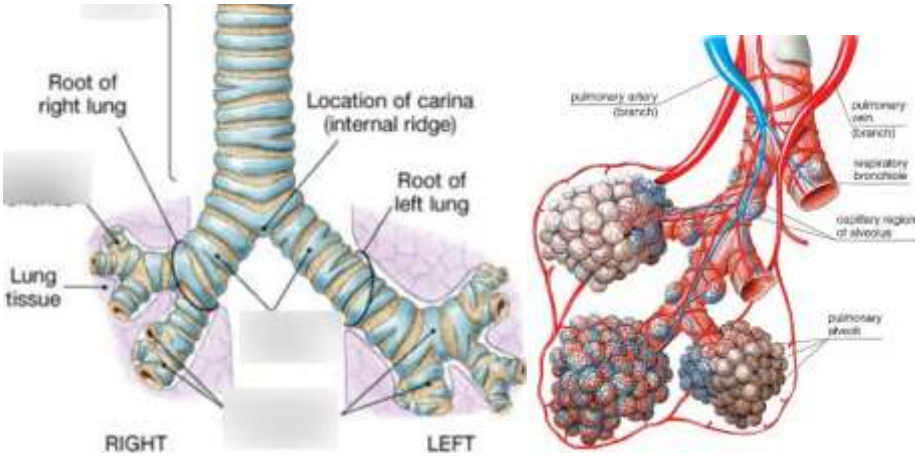
3 paired cartilages – **Arytenoid – Cuneiform – Corniculate cartilages**



Vocal folds • The mucous membrane of the larynx forms two pairs of folds. A superior pair called (false vocal cords) and an inferior pair called (true vocal cords). **Vocal cords** contain elastic fibers and are responsible for the sounds production, which are created when air is forced between these folds, causing them to vibrate from side to side. This action generates sound waves, which can be formed into words by changing the shapes of the pharynx and oral cavity and by using tongue and lips.



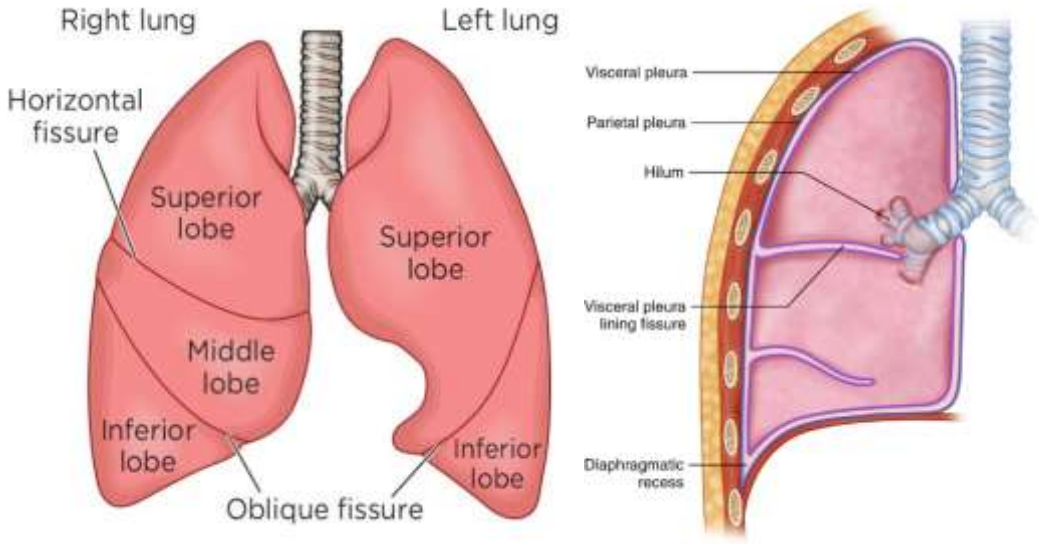
TRACHEA: is a cartilaginous and membranous tube, it measures about 13 cm in length. Extends through the mediastinum and lies anterior to the esophagus. It extends from the lower part of the larynx, on a level with the sixth cervical vertebra, to the upper border of the fifth thoracic vertebra, where it divides into the two main bronchi, one for each lung. The trachea being flattened posteriorly lined by trachealis muscle. Anterior and lateral walls of the trachea supported by 15 to 20 C-shaped tracheal cartilages. Cartilage provide rigidity to the tracheal wall.



Right primary bronchus is shorter, wider, and more vertical than the left primary bronchus. The left lung has two secondary bronchi. The right lung has three secondary bronchi. They further divide into tertiary bronchi.

Bronchial tree: It is a highly branched system of air-conducting passages that originate from the left and right primary bronchi.

Alveoli: They have a thin wall specialized to promote diffusion of gases between the alveolus and the blood in the pulmonary capillaries.



The lungs: are a pair of cone-shaped organs made up of spongy, pinkish-gray tissue. They take up most of the space in the thorax (the part of the body between the root of the neck and diaphragm, on each sides of mediastinum).

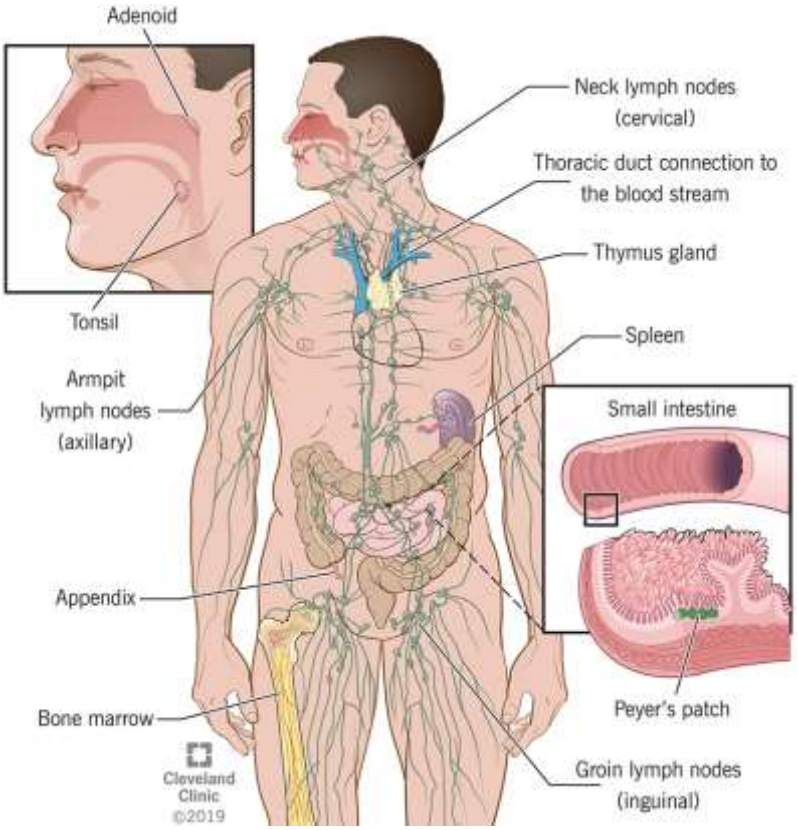
Left lung • Divided into 2 lobes by oblique fissure [Superior lobe and Inferior lobe] Smaller than the right lung •

Right lung • Divided into 3 lobes by oblique and horizontal fissures [Superior lobe, Middle lobe and Inferior lobe] •

The lungs are enveloped in a membrane called the pleura.

The pleura: is a serous membrane consist of two layers. The thin space between the two pleural layers is known as the pleural cavity; it normally contains a small amount of pleural fluid. The outer pleura (parietal pleura) is attached to the chest wall. The inner pleura (visceral pleura) covers the lungs.

Lymphatic system



Lymphatic System

The lymphatic system consists of lymphatic tissues [organs] and lymphatic vessels. Lymphatic tissues are a type of connective tissue that contains large numbers of lymphocytes. Lymphatic tissue is organized into the following organs or structures: the thymus, the lymph nodes, the spleen, tonsils and the lymphatic nodules Lymphatic tissue is essential for the immunologic defenses of the body against bacteria and viruses.

Lymphatic vessels are tubes that assist the cardiovascular system in the removal of tissue fluid from the tissue spaces of the body; the vessels then return the fluid to the blood.

Lymph is the name given to tissue fluid once it has entered a lymphatic vessel.

Lymph capillaries are a network of fine vessels that drain lymph from the tissues. The capillaries are in turn drained by small lymph vessels, which unite to form large lymph vessels. Lymph vessels have a beaded appearance because of the presence of numerous valves along their course. The lymphatic vessels are found in nearly all the organs of the body except the following:

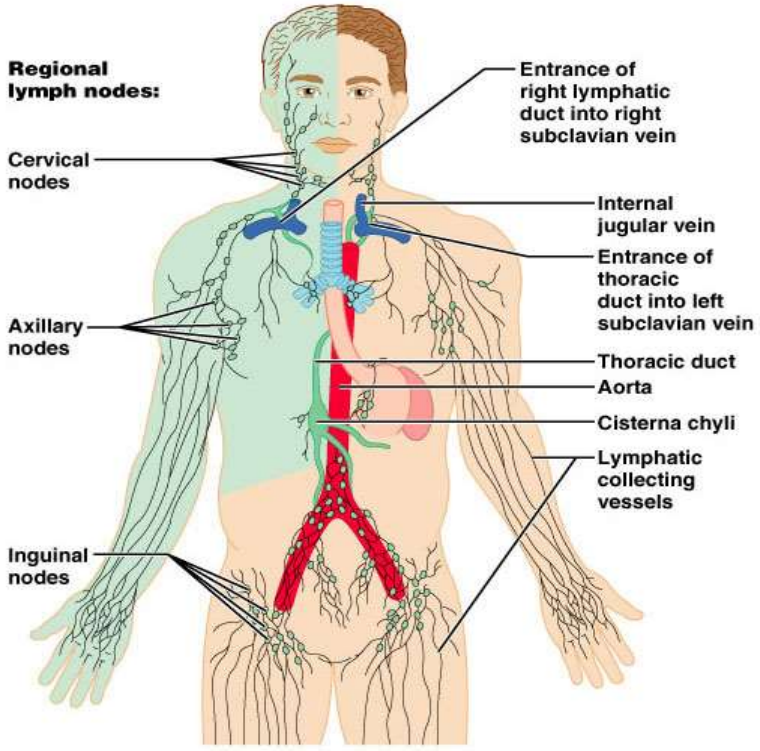
1/central nervous system

2/eye ball

3/internal ear

4/epidermis of the skin

5/cartilage.



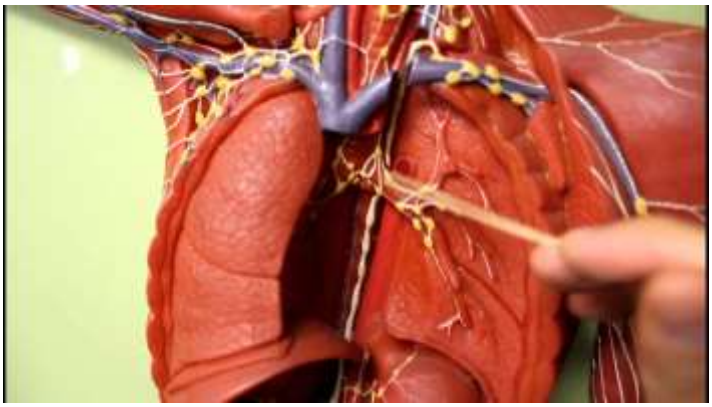
(a)

This system helps produce and distribute antibodies. When we have swelling of lymph nodes… this is when the lymph system is fighting a body infection.

Before lymph is returned to the bloodstream, it passes through at least one lymph node and often through several. The lymph vessels that carry lymph to a lymph

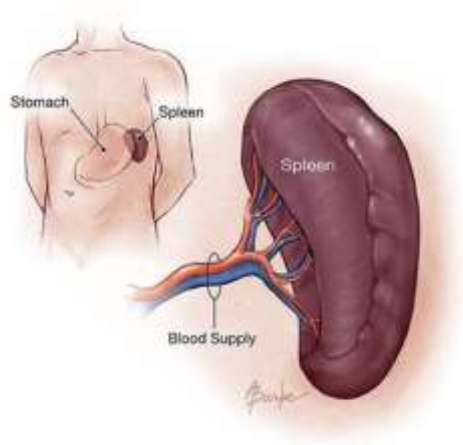
node are referred to as afferent vessels; those that transport it away from a node are efferent vessels. The lymph reaches the bloodstream at the root of the neck by large lymph vessels called the right lymphatic duct and the thoracic duct.

Lymph nodes



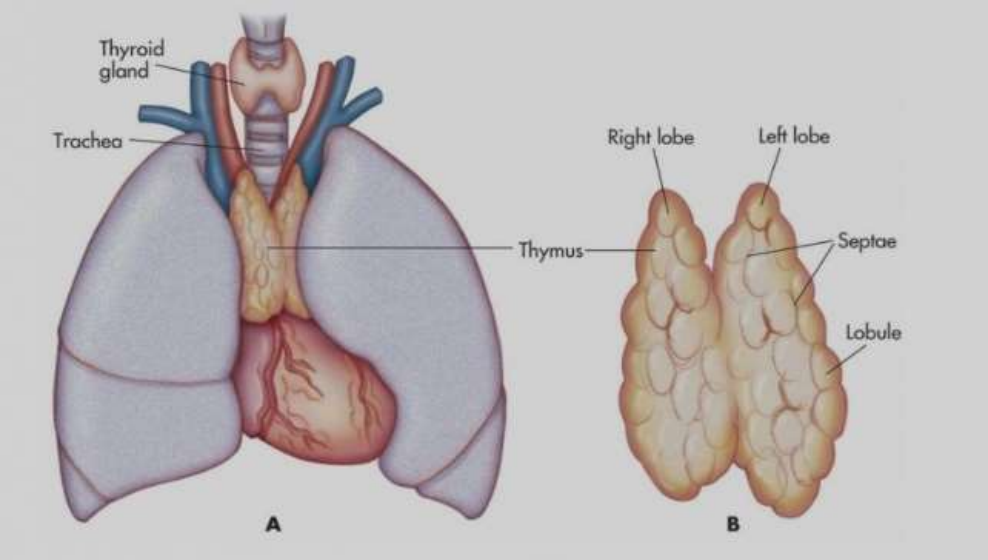
small bean-sized organs. They serve as filter stations for the lymph of a certain body region and contain specials cells of the immune system, the lymphocytes, which fight infections attacking the body. Hence, the lymph nodes clean the lymph and free it from pathogens and infectious bodies.

Spleen



It’s an organ situated in the upper left part of abdominal cavity. Its function is to removes old and damaged blood cells and microorganisms. Before birth, the spleen also helps producing blood cells. In early childhood, it plays a major role in building and maintaining the immune system.

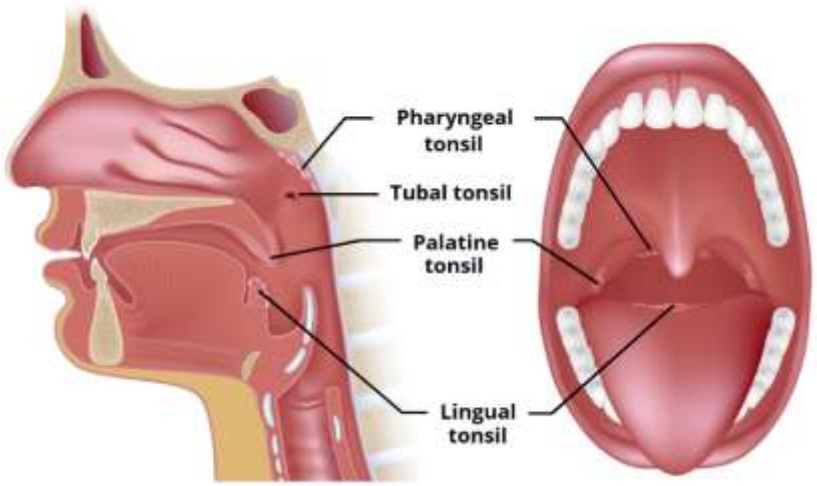
Thymus



It's a gland located behind the sternum. At birth, the thymus is the largest organ of the lymphatic system. The thymus considered as the „school "of T-lymphocytes, because it teaches this subgroup of lymphocytes to differentiate between the body's own and foreign cells. This means that in the thymus gland the T-lymphocytes learn and, thus, mature to be functional defense cells.

The organ keeps growing until puberty. In adults, it loses its size and its lymphatic tissue is mostly replaced by fat cells.

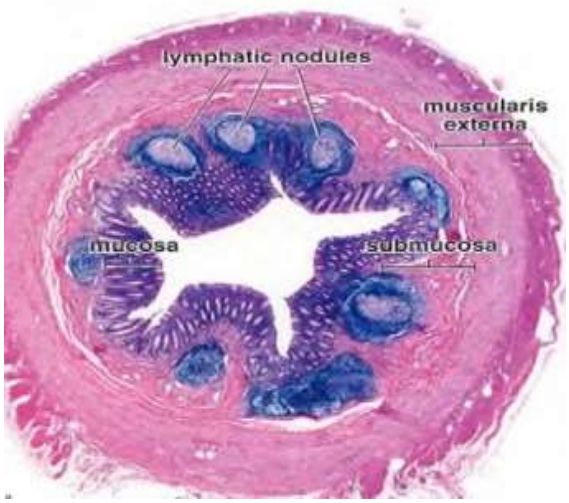
Tonsils



The tonsils are collections of lymphatic tissue located within the pharynx. They collectively form a ringed arrangement, known as Waldeyer's ring:

- Pharyngeal tonsil
- Tubal tonsils (x2)
- Palatine tonsils (x2)
- Lingual tonsil

Lymph nodule



Small, localized collection of lymphoid tissue, usually located in the loose connective tissue beneath mucous membranes, as in the digestive system, respiratory system, and urinary bladder.

Lymphocytes: the cells of the lymphatic system

the lymphocytes, are a subgroup of the white blood cells. They play a major role within the body's immune defense, because they are able to target and eliminate pathogens.

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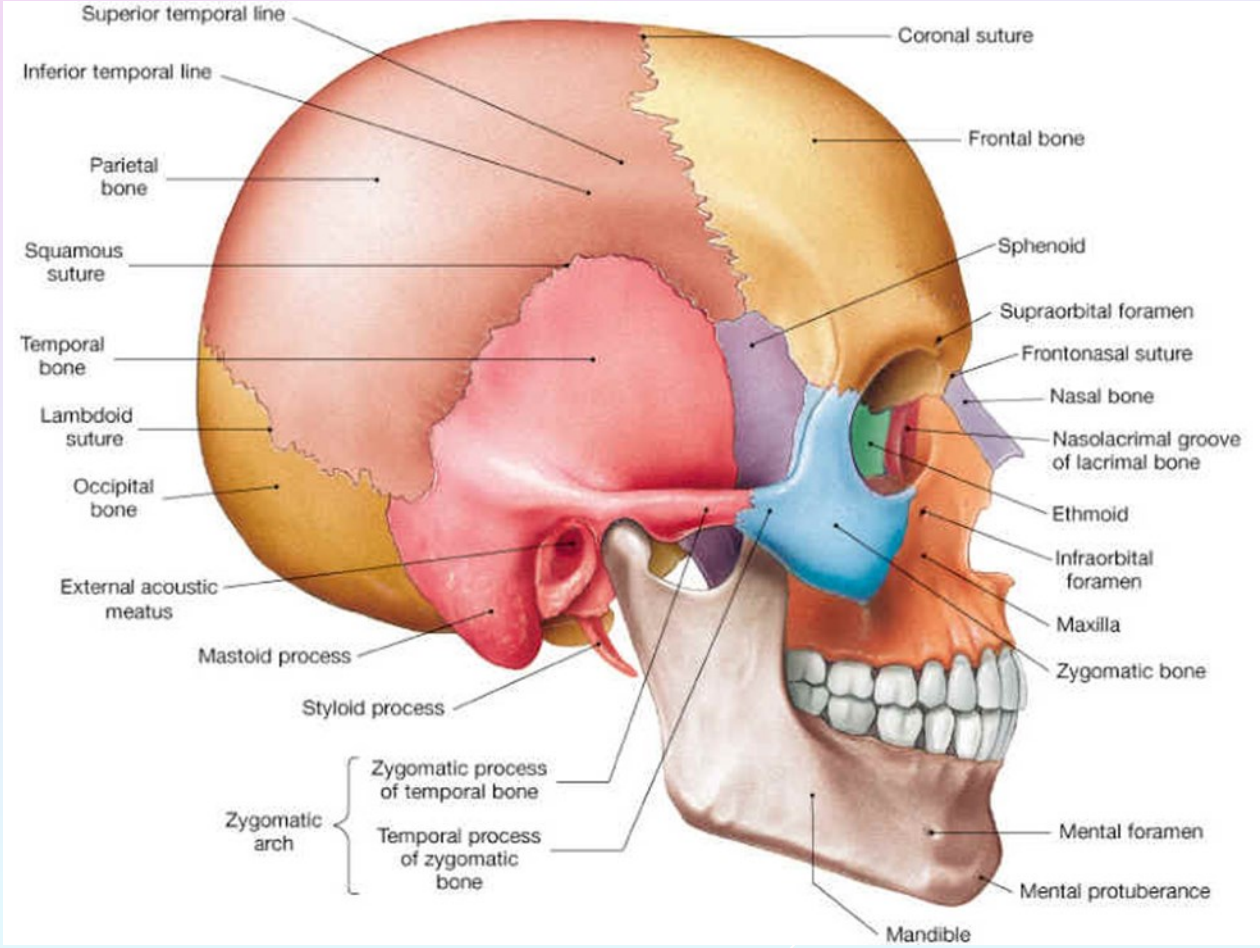
The skull is the most complex bony structure of the body, which is formed by the cranium and facial bones.

Cranium:

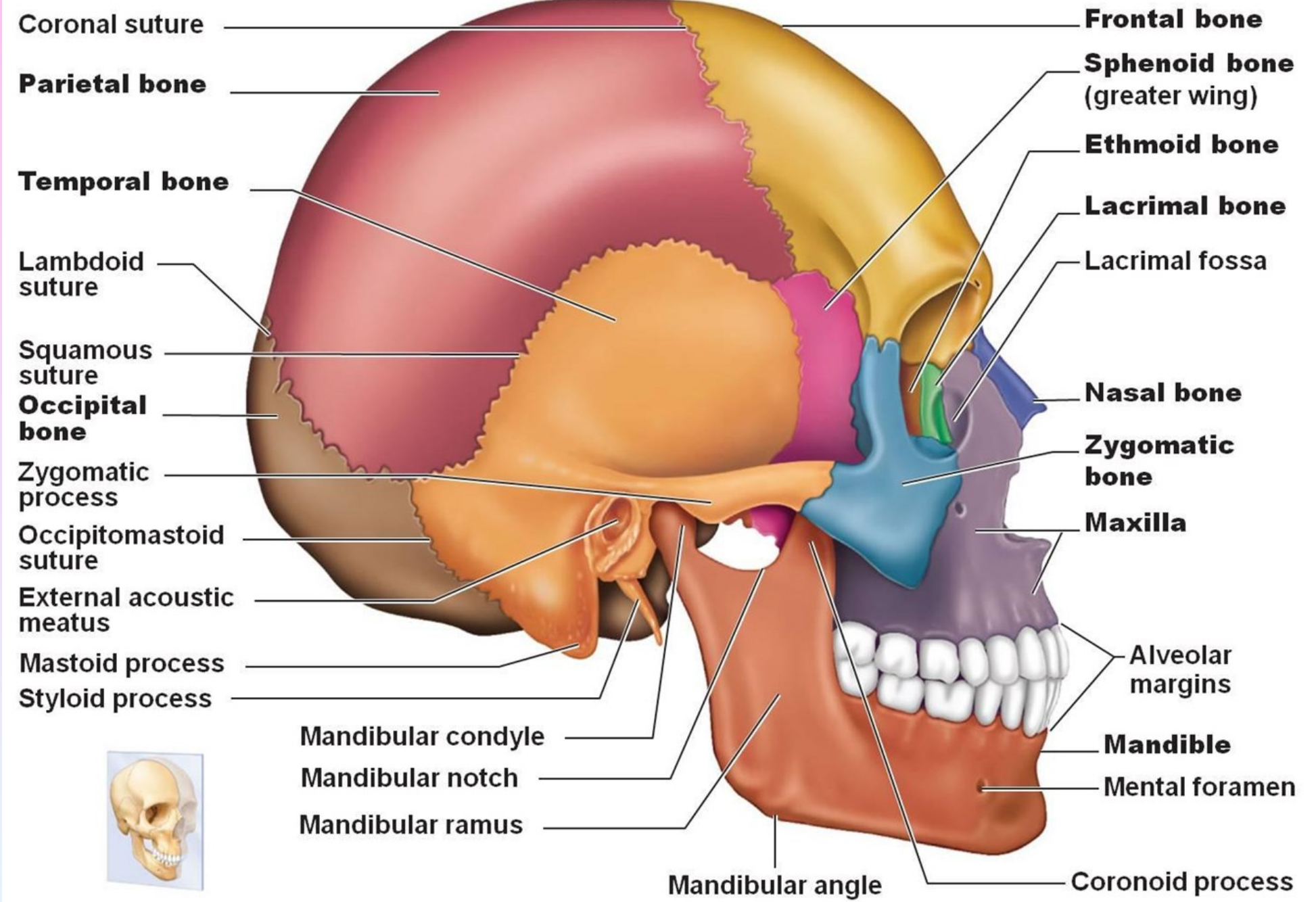
Formed from **eight** large bones Unpaired bones include: Occipital bone, Frontal bone, Sphenoid bone, Ethmoid bone

Paired bones include: Temporal bones, Parietal bones.

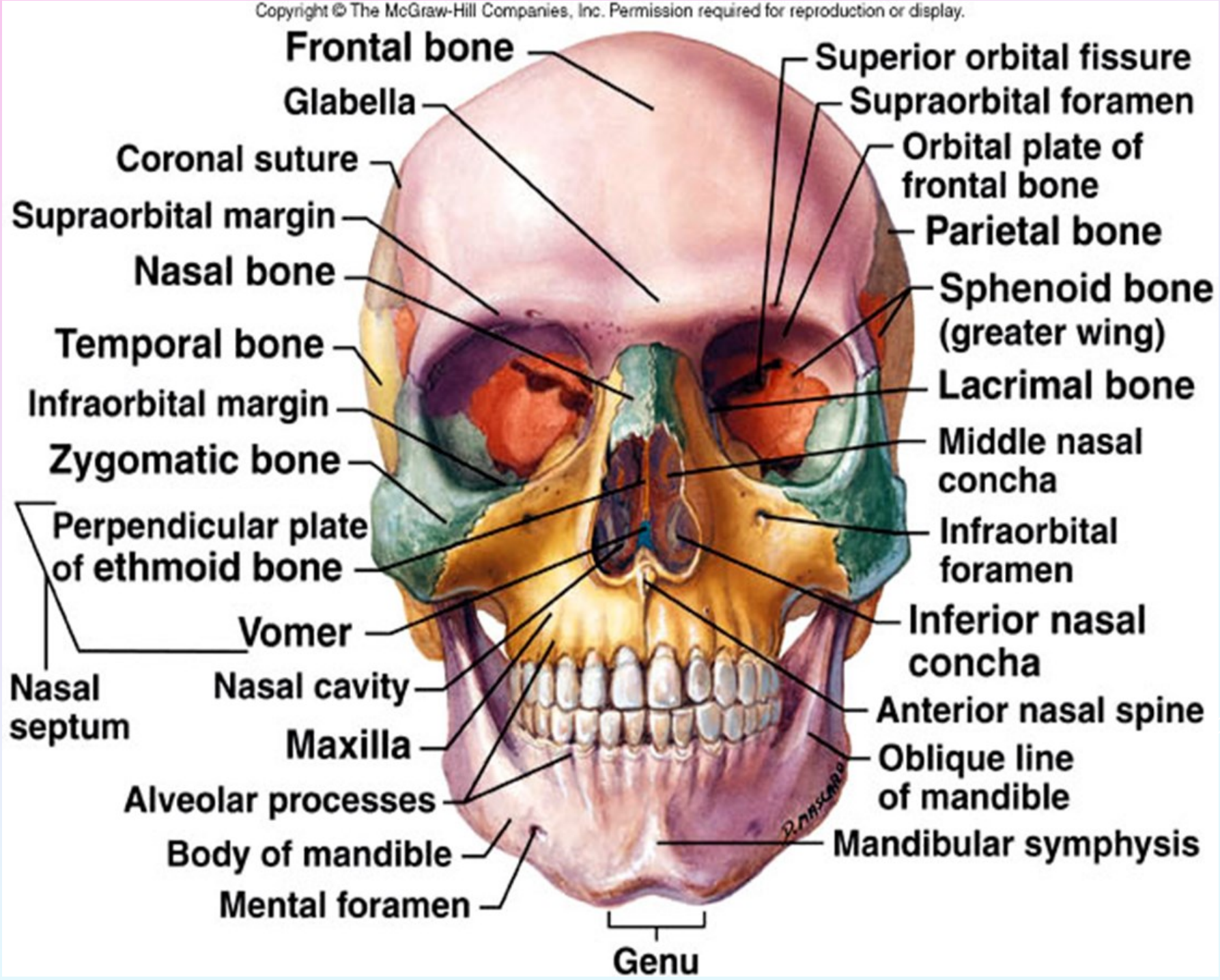


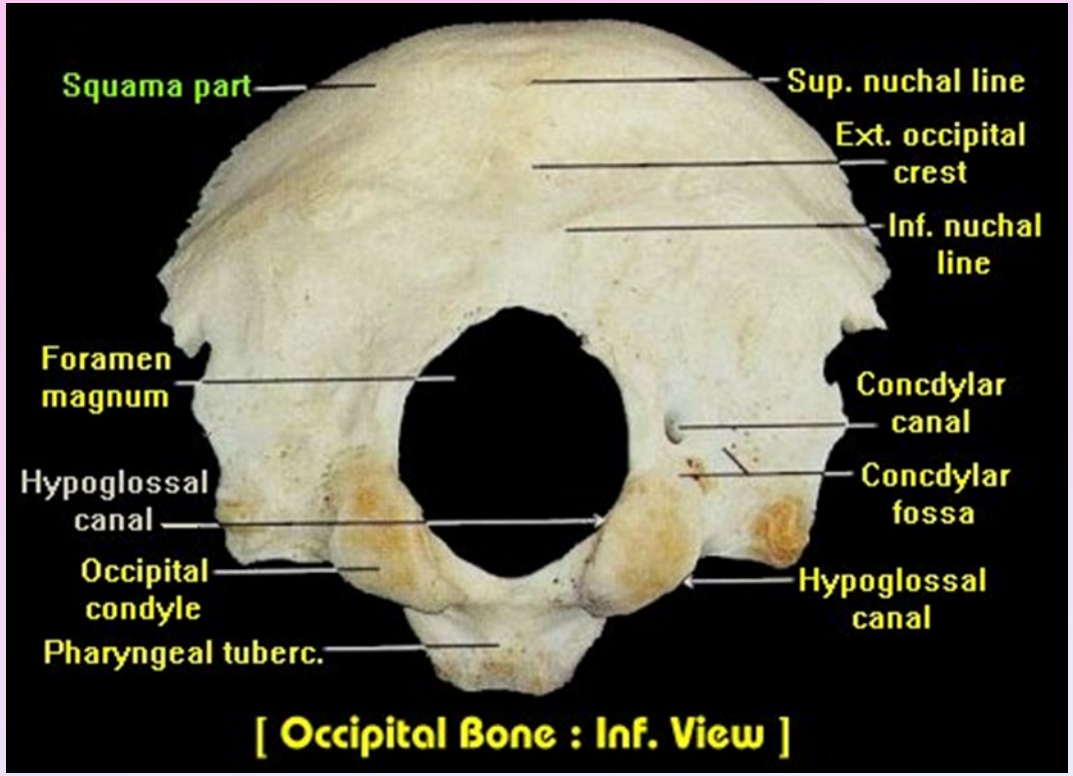
Facial Bones

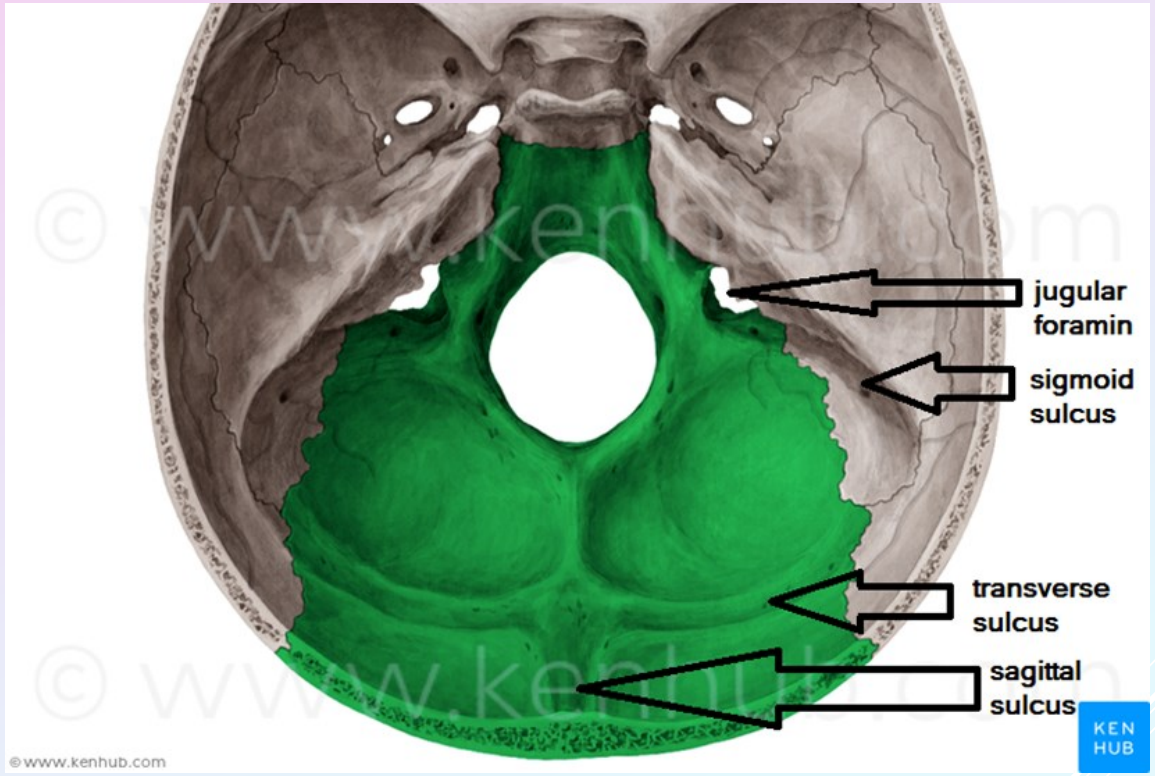
Facial skeleton is composed of **fourteen bones** of which only the mandible and vomer are unpaired. The paired bones are the maxillae, zygomatics, nasals, lacrimals, palatines, and inferior conchae.



(a) External anatomy of the right side of the skull

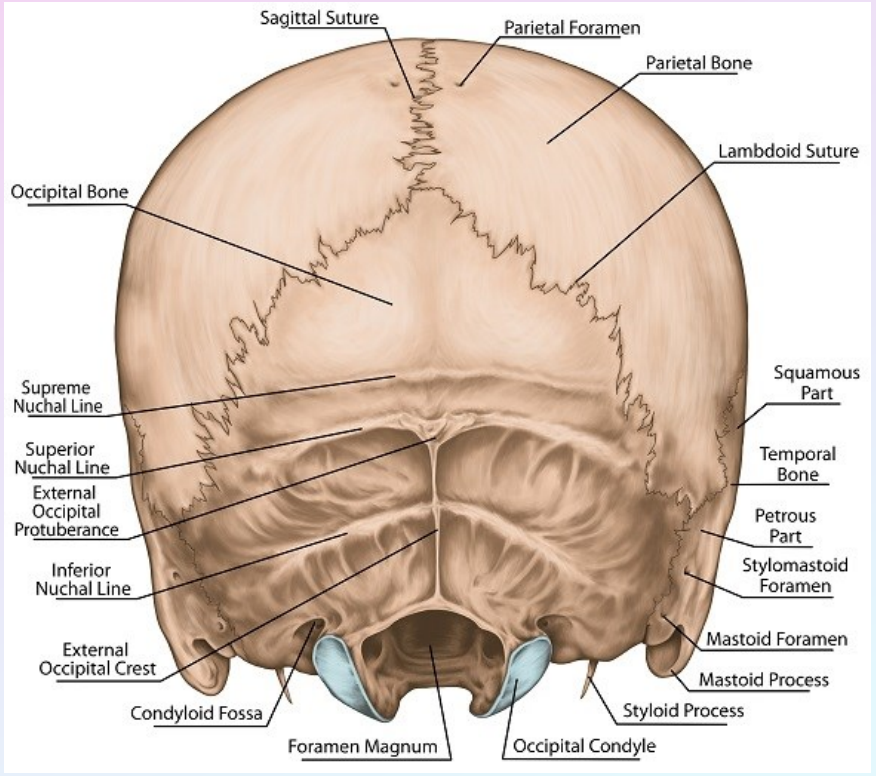






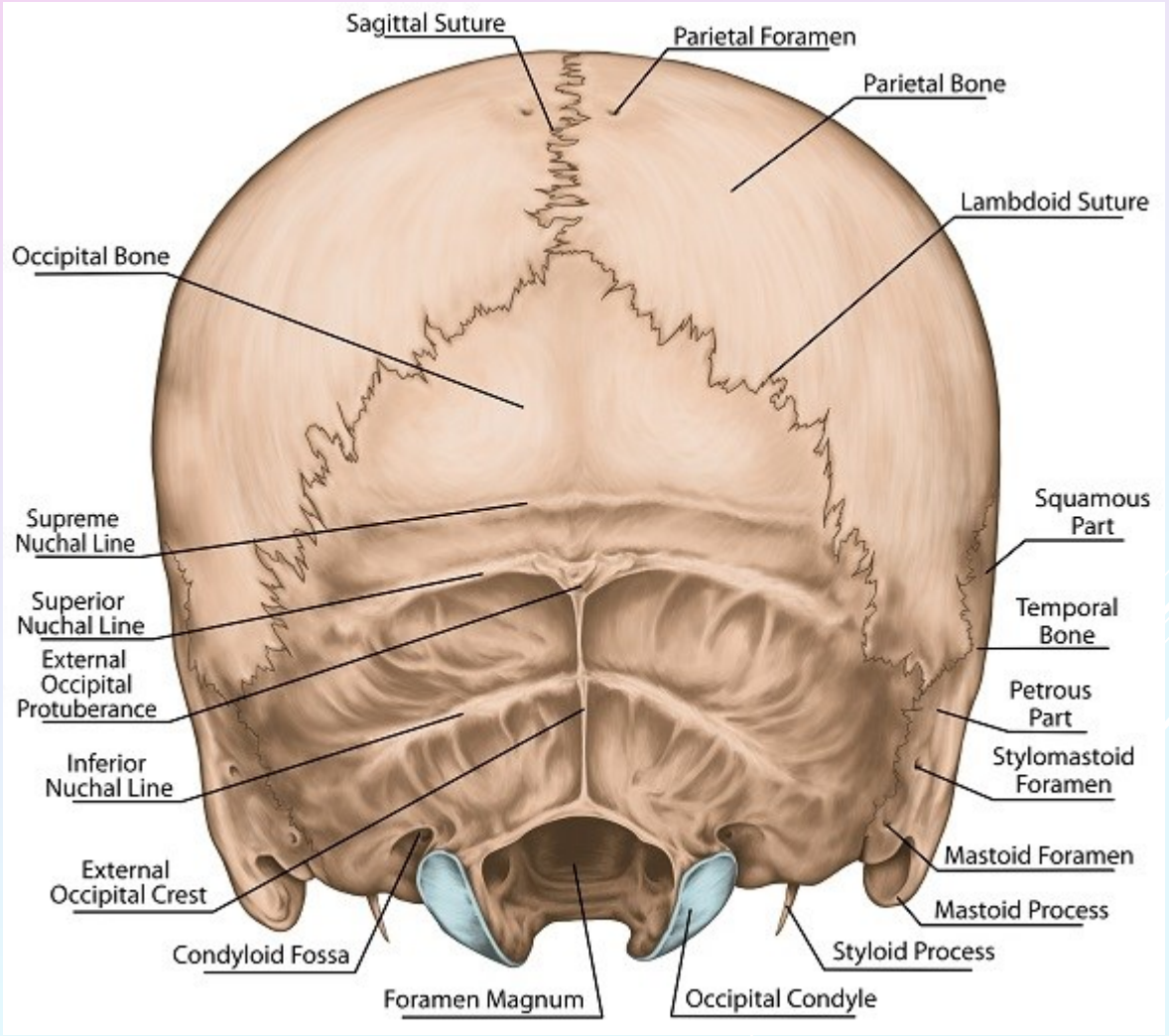
- **Occipital bone**

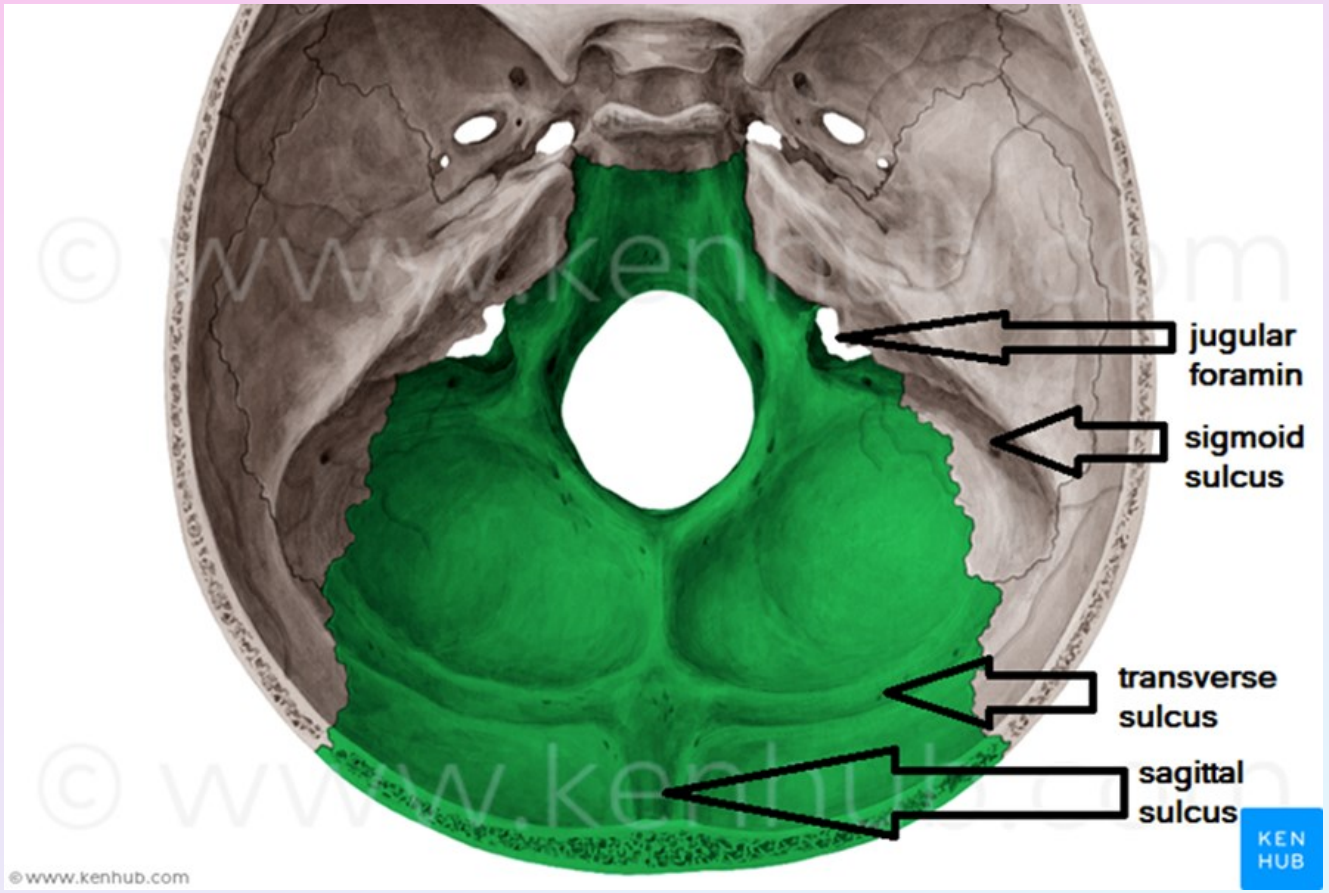
- It is the most posterior of the cranial bones forming the **posterior wall** and part of **base of the skull and most of posterior cranial fossa**. It is consist of two parts; **squamous part** and **basilar part**. In between these parts is the **foramen magnum** of the occipital bone through which passes the spinal cord. The squamous part lies posterior to the foramen magnum and the basilar part lies anterior to the foramen magnum.



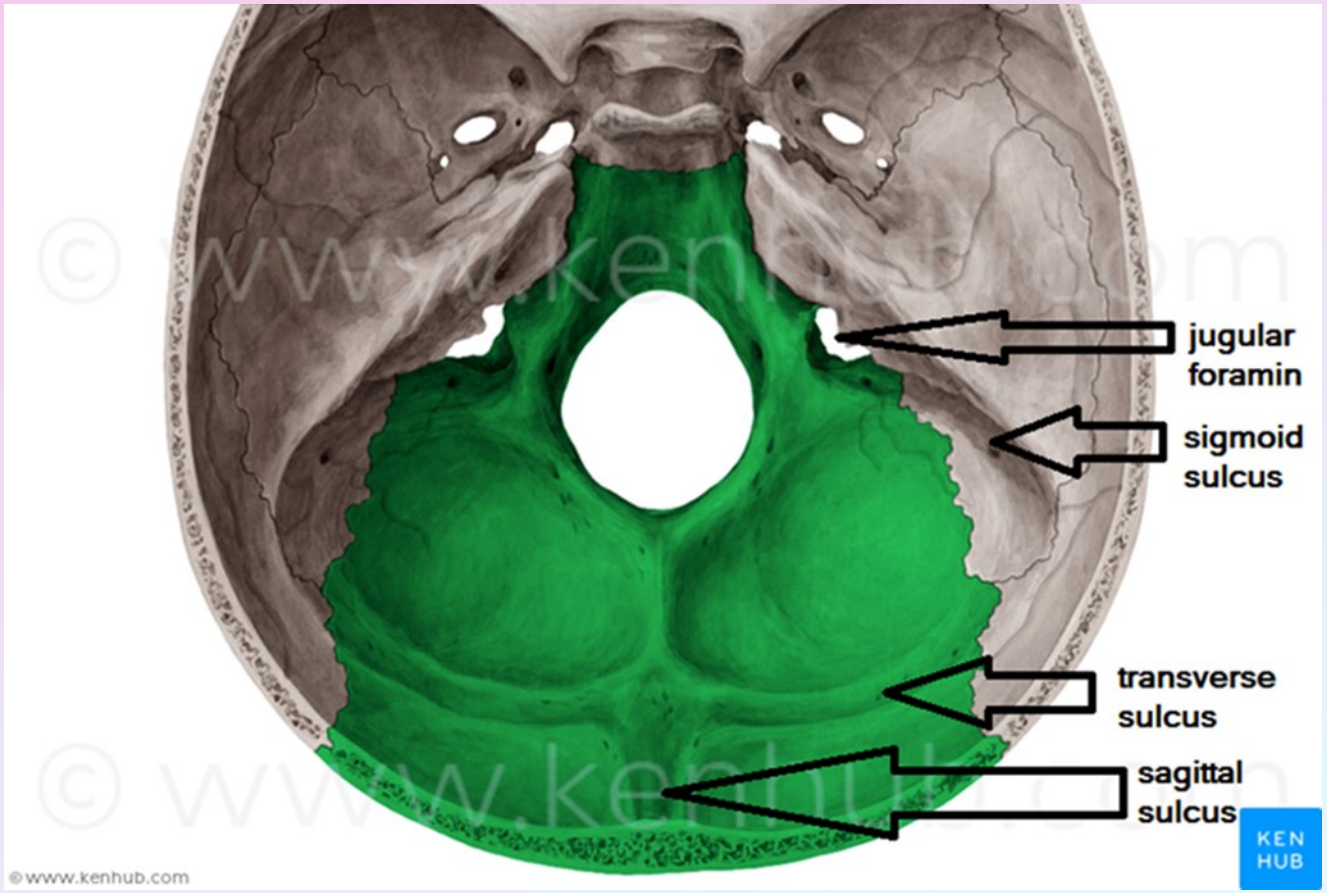
- On the inferior surface of the basilar part just anteriolateral to the foramen magnum lie two projections called as **occipital condyles** which project inferiorly and posteriorly. The occipital condyle make joint with the superior articular facets of the 1st cervical vertebrae called as **atlanto−occipital joint**. This joint transmits the weight of skull bones to the vertebral column and helps in making movements like when we say Yes (flexion anteriorly and posteriorly).

- On the posterior external part of the squamous part is the **external occipital protuberance** and on each sides lies two curve lines called as **superior nuchal line** and **inferior nuchal line**.

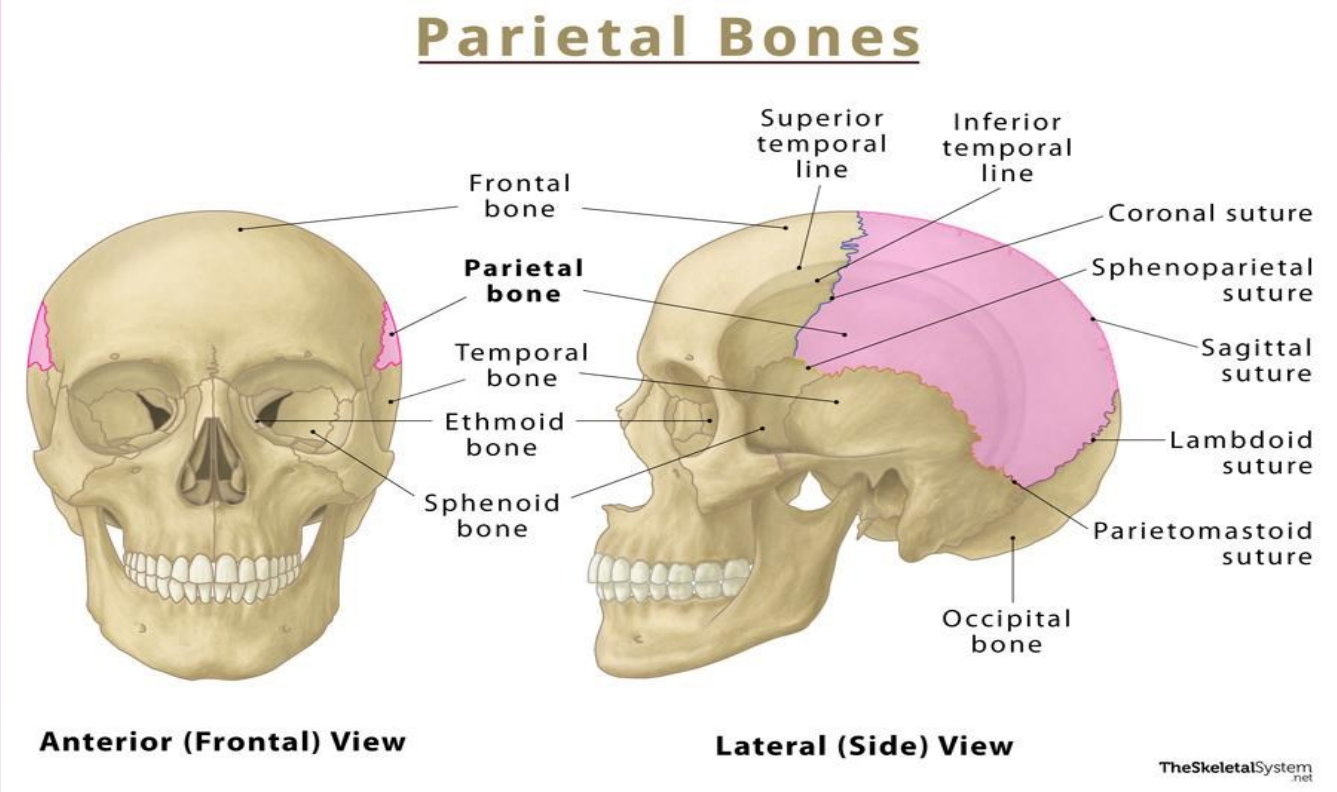




- Internally are sagittal and transverse sulci [continue with sigmoid sulci] which converge at confluence of sinuses. Internal occipital protuberance is also found in this area. Just anterior and lateral to the foramen magnum on both sides are the **hypoglossal canal** for the passage of hypoglossal nerve.

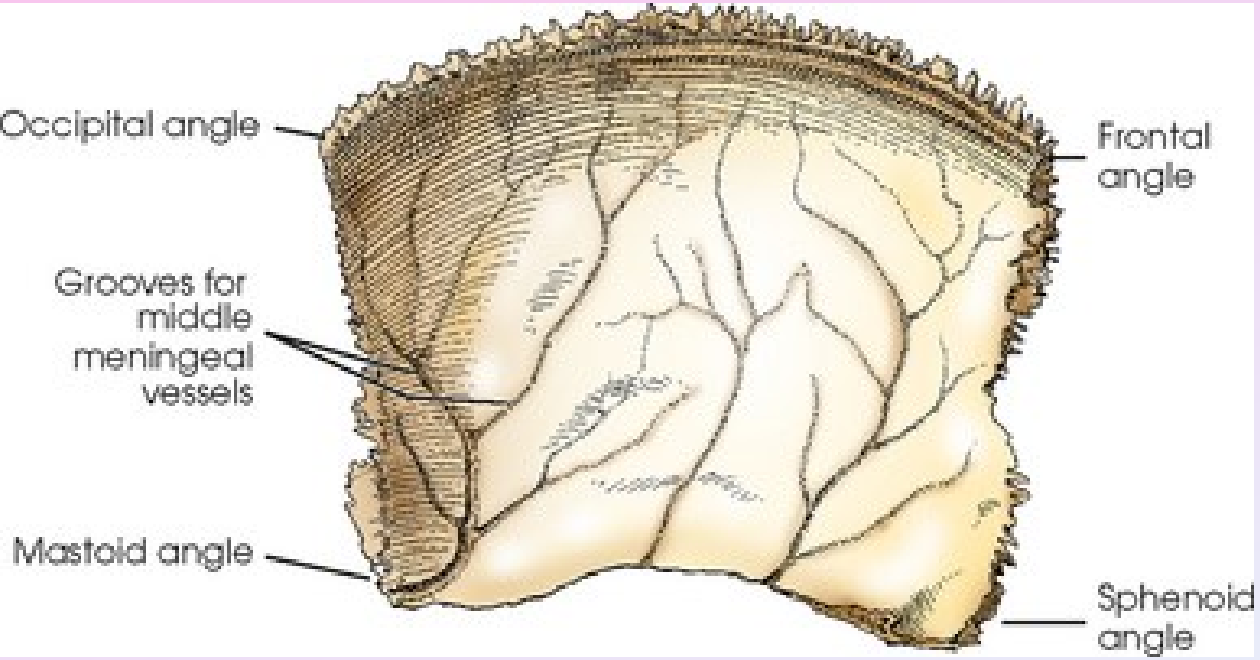


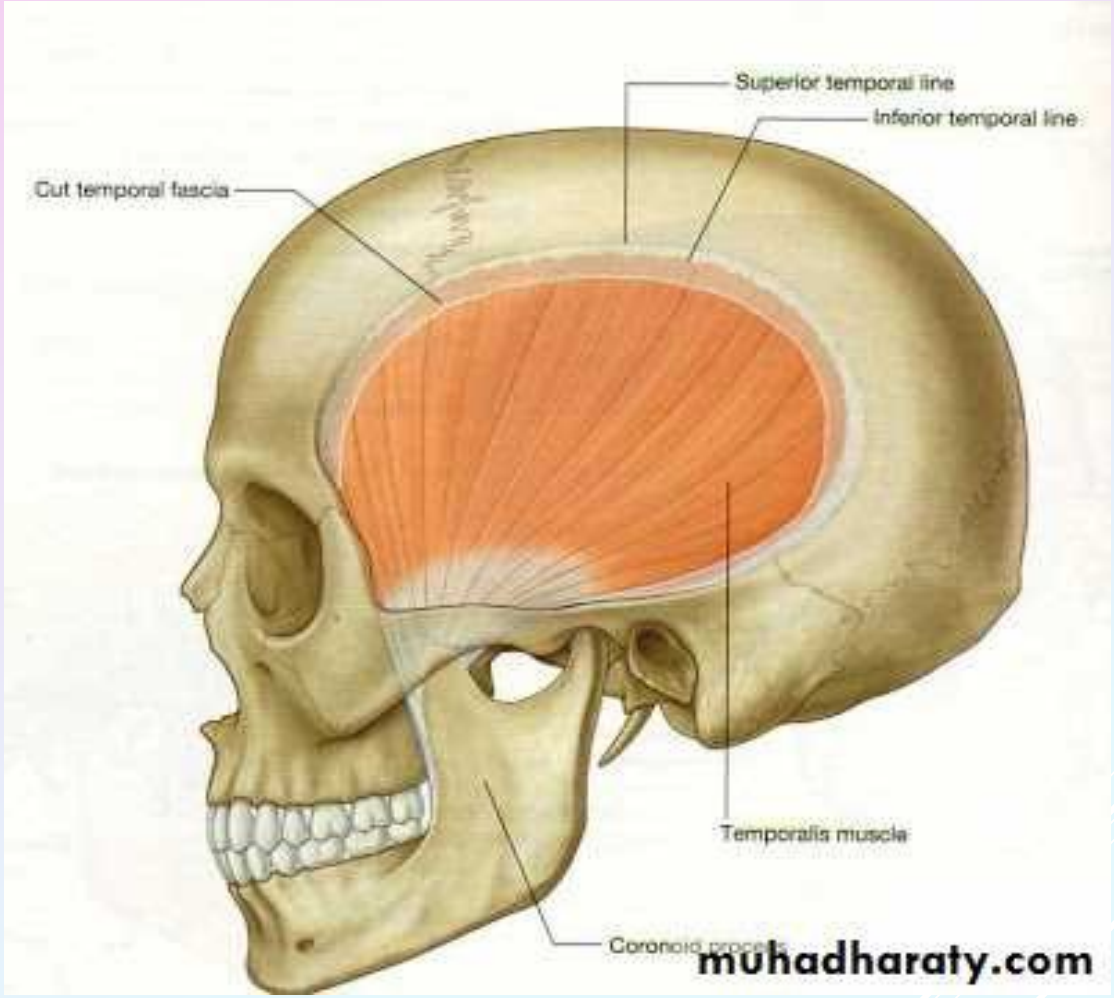
- The basilar part of the occipital bone attaches to the **sphenoid bone** and **petrous part of the temporal bone**. Laterally between the petrous part of the temporal bone and occipital bone lie the **jugular foramen** through which passes the 9th, 10th and 11th cranial nerves plus internal jugular vein. Occipital bone articulates with parietal bones by lambdoid suture.



- **Parietal bones**

- They form most of the **roof** and **part of lateral walls of the cranium**. Parietal bones articulate with the **frontal bone** anteriorly by **coronal suture**, posteriorly with occipital bone by **lambdoid suture** and laterally with the **temporal** and **sphenoid bones** through the **squamous sutures and articulate with each other by sagittal suture**.





- Parietal bones contain numerous grooves on its inferior surface for the passage of the blood vessels. On its external surface, laterally there are two lines for attachment of temporalis muscle, the superior and inferior temporal lines.

The end

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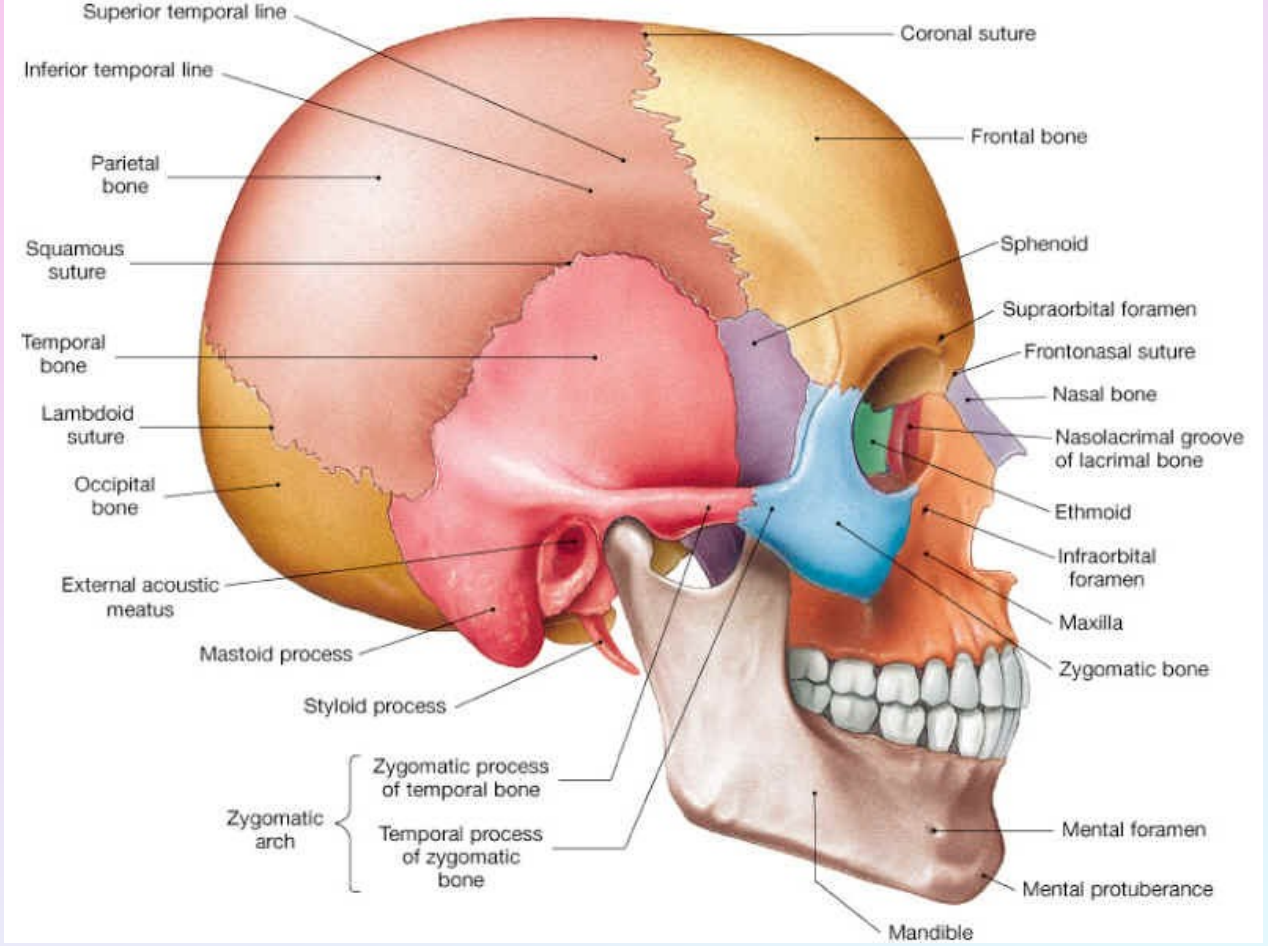
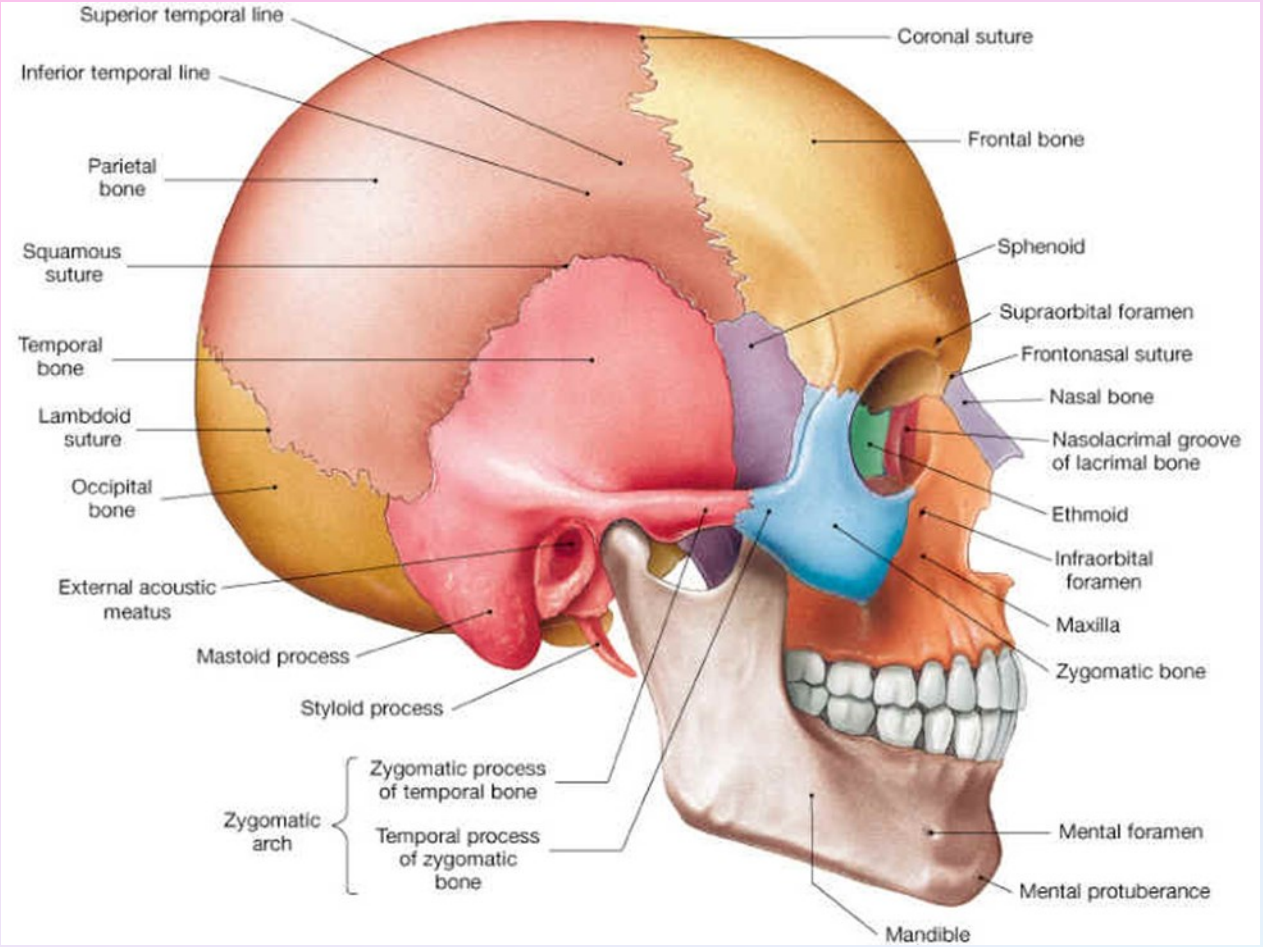
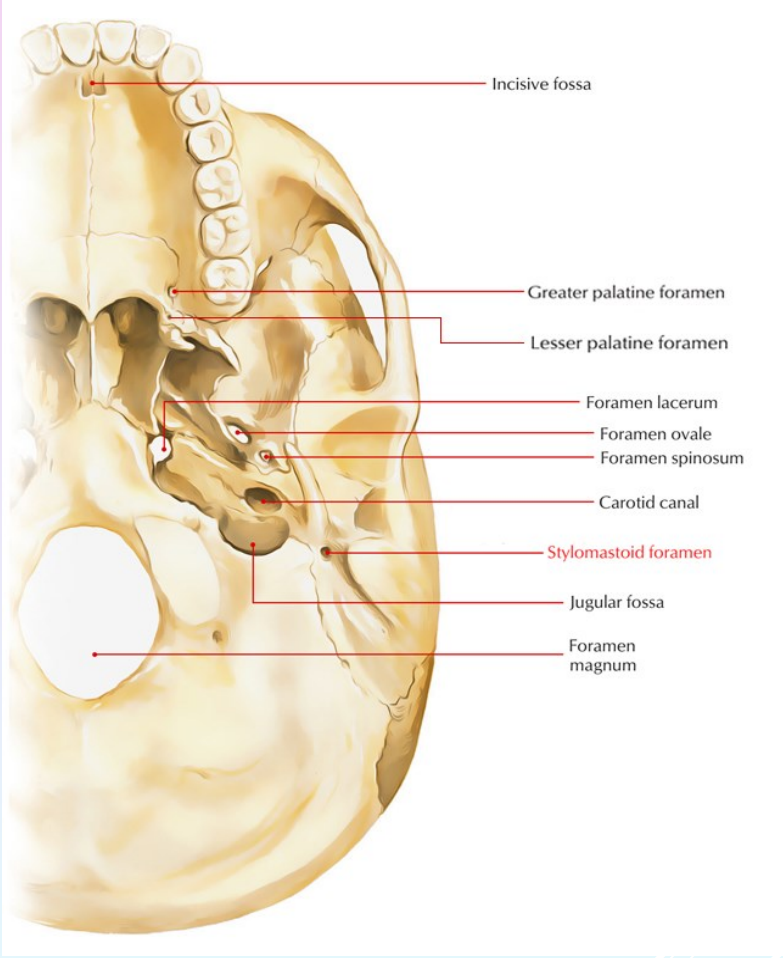


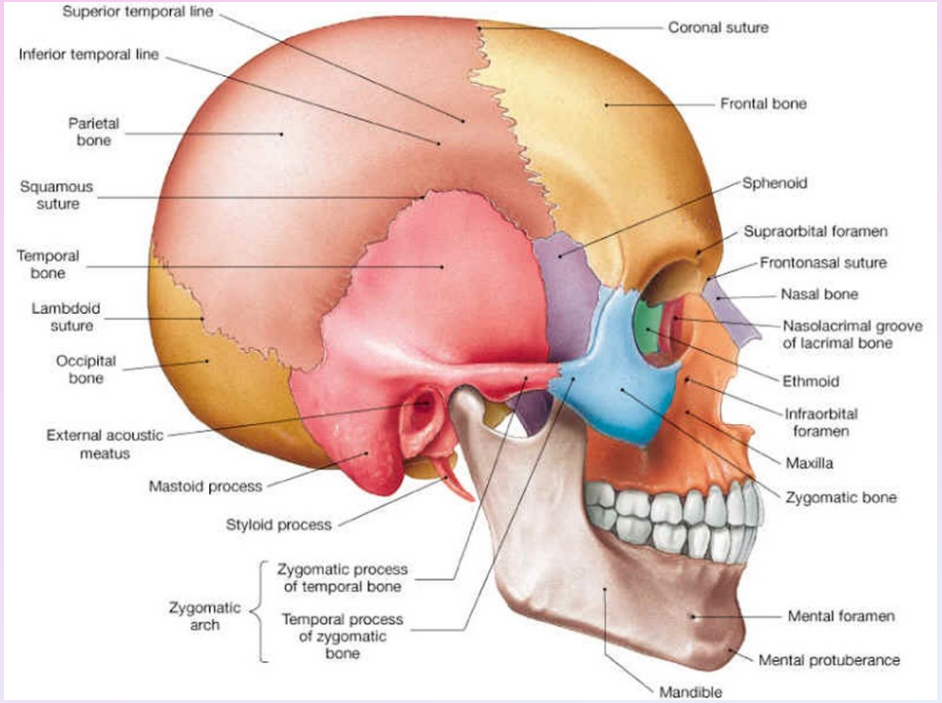
Temporal bones

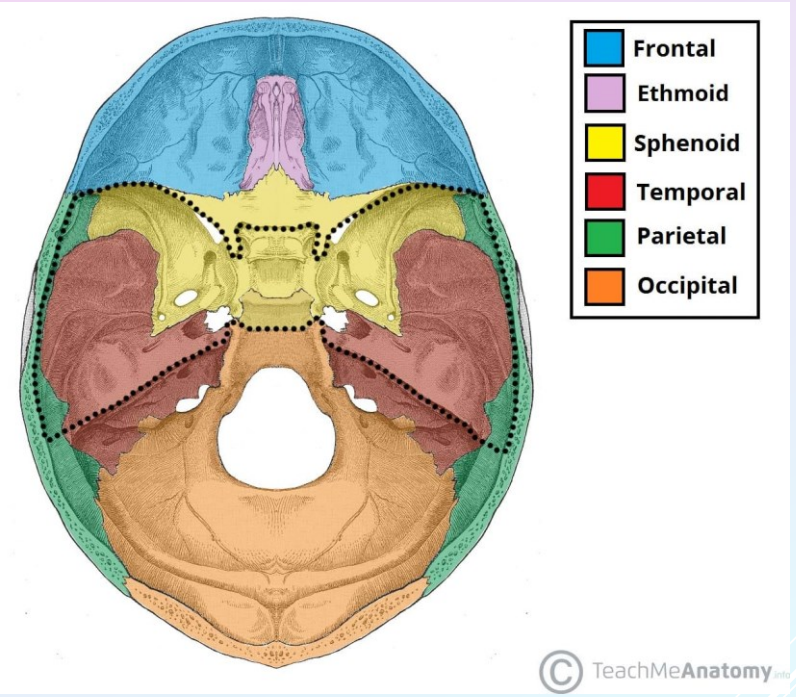
They form part of the **lateral walls** of the skull and part of base of skull. Anteriorly articulate with the **zygomatic bones**, medially with the **sphenoid bone** and posteriorly with the **occipital bone and superiorly with parietal bone**. Like the occipital bone it has two parts; **squamous part** which is flat and fun – like and project superiorly.





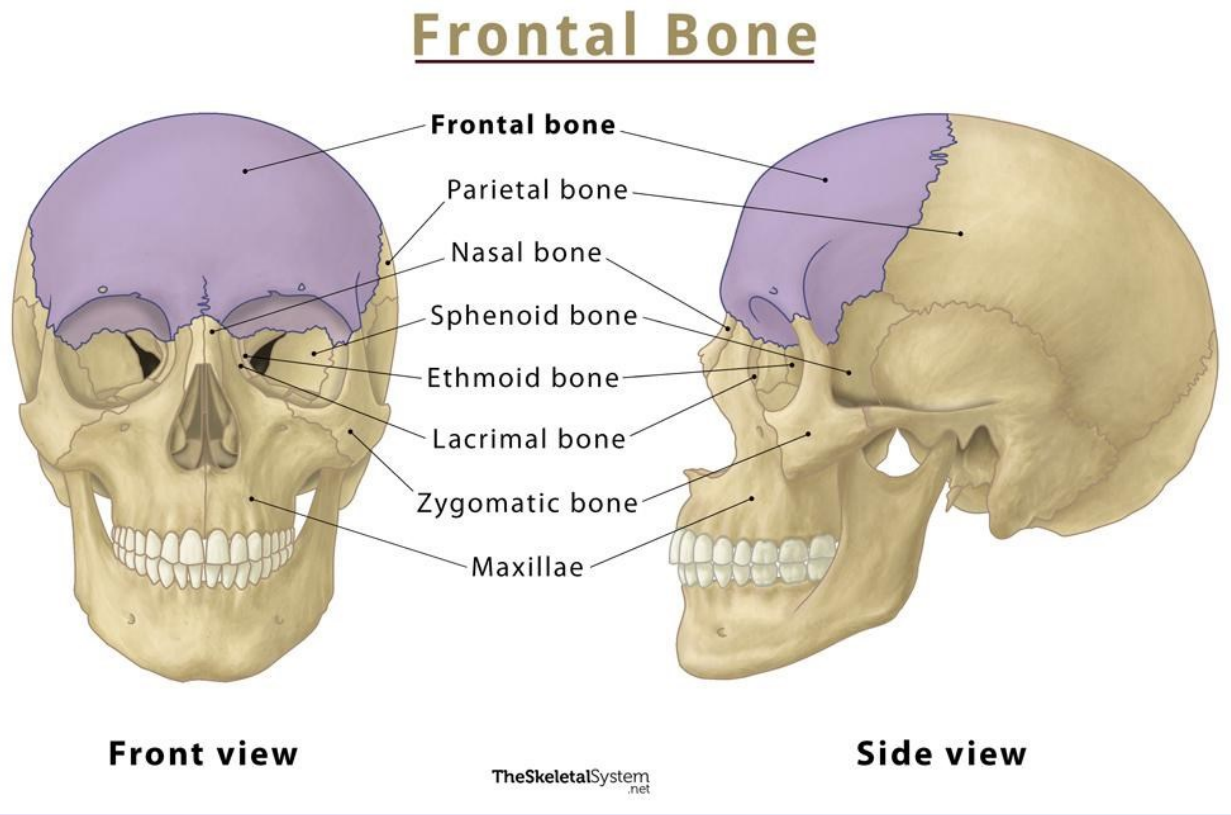
Squamous suture joins the temporal bone with parietal bone. **petrous part** which lies inferiorly. From the inferior surface of the petrous part projects two processes the **mastoid process** which lies posterior to the external auditory meatus and the **styloid process** anterior and medial to the external auditory meatus. Above the mastoid process is the supramastoid crest to which the posterior portion of the temporal muscle is attached. Between styloid and mastoid processes is an opening called stylomastoid foramen through which passes the 7th cranial nerve (facial).

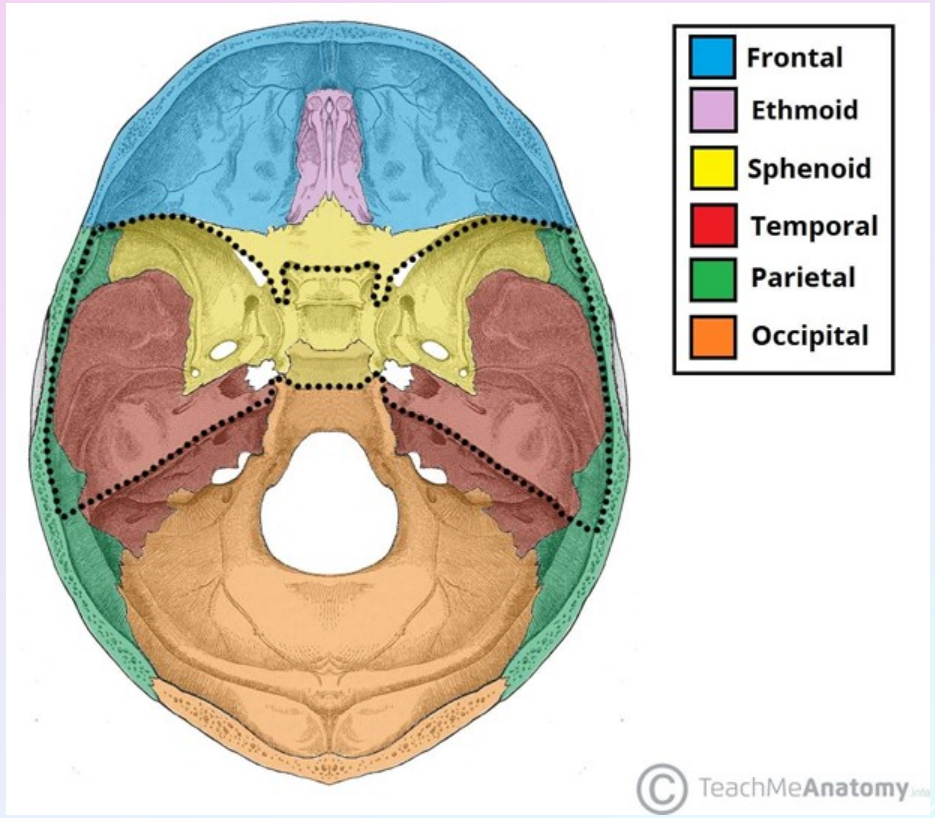




- Petrous part has a cavity which lodges middle and internal parts of ear. externally temporal bone has **zygomatic process** which articulates with the temporal process of zygomatic bone forming **zygomatic arch**. Just anterior to external acoustic meatus and inferior to the origin of the zygomatic process is the glinoid or mandibular fossa, which assists in the formation of tempero-mandibular joint.

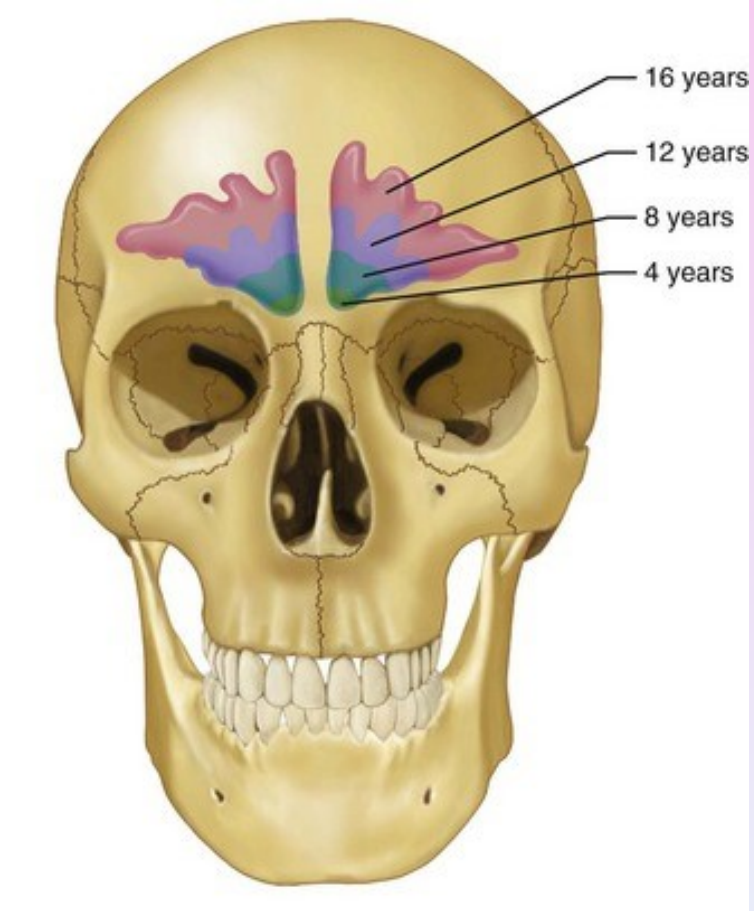
- In the internal aspect, the internal auditory canal [internal acoustic meatus] is a channel in the petrous bone that is somewhat variable in size and shape. Facial nerve is located in the anterosuperior compartment, the cochlear nerve in the anteroinferior compartment, and the vestibular nerves in the posterior compartment, respectively. The squamous portion with petrous portion participate in middle cranial fossa formation. the posterior surface of petrous participate in the formation of posterior cranial fossa,

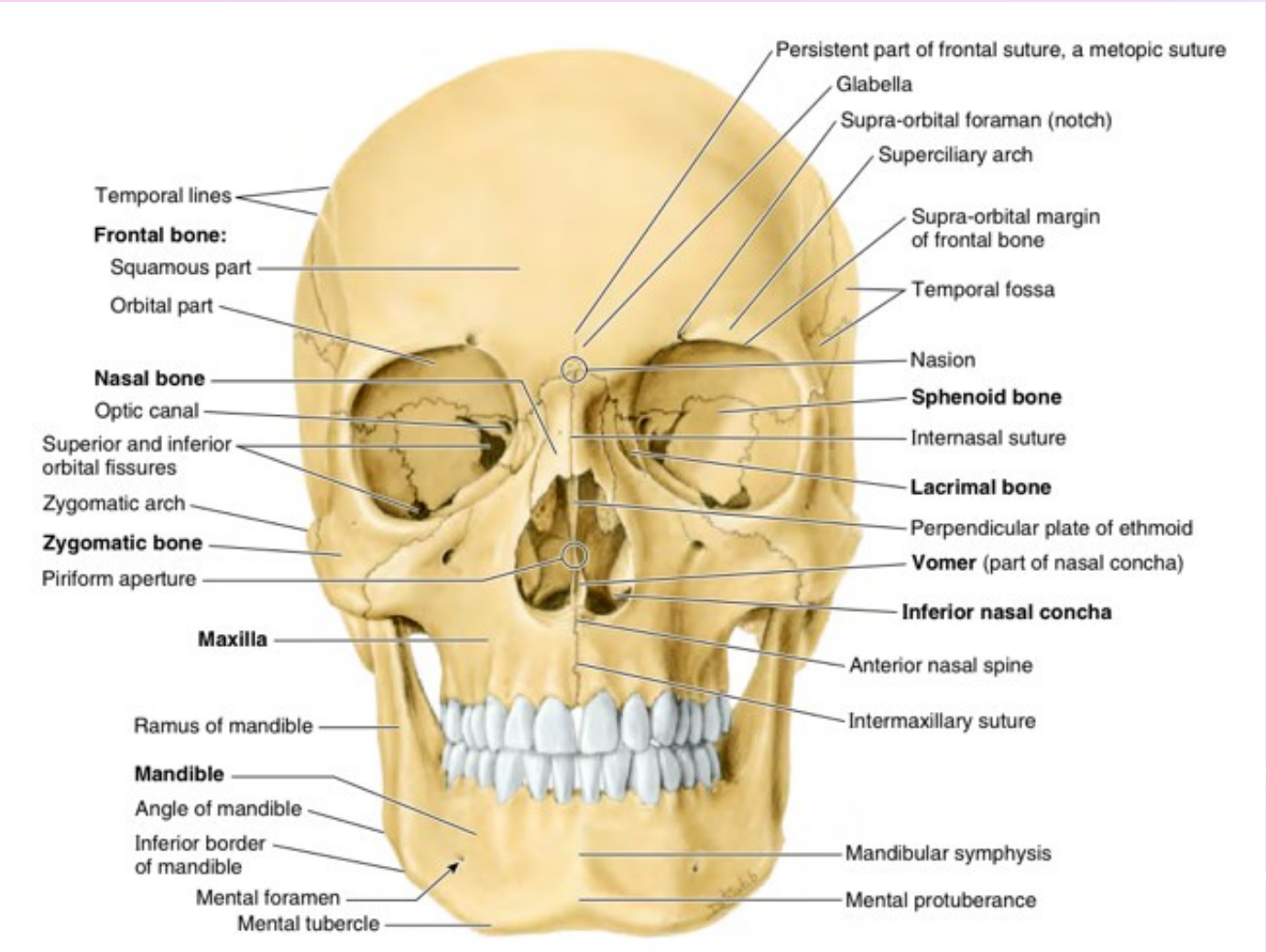




- **Frontal bone**

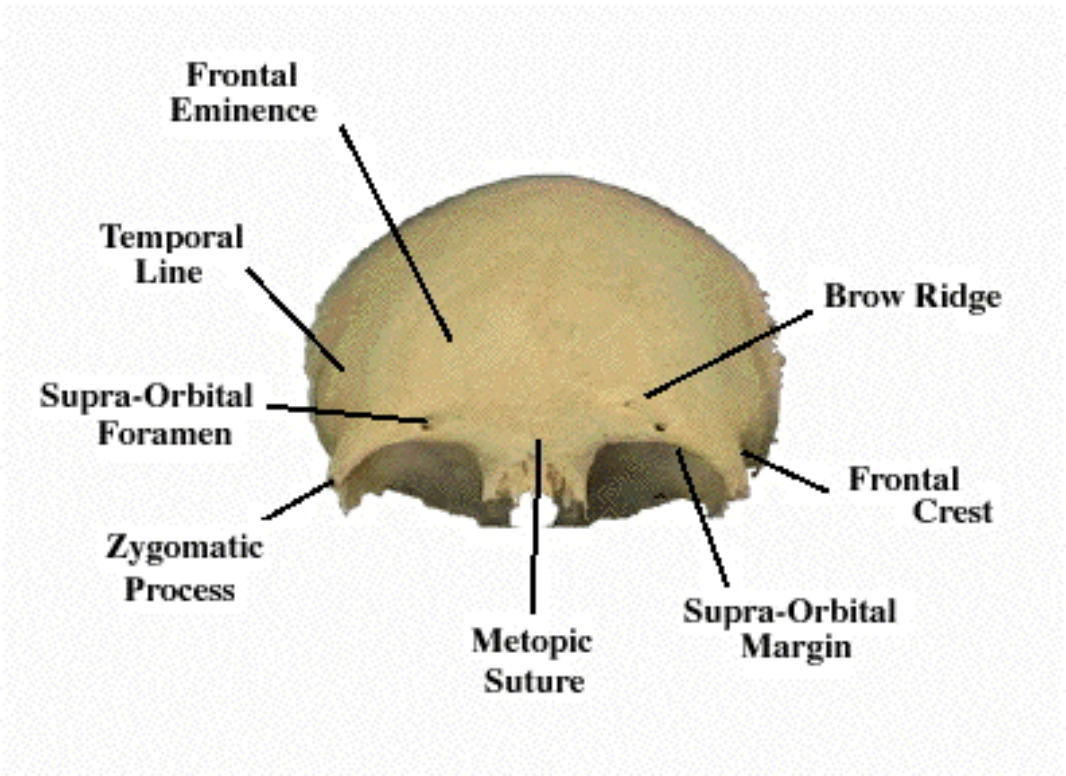
It forms the anterior wall of the cranium and most of the **anterior cranial fossa** and makes the **roof** and part of **lateral wall** of the **orbit.** It also gives shape to the forehead. It may be divided into two main portions, a vertical and horizontal portions. Frontal bone articulates with the **nasal bones**, zygomatic bones, maxilla, lacrimal bone, ethmoid, **sphenoid bone** and with **parietal bone** by coronal suture.

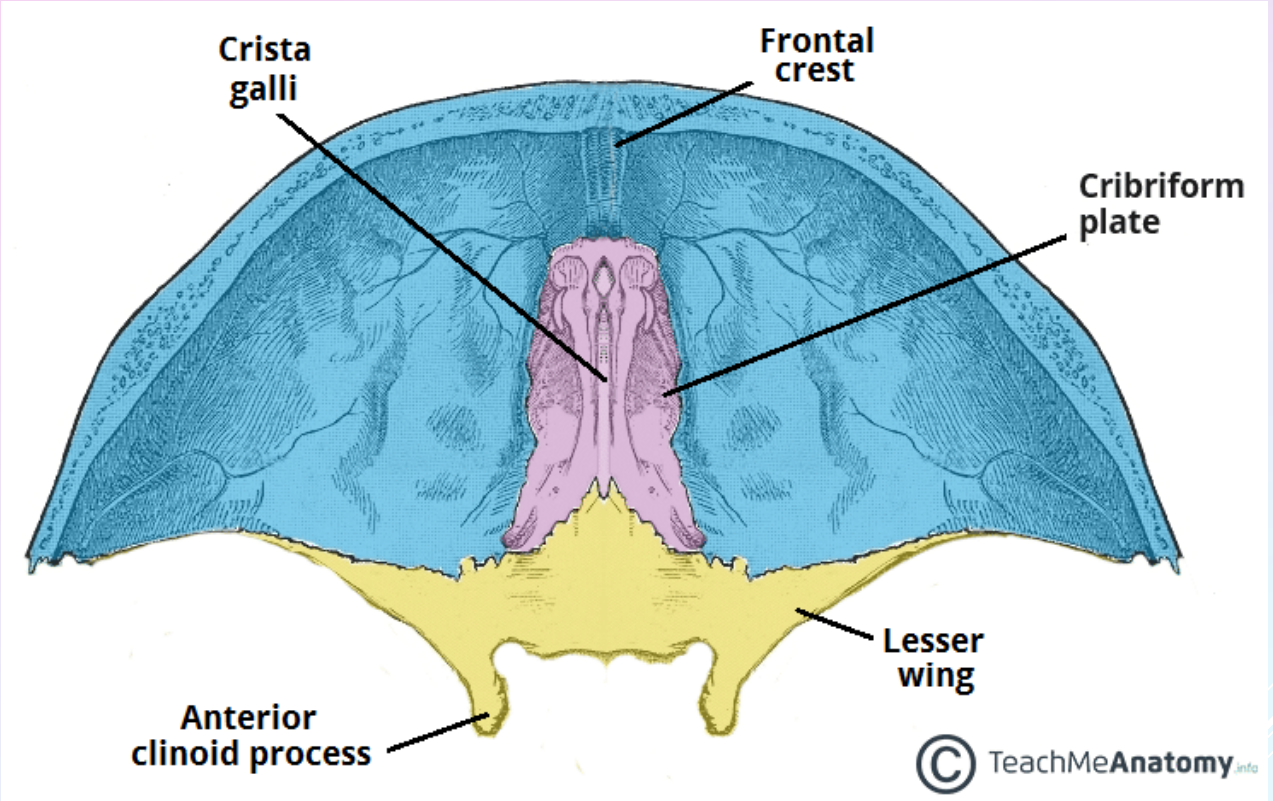




- **Frontal bone**

- Vertical portions having cavities called as **frontal sinuses,** also bone possesses 2 supraorbital ridges, assotiated with each ridges , superior orbital margin. Each ridge has either supra –orbital notch or if completely surrounded by bone supra-orbital foramen.





- The left and right frontal crest, begins at each zygomatic process and provides the anterior origin of temporal line. Internally, the frontal bone possesses median sagittal crest. The other portion of frontal bone is the horizontal portion forms the roof of orbital cavity and part of anterior cranial fossa.

The end

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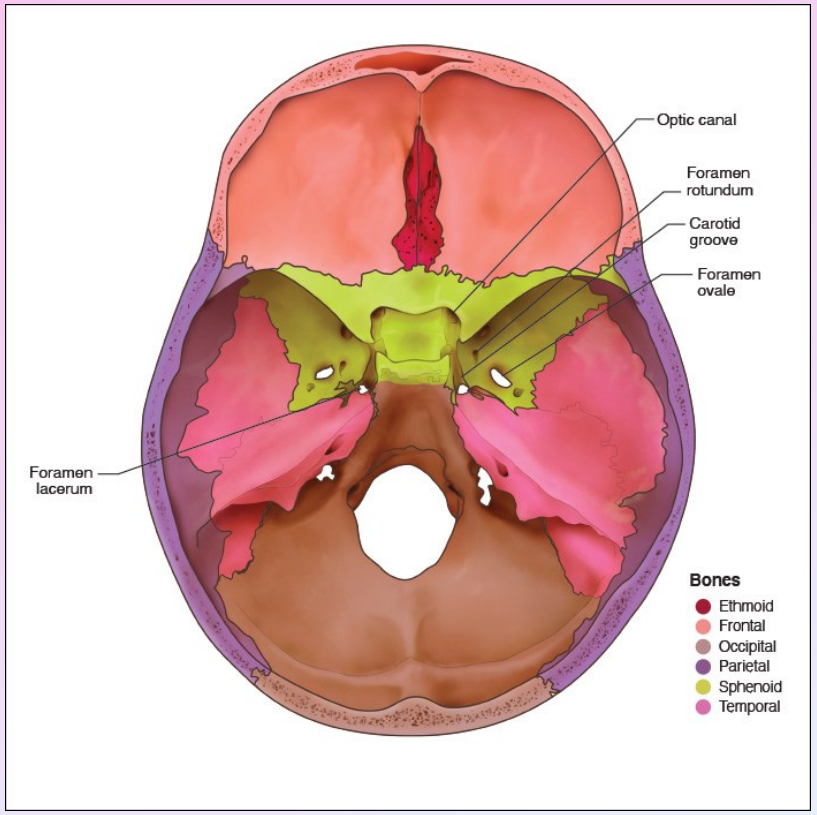
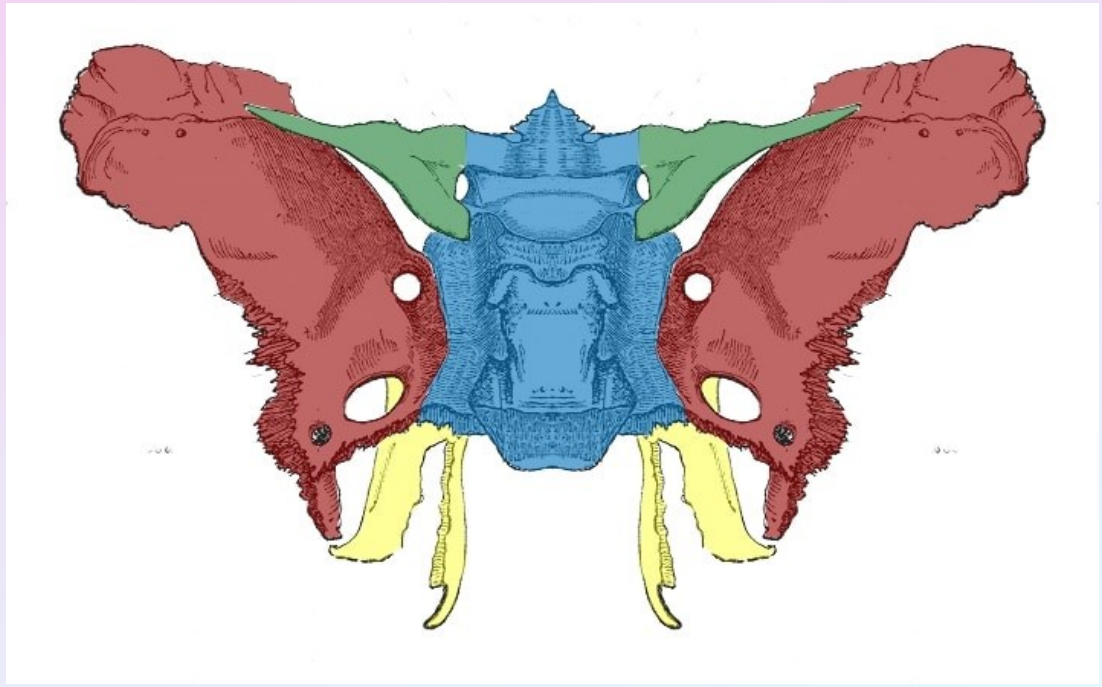
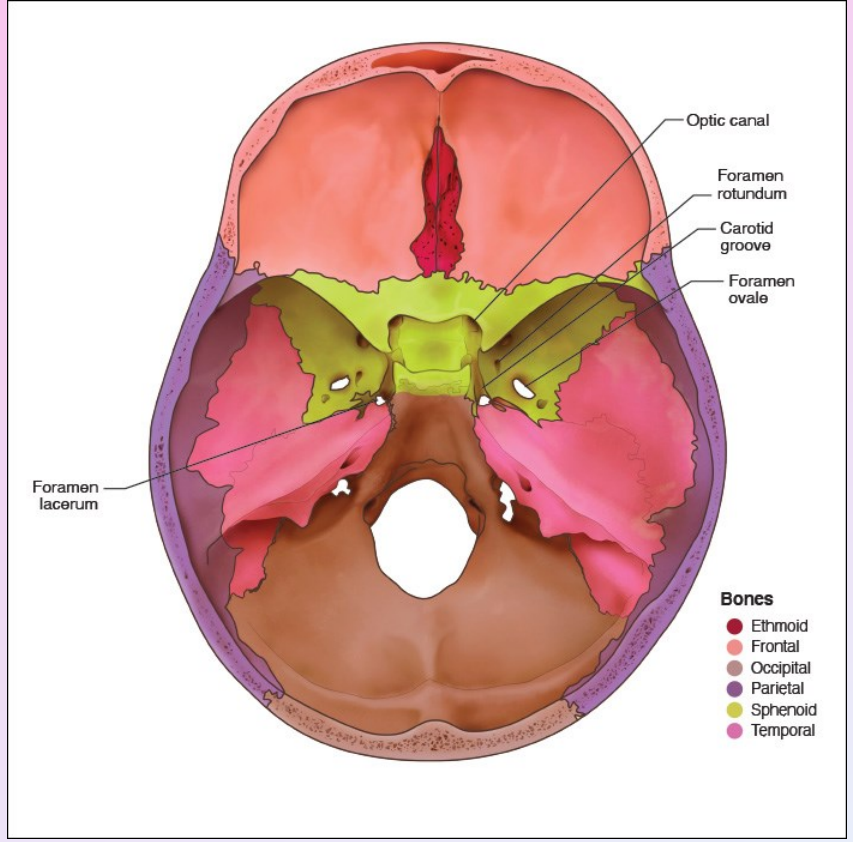
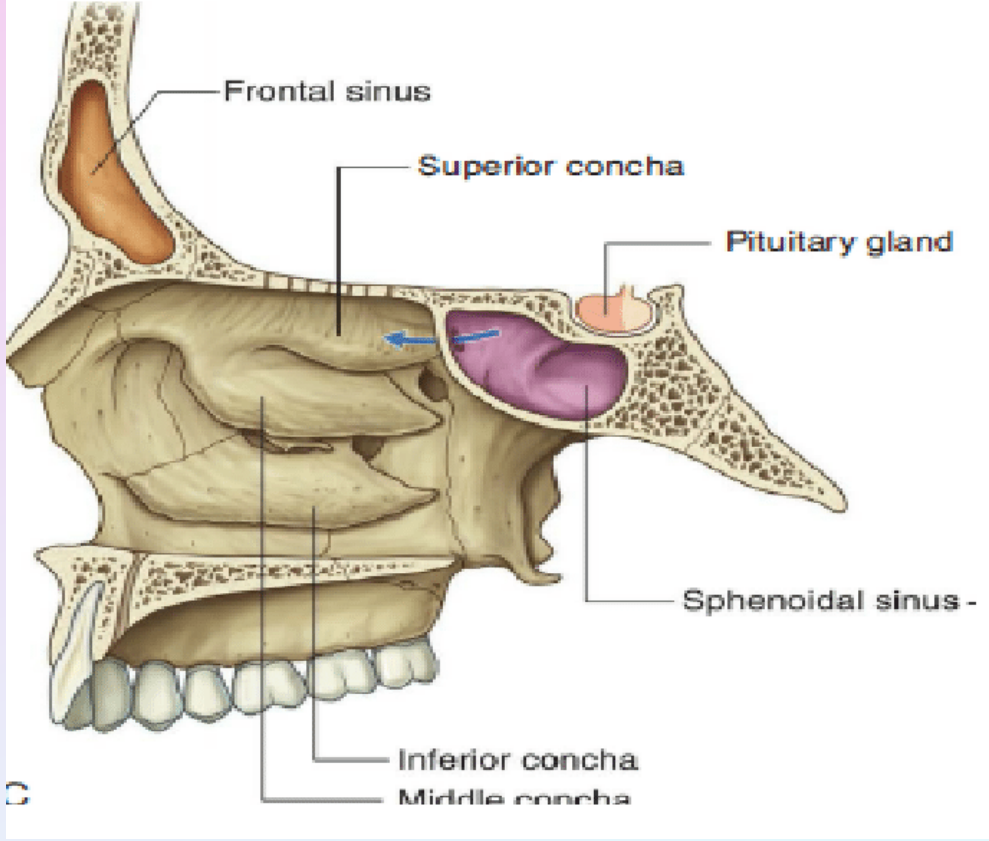




Sphenoid bone

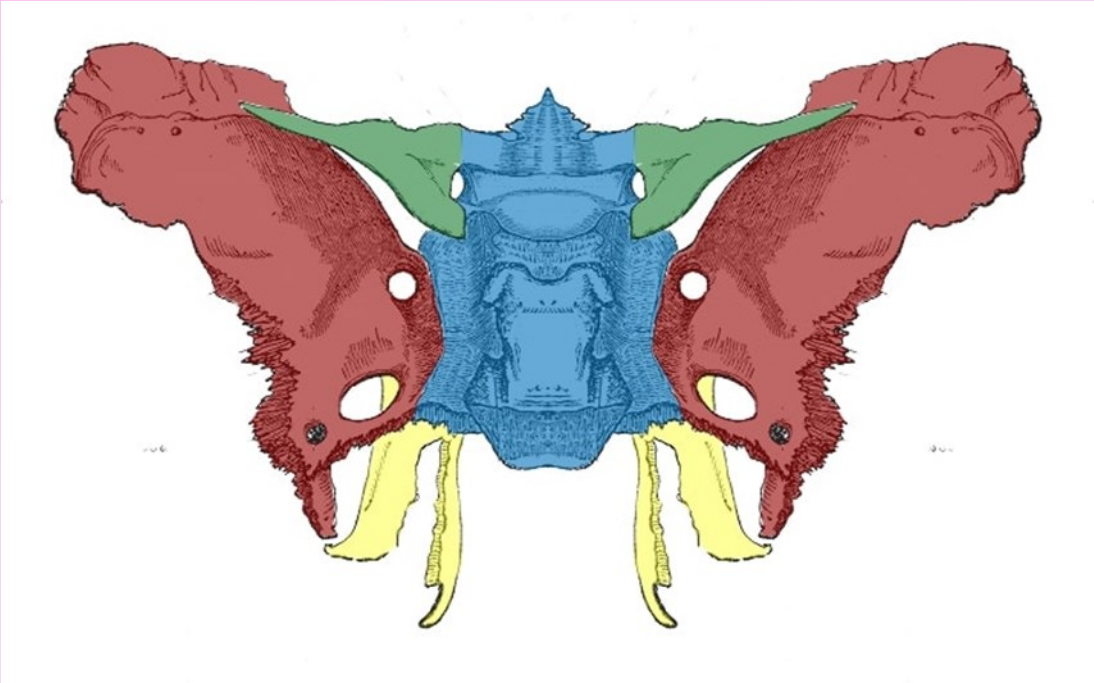
It forms part of the floor of the middle cranial fossa and posterior part of anterior cranial fossa. Anteriorly it articulates with the frontal and ethmoidal bones, laterally with the temporal and parietal bones and posteriorly with the occipital bone. Sphenoid bone has two pair of wings: greater wings and lesser wings. These wings give sphenoid bone bat shaped appearance. Between the two greater wings lies the body of sphenoid bone.

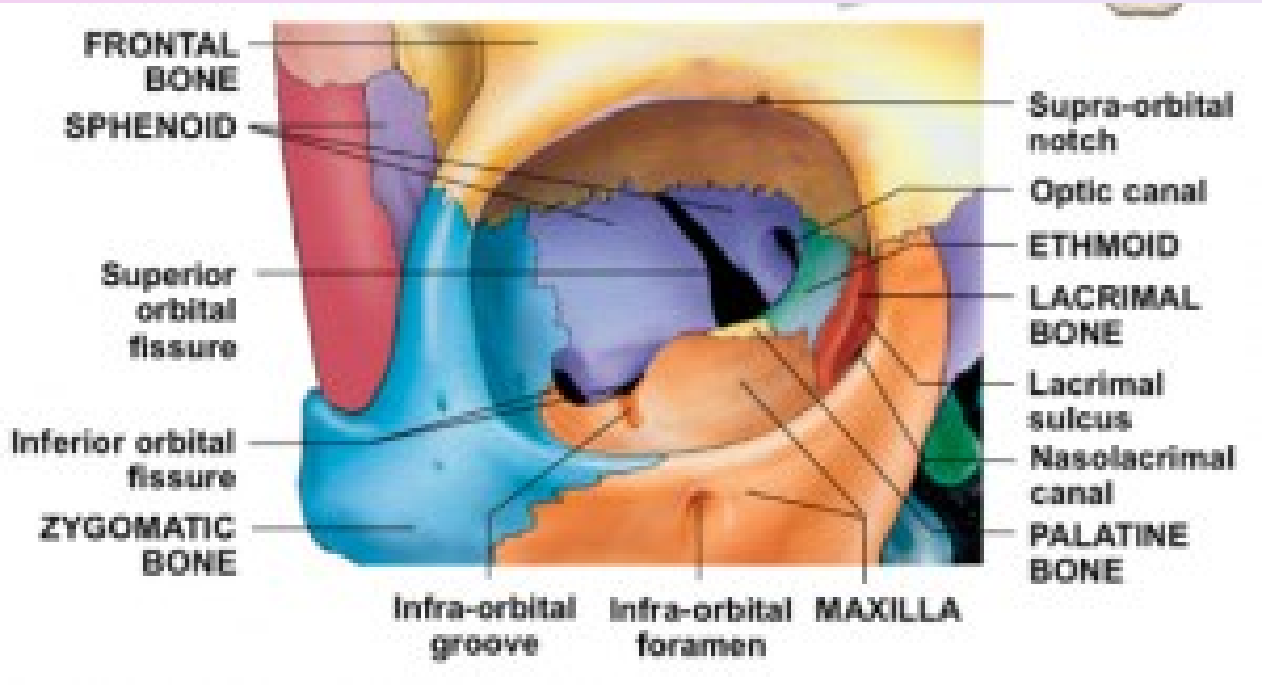




The body has two anterior projections called as anterior clinoid processes and two posterior projections called as posterior clinoid processes. In-between these two projections lie a pituitary fossa which accommodates the pituitary gland. Sphenoid air sinus located within the body.

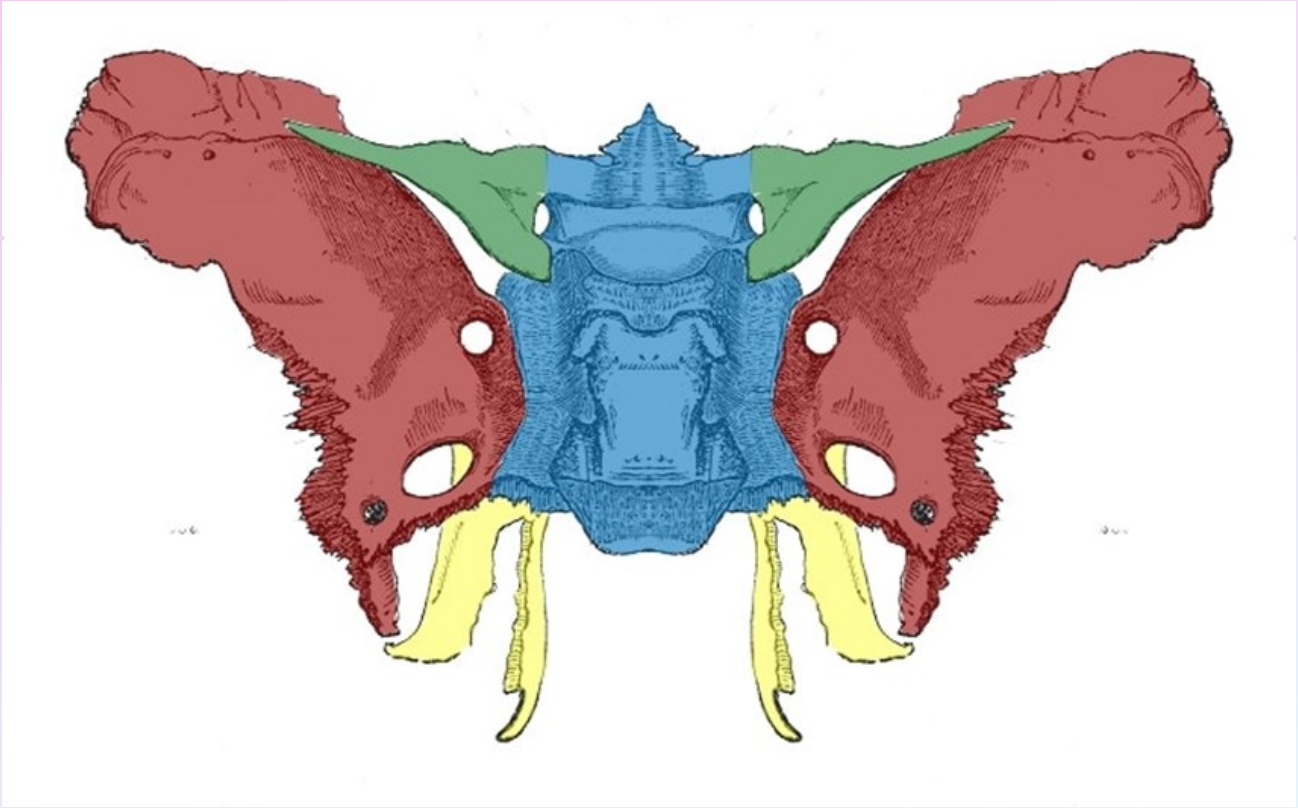
Both anterior and posterior clinoid processes along with pituitary fossa form a saddle like structure called as sella turcica..



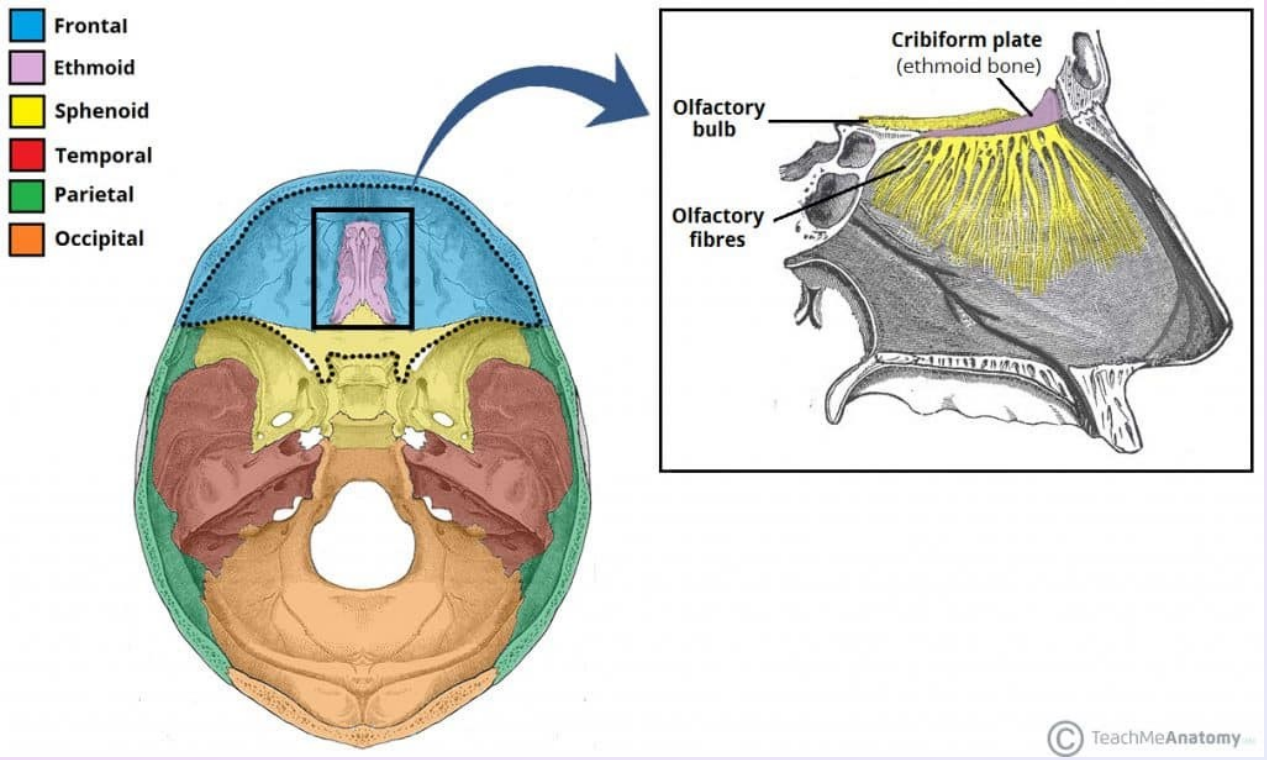


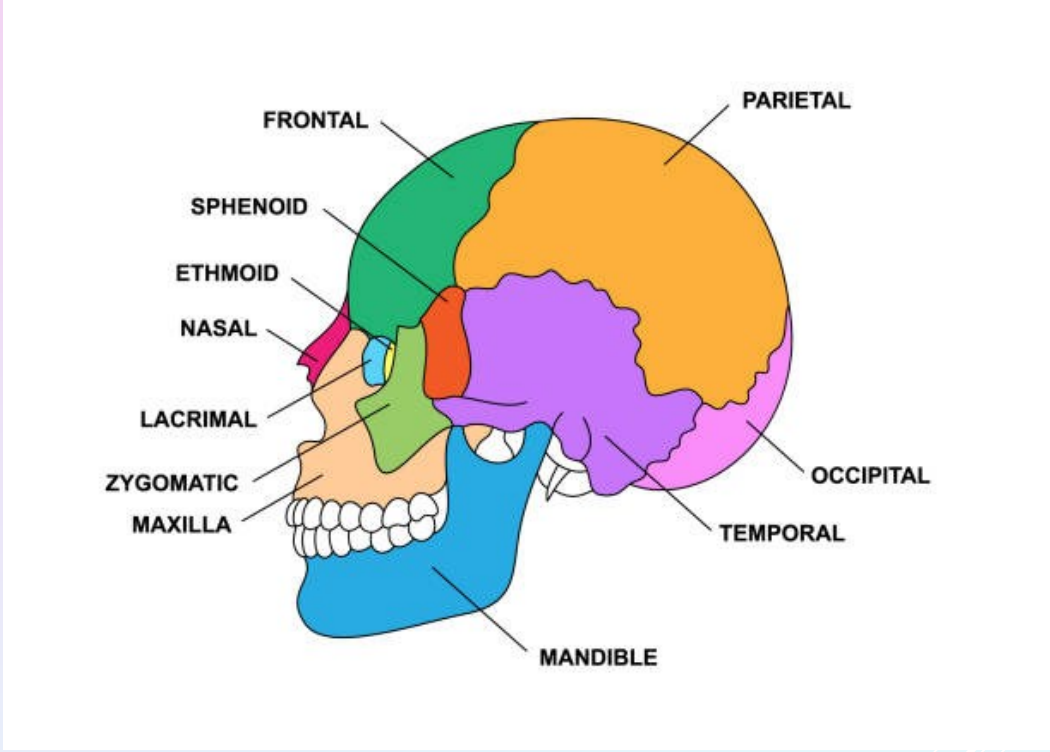
From the inferior surface of the body of sphenoid bone arise two projections called as lateral and medial pterygoid processes. In between these processes lies the pterygoid fossa.

Through the lesser wing of the sphenoid bone passes a canal called as optic canal through which passes the optic nerve. Between the lesser and greater wings anteriorly lies a fissure called superior orbital fissure through which passes the ophthalmic division of trigeminal nerve.



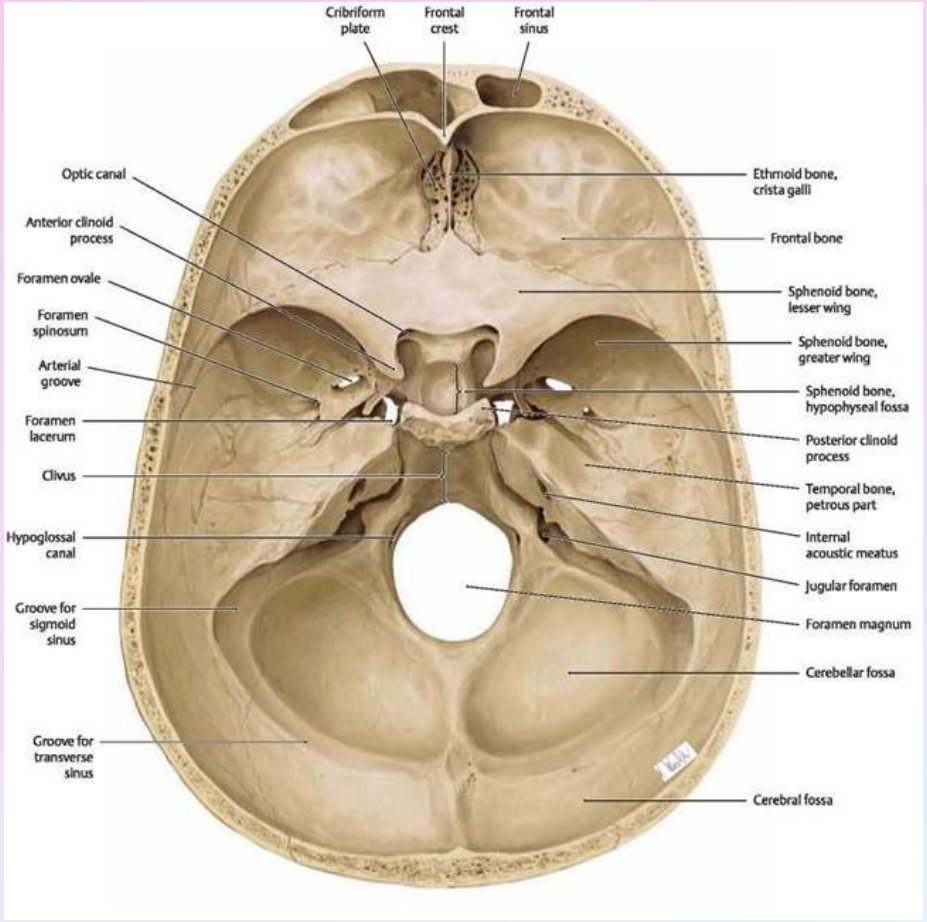
Most anterior of the greater wing has a foramen rotundum through which passes the maxillary division of trigeminal nerve. Posterior to the foramen rotundum is foramen ovale through which passes the mandibular division of trigeminal nerve. Posterior and lateral to the foramen ovale is the foramen spinosum through which passes the middle meningeal artery.

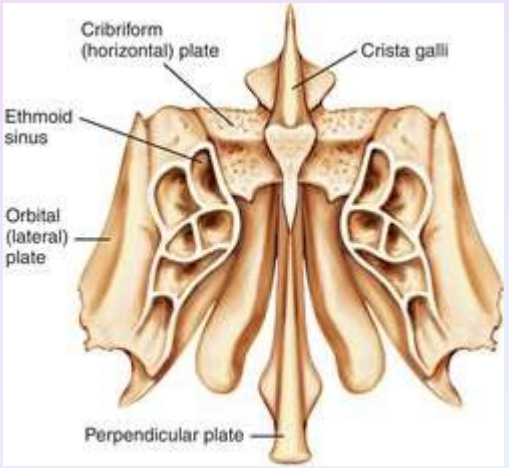




Ethmoid bone

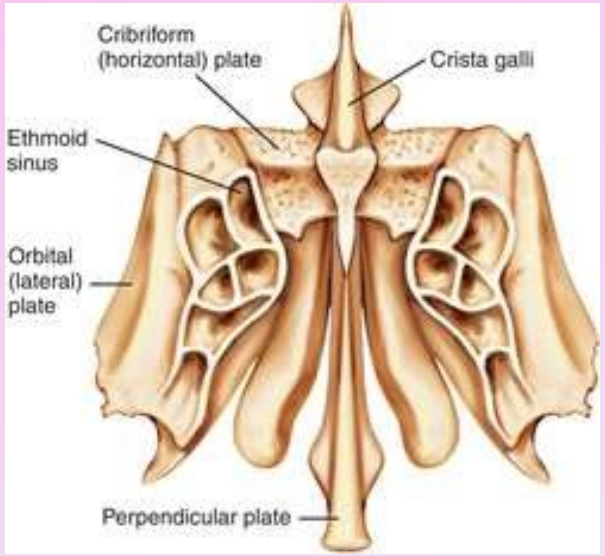
It is one of the smallest among the cranial bones. It helps in the formation of some part of anterior cranial fossa. Anteriorly it articulates with the nasal and lacrimal bones , posteriorly with the sphenoid bone and laterally with the frontal bone, infriolateraly with maxilla and inferiorly with vomer bone.

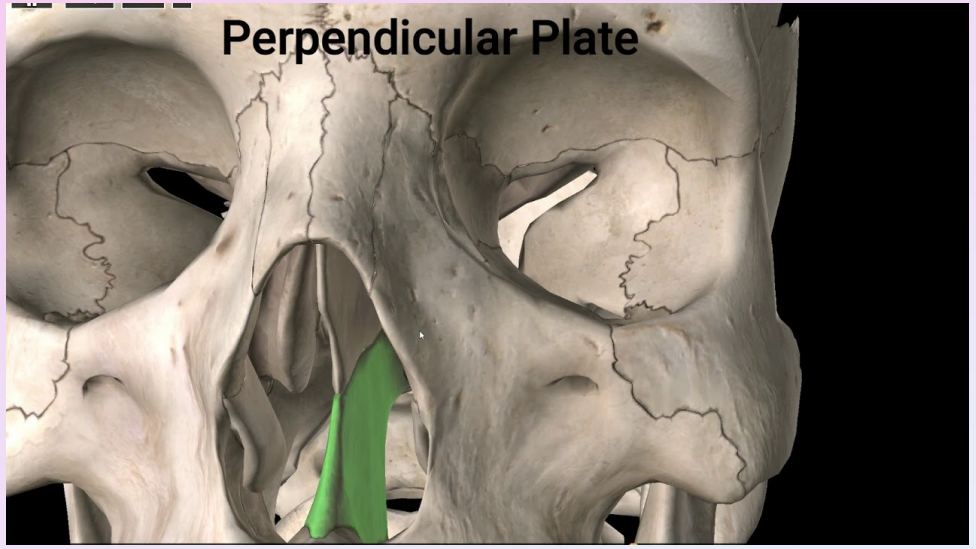


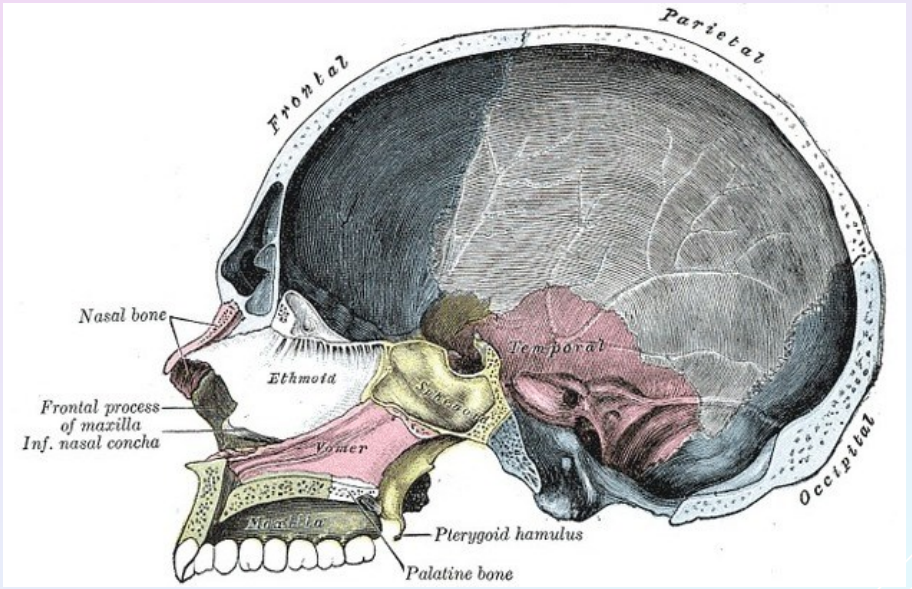


Ethmoid bone has four parts:

Cribriform plate is the most superior part of the ethmoid bone. It has central upward projection called as crista galli (site of attachment of falx cerebri or durra matter). The two horizontal plates of cribriform plate contain foramina for the passage of olfactory nerves.







Perpendicular plate projects downward and helps in the formation of the nasal septum.

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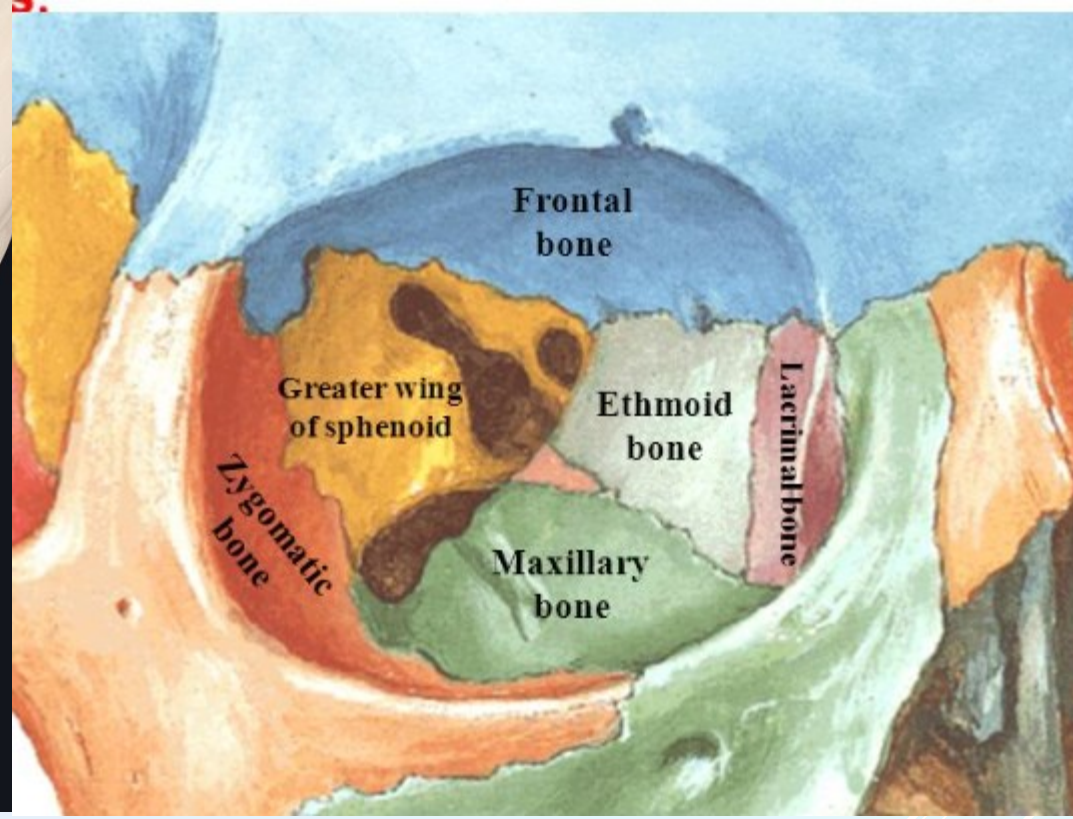
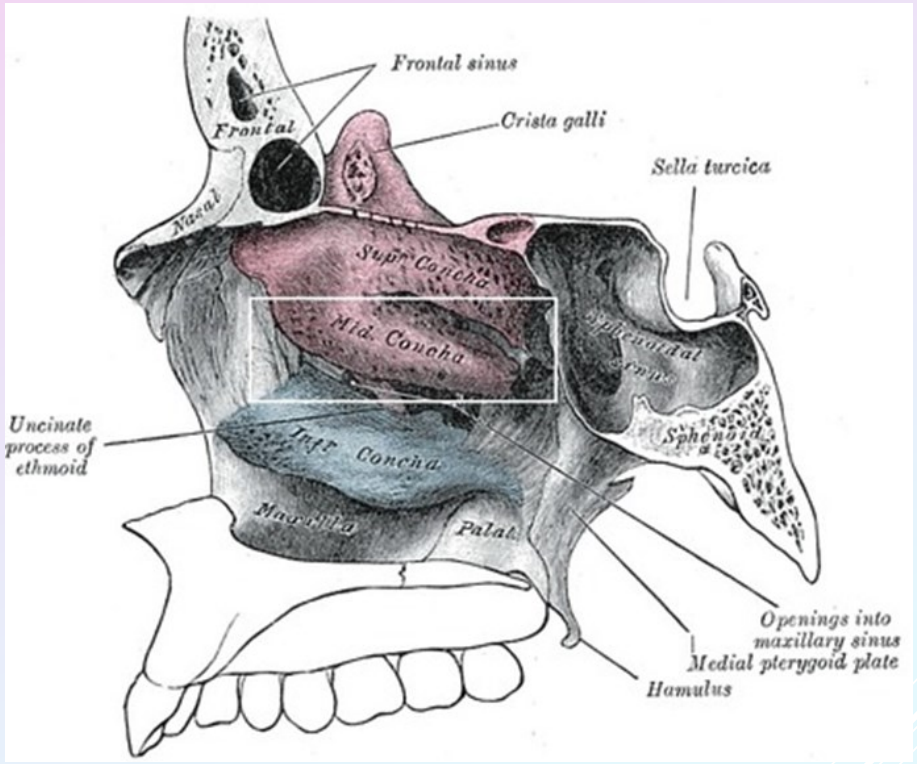


2 plates (Medial and Lateral labyrinths): The lateral labyrinth forms part of the medial wall of the orbit.

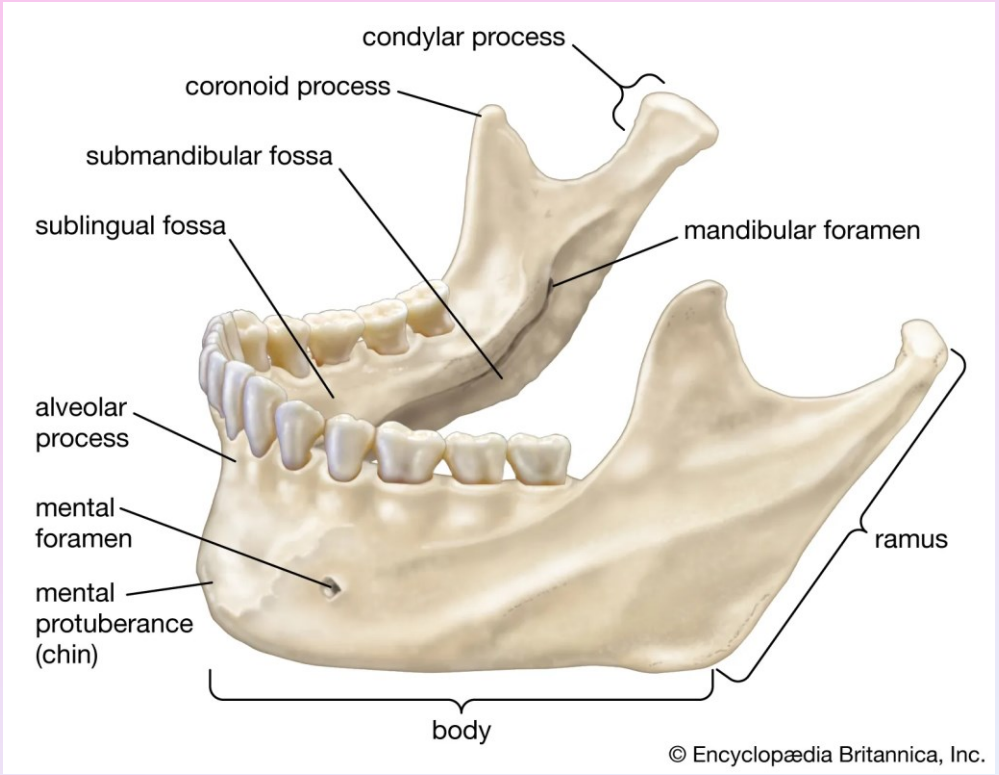


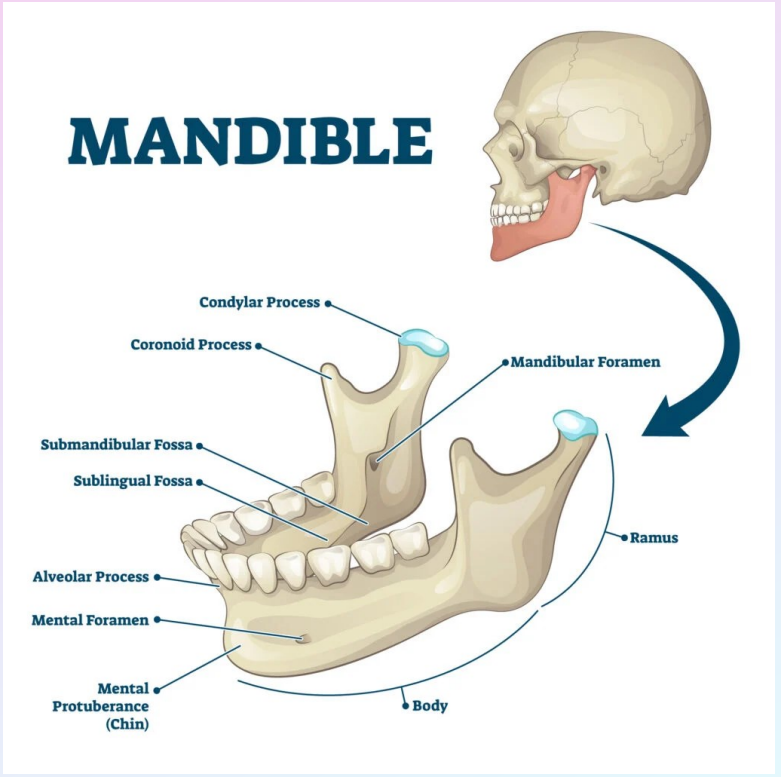
The medial labyrinth forms two projections, which protrudes inside the nasal cavity forming two projections called as the superior nasal conchae and middle nasal conchae. These nasal conchae contain air cells which make the ethmoid sinuses

The end

ANATOMY/ 1ST YEAR

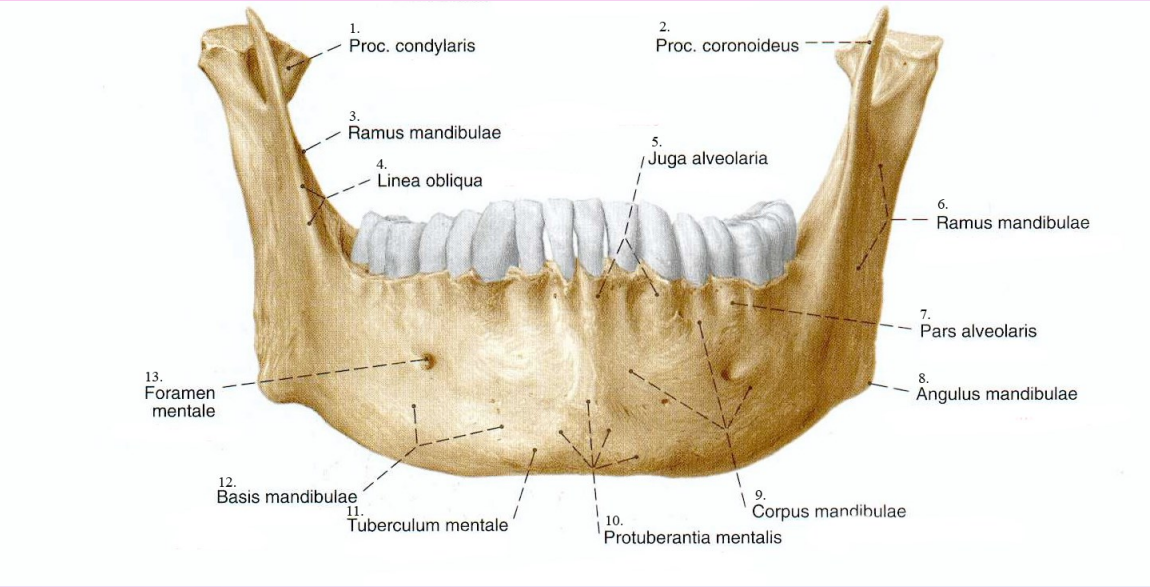
Dr. Ban Ismael

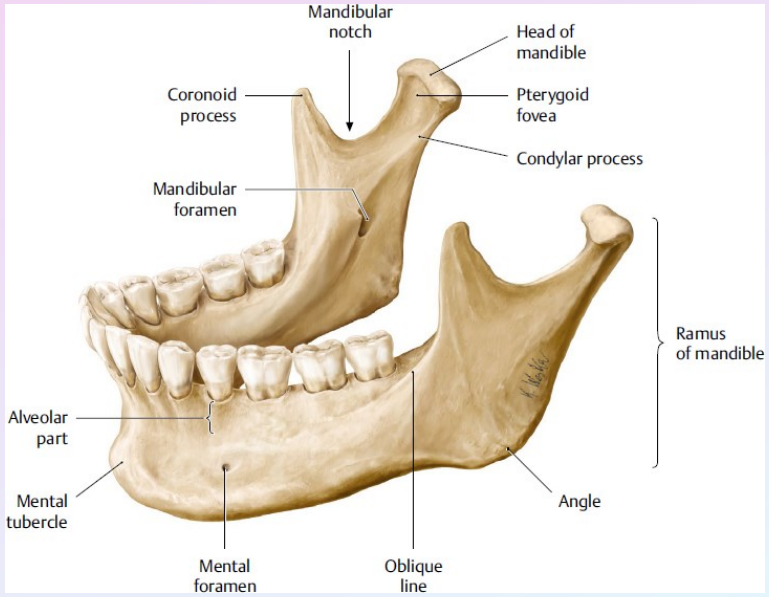




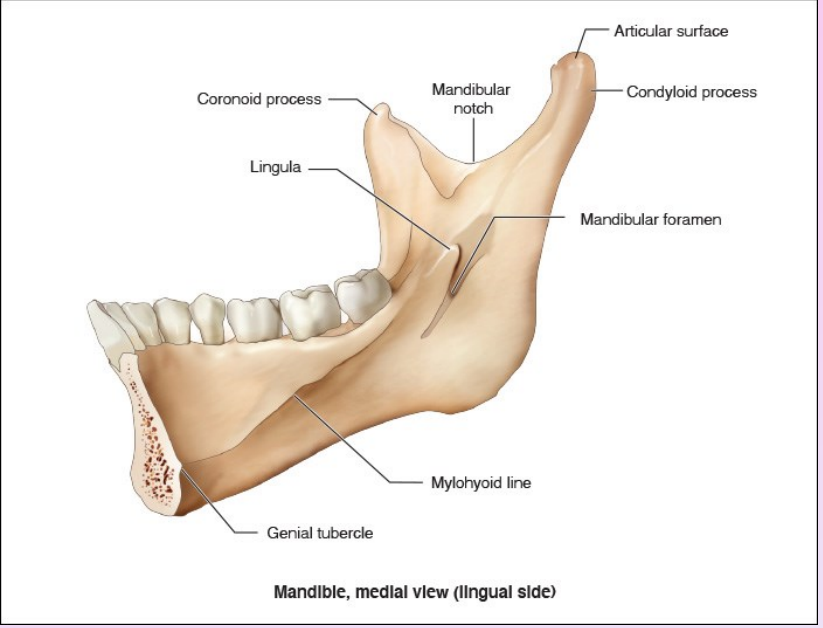
- **Mandible bone**

- It is unpaired, strongest and the **only moveable bone of the skull**. Mandible has two parts i.e. two **rami** and one **body [during development the body consist of 2 halves which fuse together in the midline at the symphysis menti]**.
- The rami join the body at the angle called as **angle of the mandible**. The superior part of the each ramus has two projections called as **coronoid process (anteriorly)** and **condyloid process (posteriorly).** The condyloid process makes joint with the mandibular fossa of the temporal bone making the only moveable joint of the skull called as **temporomandibular joint**.
- The upper margin of the body of mandible has **inferior alveolar processes** which fit the lower teeth.

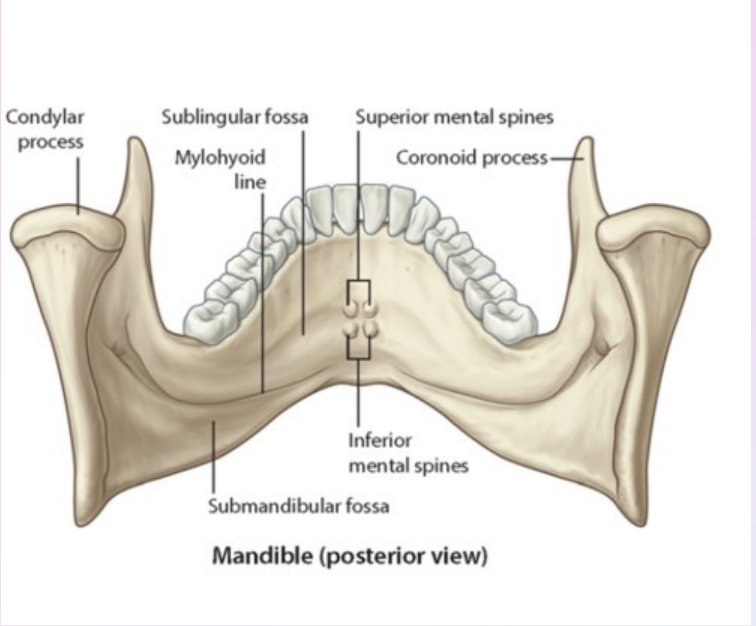




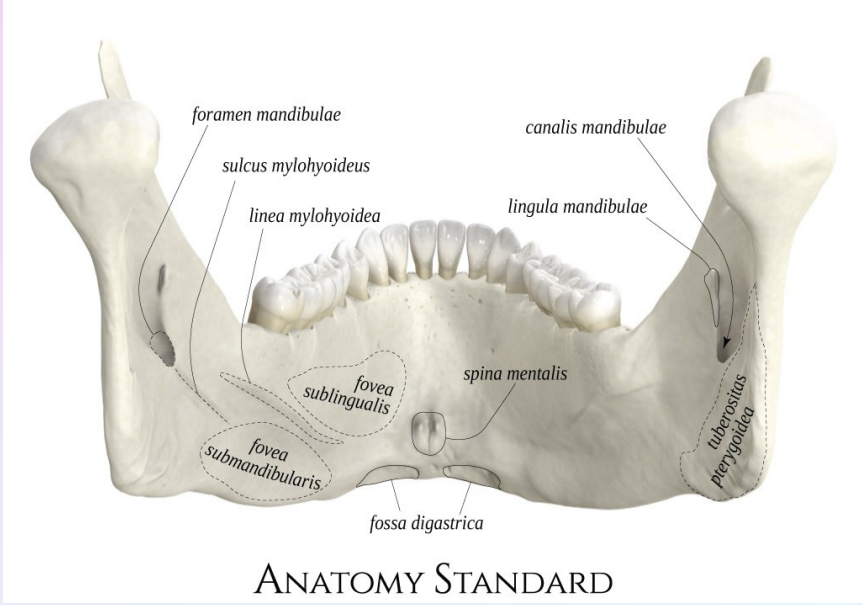
- **Land marks on the outer surface:**
- 1-mental protuberance: a median elevation on the front of the body close to the lower border. The protuberance forms projections on each side called mental tubercle.
- 2-mental foramen: lateral and posterior to mental tubercles below 1st premolar.
- 3-oblique line: an oblique ridge from anterior border of ramus extends downwards and forwards.
- 4- base of mandible: lower border of mandible.
- 5- angle of mandible: junction between the base and posterior border of ramus.



Mandible, medial view (lingual side)

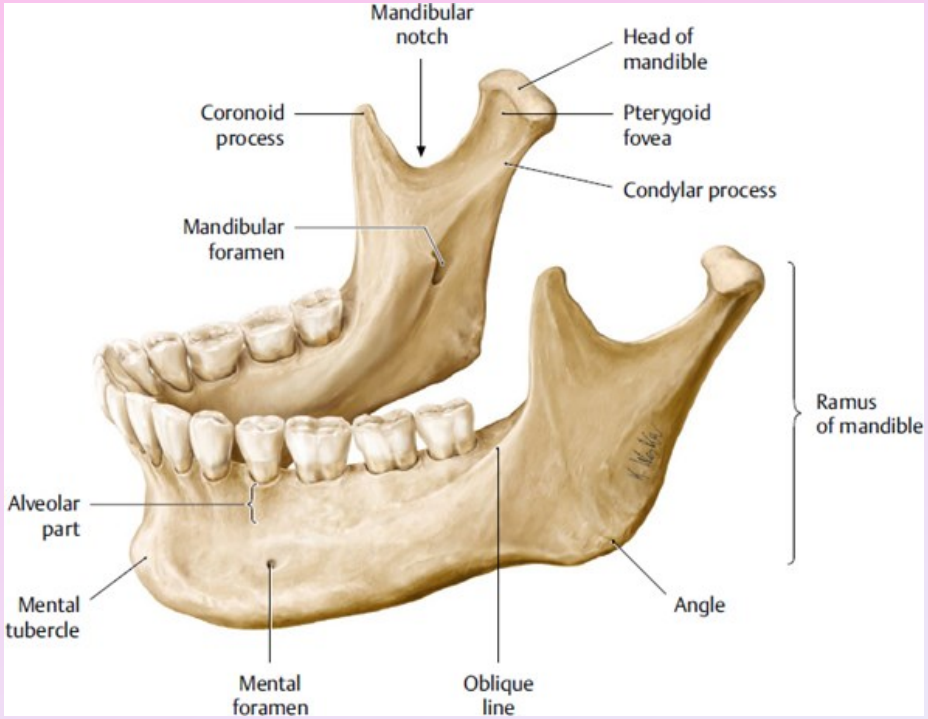


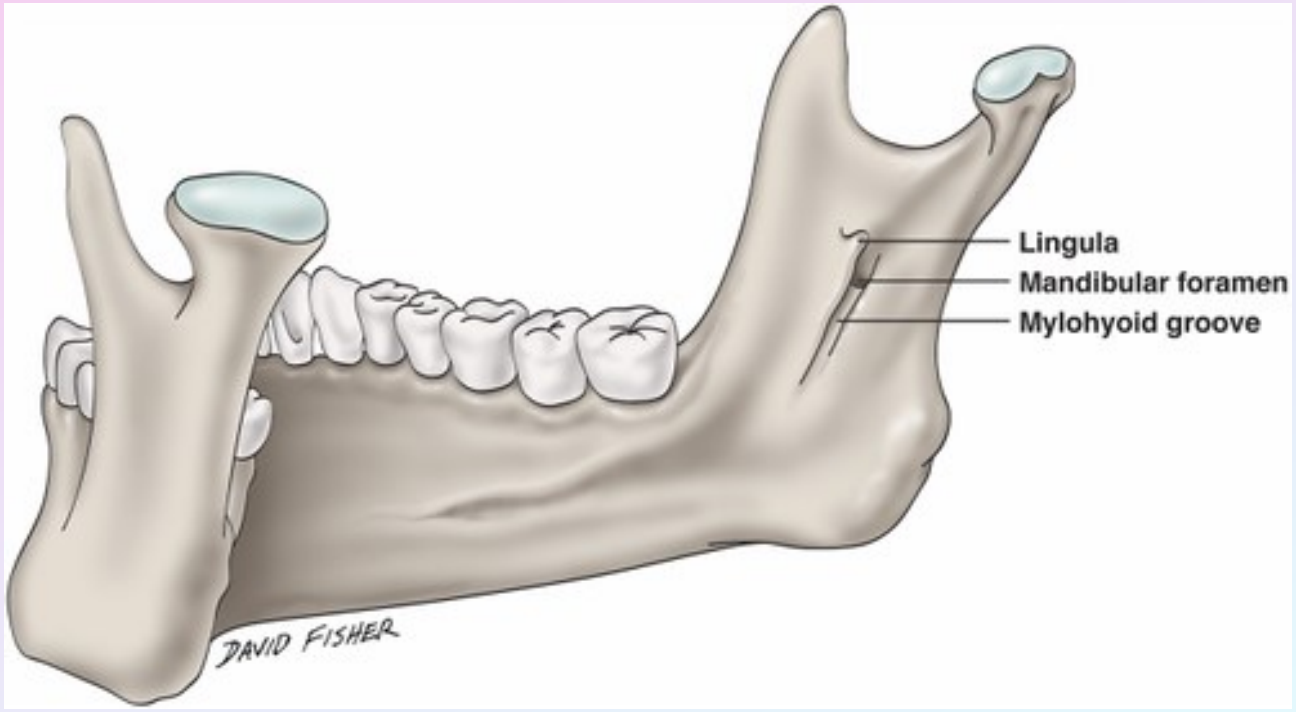
Mandible (posterior view)



ANATOMY STANDARD

- **Land marks on the inner surface**:
- 1-mylohyoid line: an oblique line on the inner surface of the body.
- 2-Submandibular fossa: a depression below the posterior part of mylohyoid line.
- 3-sublingual fossa: depression above the anterior part of mylohyoid line.
- 4- genial tubercles: small projections on the back of symphysis menti.
- 5- digestive fossa: a slight depression on the base close to symphysis menti on each side.



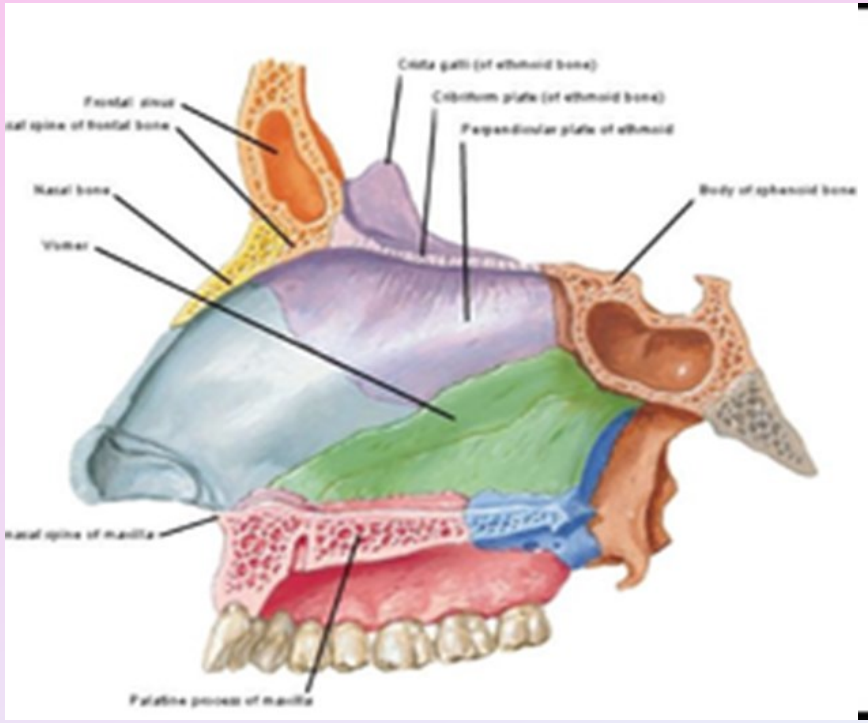


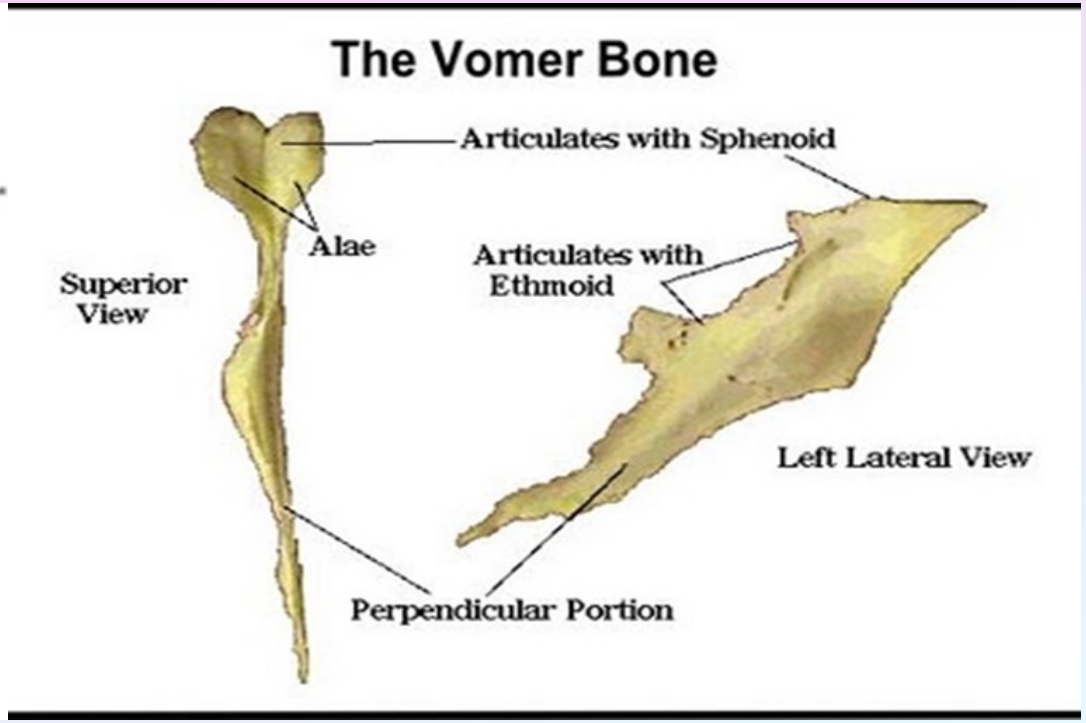
6- mandibular foramen: on the inner aspect of ramus it leads to mandibular canal contain inferior alveolar nerve and vessels, this canal runs downwards and forwards in the ramus and horizontally in the body , below the second premolar tooth it bifurcates in to the incisive and mental canals.

7- Lingula: small bone projuction medial to mandibular foramen.

8-mandibular notch:concave upper border of ramus.

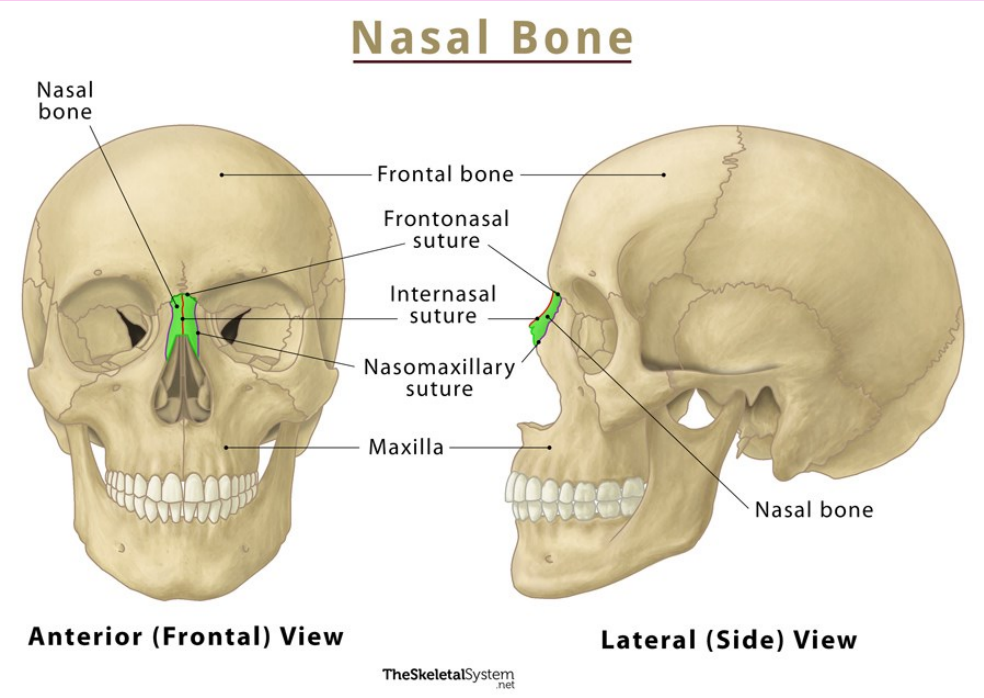
9-mylohyoid groove: a narrow groove extends from mandibuler foramen below and parallel to the mylohyoid line.

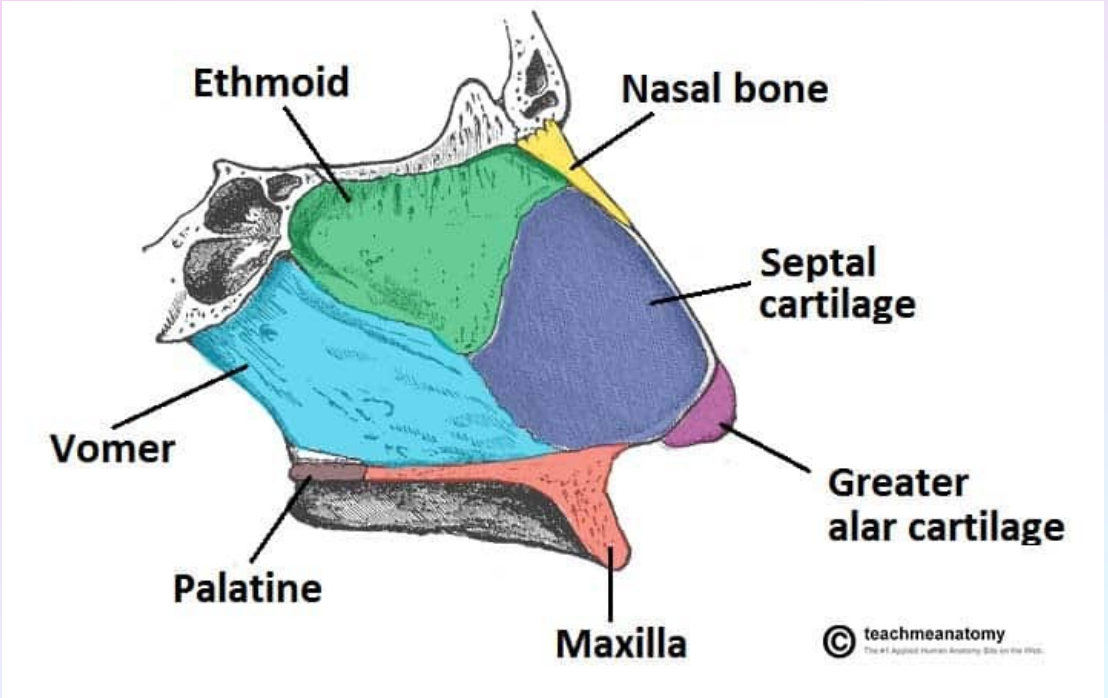




Vomer bone

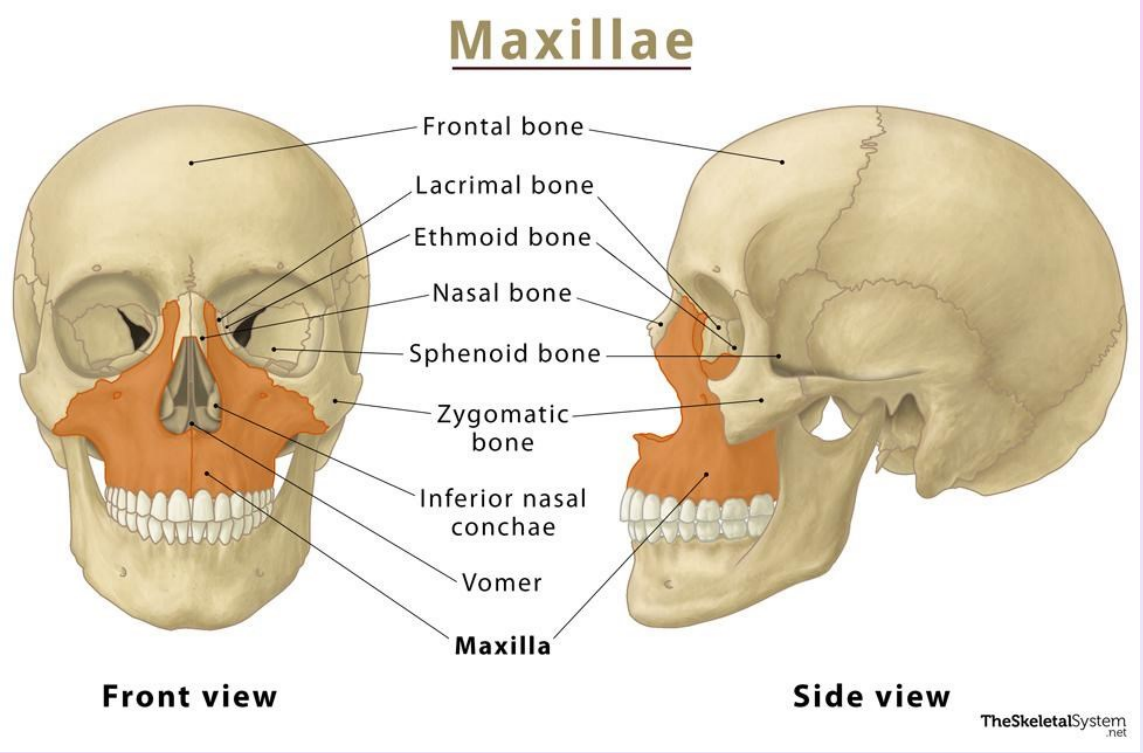
It is the unpaired bone located in the mid saggital plain. Which forms **part of the nasal septum**. Superioanteriorly it articulates with the perpendicular plate of **ethmoid bone**, superioposteriorly articulate with sphenoid bone inferiorly with the **palatine bone** and **palatine processes of the maxillae**.

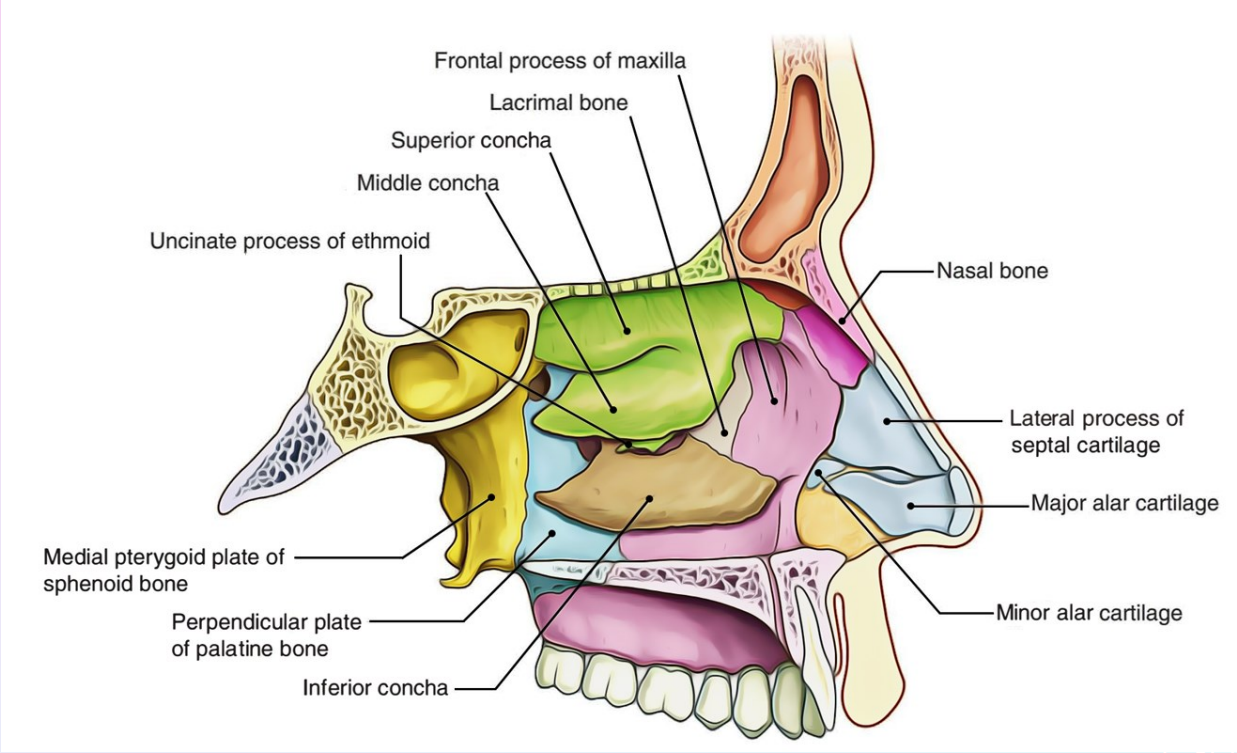




Nasal bones

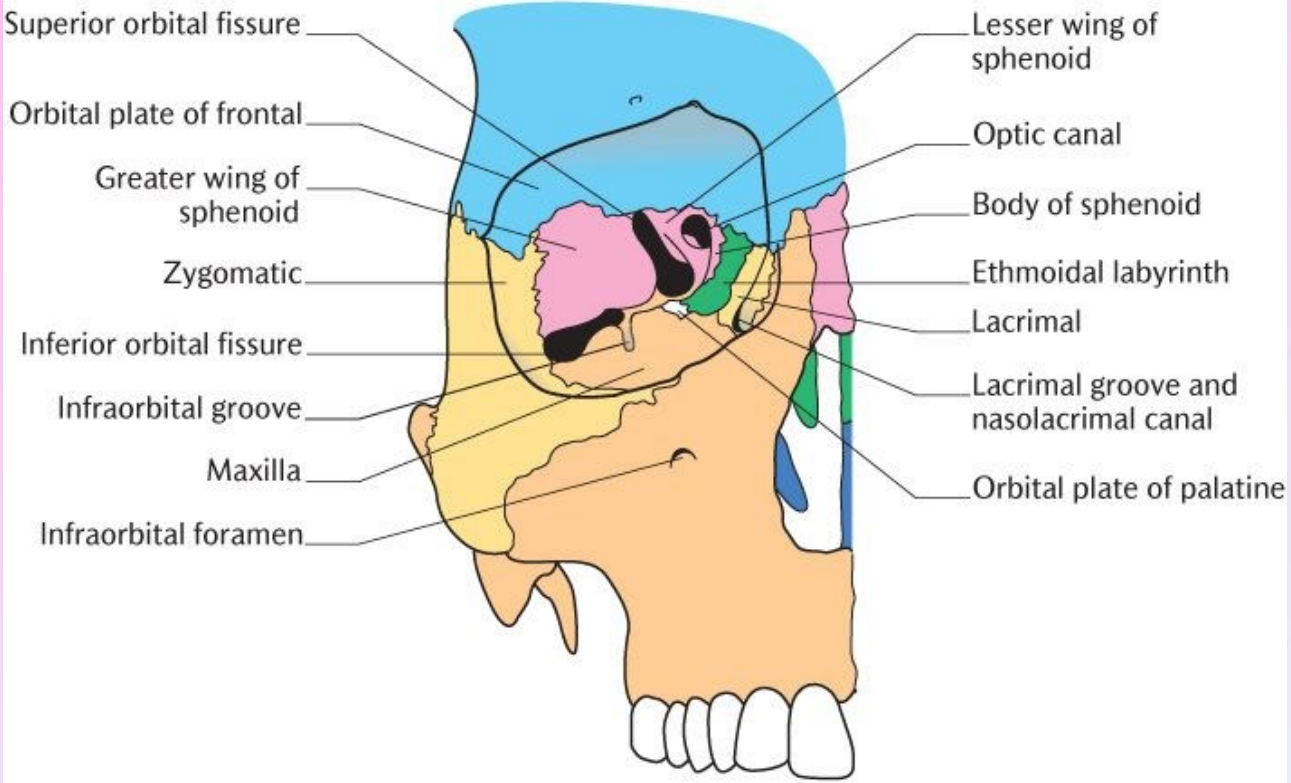
They form the bridge **of the nose**. They articulate with each other by way of the internasal suture. Superiorly they articulate with the **frontal bone by the way of frontonasal suture, the insertion of these two sutures marks the anatomical landmark called nasion.** Posteriolaterally each of the nasal bones articulates with the frontal process of the maxilla. Posteriorly articulate with ethmoid bone.

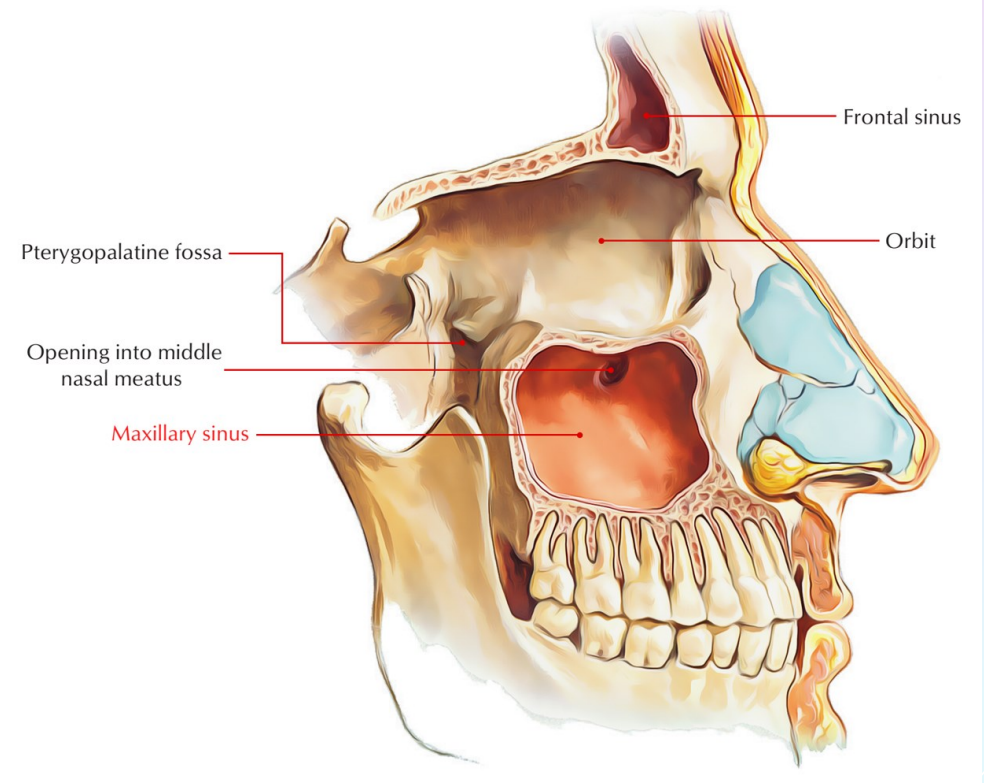




- **Maxillary bones**

They articulate with all the bones of the facial skeleton except the mandible. Superiorly they articulate with the **nasal** and **lacrimal bones** and **frontal bone**[cranial bone], laterally with the **zygomatic bones**, medially with each other[by way of intermaxillary suture,the superior end of this suture terminates with nasal spine] and with **vomer** , ethmoid and **inferior nasal conhae** and posteriorly with the **palatine bones**.





- An orbital plate forms the floor of the eye orbit. Both maxillary bones contain air filled cavities called as **maxillary sinuses** which open into the nasal cavity. The alveolar process contains the upper dentition and assist in giving rise to the palatine portion which form the anterior 2/3 of hard palate. Anteriorly below the orbit there is an infra orbital foramen.

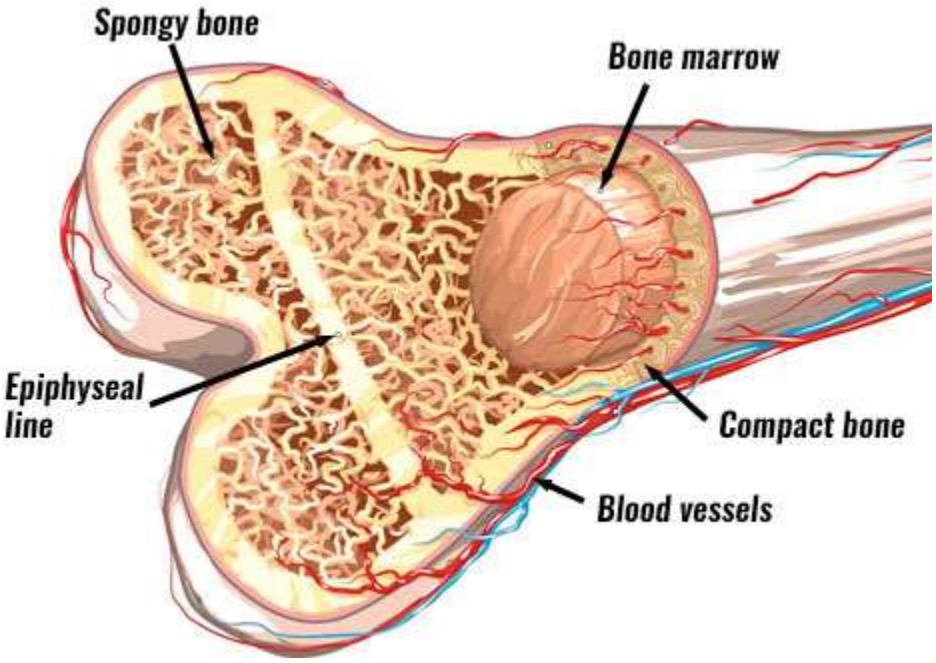
The end

Lecture (9) The Bones and Cartilages

Bone:

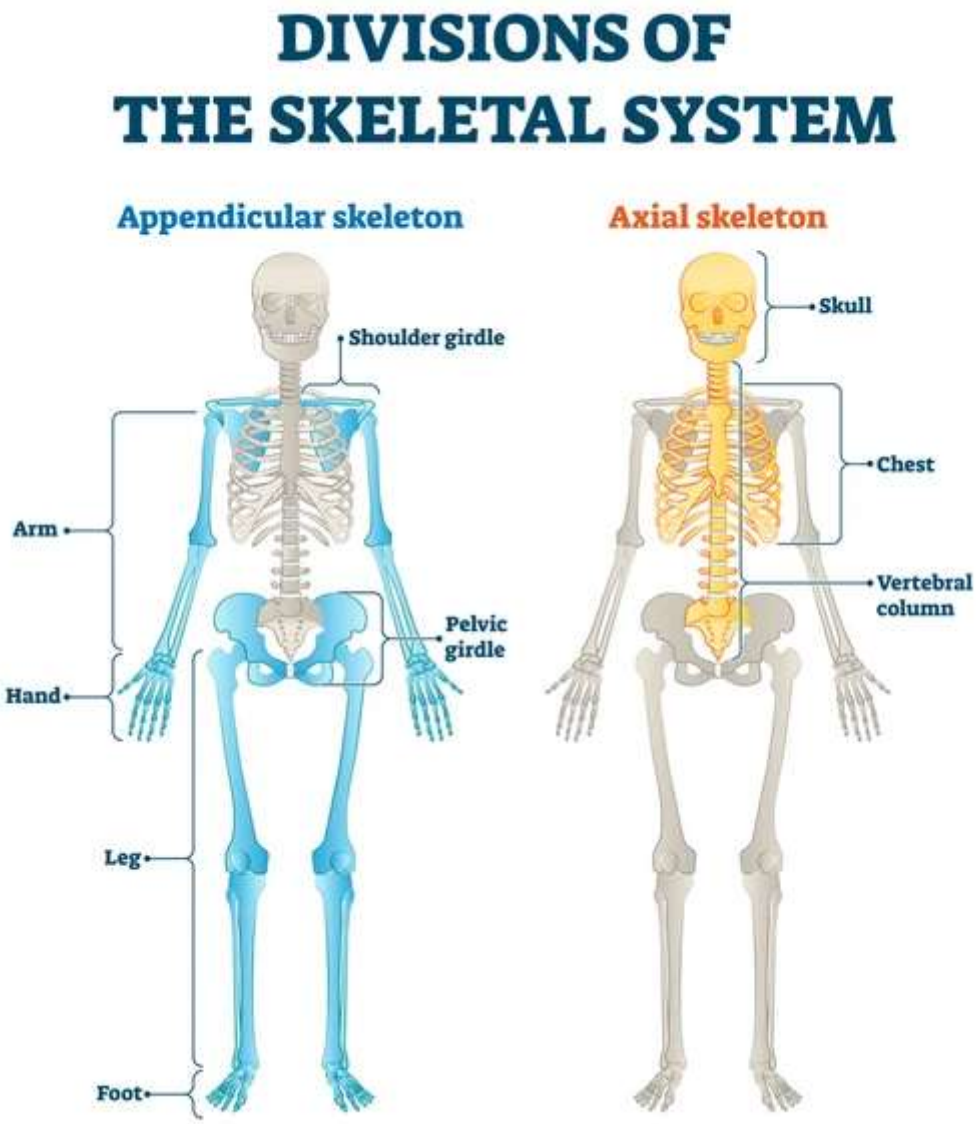
Bone is a type of connective tissues, consists of cells, fibers, and matrix. It is hard because of the calcification of its extracellular matrix and possesses a degree of elasticity because of the presence of organic fibers.

Bone has a protective function; the skull and vertebral column, for example, protect the brain and spinal cord from injury; the sternum and ribs protect the thoracic and upper abdominal viscera. It serves as a lever, as seen in the long bones of the limbs, and as an important storage area for calcium salts. It houses and protects within its cavities the delicate blood-forming bone marrow.



Bone exists in two forms: compact (cortical) and cancellous (spongy).Compact bone appears as a solid mass; cancellous bone consists of a branching network of trabeculae. The trabeculae are arranged in such a manner to resist the stresses and strains to which the bone is exposed.

Regional Classification of Bones:



A. Axial skeleton:

1- Skull

a) Cranium
b) Face
c) Auditory ossicles

2- Hyoid

3- Vertebrae (including sacrum and coccyx)

4- Thoracic cage

a) Sternum
b) Ribs

B. Appendicular skeleton

• Shoulder girdles

a) Clavicle 2
b) Scapula 2

• Upper extremities

1. Humerus 2
2. Radius 2
3. Ulna 2
4. Carpals 16
5. Metacarpals 10
6. Phalanges 28

• Pelvic girdle

* Hip bone 2

• Lower extremities

1. Femur 2
2. Patella 2
3. Fibula 2
4. Tibia 2
5. Tarsals 14

6. Metatarsals 10
7. Phalanges 28

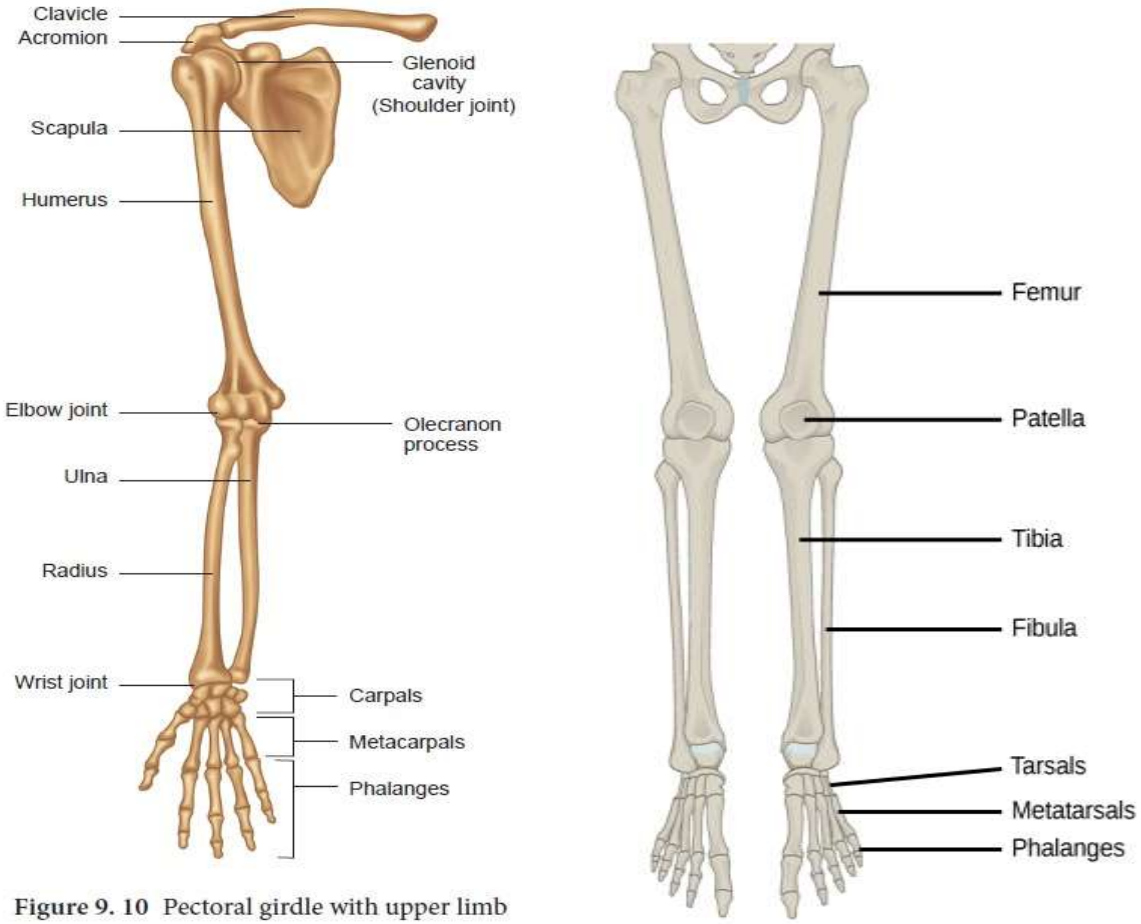
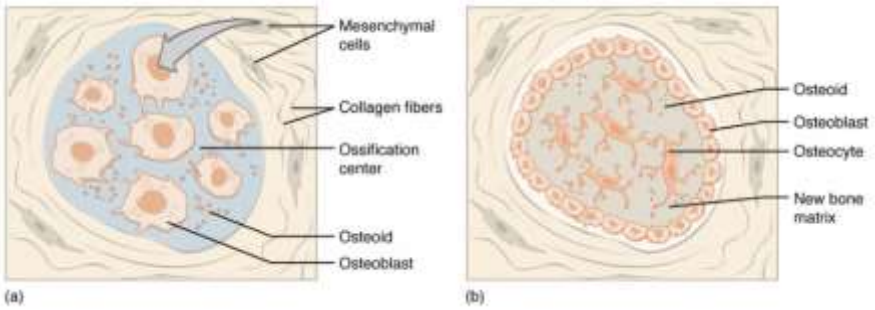


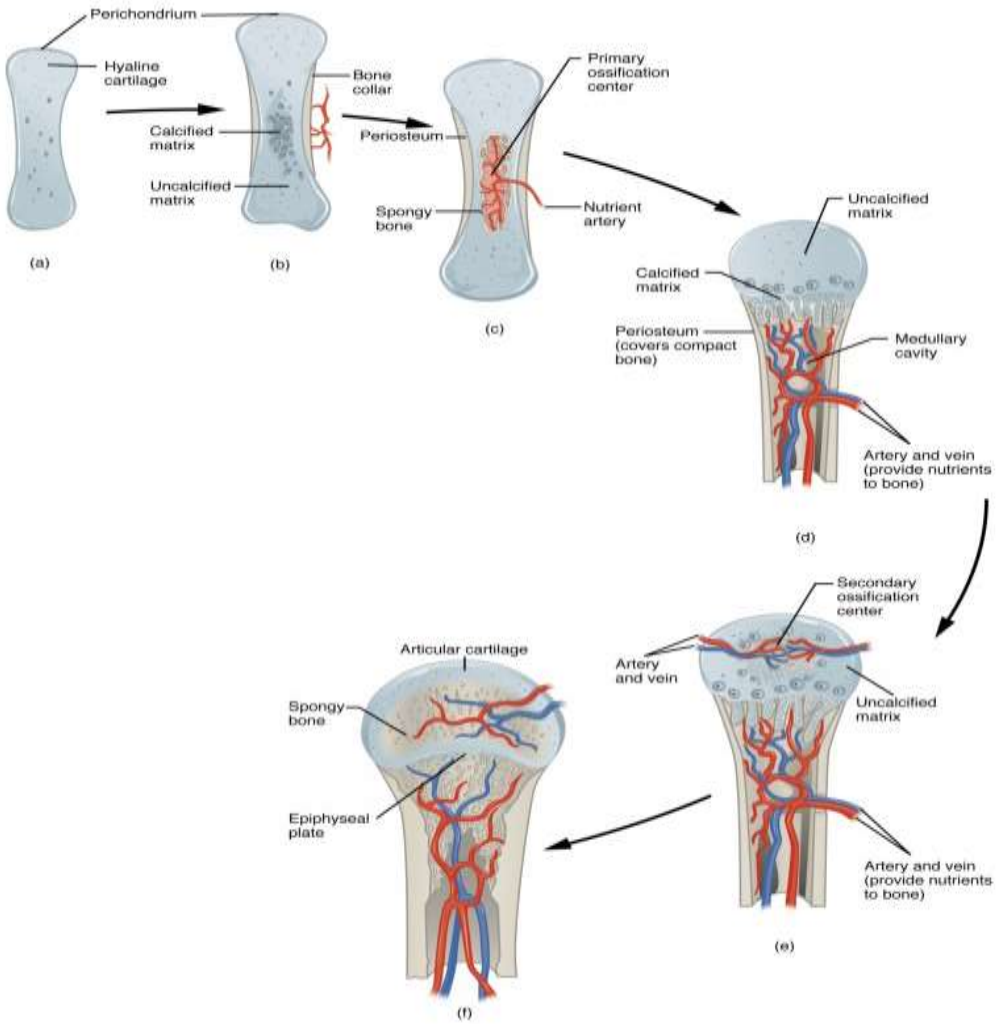
Figure 9. 10 Pectoral girdle with upper limb

Development of Bone

Bone is developed by two processes: **membranous and endochondral.** In the first process, the bone is developed directly from a connective tissue membrane.



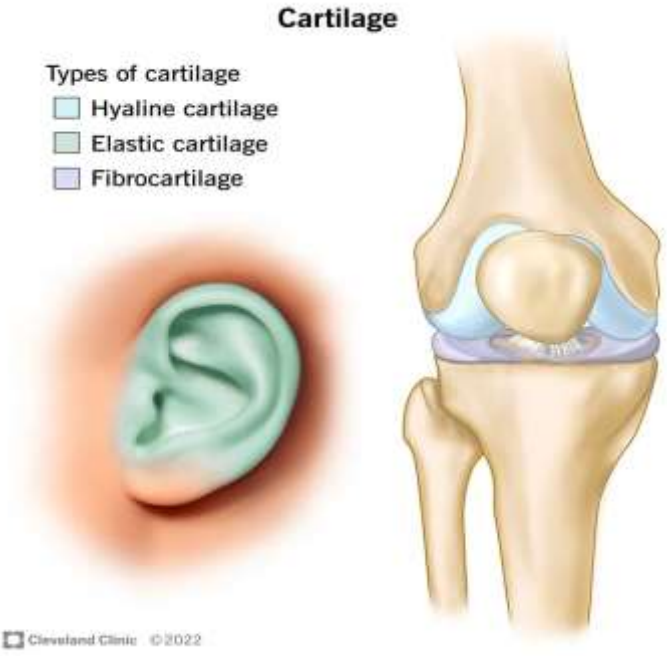
In the second, a cartilaginous model is first laid down and is later replaced by bone.



The bones of the vault of the skull are developed rapidly by the membranous method in the embryo.

Cartilage:

Cartilage is a form of connective tissue in which the cells and fibers are embedded in a gel-like matrix, the latter being responsible for its firmness and resilience. a fibrous membrane called the perichondrium covers the cartilage.



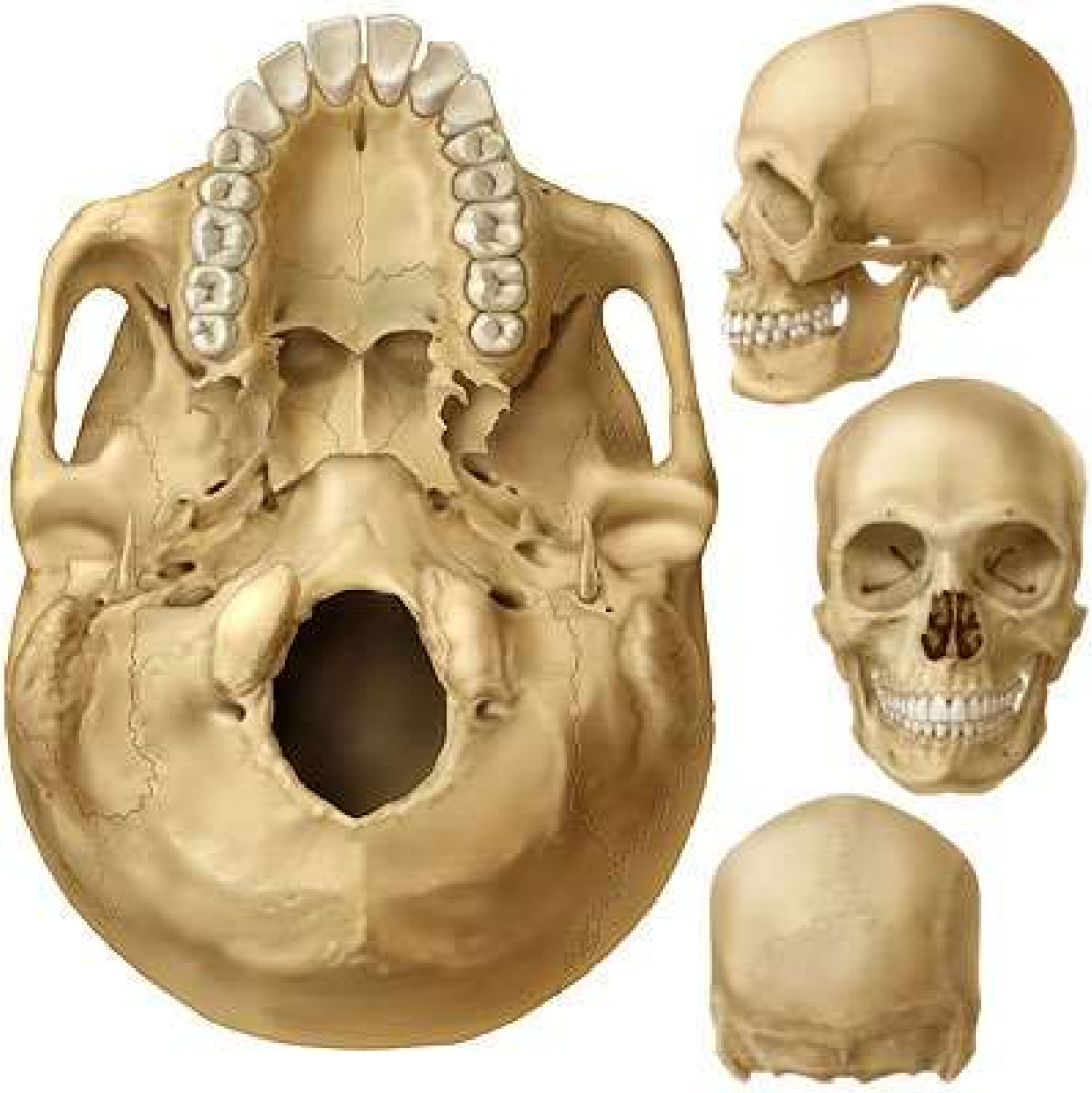
There are three types of cartilage:

1. Hyaline cartilage: Throughout childhood and adolescence,it plays an important part in the growth in length of long bones. It covers the articular surfaces of nearly all synovial joints.

2. Fibrocartilage: has many collagen fibers embedded in a small amount of matrix and is found in the discs within joints.

3. Elastic cartilage: possesses large numbers of elastic fibers embedded in matrix. As would be expected, it is flexible and is found in the auricle of the ear, the external auditory meatus, the auditory tube, and the epiglottis.

The Skull



The skull is the most complex bony structure of the body, which is formed by the cranium and facial bones.

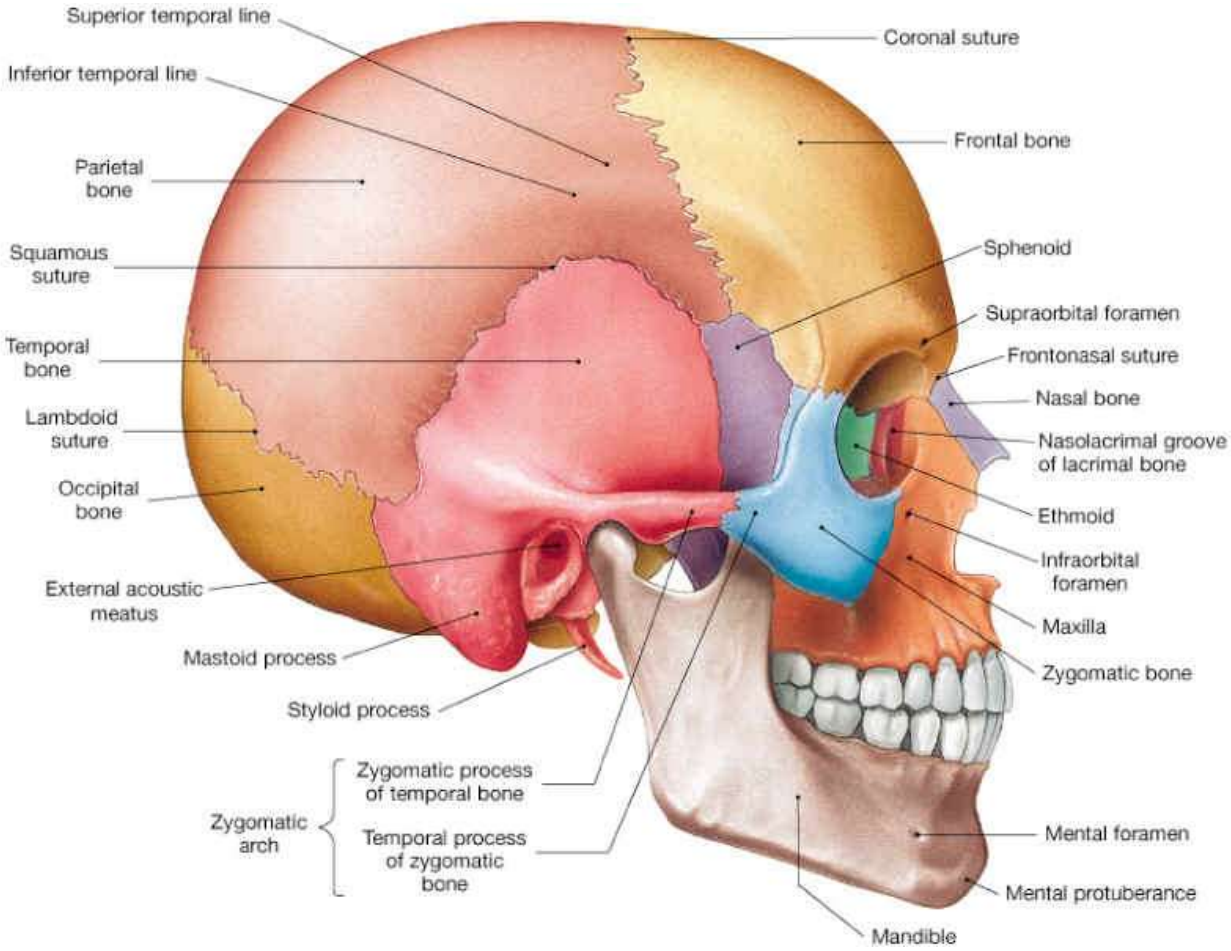
Cranium:

Formed from **eight** large bones Unpaired bones include: Occipital bone, Frontal bone, Sphenoid bone, Ethmoid bone

Paired bones include: Temporal bones, Parietal bones.

Facial Bones

Facial skeleton is composed of **fourteen bones** of which only the mandible and vomer are unpaired. The paired bones are the maxillae, zygomatics, nasals, lacrimals, palatines, and inferior conchae.



Occipital bone

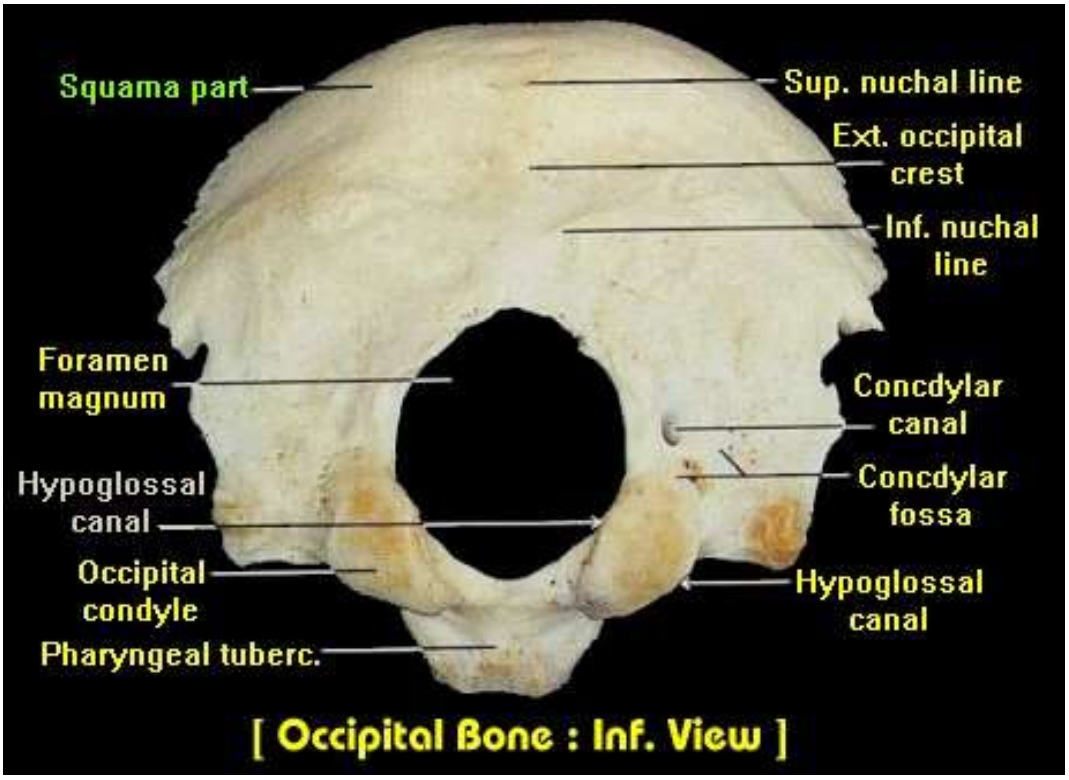
It is the most posterior of the cranial bones forming the **posterior wall** and part of **base of the skull and most of posterior cranial fossa**. It is consist of two parts; **squamous part** and **basilar part**. In between these parts is the **foramen magnum** of the occipital bone through which passes the spinal cord. The squamous part lies posterior to the foramen magnum and the basilar part lies anterior to the foramen magnum.

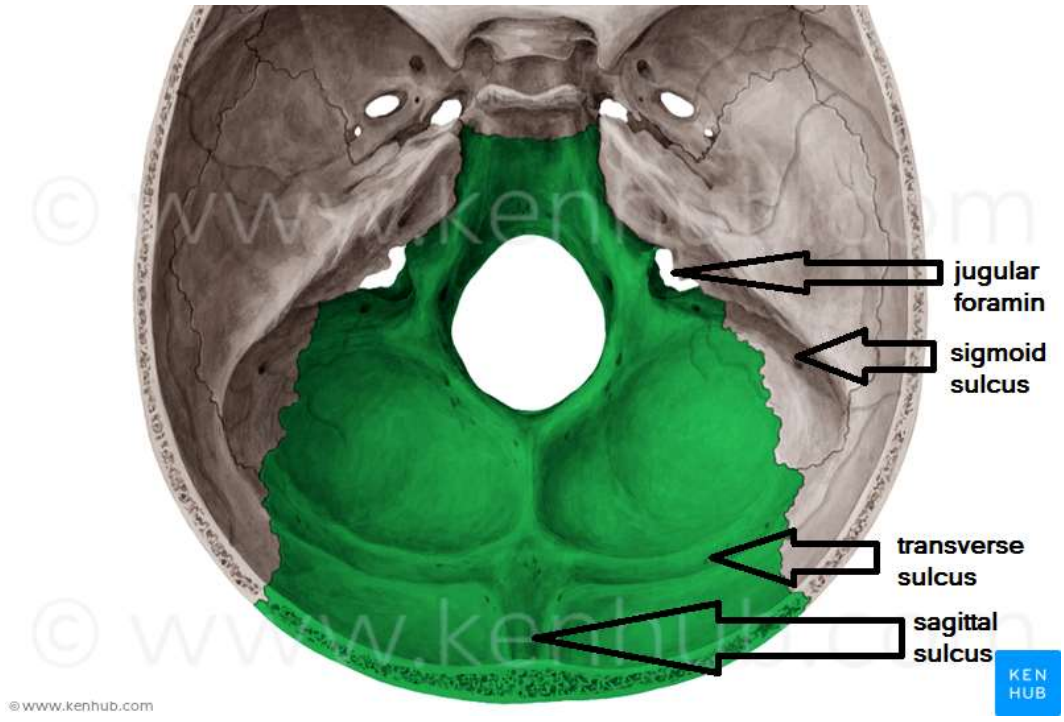
On the inferior surface of the basilar part just anteriolateral to the foramen magnum lie two projections called as **occipital condyles** which project inferiorly and posteriorly. The occipital condyle make joint with the superior articular facets of the 1st cervical vertebrae called as **atlanto−occipital joint**. This joint transmits the weight of skull bones to the vertebral column and helps in making movements like when we say Yes (flexion anteriorly and posteriorly).

On the posterior external part of the squamous part is the **external occipital protuberance** and on each sides lies two curve lines called as **superior nuchal line** and **inferior nuchal line**. Internally are sagittal and transverse sulci [continue with sigmoid sulci] which converge at confluence of sinuses. Internal occipital protuberance is also found in this area. Just anterior and lateral to the foramen magnum on both sides are the **hypoglossal canal** for the passage of hypoglossal nerve.

The basilar part of the occipital bone attaches to the **sphenoid bone** and **petrous part of the temporal bone**. Laterally between the petrous part

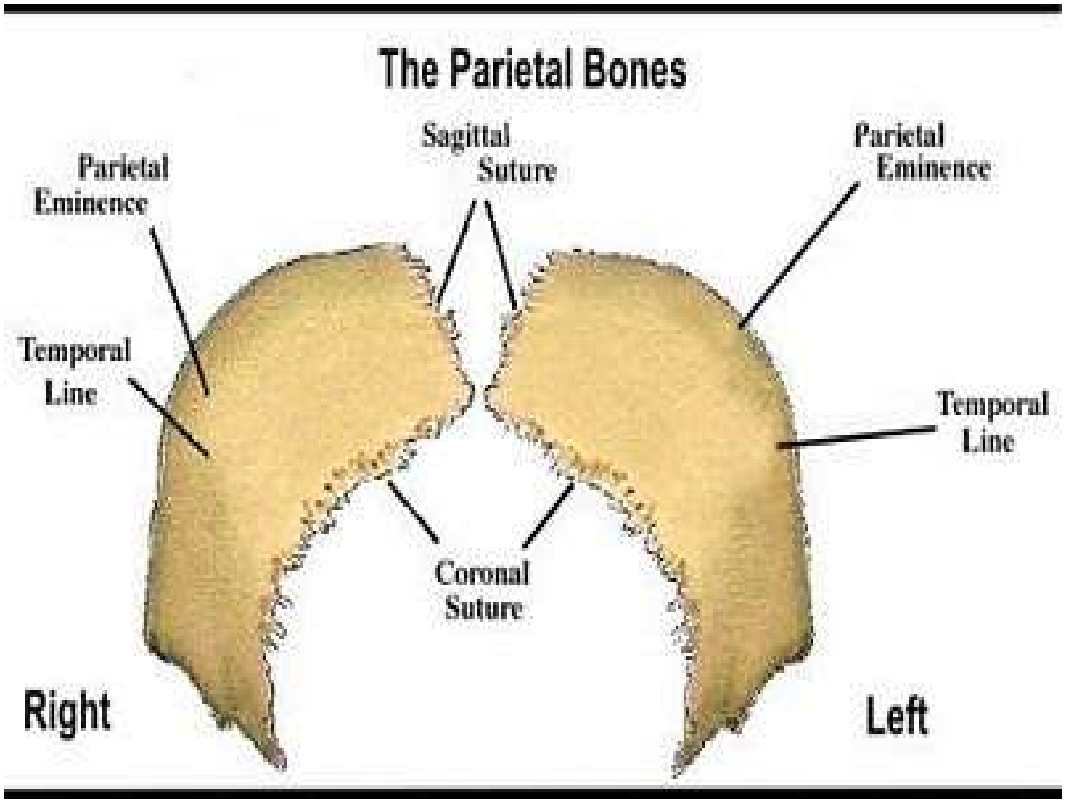
of the temporal bone and occipital bone lie the **jugular foramen** through which passes the 9th, 10th and 11th cranial nerves plus internal jugular vein. Occipital bone articulates with parietal bones by lambdoid suture.





Parietal bones

They form most of the **roof** and **part of lateral walls of the cranium**. Parietal bones articulate with the **frontal bone** anteriorly by **coronal suture**, posteriorly with occipital bone by **lambdoid suture** and laterally with the **temporal** and **sphenoid bones** through the **squamous sutures and articulate with each other by sagittal suture**. Parietal bones contain numerous grooves on its inferior surface for the passage of the blood vessels. On its external surface, laterally there are two lines for attachment of temporalis muscle, the superior and inferior temporal lines.



Temporal bones

They form part of the **lateral walls** of the skull and part of base of skull. Anteriorly articulate with the **zygomatic bones**, medially with the **sphenoid bone** and posteriorly with the **occipital bone and superiorly with parietal bone**. Like the occipital bone it has two parts; **squamous part** which is flat and fun – like and project superiorly.

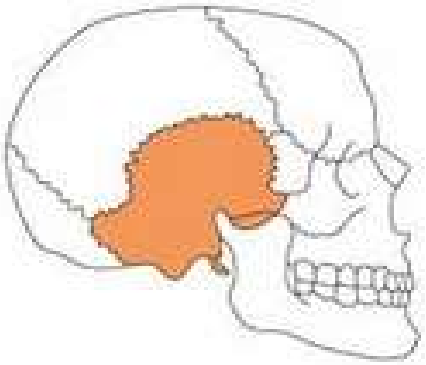
Squamous suture joins the temporal bone with parietal bone. **petrous part** which lies inferiorly. From the inferior surface of the petrous part projects two processes the **mastoid process** which lies posterior to the external auditory meatus and the **styloid process** anterior and medial to the external auditory meatus.

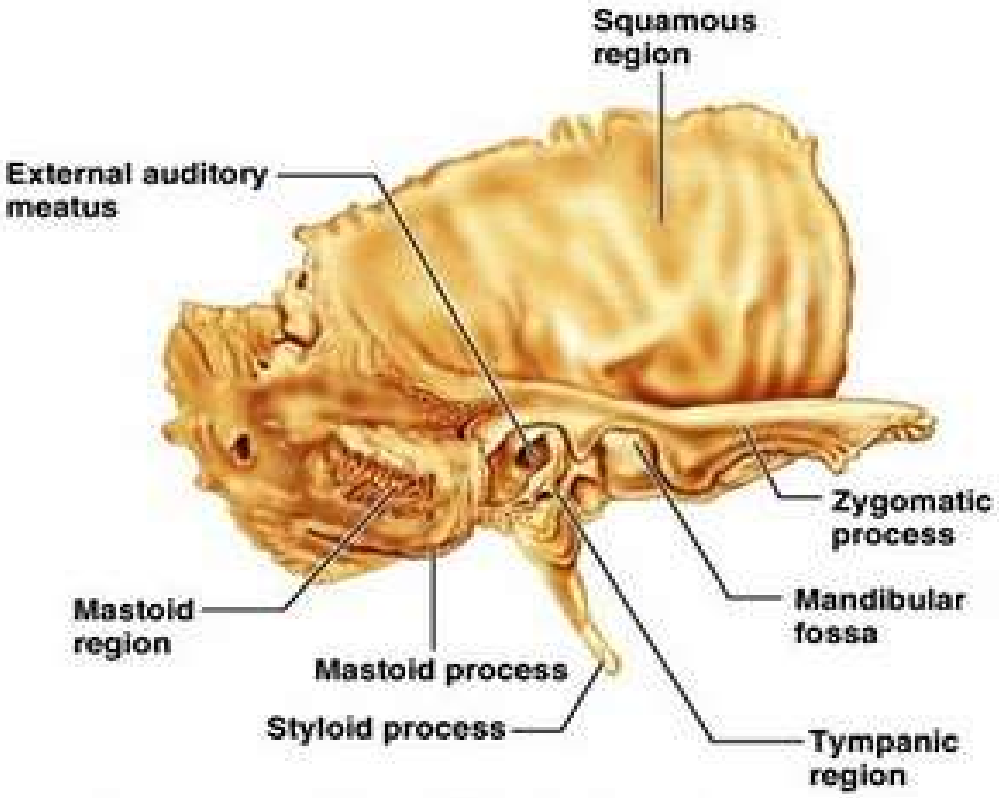
Above the mastoid process is the supramastoid crest to which the posterior portion of the temporal muscle is attached. Between styloid and mastoid processes is an opening called **stylomastoid foramen** through which passes the 7th cranial nerve (facial).

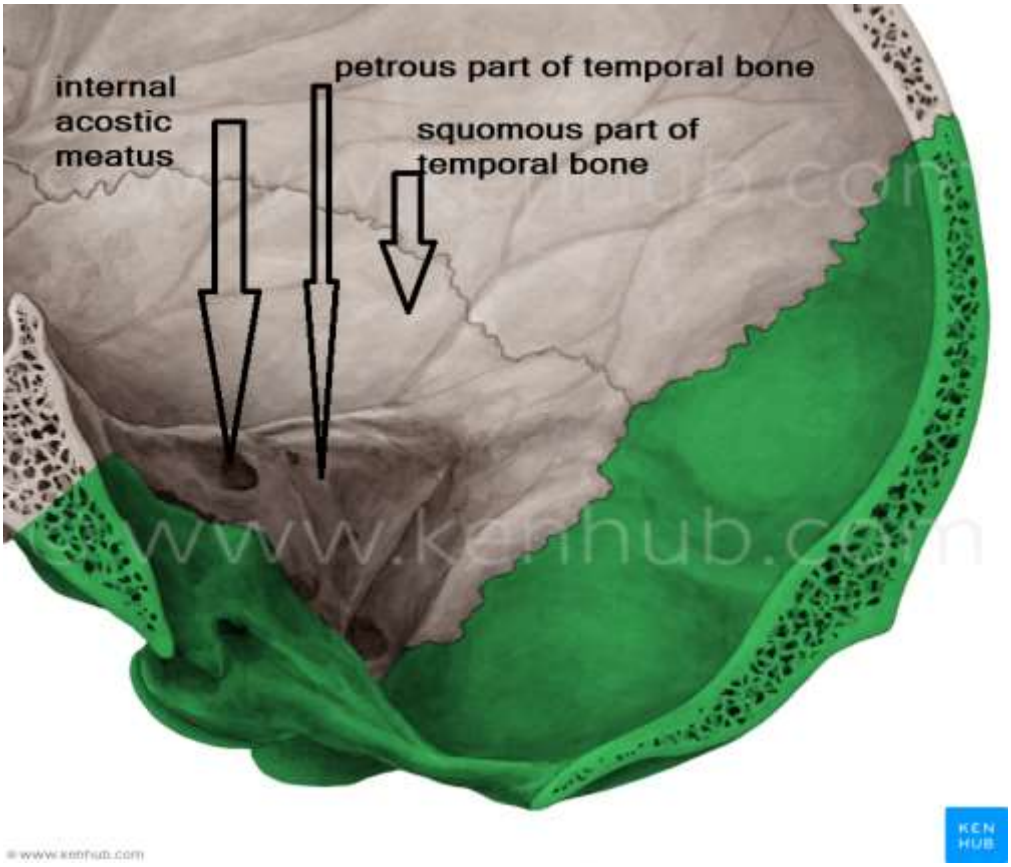
Petrous part has a cavity which lodges middle and internal parts of ear. externally temporal bone has **zygomatic process** which articulates with the temporal process of zygomatic bone forming **zygomatic arch**. Just anterior to external acoustic meatus and inferior to the origin of the zygomatic process is the glinoid or mandibular fossa, which assists in the formation of tempero-mandibular joint.

In the internal aspect, the internal auditory canal [internal acoustic meatus] is a channel in the petrous bone that is somewhat variable in size and

shape. Facial nerve is located in the anterosuperior compartment, the cochlear nerve in the anteroinferior compartment, and the vestibular nerves in the posterior compartment, respectively. The squamous portion with petrous portion participate in middle cranial fossa formation. the posterior surface of petrous participate in the formation of posterior cranial fossa,







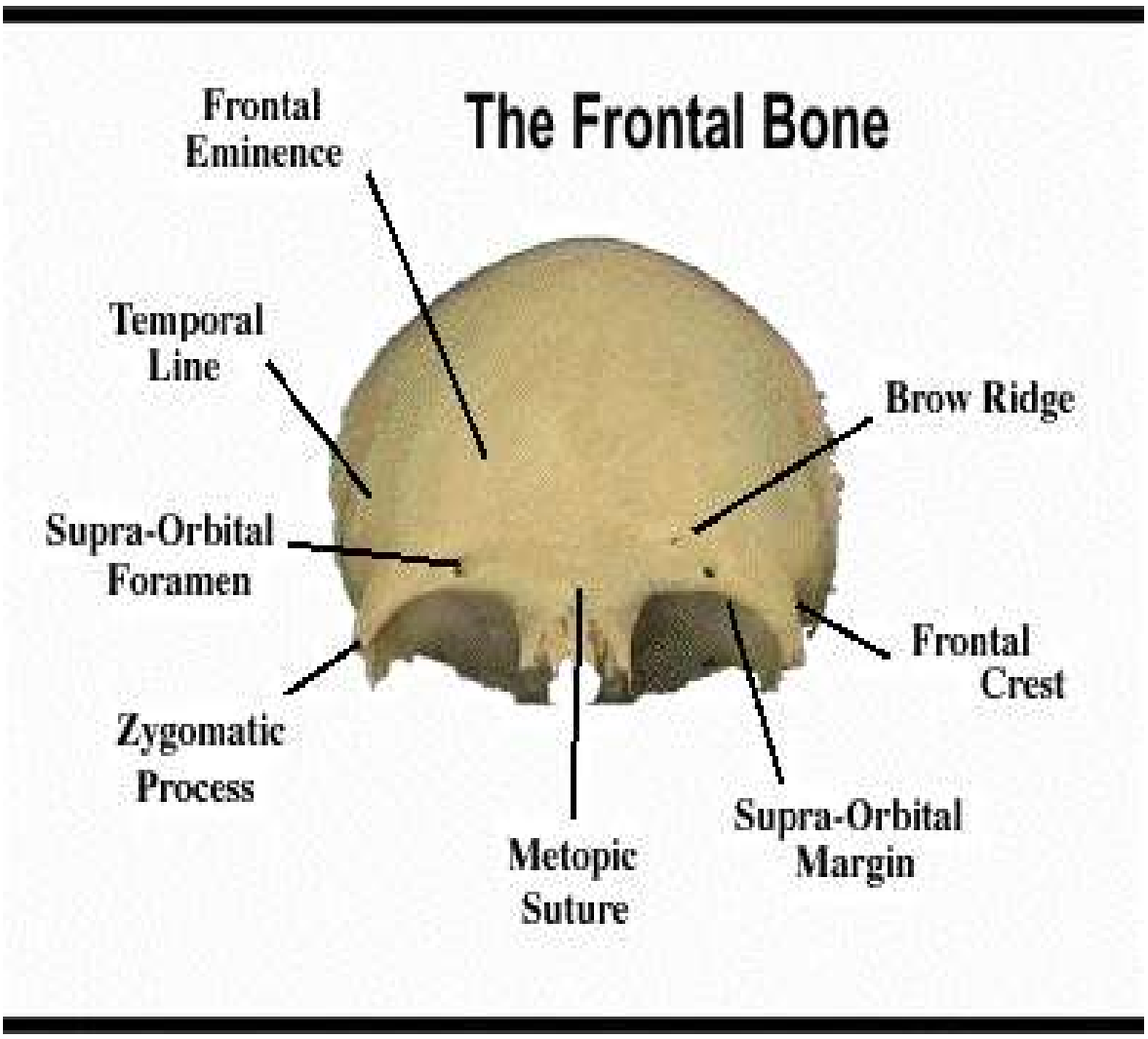
Frontal bone

It forms the anterior wall of the cranium and most of the **anterior cranial fossa** and makes the **roof** and part of **lateral wall** of the **orbit.** It also gives shape to the forehead. It may be divided into two main portions, a vertical and horizontal portions. Frontal bone articulates with the **nasal bones**, zygomatic bones, maxilla, lacrimal bone, ethmoid, **sphenoid bone** and **parietal bone** by coronal suture.

Vertical portions having cavities called as **frontal sinuses**.also bone possesses 2 supraorbital ridges, assotiated with each ridges , superior orbital

margin. Each ridge has either supra –orbital notch or if completely surrounded by bone supra-orbital foramen.

The left and right frontal crest, begins at each zygomatic process and provides the anterior origin of temporal line. Internally, the frontal bone possesses median sagittal crest. The other portion of frontal bone is the horizontal portion forms the roof of orbital cavity and part of anterior cranial fossa.



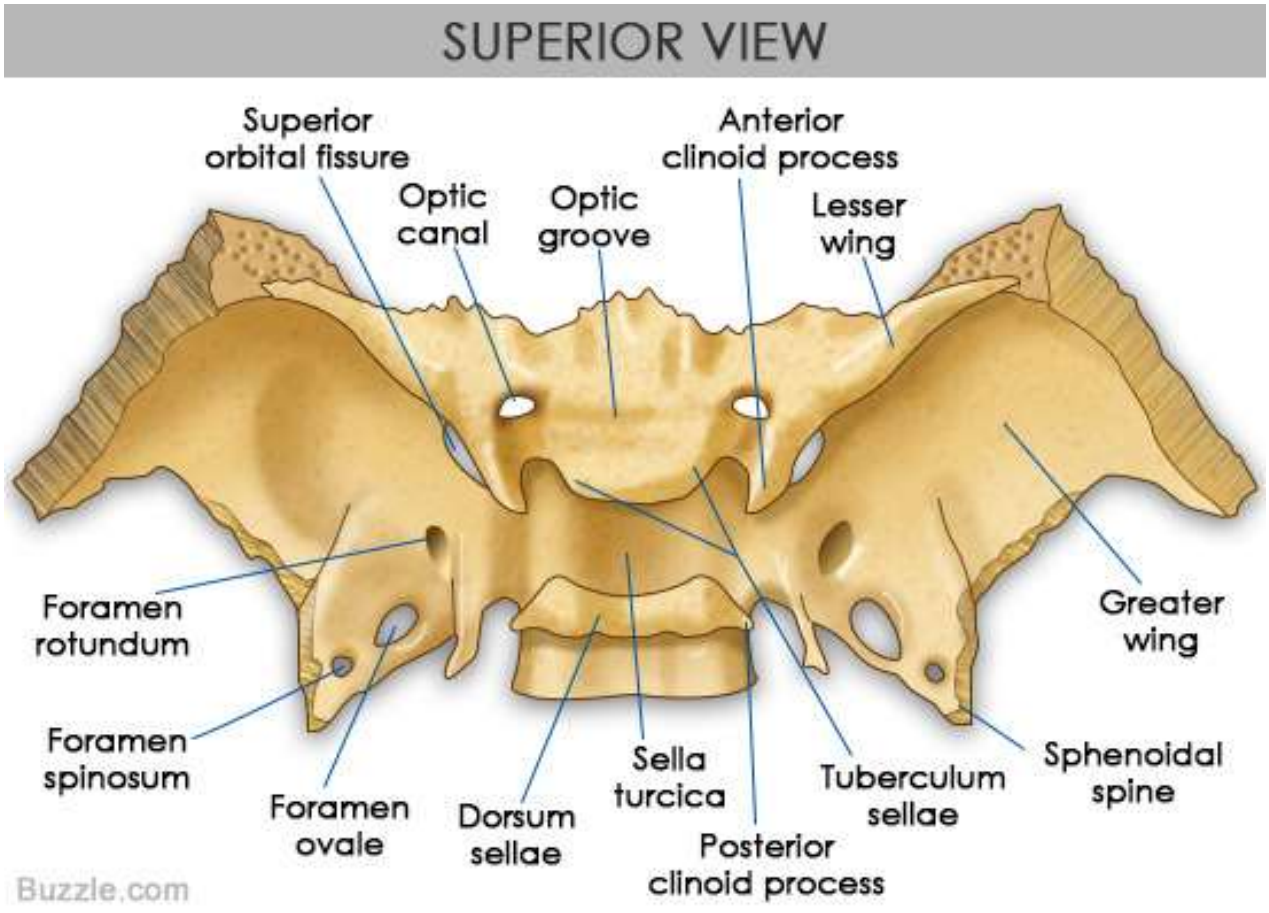
Sphenoid bone

It forms part of the **floor of the middle cranial fossa and posterior part of anterior cranial fossa**. Anteriorly it articulates with the **frontal and ethmoidal bones**, laterally with the **temporal and parietal bones** and posteriorly with the **occipital bone**. Sphenoid bone has two pair of wings: **greater wings** and **lesser wings**. These wings give sphenoid bone **bat shaped** appearance. Between the two greater wings lies the **body of sphenoid bone**.

The body has two anterior projections called as **anterior clinoid processes** and two posterior projections called as **posterior clinoid processes**. In-between these two projections lie a **pituitary fossa** which

accommodates the pituitary gland. Sphenoid air sinus located within the body.

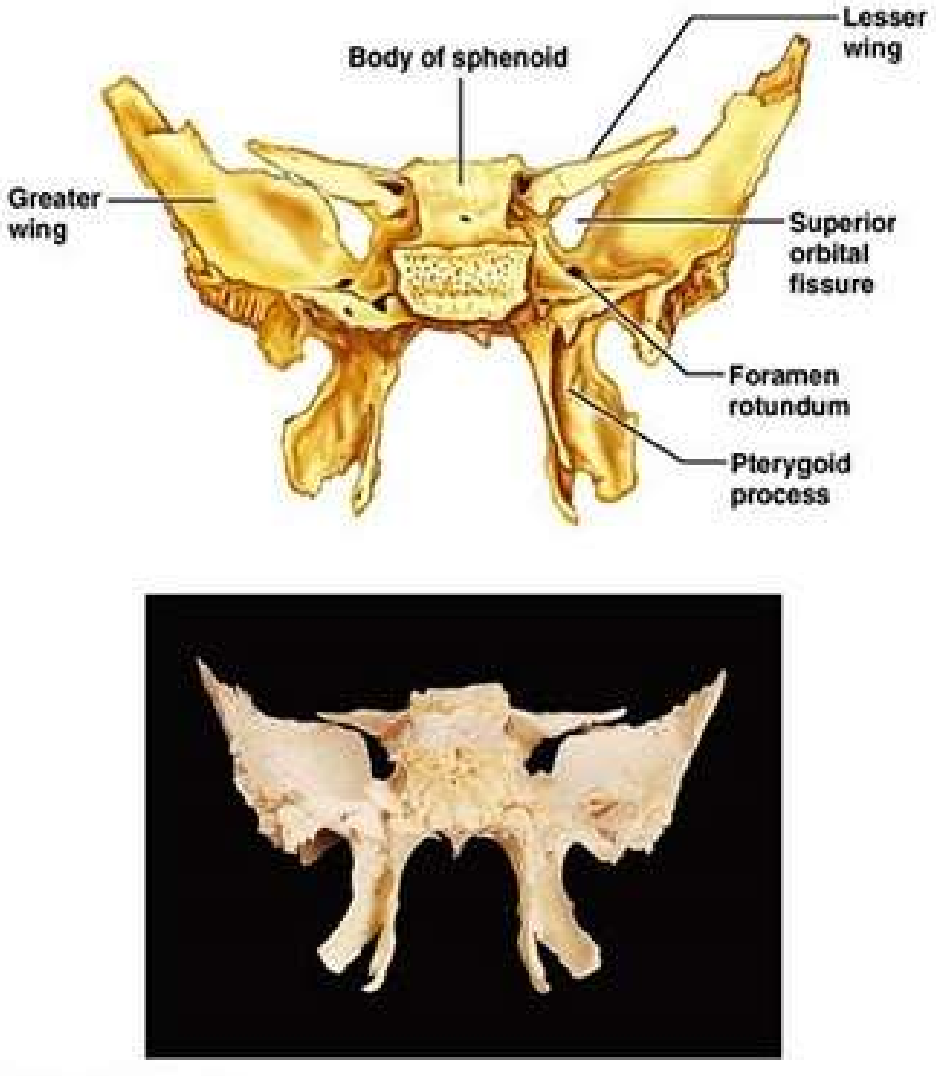
Both anterior and posterior clinoid processes along with pituitary fossa form a saddle like structure called as **sella turcica**. From the inferior surface of the body of sphenoid bone arise two projections called as **lateral** and **medial pterygoid processes**. In between these processes lies the **pterygoid fossa**.



Sphenoid bone

Through the lesser wing of the sphenoid bone passes a canal called as **optic canal** through which passes the optic nerve. Between the lesser and greater wings anteriorly lies a fissure called **superior orbital fissure** through which passes the ophthalmic division of trigeminal nerve.

Most anterior of the greater wing has a **foramen rotundum** through which passes the maxillary division of trigeminal nerve. Posterior to the foramen rotundum is **foramen ovale** through which passes the mandibular division of trigeminal nerve. Posterior and lateral to the foramen ovale is the **foramen spinosum** through which passes the middle meningeal artery.



(b) Posterior view

Sphenoid bone

Ethmoid bone

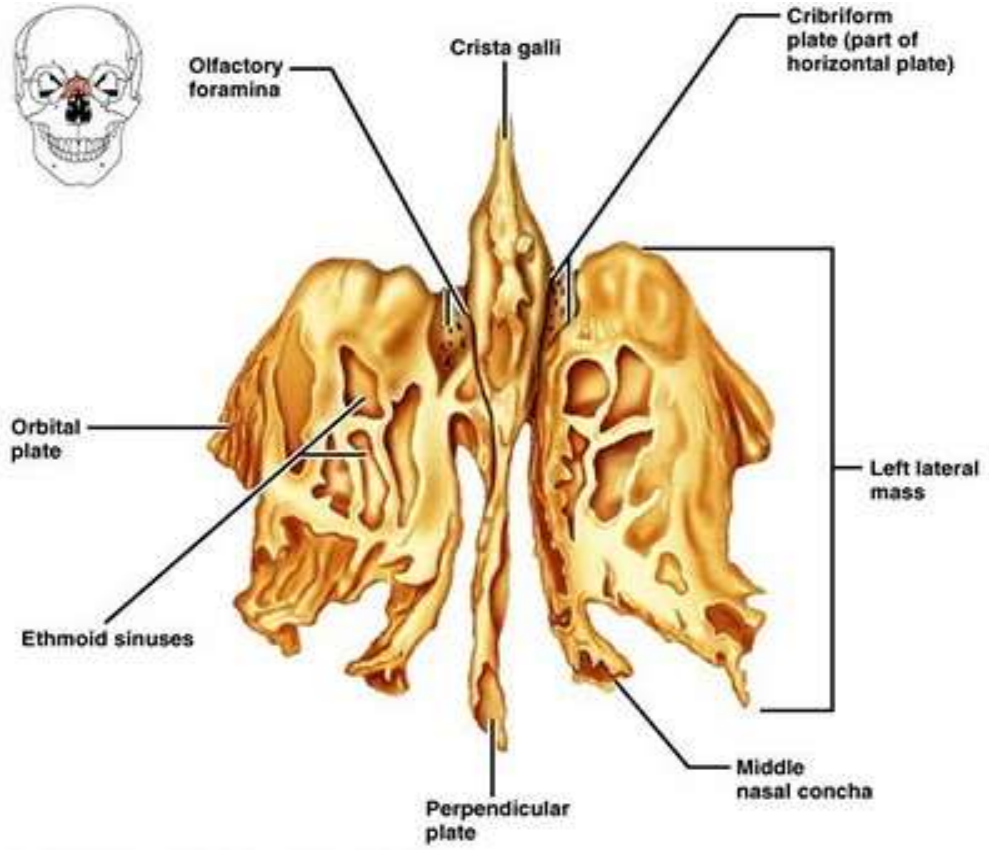
It is one of the smallest among the cranial bones. It helps in the formation of some part of **anterior cranial fossa**. Anteriorly it articulates with the **nasal and lacrimal bones** , posteriorly with the **sphenoid bone** and laterally with the **frontal bone**, infriolateraly with maxilla and inferiorly with vomer bone.

Ethmoid bone has **four** parts:

• **Cribriform plate** is the most superior part of the ethmoid bone. It has central upward projection called as **crista galli** (site of attachment of falx cerebri or durra matter). The two horizontal plates of cribriform plate contain foramina for the passage of olfactory nerves.

• **Perpendicular plate** projects downward and helps in the formation of the **nasal septum**.

• **2 plates (Medial and Lateral labyrinths):** The lateral labyrinth forms part of the medial wall of the orbit. The medial labyrinth forms two projections, which protrudes inside the nasal cavity forming two projections called as the **superior nasal conchae** and **middle nasal conchae**. These nasal conchae contain air cells which make the **ethmoid sinuses**.



Ethmoid bone

Mandible bone

It is unpaired, strongest and the **only moveable bone of the skull**. Mandible has two parts i.e. two **rami** and one **body [during development the body consist of 2 halves which fuse together in the midline at the symphysis menti]**.

The rami join the body at the angle called as **angle of the mandible**. The superior part of the each ramus has two projections called as **coronoid process (anteriorly)** and **condyloid process (posteriorly).** The condyloid process makes joint with the mandibular fossa of the temporal bone making the only moveable joint of the skull called as **temporomandibular joint**.

The upper margin of the body of mandible has **inferior alveolar processes** which fit the lower teeth.

Land marks on the outer surface:

1-mental protuberance: a median elevation on the front of the body close to the lower border. The protuberance forms projections on each side called mental tubercle.

2-mental foramen: lateral and posterior to mental tubercles below 1st premolar.

3-oblique line: an oblique ridge from anterior border of ramus extends downwards and forwards.

4- base of mandible: lower border of mandible.

5- angle of mandible: junction between the base and posterior border of ramus.

Land marks on the inner surface:

1-mylohyoid line: an oblique line on the inner surface of the body.

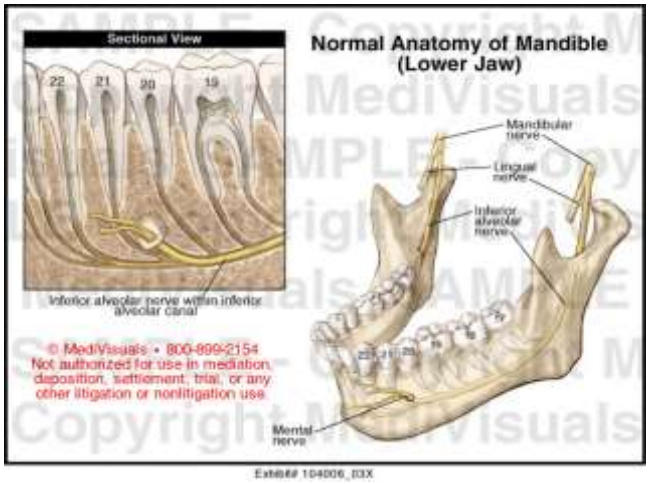
2-Submandibular fossa: a depression below the posterior part of mylohyoid line.

3-sublingual fossa: depression above the anterior part of mylohyoid line.

4- genial tubercles: small projections on the back of symphysis menti.

5- digestive fossa: a slight depression on the base close to symphysis menti on each side.

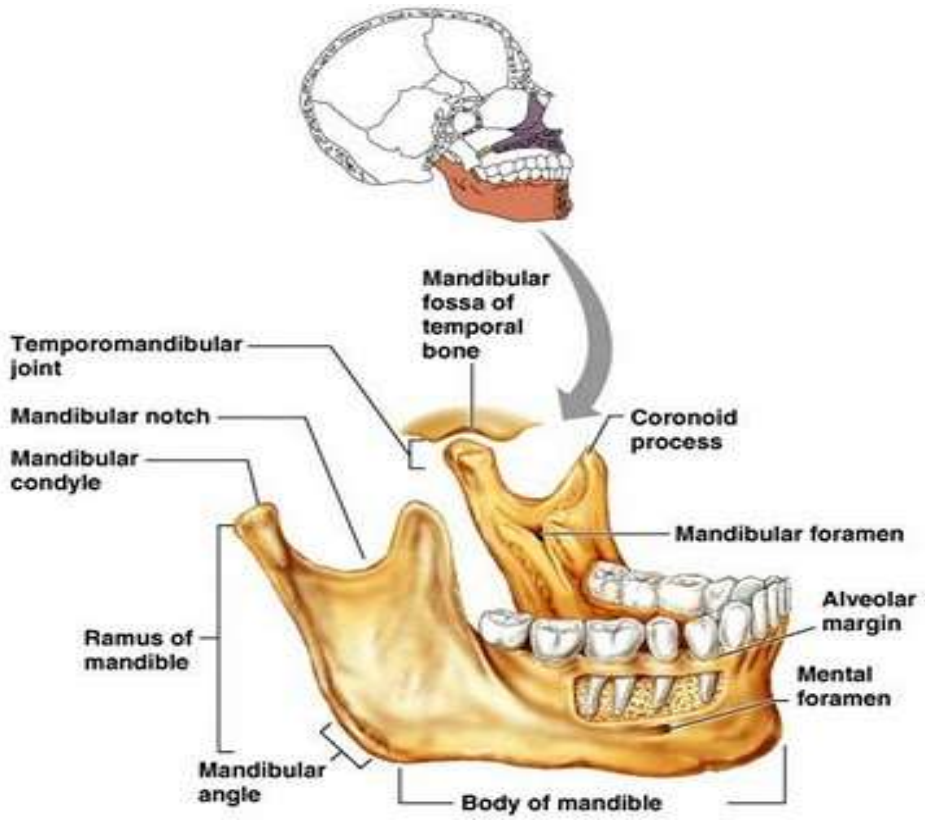
6- mandibular foramen: on the inner aspect of ramus it leads to mandibular canal contain inferior alveolar nerve and vessels, this canal runs downwards and forwards in the ramus and horizontally in the body , below the second premolar tooth it bifurcates in to the incisive and mental canals.



7- Lingula: small bone projuction medial to mandibular foramen.

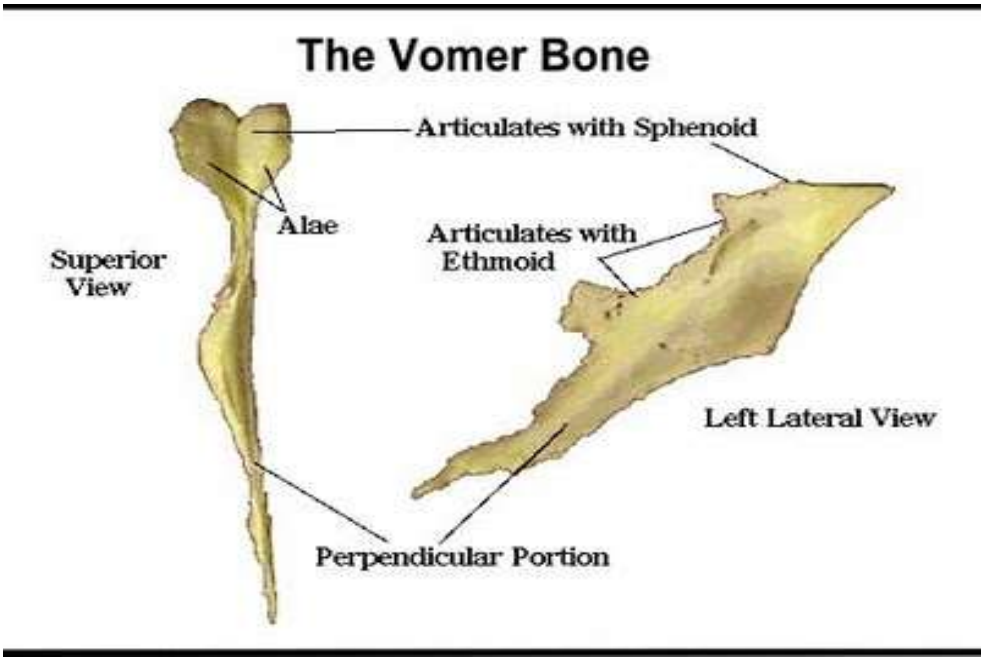
8-mandibular notch:concave upper border of ramus.

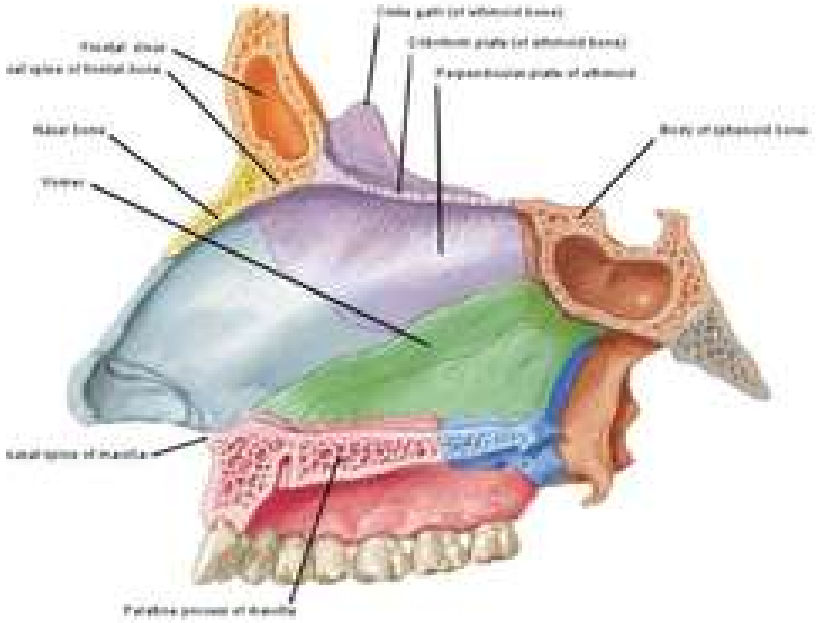
9 mylohyoid groove: a narrow groove extends from mandibuler foramen below and parallel to the mylohyoid line.



Vomer bone

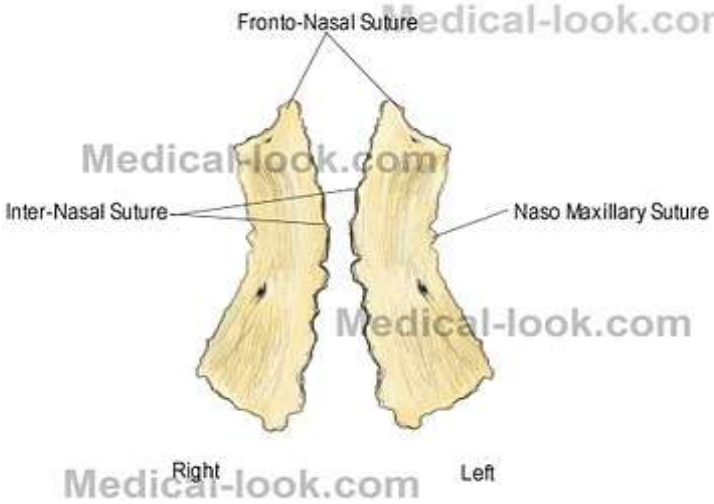
It is the unpaired bone located in the mid saggital plain. Which forms **part of the nasal septum**. Superioanteriorly it articulates with the perpendicular plate of **ethmoid bone**, superioposteriorly articulate with sphenoid bone inferiorly with the **palatine bone** and **palatine processes of the maxillae**.





Nasal bones

They form the bridge **of the nose**. They articulate with each other by way of the internasal suture . Superiorly they articulate with the **frontal bone by the way of frontonasal suture, the insertion of these two sutures marks the anatomical landmark called nasion.** Posteriolaterally each of the nasal bones articulates with the frontal process of the maxilla. Posteriorly articulate with ethmoid bone.



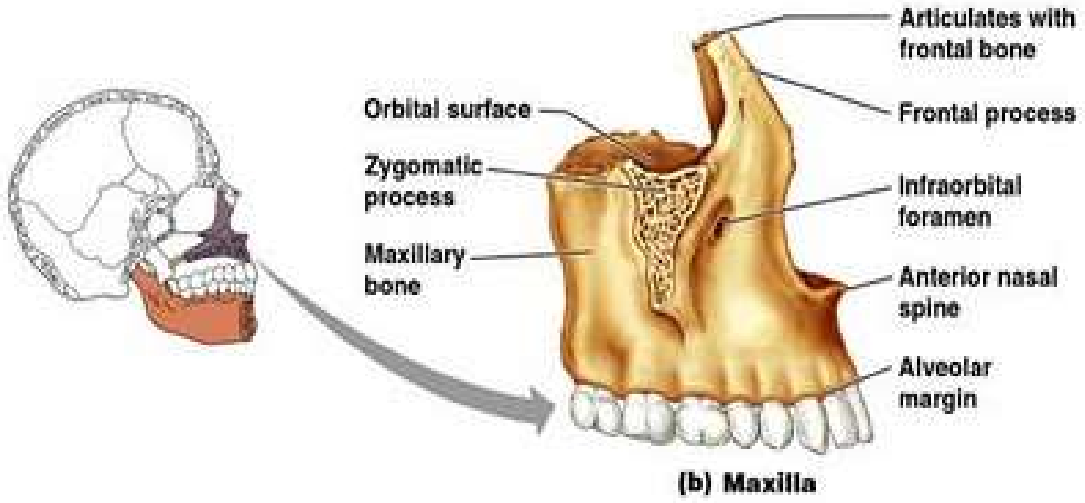
Nasal bones

Maxillary bones

They articulate with all the bones of the facial skeleton except the mandible. Superiorly they articulate with the **nasal** and **lacrimal bones** and frontal bone[cranial bone], laterally with the **zygomatic bones**, medially with each other[by way of intermaxillary suture,the superior end of this suture

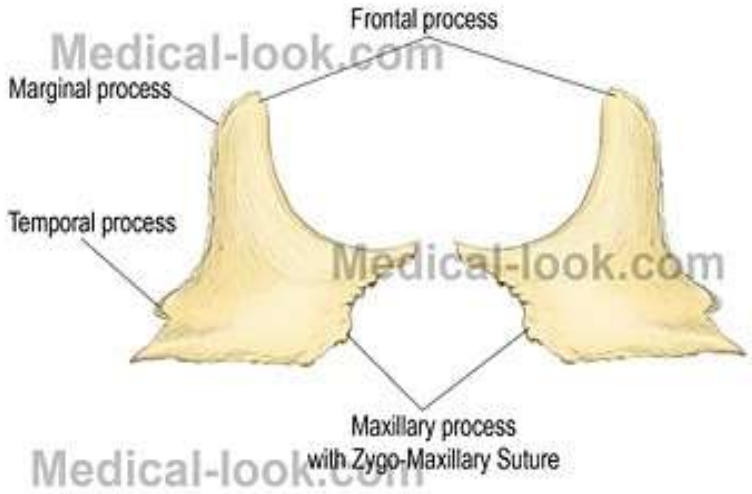
terminates with nasal spine] and with **vomer** , ethmoid and **inferior nasal conhae** and posteriorly with the **palatine bones**.

An orbital plate forms the floor of the eye orbit. Both maxillary bones contain air filled cavities called as **maxillary sinuses** which open into the nasal cavity. The alveolar process contains the upper dentition and assist in giving rise to the palatine portion which form the anterior 2/3 of hard palate. Anteriorly below the orbit there is an infra orbital foramen.



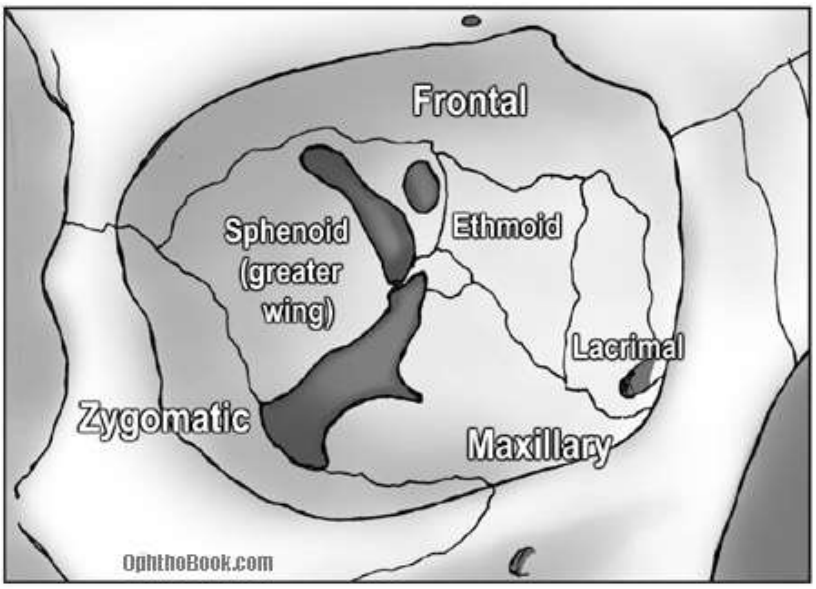
Zygomatic bones:

They form the **lateral wall** of the facial skeleton, part of lateral wall of orbital cavity and part of floor of orbital cavity. They are also called **cheek bones** as they form the prominence of the cheeks. Anteriorly they articulate with the **maxillary bone**, posteriorly with the zygomatic process of **temporal bone** and superiorly with zygomatic process of frontal bone.



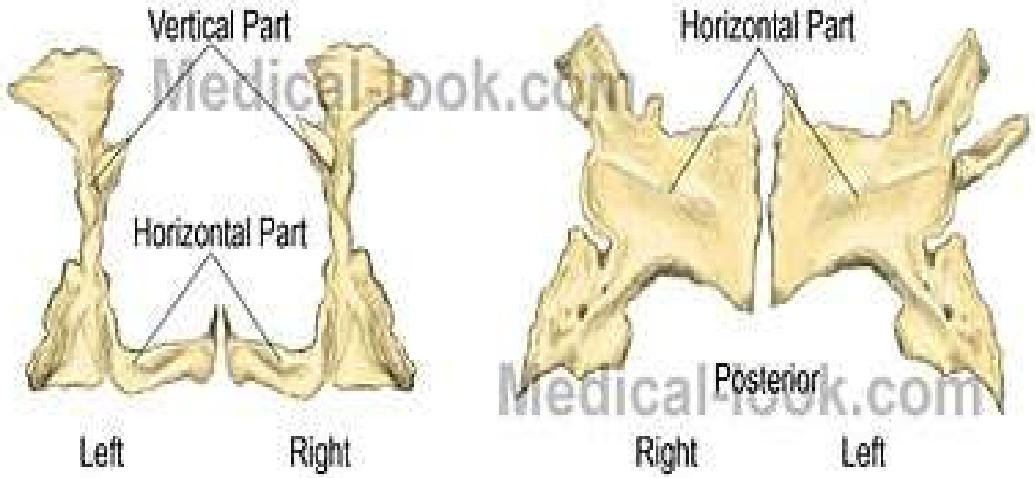
Lacrimal bones:

They lie posterior to the nasal bones and frontal processes of maxillary bones. Through the lacrimal bones passes the **lacrimal canal** which is a passage for tears into the nasal cavity. Lacrimal bone articulate with frontal, ethmoid and maxillary bones.



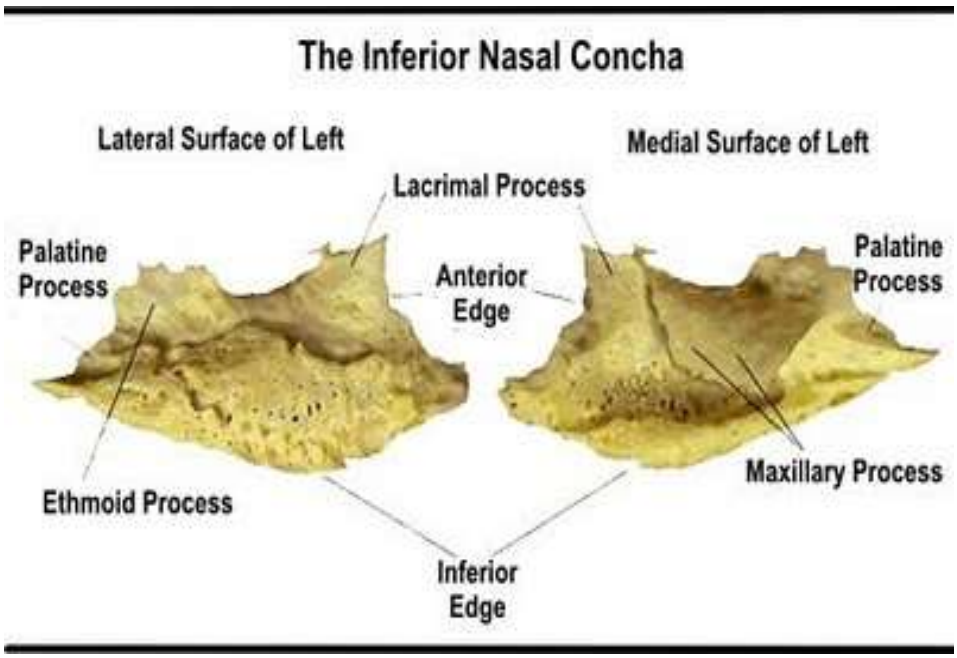
Palatine bones:

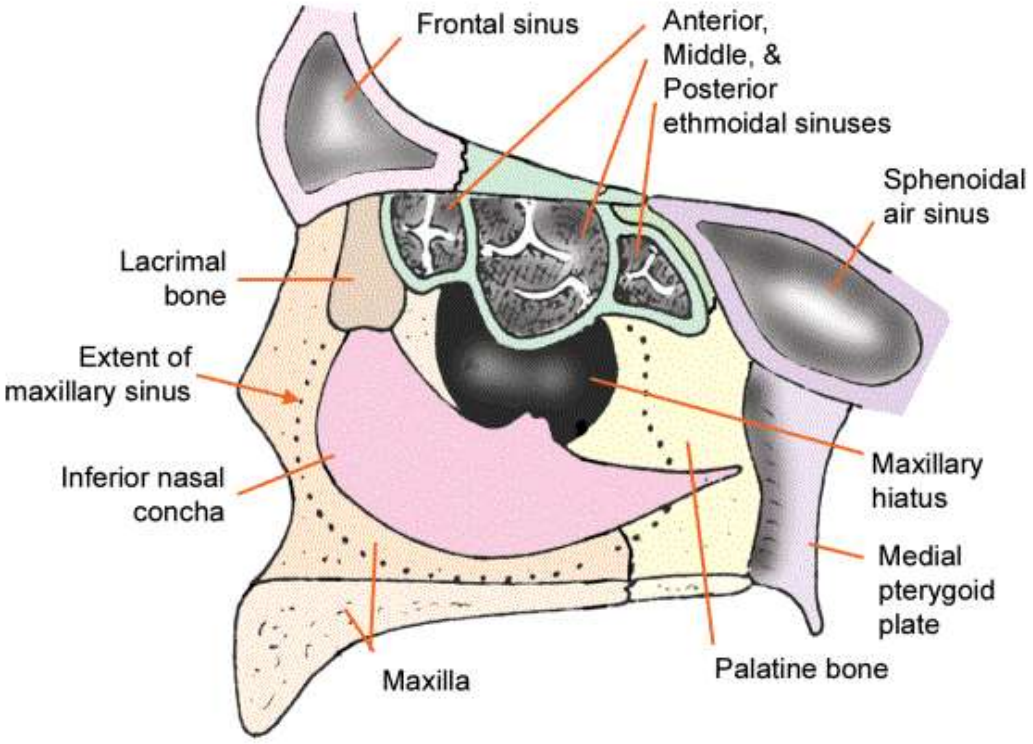
They lie posterior to the maxillary bones (palatine processes). They possesses an L- shape. Each one consist of two plates horizontal, form the posterior one third of the **hard palate** and separating the nasal cavity from the oral cavity, and vertical plate form the posterior part of lateral wall of nasal cavity. Palatine bones articulate with each other via interpalatine suture, and articulate with vomer, maxilla , inferior nasal chonchae , ethmoid and sphenoid.



Inferior nasal conchae:

These are the two small bones which form the **inferior lateral wall of the nasal cavity**. Superiorly articulate with the **middle nasal conchae** of the ethmoid bone while laterally with the **maxillary and palatine bones**.



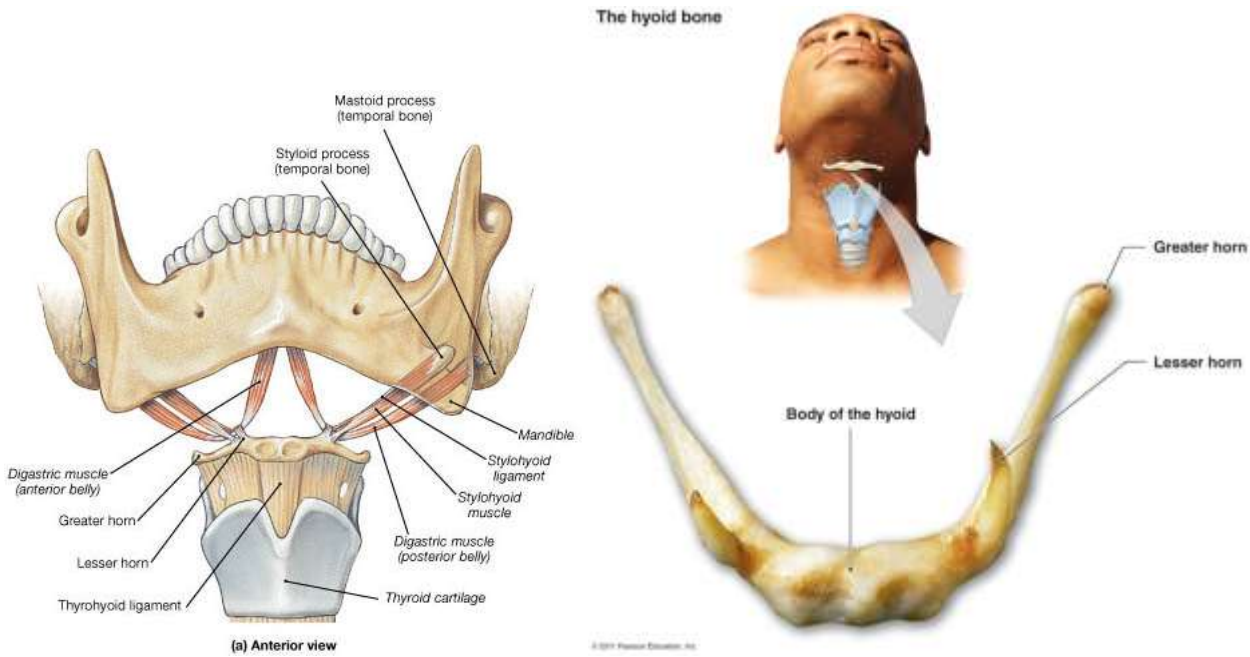


Hyoid bone:

Is a horseshoe-shaped bone situated in the anterior midline of the neck between the chin and the thyroid cartilage. At rest, it lies at the level of the base of the mandible in the front and the third cervical vertebra (C3) behind.

Unlike other bones, the hyoid is only distantly connected to other bones by muscles or ligaments. The hyoid is anchored by muscles from the anterior, posterior and inferior directions, and aids in tongue movement and swallowing. The hyoid bone provides attachment to the muscles of the floor of the mouth and the tongue above, the larynx below, and the epiglottis and pharynx behind.

The bone can be divided into three component parts: the body of the hyoid, the greater cornua and the lesser cornua. The body of the hyoid is centrally located, while the cornua types are on both sides. The lesser cornua are small conical projections oriented upwards. The greater cornua extends backwards from the body of the hyoid. Since cornua come in pairs, the greater and lesser cornua can be differentiated into left and right designations.



Bones of the Human Cranium and Face

T

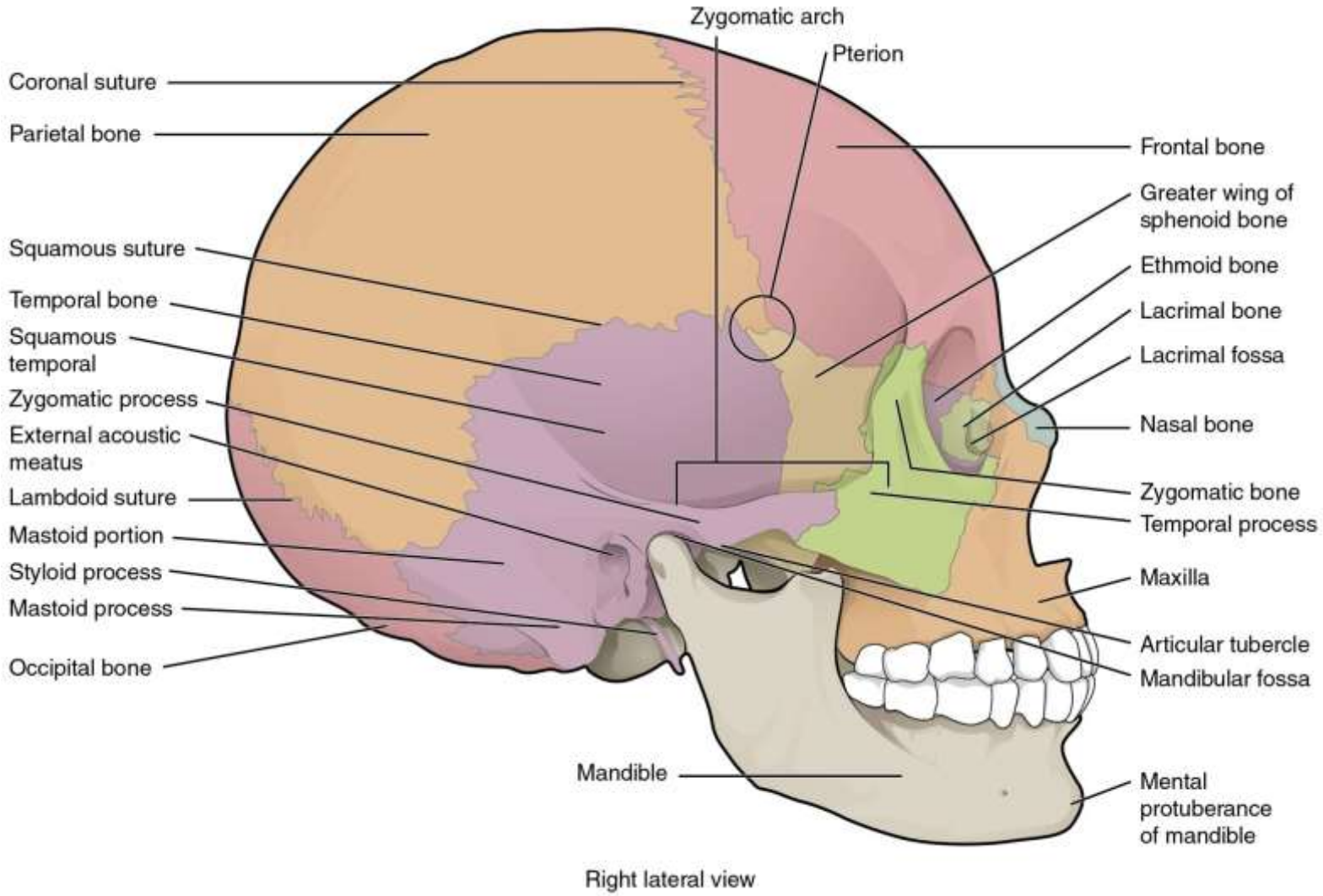
here are 22 bones of the Skull, which include:

8 Cranial Bones:
- 1 x Ethmoid Bone
- 1 x Frontal Bone
- 1 x Occipital Bone
- 2 x Parietal Bones
- 1 x Sphenoid Bone
- 2 x Temporal Bones

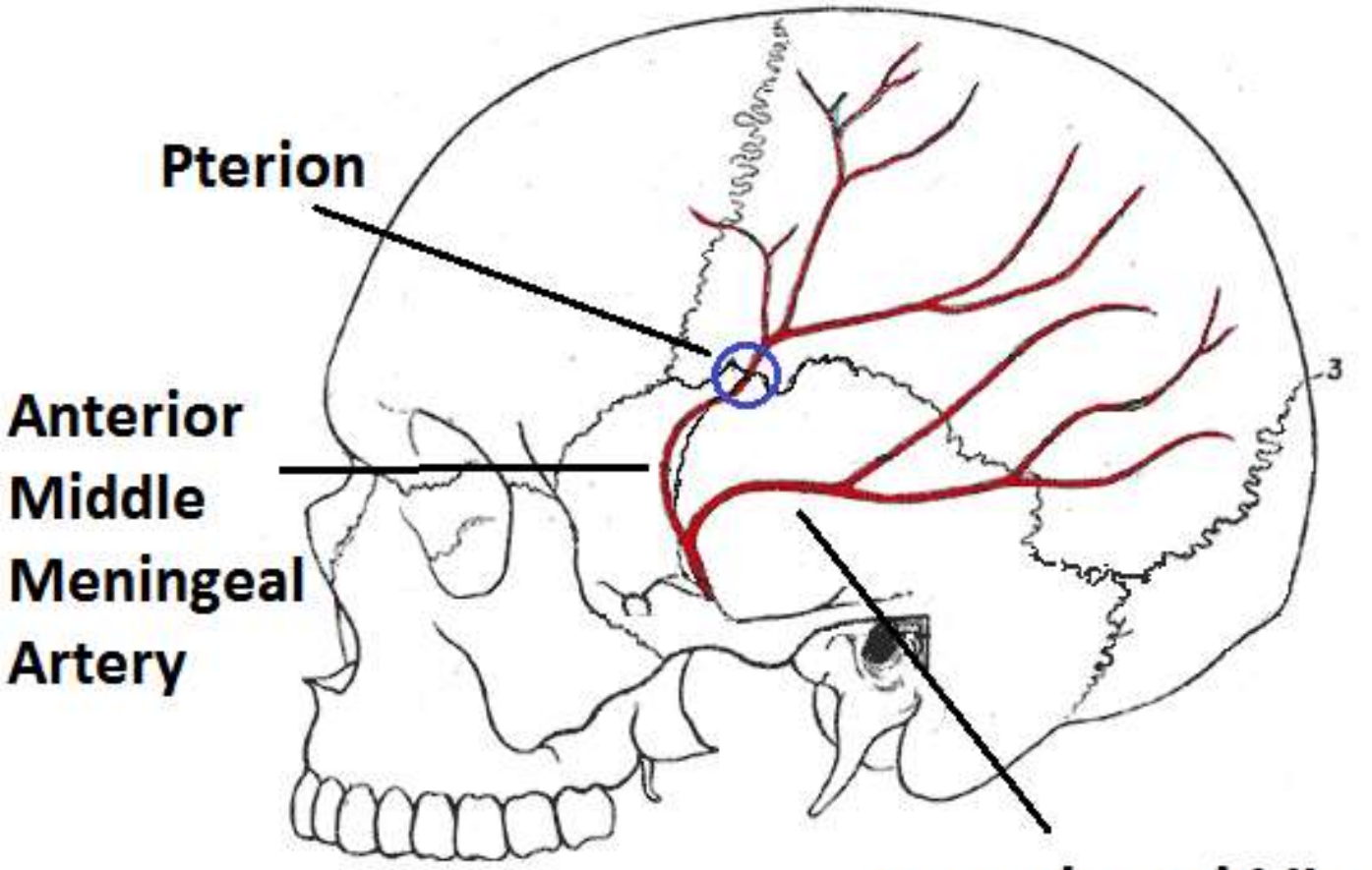
14 Facial Bones:
- 2 x Inferior Nasal Conchae
- 2 x Lacrimal Bones
- 1 x Mandible
- 2 x Maxillae (pl.); Maxilla (sing.)
- 2 x Nasal Bones
- 2 x Palatine Bones
- 1 x Vomer
- 2 x Zygomatic Bones

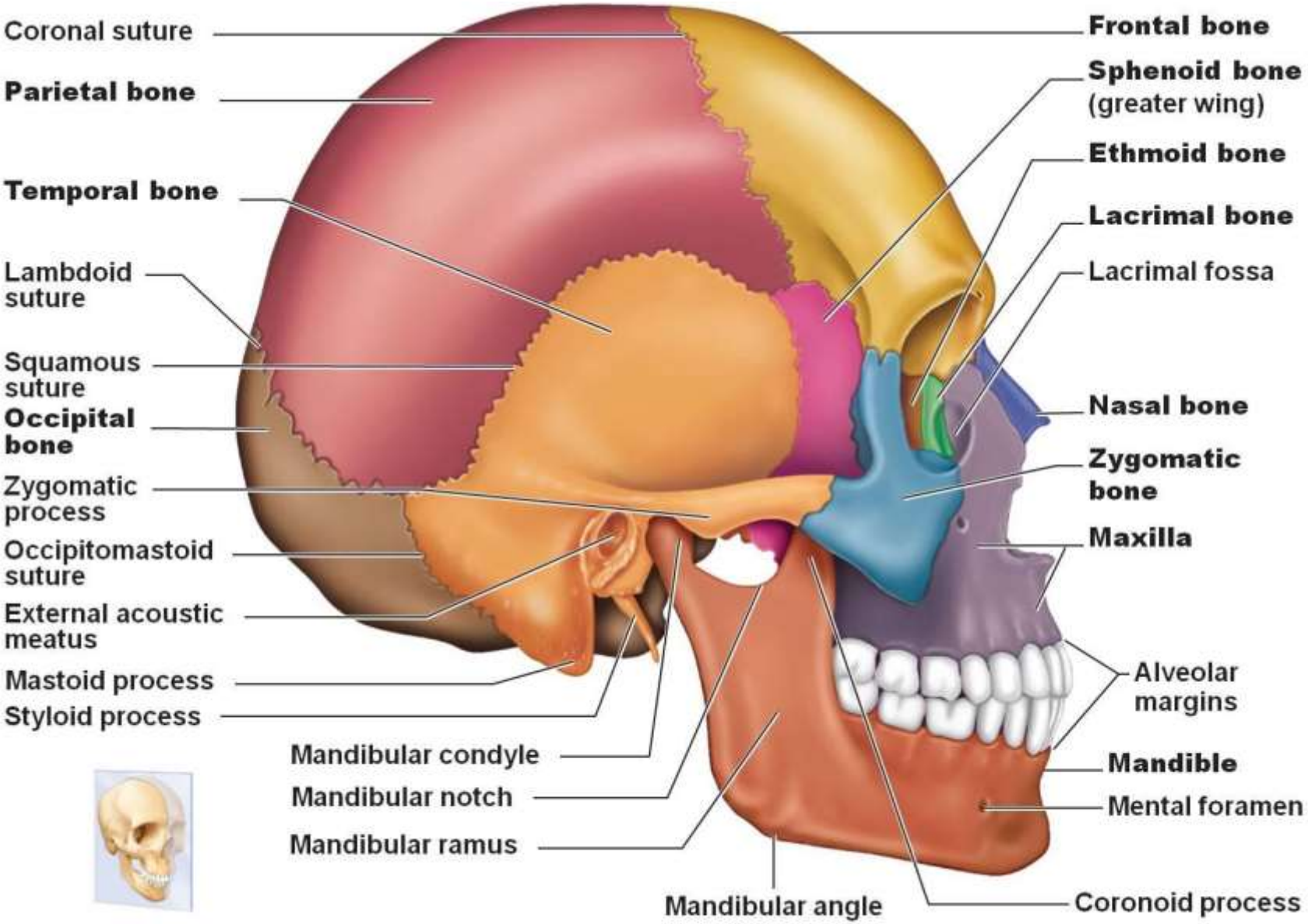
The other bone also included in this section is the hyoid bone, which is located in the neck (as illustrated below)

Diagrams of Cranial and Facial Bones

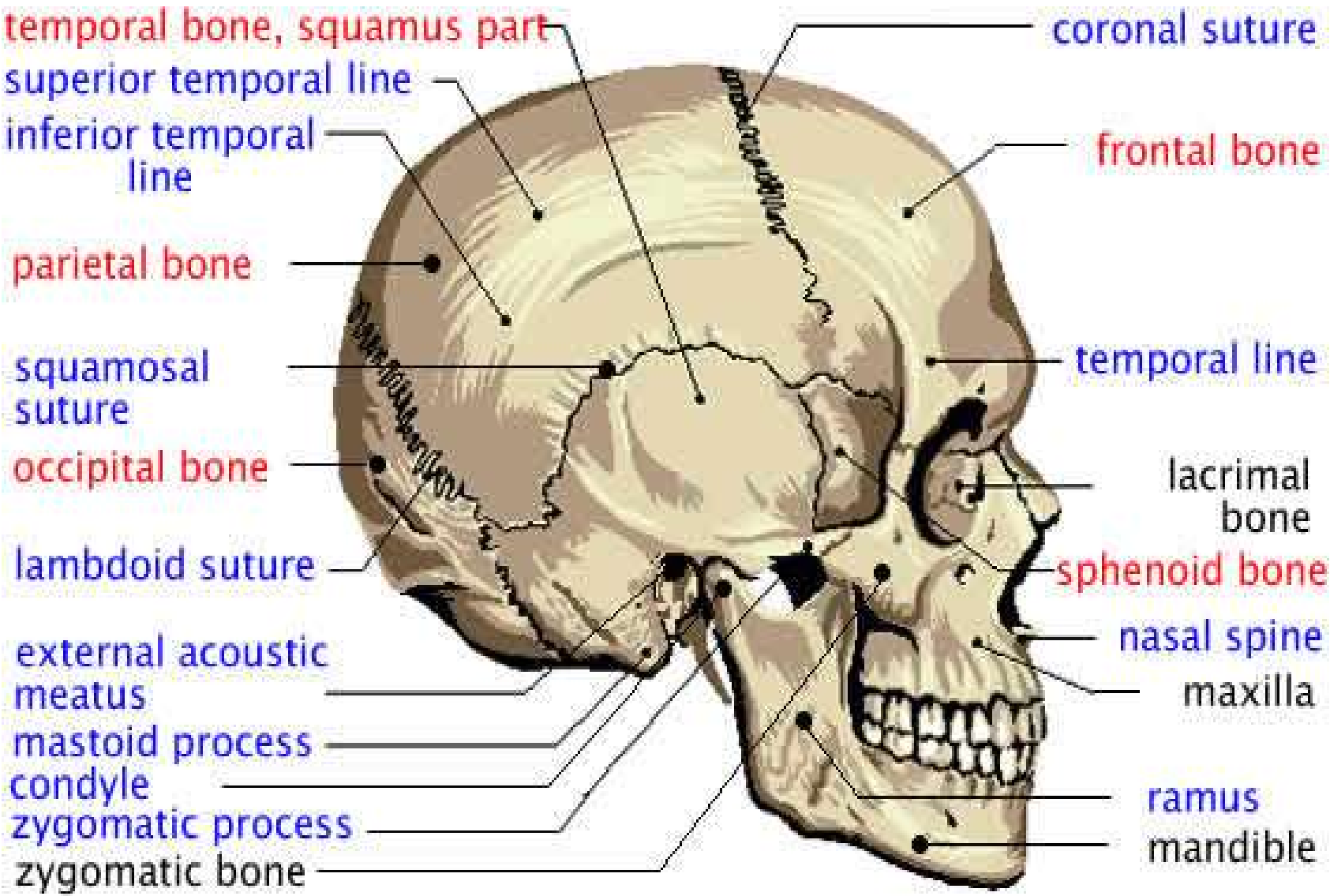


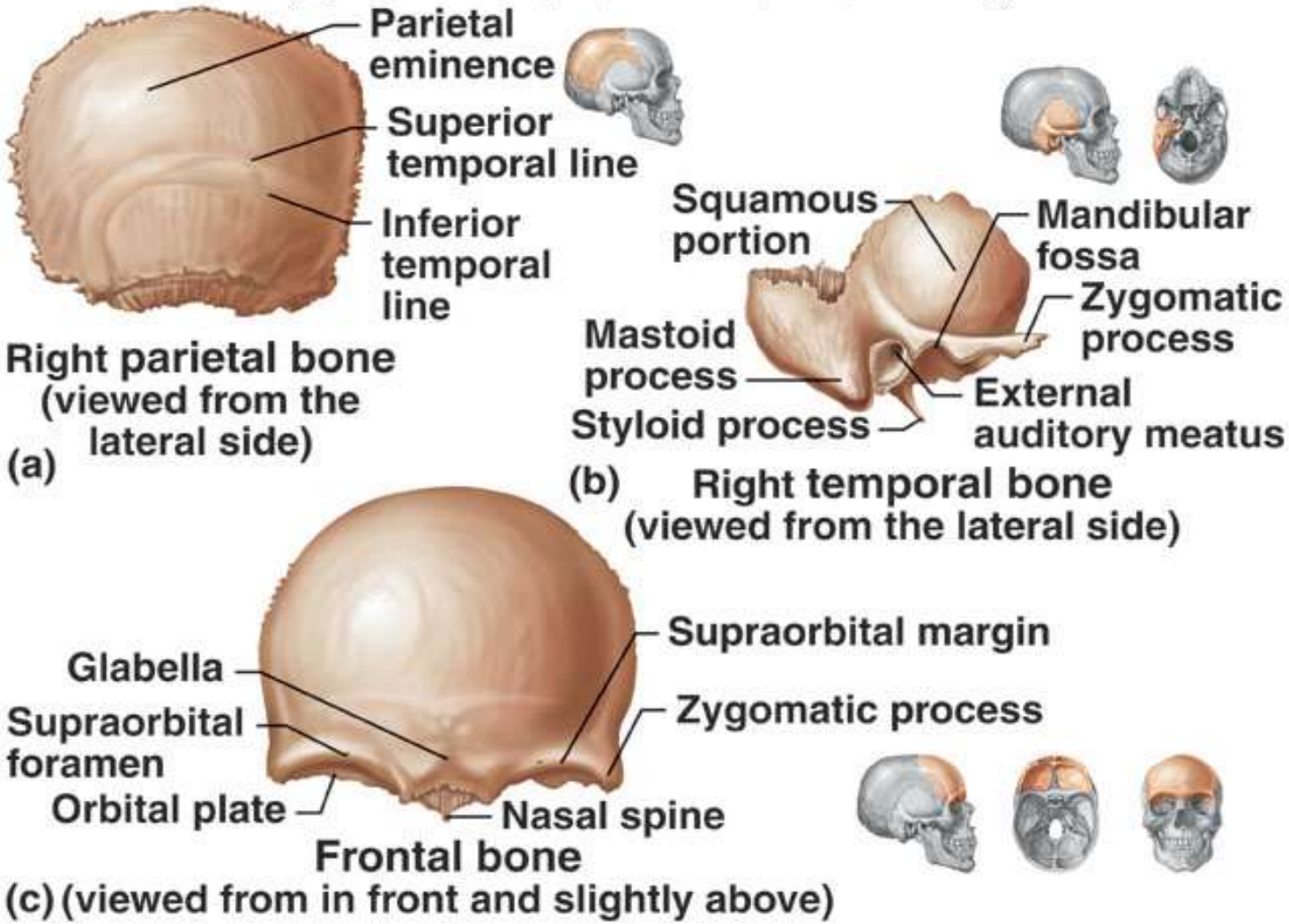
Right lateral view

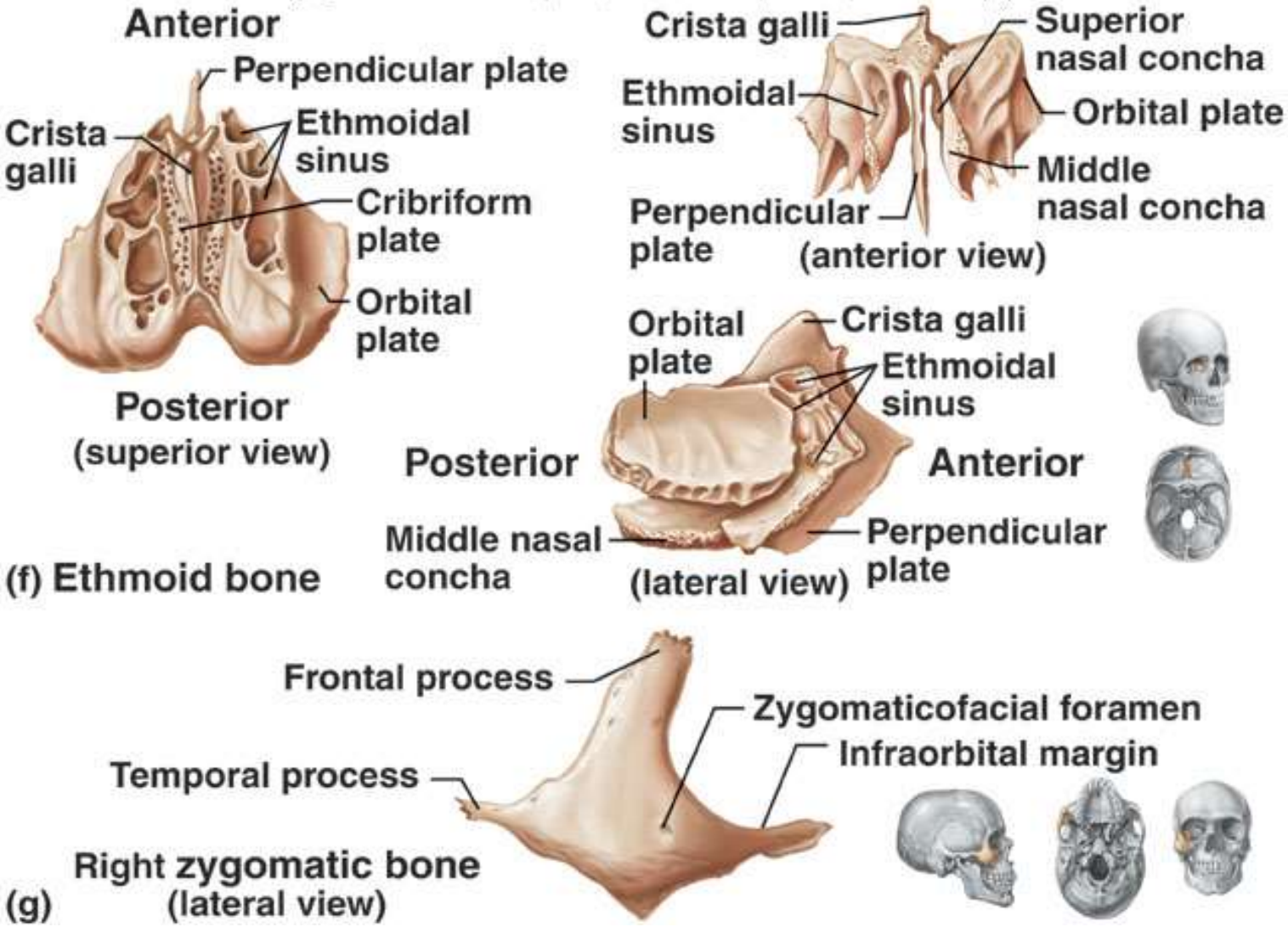


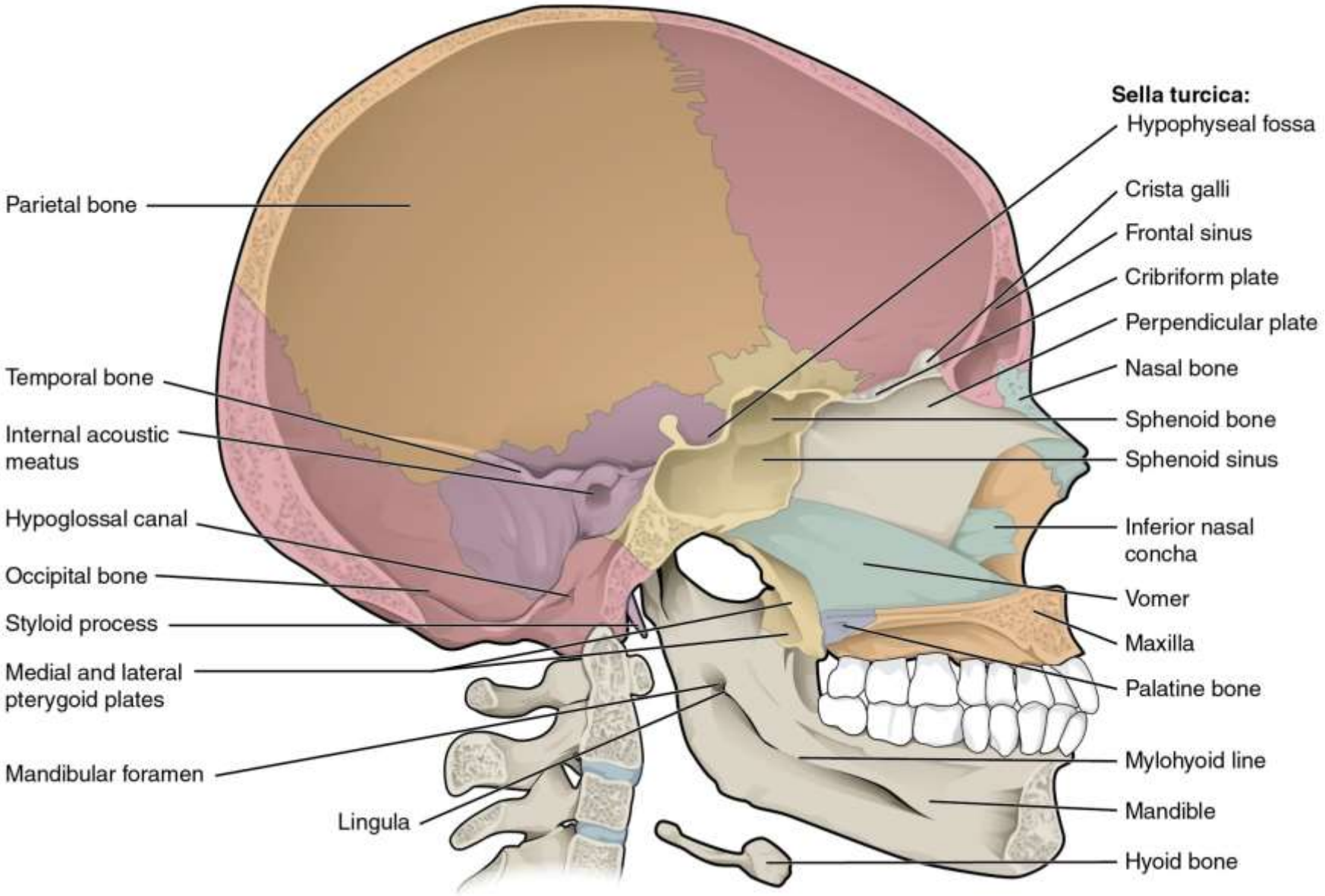


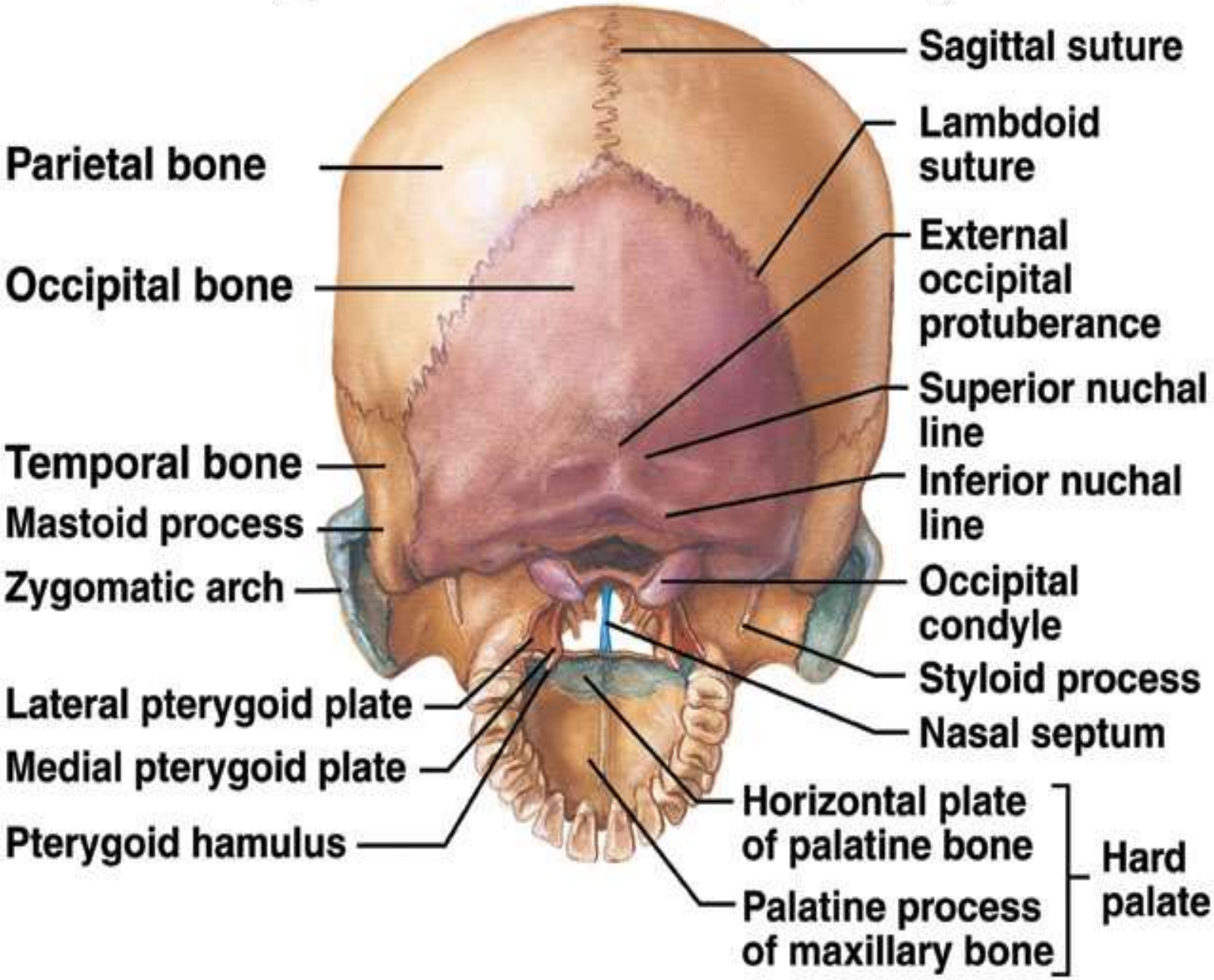
(a) External anatomy of the right side of the skull

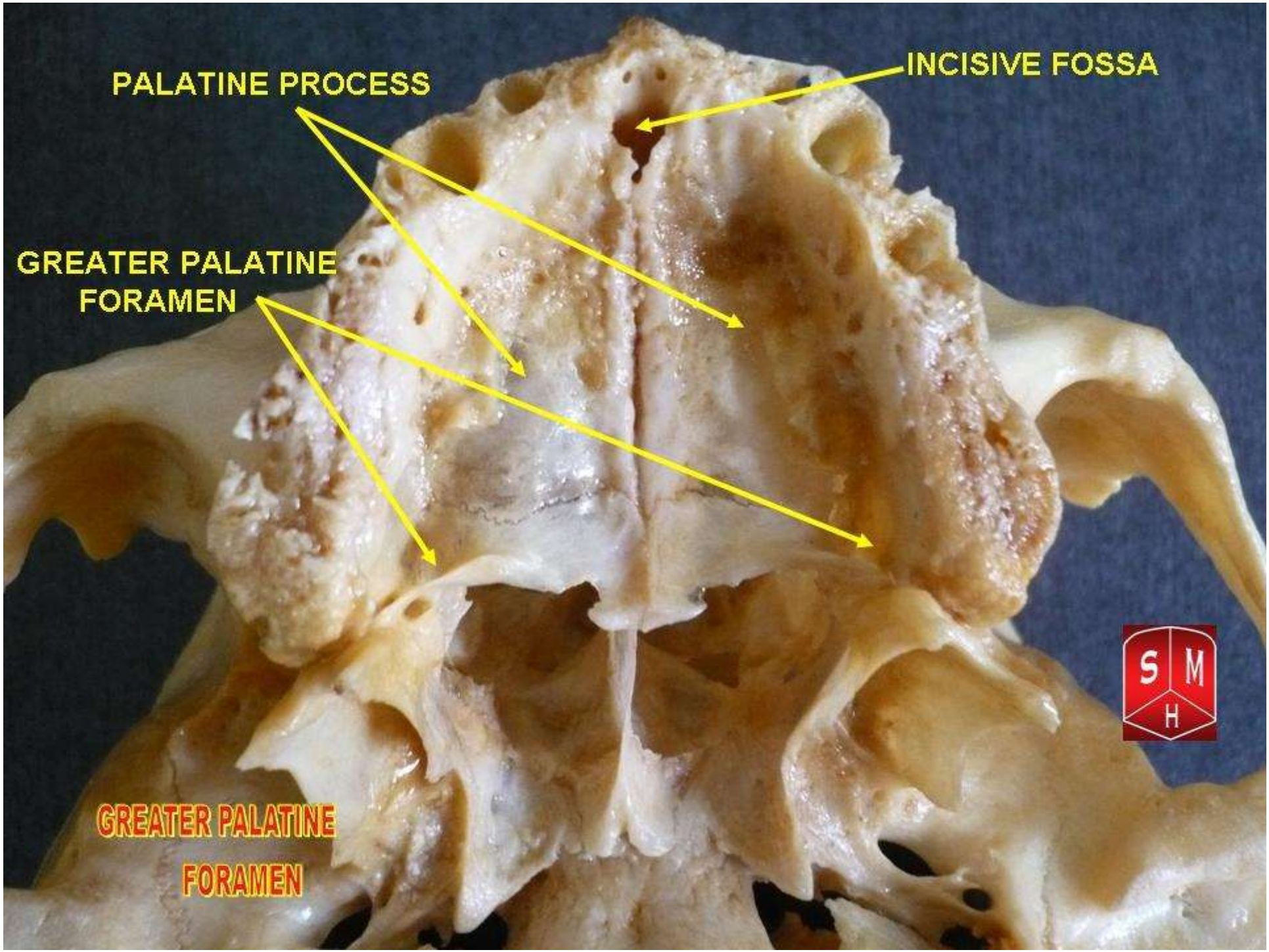

temporal bone, squamus part
superior temporal line
inferior temporal line
parietal bone
squamosal suture
occipital bone
lambdoid suture
external acoustic meatus
mastoid process
condyle
zygomatic process
zygomatic bone
coronal suture
frontal bone
temporal line
lacrimal bone
sphenoid bone
nasal spine
maxilla
ramus
mandible






Parietal bone
Temporal bone
Internal acoustic meatus
Hypoglossal canal
Occipital bone
Styloid process
Medial and lateral pterygoid plates
Mandibular foramen
Lingula
Sella turcica:
Hypophyseal fossa
Crista galli
Frontal sinus
Cribriform plate
Perpendicular plate
Nasal bone
Sphenoid bone
Sphenoid sinus
Inferior nasal concha
Vomer
Maxilla
Palatine bone
Mylohyoid line
Mandible
Hyoid bone



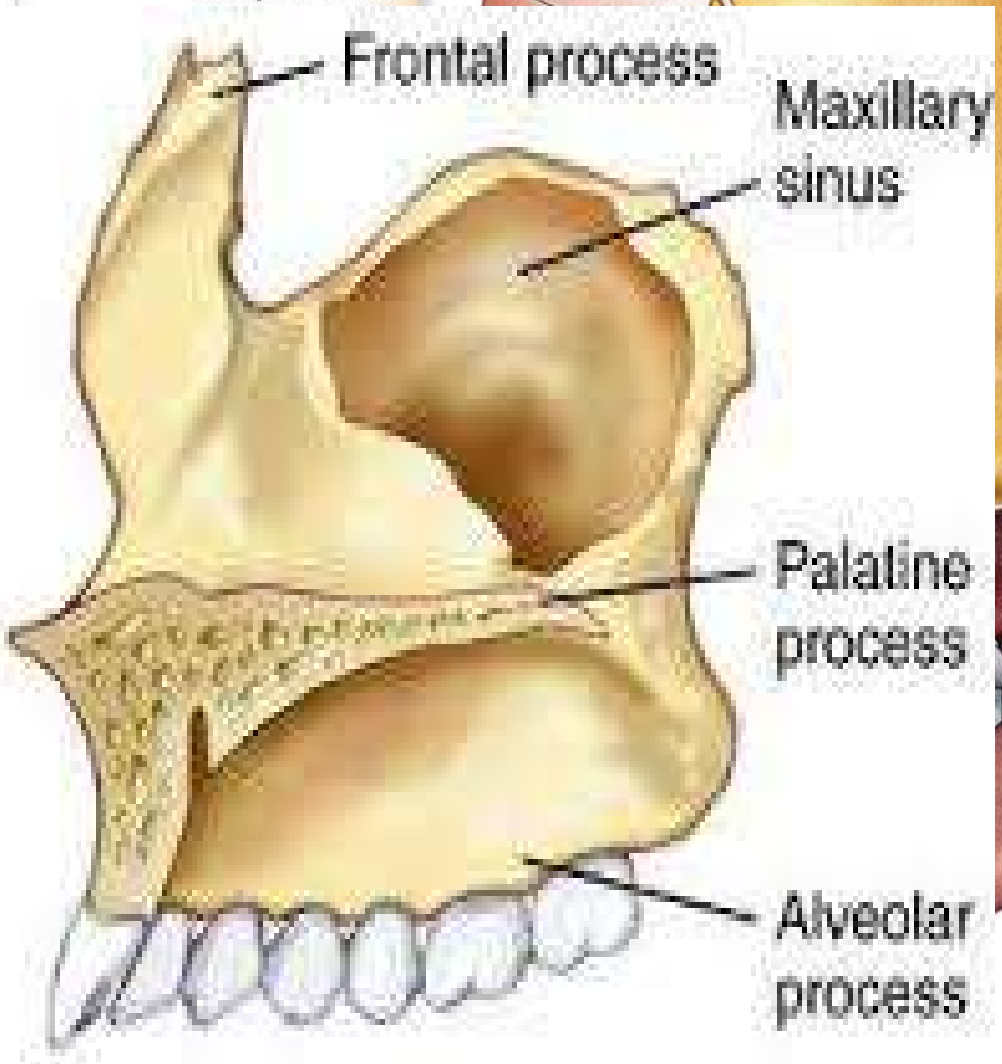

PALATINE PROCESS
INCISIVE FOSSA
GREATER PALATINE FORAMEN
GREATER PALATINE FORAMEN
S
M
H

The bones of the skull in posterior view

Cranial Bones

Parietal bones

Occipital bone



Sagittal suture

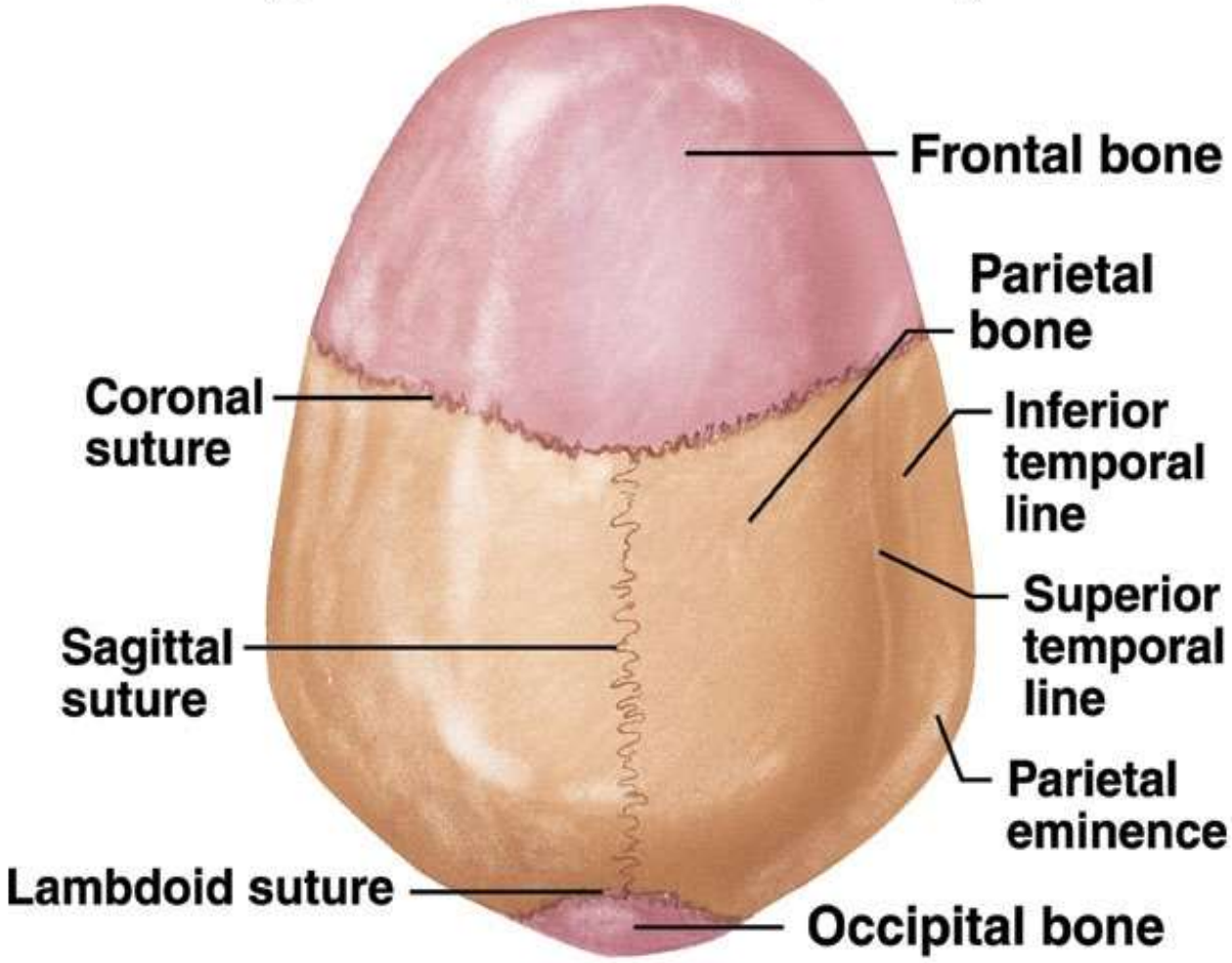
Lambdoid suture

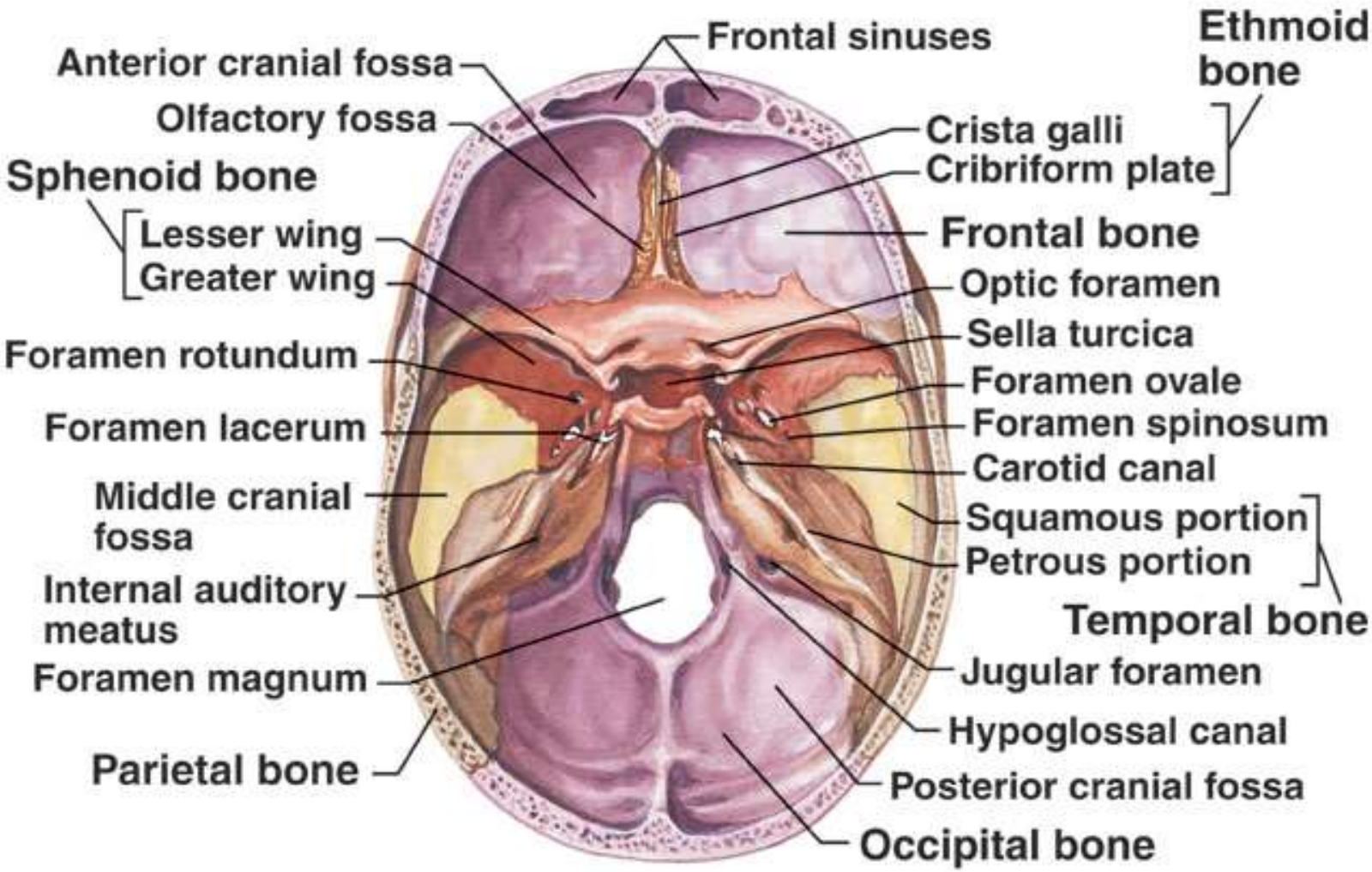
Squamous suture

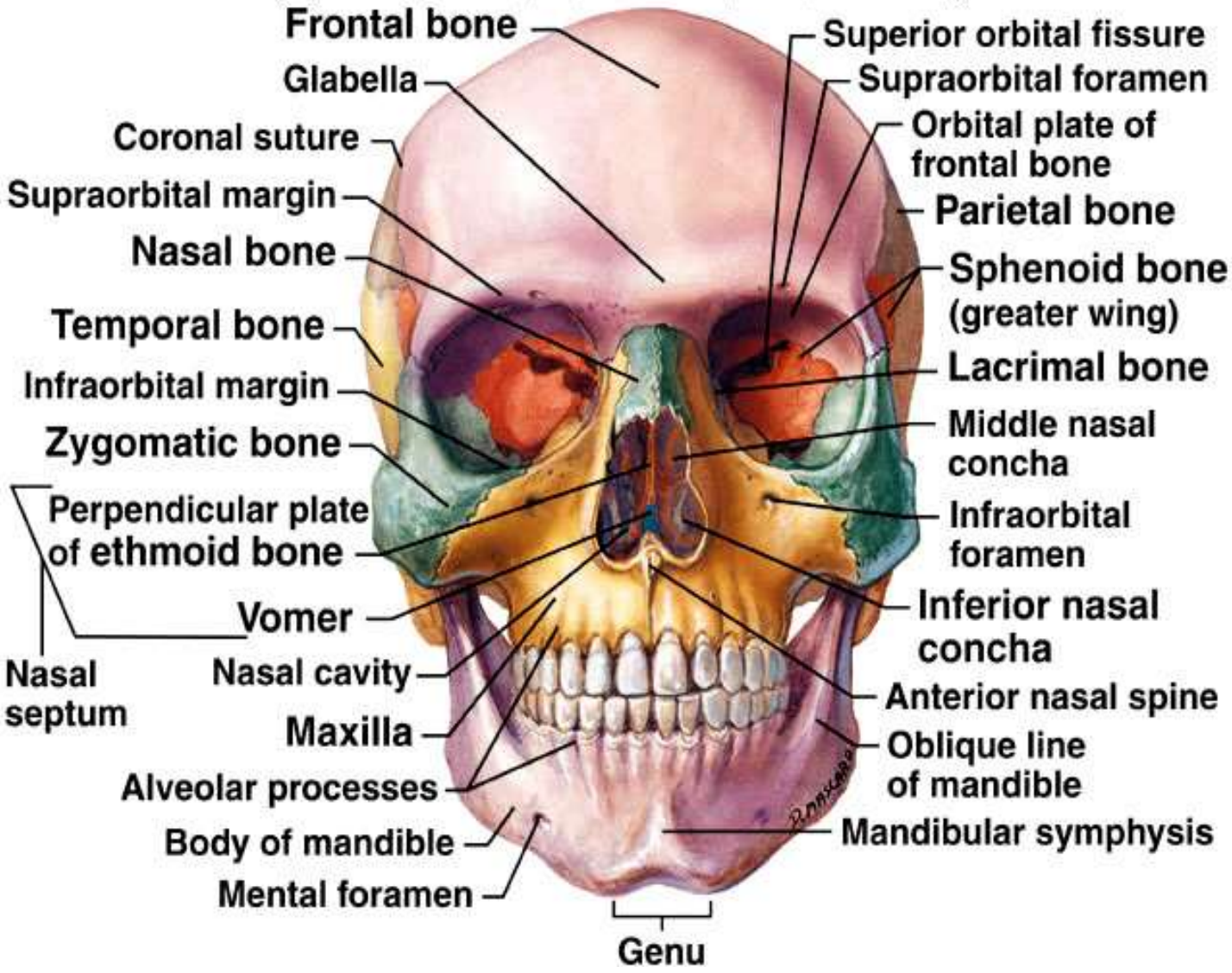
Mastoid process

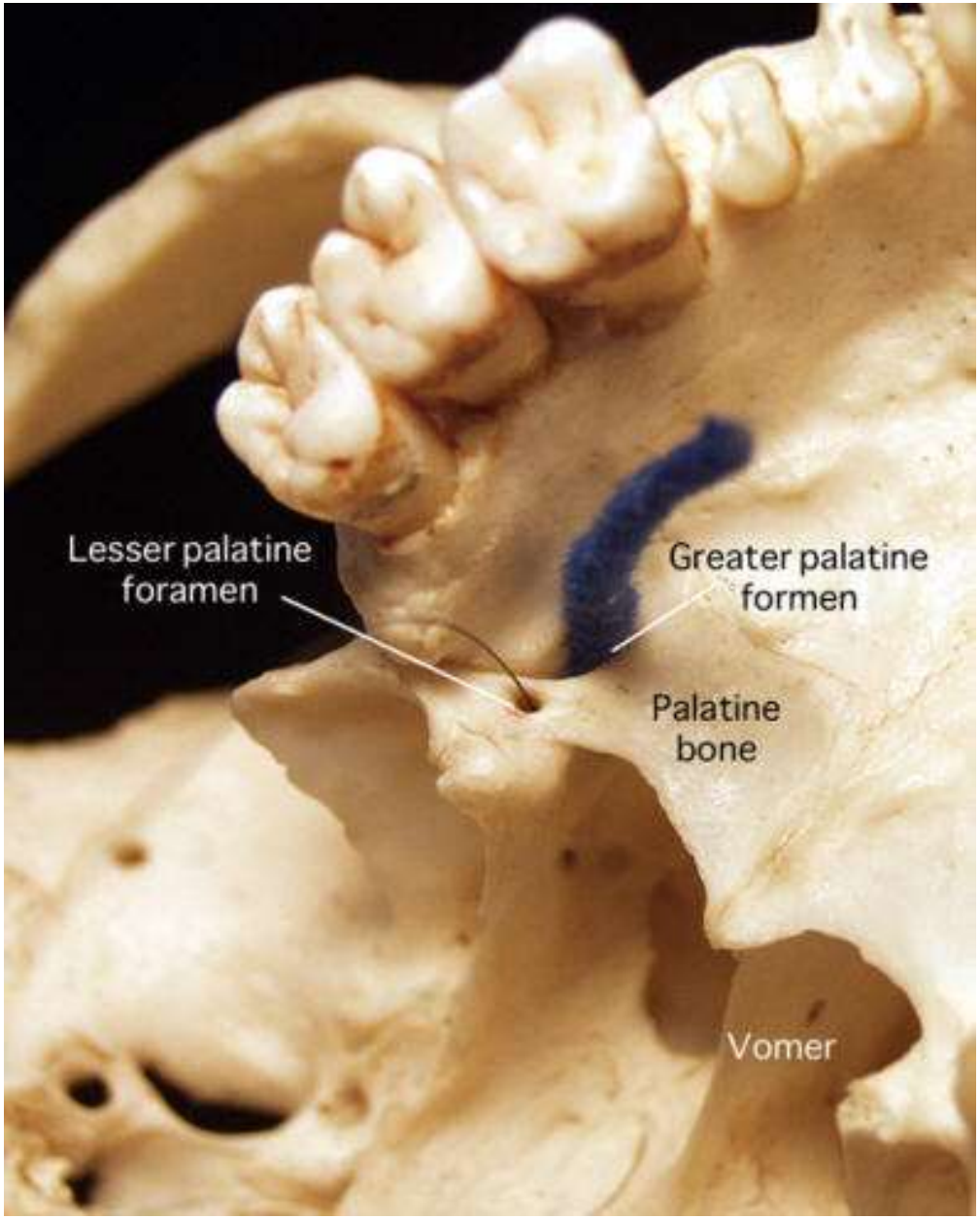
Styloid process

Mandible

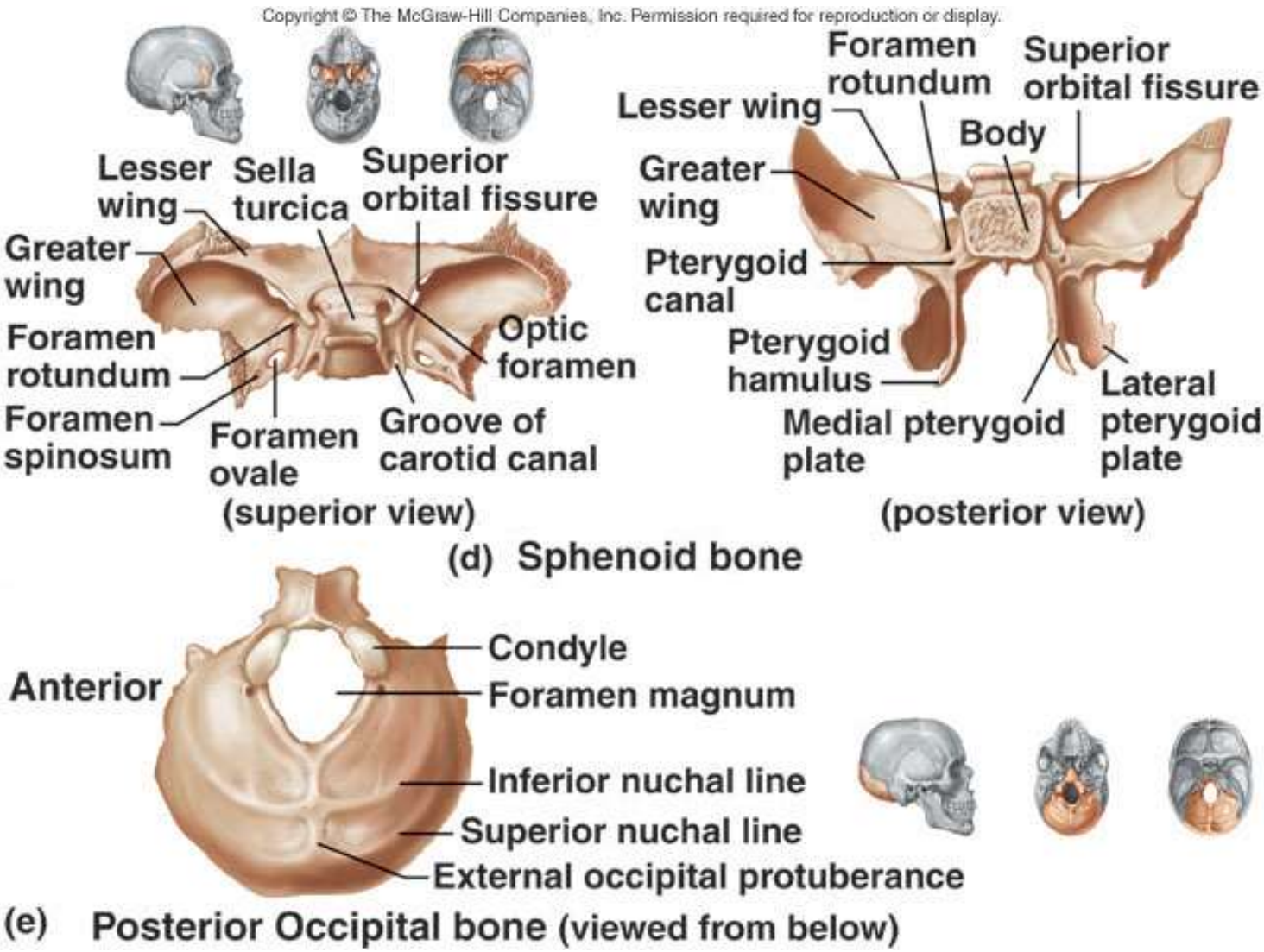


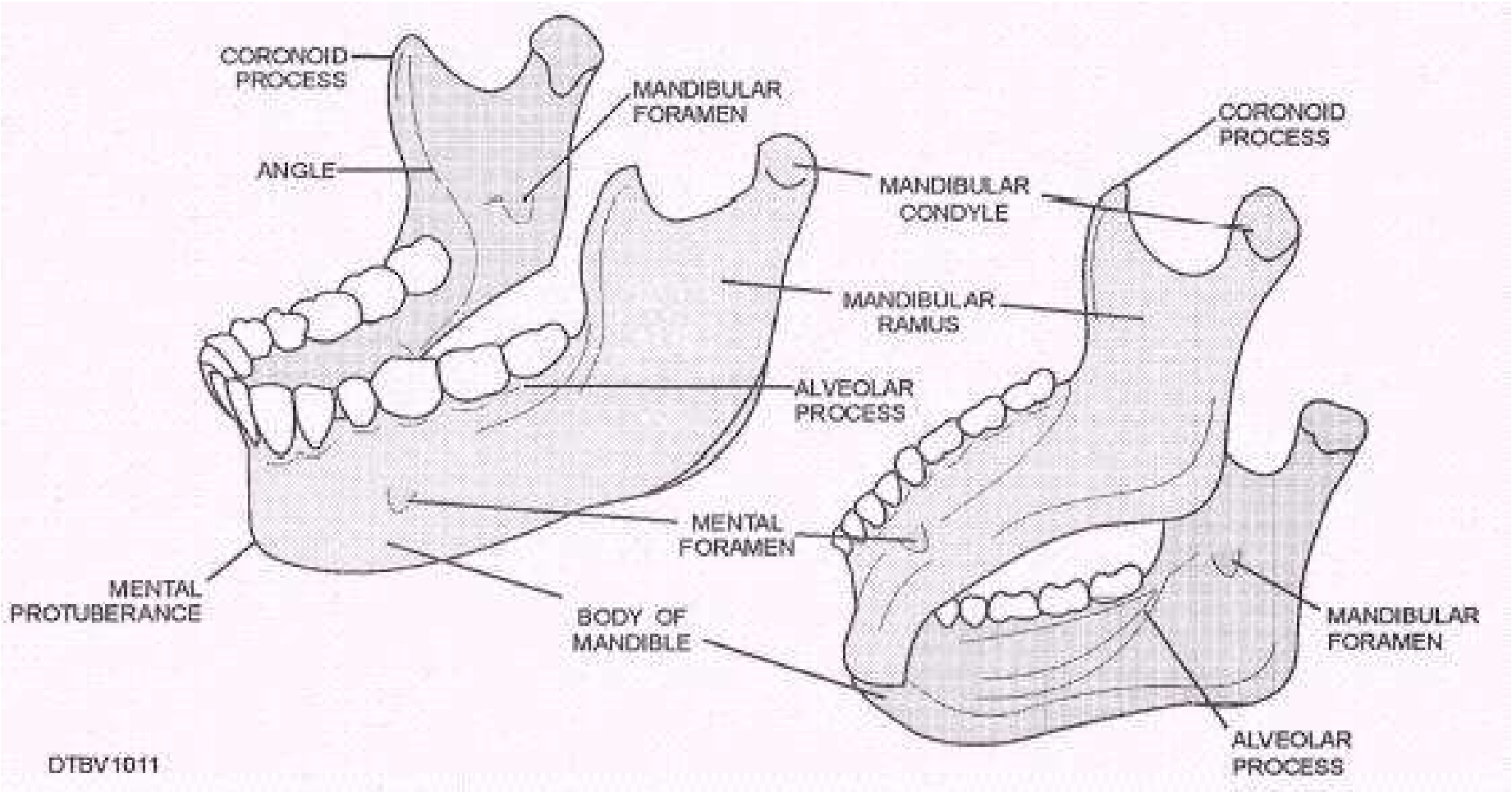




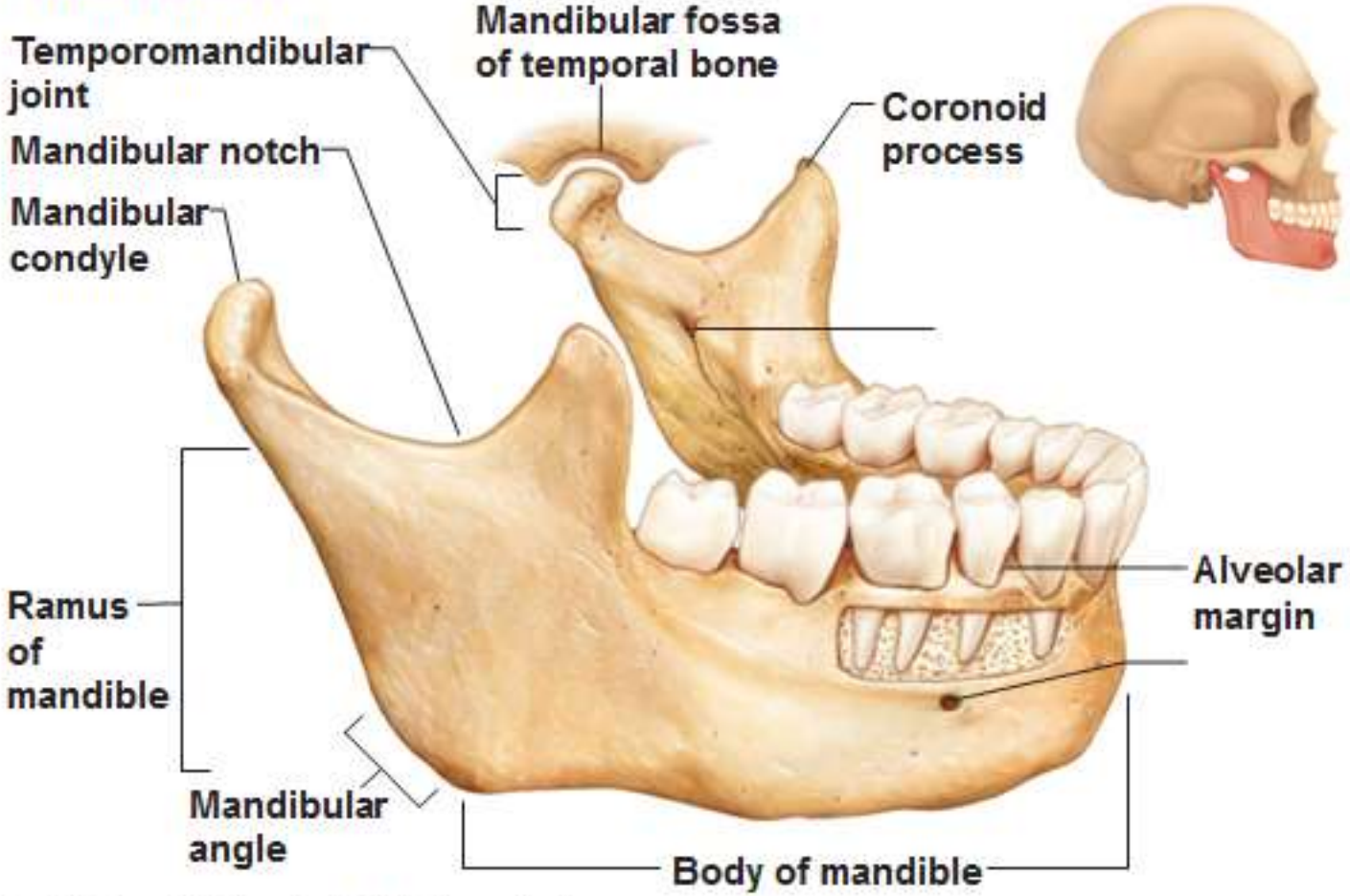

Lesser palatine
foramen
Greater palatine
formen
Palatine
bone
Vomer

Sphenoid bone

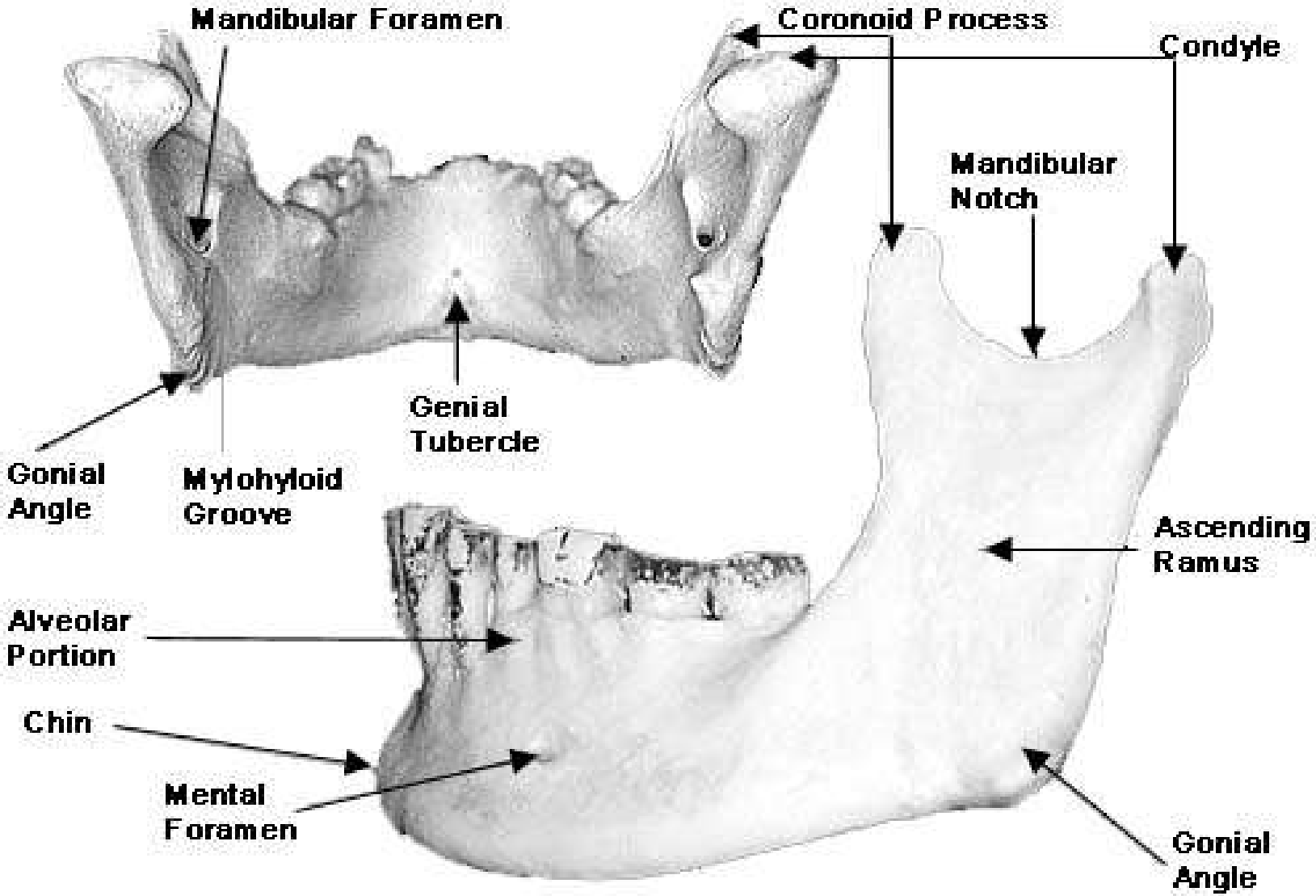


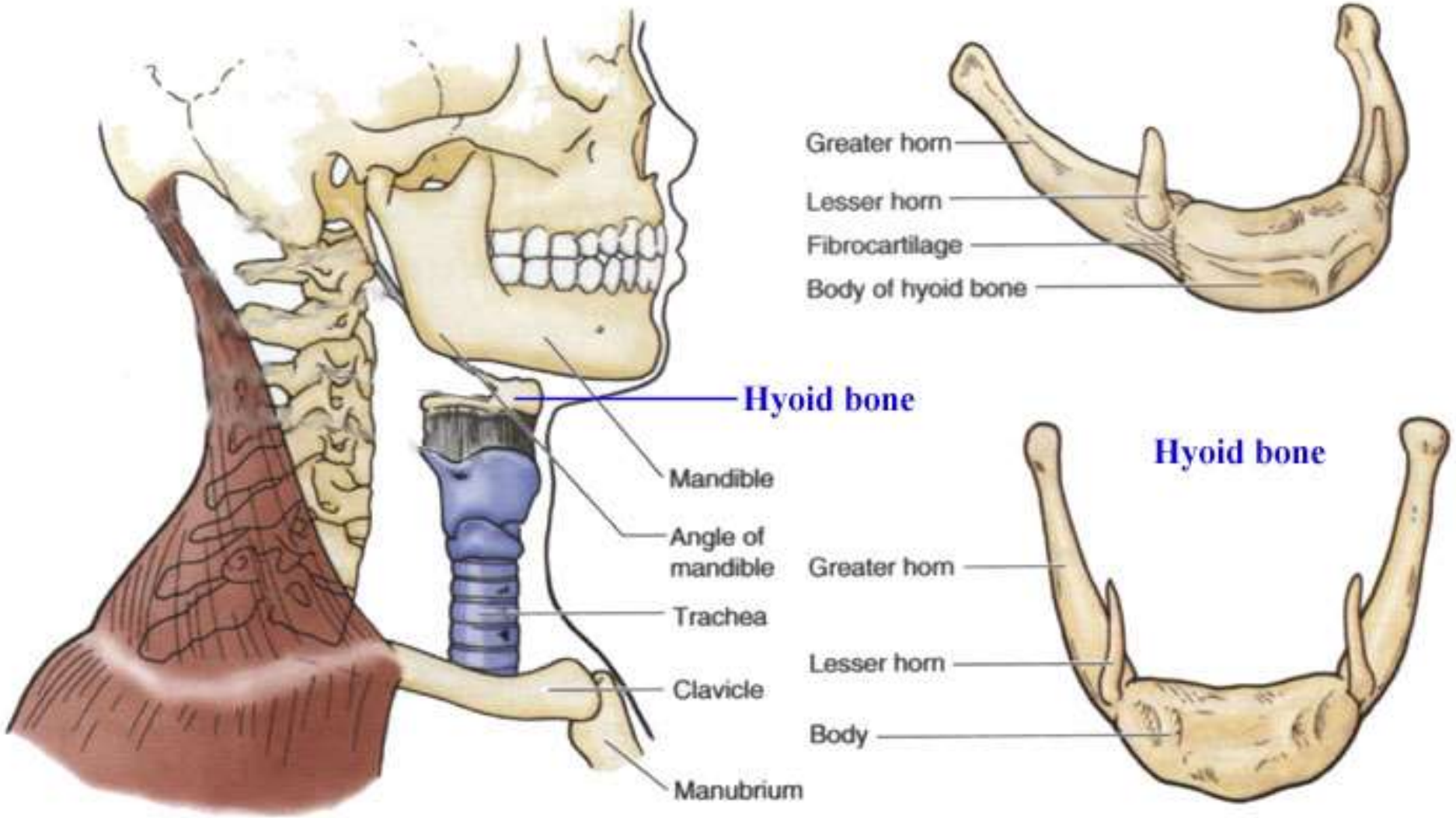

CORONOID PROCESS
MANDIBULAR FORAMEN
ANGLE
MANDIBULAR CONDYLE
CORONOID PROCESS
MANDIBULAR RAMUS
ALVEOLAR PROCESS
MENTAL FORAMEN
MENTAL PROTUBERANCE
BODY OF MANDIBLE
MANDIBULAR FORAMEN
ALVEOLAR PROCESS
DTBV1011

Mandible



(a) Mandible, right lateral view


Mandibular Foramen
Coronoid Process
Condyle
Mandibular Notch
Genial Tubercle
Gonial Angle
Mylohyloid Groove
Ascending Ramus
Alveolar Portion
Chin
Mental Foramen
Gonial Angle


Greater horn
Lesser horn
Fibrocartilage
Body of hyoid bone
Hyoid bone
Mandible
Angle of mandible
Trachea
Clavicle
Manubrium
Hyoid bone
Greater horn
Lesser horn
Body