Skull and Facial Anatomy

The Skull

- The skull (cranium) has 22 bones
- These are grouped into 2 categories:
  - Cranial bones and facial bones
- 8 cranial bones form the cranial cavity which house and protect the brain
- 14 facial bones form the face

Cranial Bones

- Frontal (forehead)
- 2 Parietal
- 2 Temporal
- Occipital
- Sphenoid
- Ethmoid

Facial Bones

- 2 Nasal
- 2 Maxillae
- 2 Zygomatic
- Mandible
- 2 Lacrimal (tear duct)
- 2 Palatine (Hard palate)
- 2 Inferior nasal conchae
- Vomer (forms nasal septum)

Functions of the Skull

- Functions of the skull include:
  - Protecting the brain
  - Forming the nasal cavity and orbits
  - Containing cavities called **paranasal sinuses** and cavities to house structures for hearing and balance
  - Provides areas for muscle attachments
  - Form the framework for the face and provides the portals of entry to digestion and respiratory system
  - Protects the delicate special sense organs

Frontal Bones

- Forms the forehead, the roof of the orbits and most of the anterior cranial floor
- The left and right halves of the frontal bone unite soon after birth at the **metopic suture**
- This suture has disappeared by age 8

Landmarks of the Frontal Bones

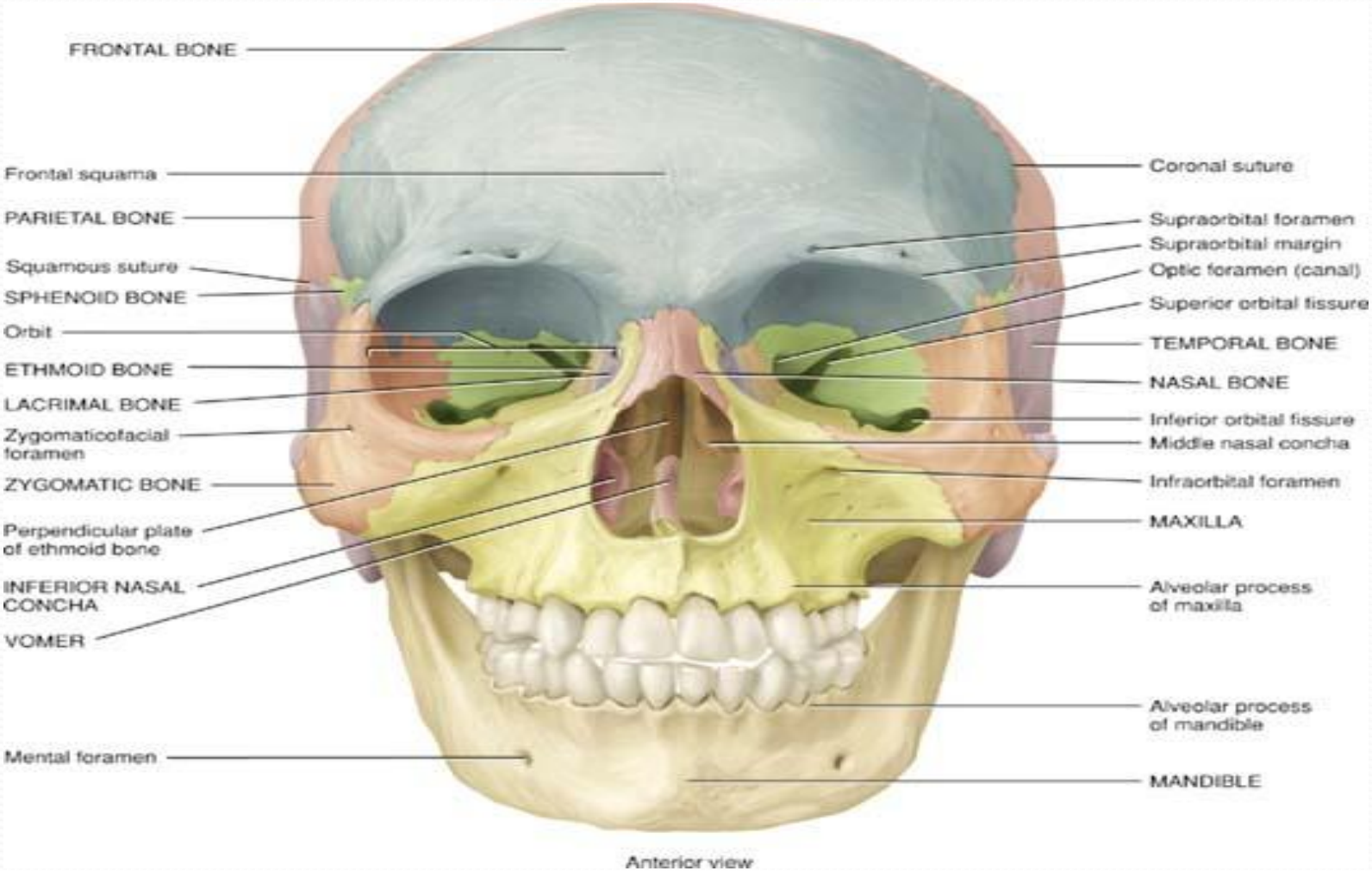
- Frontal squama – Plate of bone anteriorly forming the forehead
- Supraorbital margins – A hole within the supraorbital margin for nerves and vessels
  - Sometimes the foramen is not complete and is called the supraorbital notch
- Frontal sinuses – Cavities between the orbits

Sinuses

- Called paranasal sinuses
- These are cavities lined with mucous membranes
- They are found within different skull bones and all have openings into the nasal cavity

https://www.youtube.com/watch?v=oqTzrgzv3-8

Anterior View



Anterior view

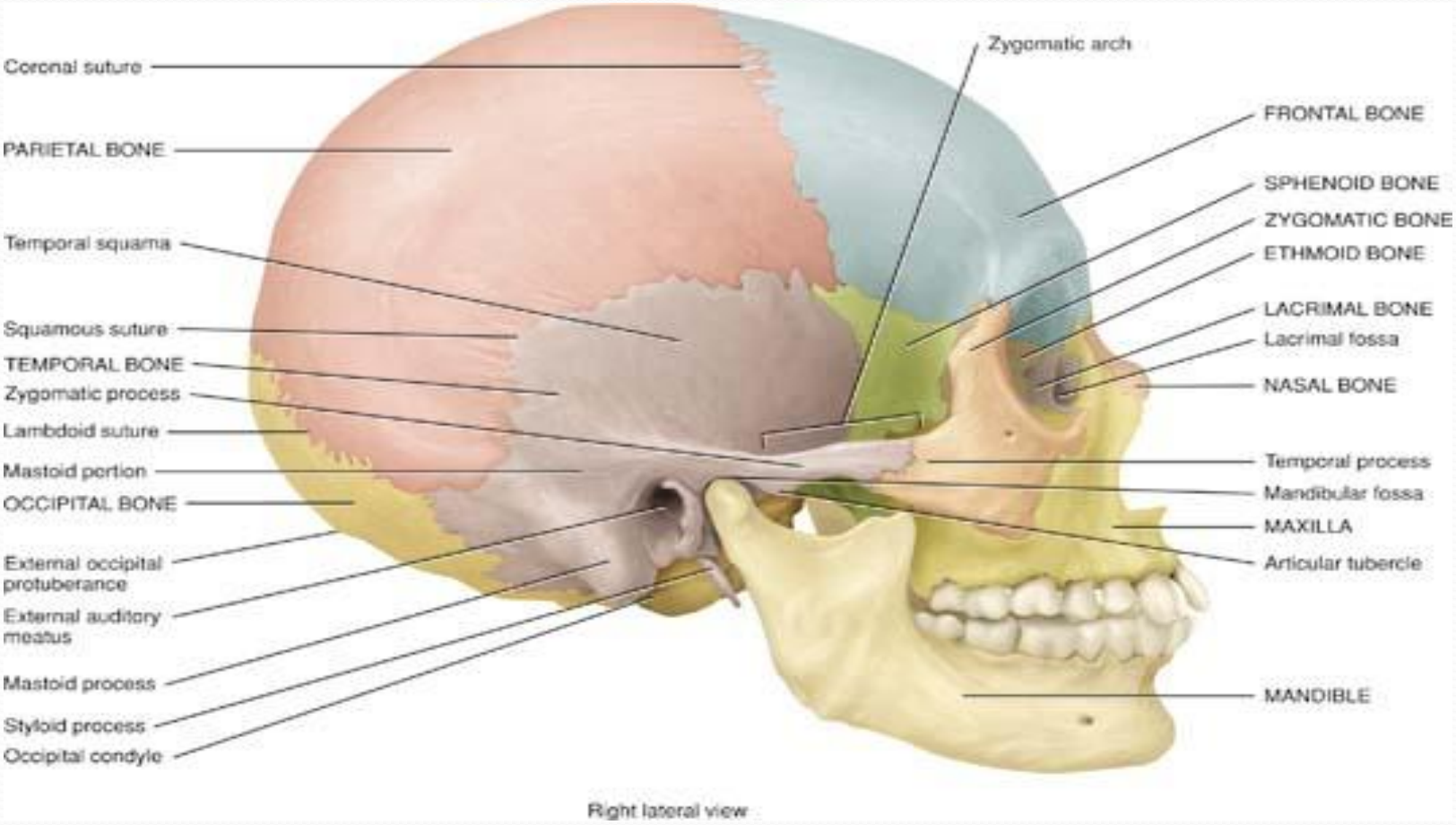
Parietal and Temporal Bones

- **PARIETAL BONES**
  - The 2 parietal bones form most of the sides of the cranium
  - Inside you can see many protrusions and depressions – indicative of blood vessles
- **TEMPORAL BONES**
  - The temporal bones form the inferior lateral portions of the cranium and part of the cranial floor

Landmarks of the Temporal Bones

- **Temporal squama** – Thin plate of bone at the temples
- **Zygomatic process** – A projection from the squama that articulates with the temporal process of the zygomatic bone
  - Together these two processes form **the zygomatic arch**
- **Mandibular fossa** – A socket for the mandible
- **Mastoid portion of the bone** – Posterior and inferior to the external auditory meatus (ear canal)
- **Styloid process** – A pointed projection for muscle attachment
- **Stylomastoid foramen** – Between the 2 processes
- **Internal auditory meatus** – openings for the cranial nerves responsible for hearing and balance
- **Petrous portion of the bone** – on the floor of the cranial cavity houses the internal and middle ear structures
- **Carotid foramen** – for the carotid artery
- **Jugular foramen –** for the jugular vein

Right Lateral View



Right lateral view

Occipital Bone

- The occipital bone forms the posterior and most of the base of the cranium
- It is best seen from an inferior view

Landmarks of the Occipital Bone

- **Foramen magnum** – A large hole in the base of the skull for the spinal cord
- **Occipital condyles** – Articulating processes for the atlanto –occipital joint
- **Hypoglossal canal** - a small foramen for the hypoglossal nerve (hypoglossal nerve = cranial nerve XII (12))
- **External occipital protuberance** – A prominent midline projection just above the foramen magnum
- **Superior nuchal lines –** extend laterally from the external occipital protuberance
- **Inferior nuchal lines –** Found below the superior nuchal lines
- Both sets of lines serve as areas for muscle attachments

Sphenoid Bone

- The sphenoid bone is found in the middle of the base of the skull
- **It is known as the keystone because it articulates with all other cranial bones** (and helps hold them together)
- **It forms part of the floor, side walls and rear wall of the orbit**

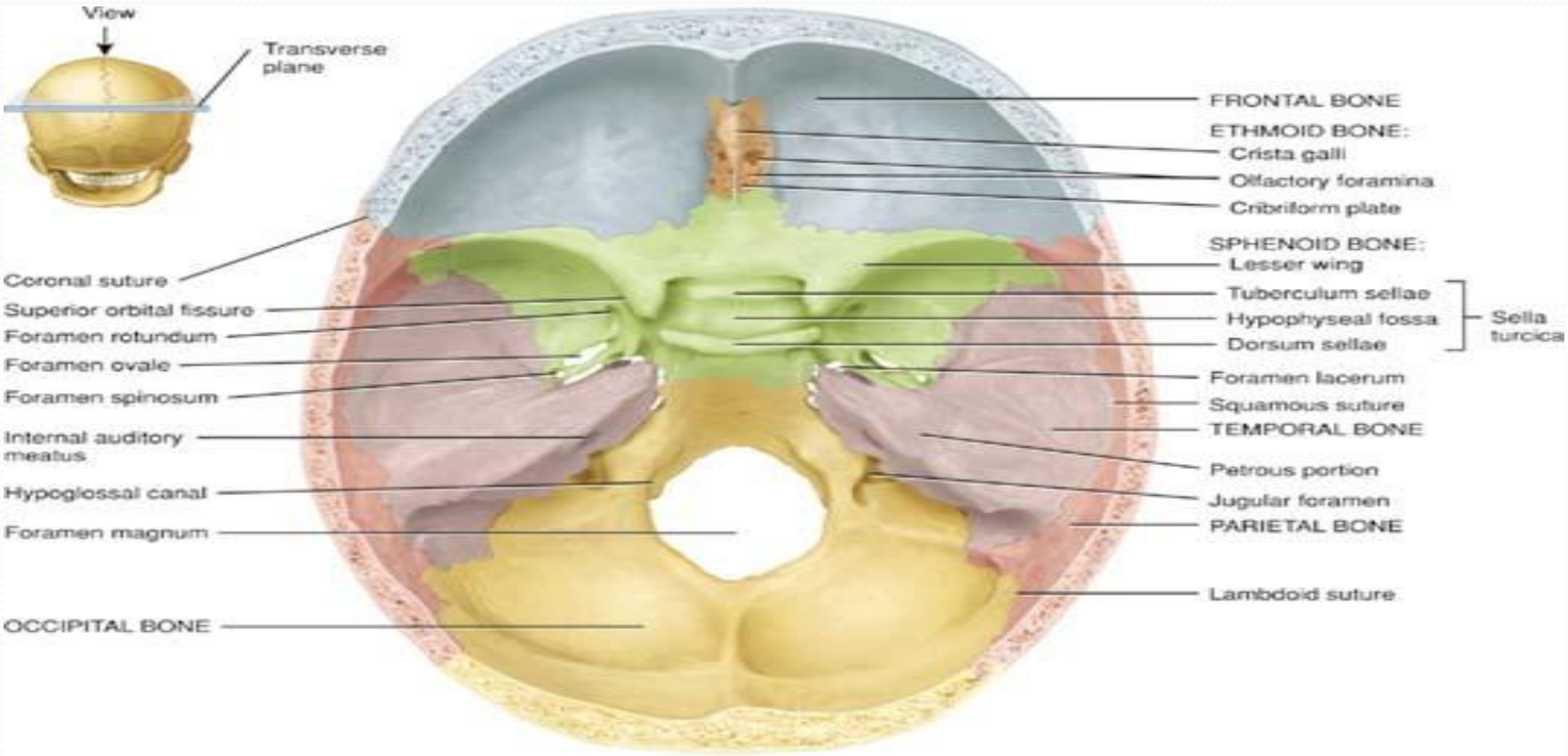
Landmarks of the Sphenoid Bone

- Resembles a butterfly with a body and 2 sets of wings
- **Body** – A hollow cube like portion
  - **Space inside is the sphenoidal sinus**
- **Sella turcica** – A saddle shaped structure on the superior surface of the body
  - **Tuberculum sellae and dorsum sellae ridges** flank the middle depression known as the **hypophyseal fossa** – this houses the pituitary gland
- **Greater wings –** Project laterally from the body and from the anterolateral floor of the cranium
  - They can be viewed externally between the temporal bone and zygomatic bone
- **Lesser wings** – Smaller form the posterior part of the orbit
- **Optic foramen** – Between the body and lesser wing for the optic nerves and vessels
- (optic nerve = CNII)

Continued

- **Superior orbital fissure** – Between greater and lesser wings for vessels and nerves
- **Pterygoid processes** – Project inferiorly and form the posterolateral region of the nasal cavity
  - Also serve as sites for muscle attachments
- There are 3 other foramen
  - Lacerum
  - Rotundum
  - Ovale
  - Spinosum

Floor of Cranium



(a) Superior view of sphenoid bone in floor of cranium

Ethmoid Bone

- Sponge like, found between the orbits
- Anterior to the sphenoid and posterior to the nasal bones
- Forms:
  - Part of the anterior cranial floor
  - The medial wall of the orbits
  - Superior portion of the nasal septum
  - Most of the superior sidewalls of the nasal cavity

Landmarks of Ethmoid Bones

- **Cribriform plate** – forms the roof of the nasal cavity
- **Olfactory foramina** – (smell) Holes in the cribriform plate for olfactory nerves (olfactory nerve I)
- **Crista galli** – As superior projection from the cribriform plate for the attachment of the dura mater
- **Perpendicular plate** – an inferior projection that forms the superior portion of the nasal septum
- **Lateral masses** – separate the nasal cavity from the orbits
- **Ethmoidal air cells** – spaces found within the lateral masses
  - Together we call these the ethmoidal sinuses
- **Superior and middle nasal conchae** – Scroll-like medial projections of the lateral masses that churn incoming air (warm, humidify)

Facial Bones - Nasal Bones

- **NASAL BONES**
- There are 2 nasal bones that meet in the midline
- They form the bridge of the nose

Maxillae Bones

- There are 2 maxillae, they unite in the midline to form the upper jaw bone
- **They articulate with all facial bones except for the mandible**
- They help to form part of the floor of the orbit, part of the lateral walls and floor of the nasal cavity and most of the hard palate

Landmarks of the Maxillae

- **Maxillary sinus** – A large cavity that drains into the nasal cavity
- **Alveolar process** – Contains sockets for the upper teeth
- **Palatine process** – A projection that forms the anterior portion of the hard palate
- **Infraorbital fissure** – Seen through the orbit
- **Incisive foramen** – A foramen just posterior to the incisor teeth for passage of nerves and vessels

Zygomatic and Lacrimal Bones

- **ZYGOMATIC BONES**
  - There are 2 zygomatic bones, these are often called the cheek bones
  - **The temporal process of the zygomatic bone articulates with the zygomatic process of the temporal bone to form the zygomatic arch**
- **LACRIMAL BONES**
  - Lacrimal means teardrops
  - Roughly the size and shape of a fingernail
  - Smallest bones of the face
  - Found posterior and lateral to the nasal bones and help form part of the medial walls of the orbits
  - Each bone contains a lacrimal fossa that gathers tears and passes them into the nasal cavity

Palatine Bones and Inferior Nasal Conchae

- **PALATINE BONES**
- There are **2 L-shaped palatine bones**
- These form the posterior portion of the hard palate
  - Specifically it is the horizontal plates of the palatine bones that form the palate
- **INFERIOR NASAL CONCHAE**
- These are separate bones (not a part of the ethmoid)
- Scroll-shaped bones that form the inferior lateral wall of the nasal cavity
- Help to churn incoming air to warm it and humidify it

Vomer Bone

- A triangular bone on the floor of the nasal cavity
- Helps to form the nasal septum
- Articulates with the perpendicular plate of the ethmoid bone and with the maxilla and palatine bones at the midline

Mandible

- Largest, strongest facial bone
- Only facial bone that moves
- Consists of a body and 2 rami
  - The angle is where ramus meets body
- Each ramus has a posterior condylar process and an anterior coronoid process
  - Condylar process articulates with the mandibular fossa of the temperal fossa to form the temperomandibular joint
  - Coronoid process is a site for muscle attachement
- Depression between the two processes is the mandibular notch
- The alveolar process holds the teeth
- On the medial side of the ramus (inside) there is a mandibular foramen. This opens into a mandibular canal. Nerves and vessels pass through the foramen and canal and then pass out of the bone through the mental (chin) foramen

Nasal Septum

- The nasal septum functions to divide the nasal cavity into left and right halves
- The nasal septum is composed of 3 structures:
  - Vomer
  - Septal cartilage
  - Perpendicular plate of the ethmoid bone

Orbits

- There are 7 bones that help to form the orbits:
  - **Roof – frontal** and **sphenoid bones**
  - **Lateral wall – zygomatic** and sphenoid bones
  - **Floor – maxilla**, zygomatic and **palatine bones**
  - **Medial wall** – maxilla, **lacrimal, ethmoid** and sphenoid bones
  - **Posterior wall** – mostly sphenoid bone

Openings in the Orbits

- The **optic foramen** (canal) is at the **junction of the roof and medial wall**
- The **superior orbital fissure** is at the **superior lateral angle of the apex**
- **The inferior orbital fissure** is at the **junction of the lateral wall and floor**
- The **supraorbital foramen** is on the medial side of the **supraorbital margin of the frontal bone**
- The **lacrimal fossa** is in the **lacrimal bone**

Foramina of the skull

- Print and distribute foramin table

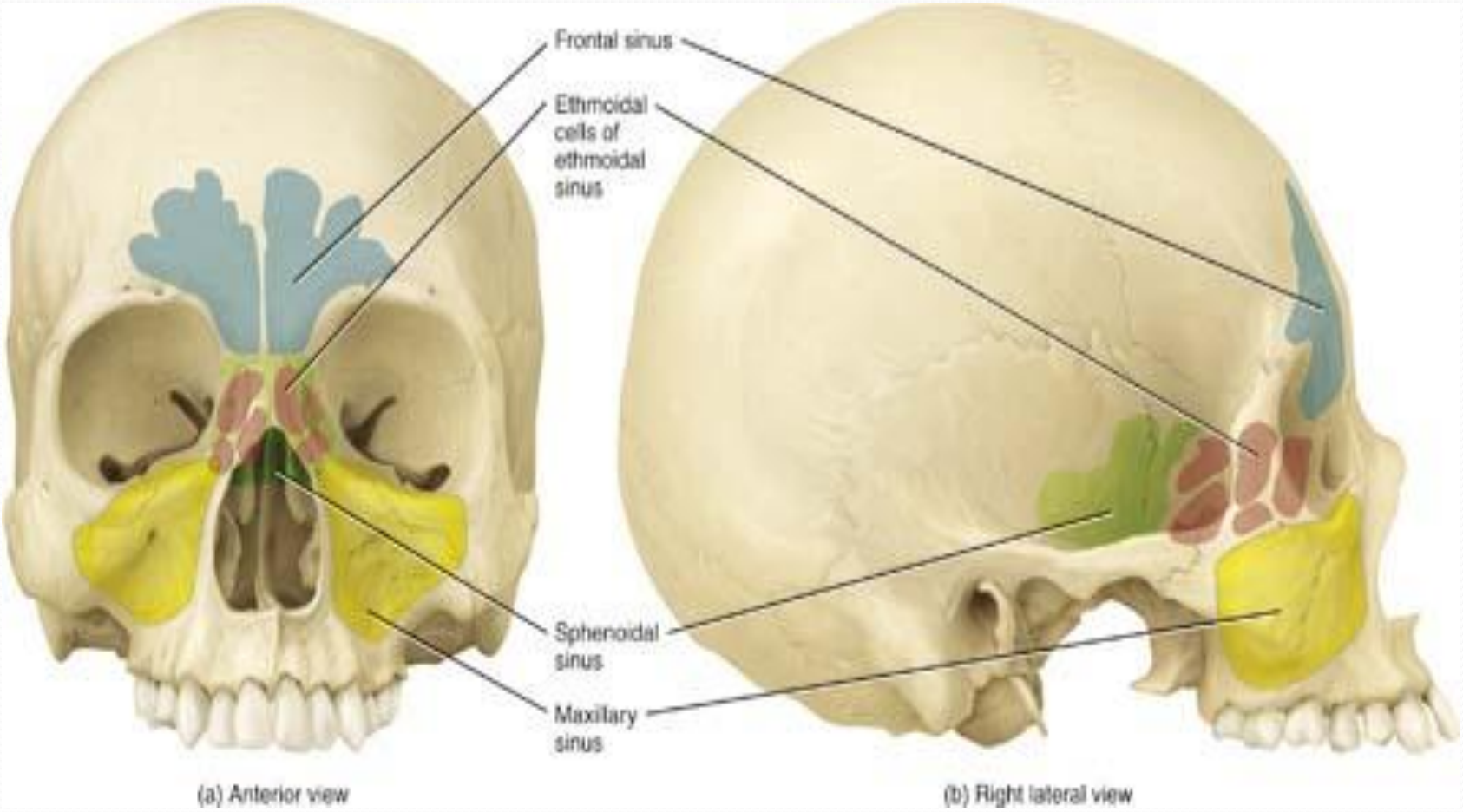
Skull Sutures

- There are 4 skull sutures:
  - **Coronal (1)** –Between frontal and parietal bones (hairband)
  - **Sagittal (1)** –Between left and right parietal bones
  - **Lambdoid (1)** – Between parietal bones and occipital bone
- **Squamous (2)** – Between parietal bone and temporal bone

Paranasal Sinuses

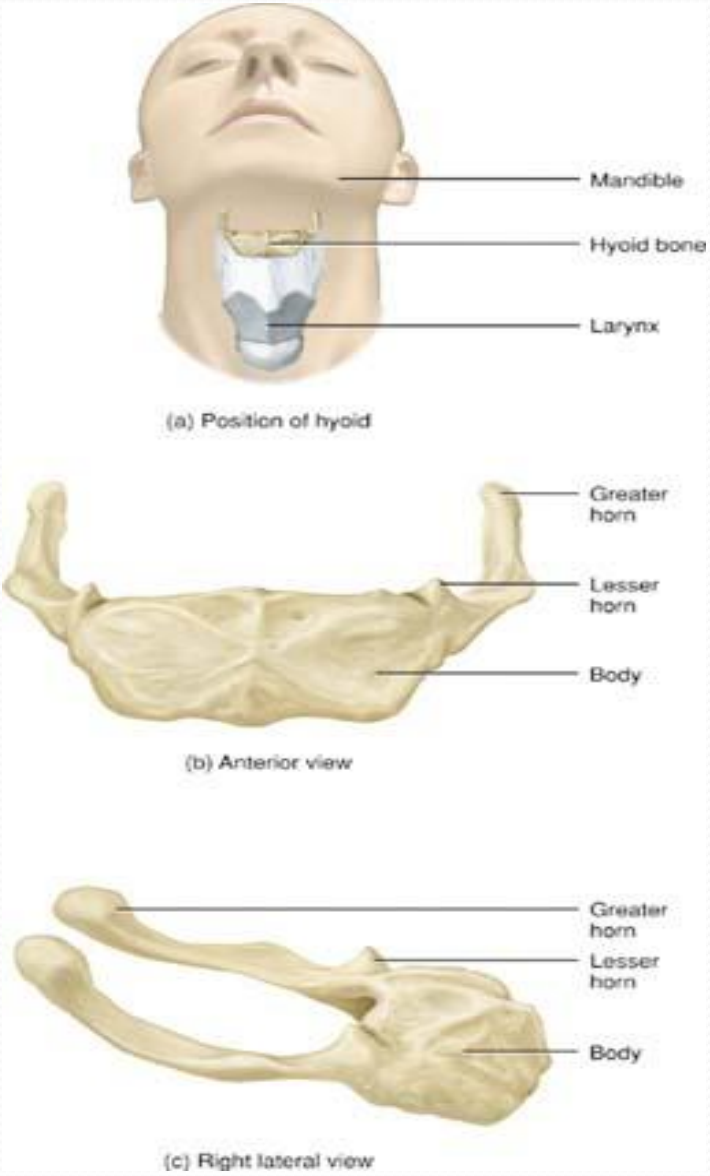
- There are 4 para-nasal sinuses
- These are cavities within bones that lie close to the nasal cavity
- They are lined with mucous membranes and are open to the nasal cavities
- Skull bones containing the para-nasal sinuses are the frontal, sphenoid, ethmoid and maxillary

Paranasal Sinuses



Hyoid Bone

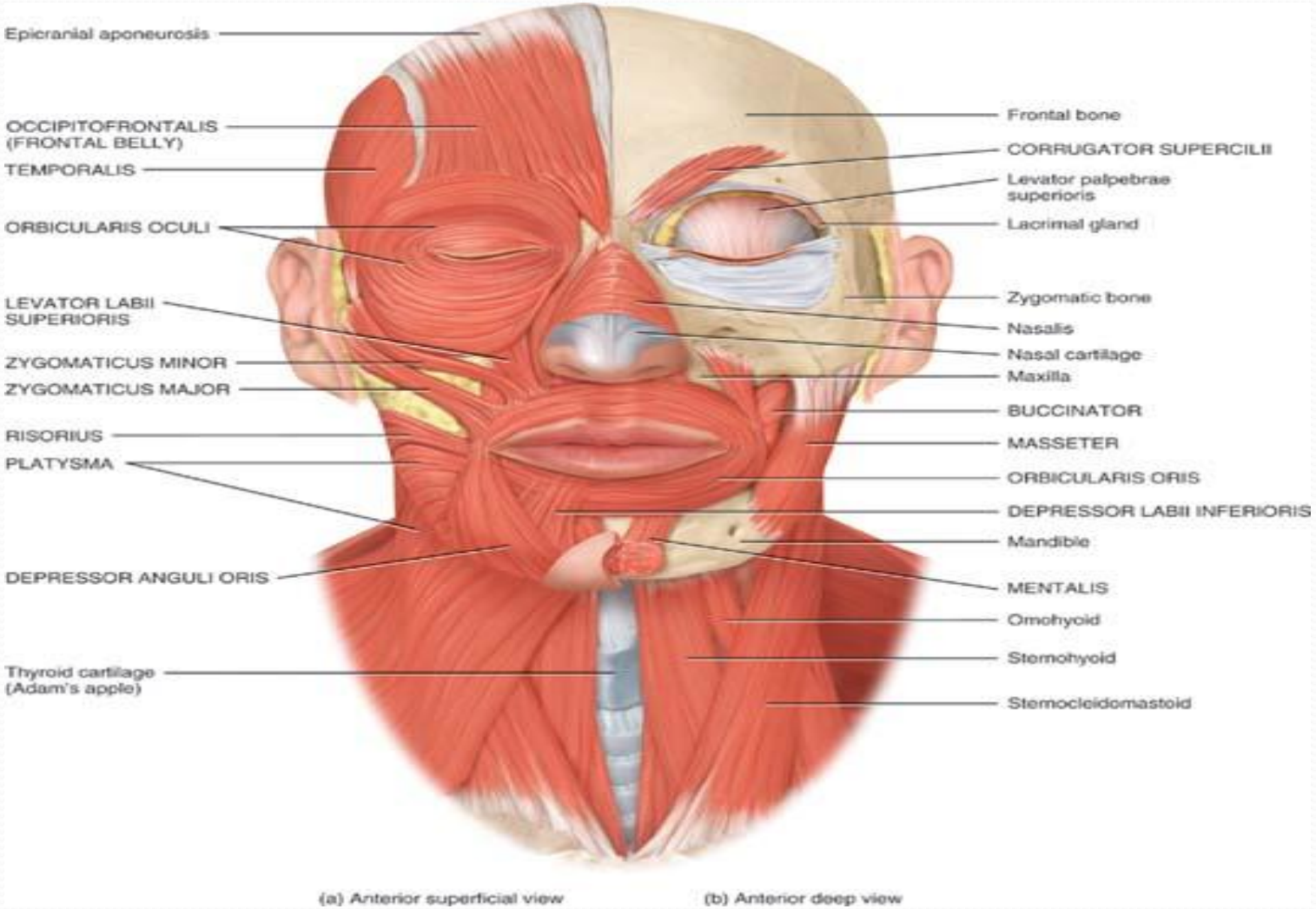
- Does not articulate with any other bone
- It is suspended from the styloid processes (temporal bone) by ligaments and muscles
- It is located between the mandible and larynx
- It functions to support the tongue by providing muscle attachment sites
- Also helps to keep the larynx open at all times
- Consists of a body, greater horns and lesser horns



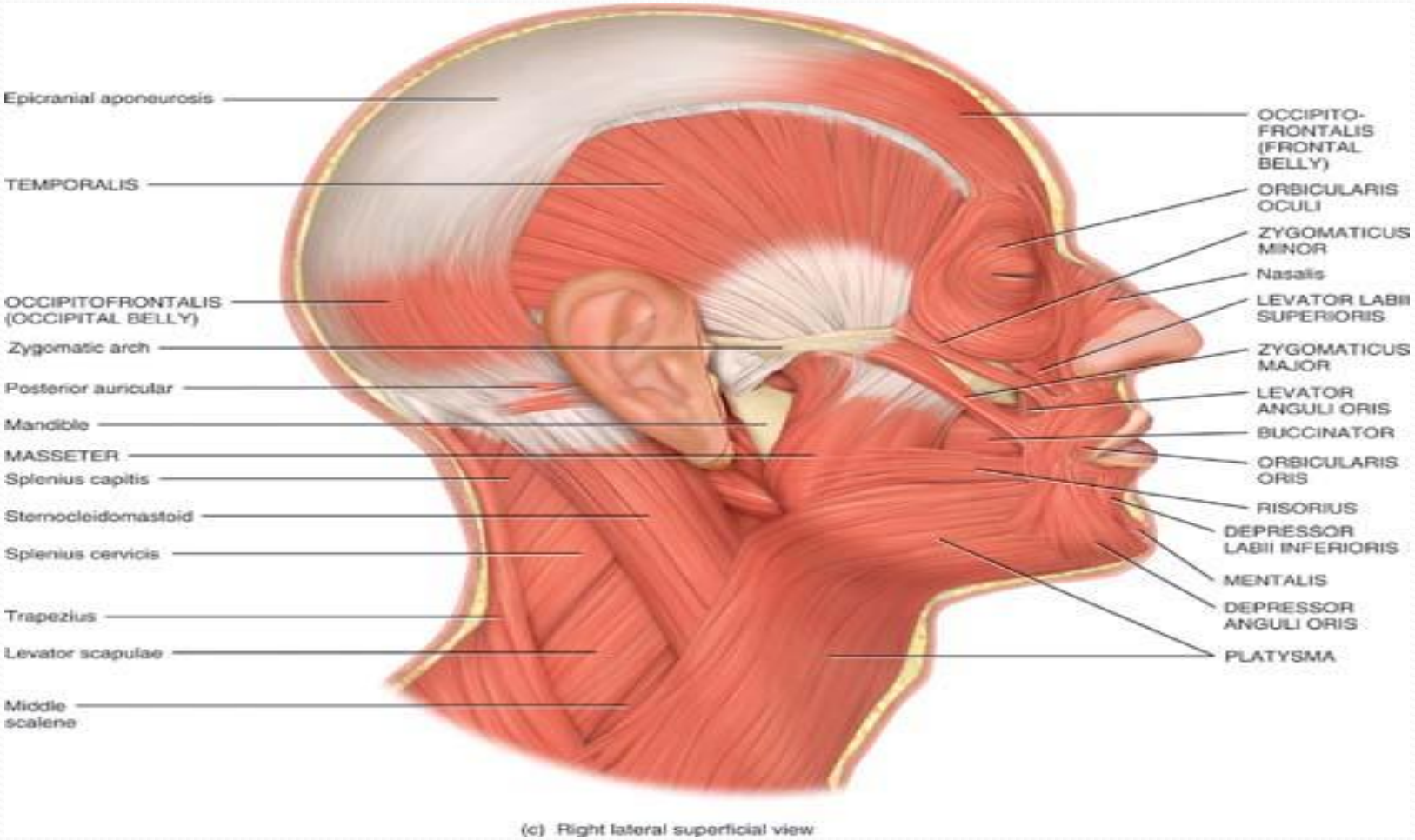
Muscles of the Face

- Also known as the muscles of facial expression

Facial Muscles



Facial Muscles – Side View



(c) Right lateral superficial view

Scalp

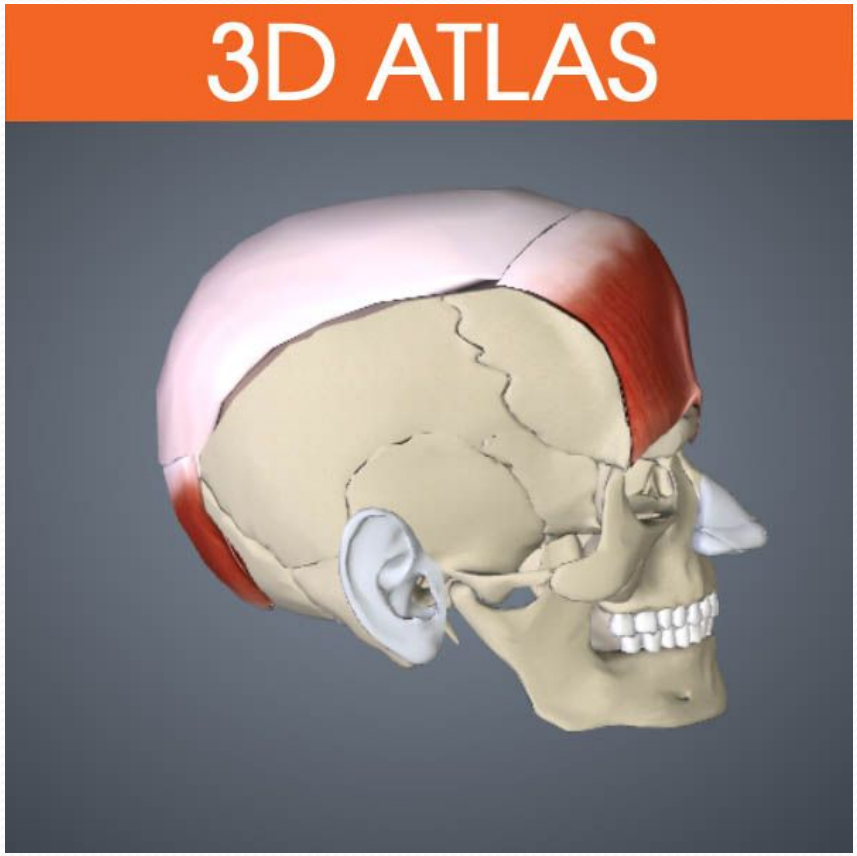
Occipitofrontalis

Origin – *occipitalis* - Occipital & Temporal Bone; *frontalis*- Galea Aponuerosis

Insertion - *occipitalis* – Galea Aponeurosis; *Frontalis* – Fascia & skin overlying the Frontal bone

Action – Draws scalp posteriorly

Nerve – Facial Nerve



Eye

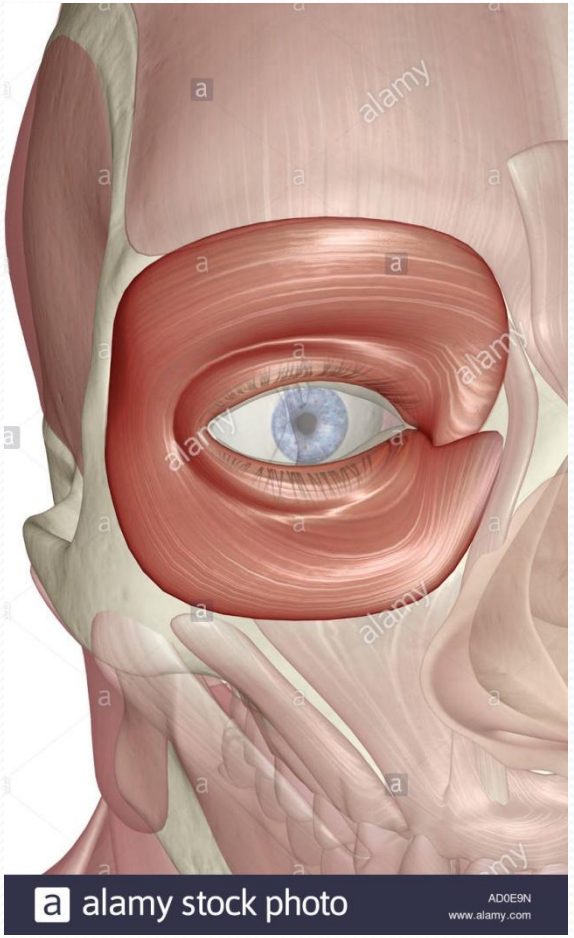
Orbicularis Oculi

Origin – Medial side of eye

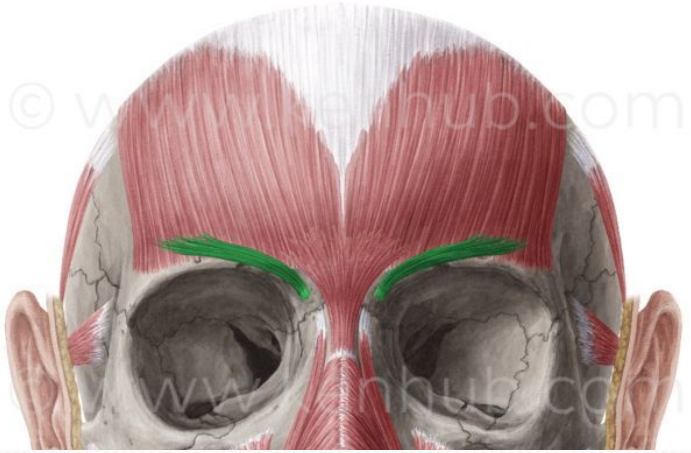
Insertion – Medial side of eye (encircles the eye)

Action – Closes and squints the eye

Nerve – Facial Nerve



Corrugator Supercilii



Origin – Inferior frontal bone

Insertion – Fascia and deep skin of the eyebrow

Action – Draws eyebrow inferomedially

Nerve – Facial Nerve

Nose

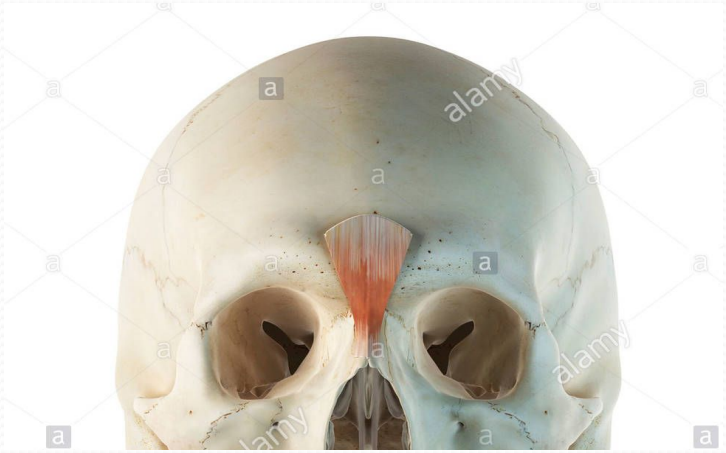
Procerus

Origin – Fascia and skin over the nasal bone

Insertion- Fascia and skin medial to the eyebrow

Action- Wrinkles the skin of the nose upward, Draws down the medial eyebrow

Nerve - Facial Nerve



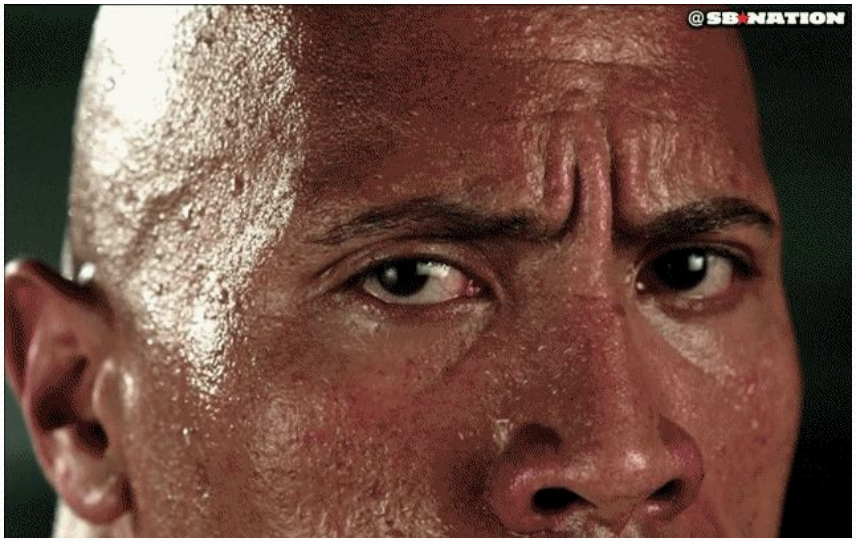
Nasalis

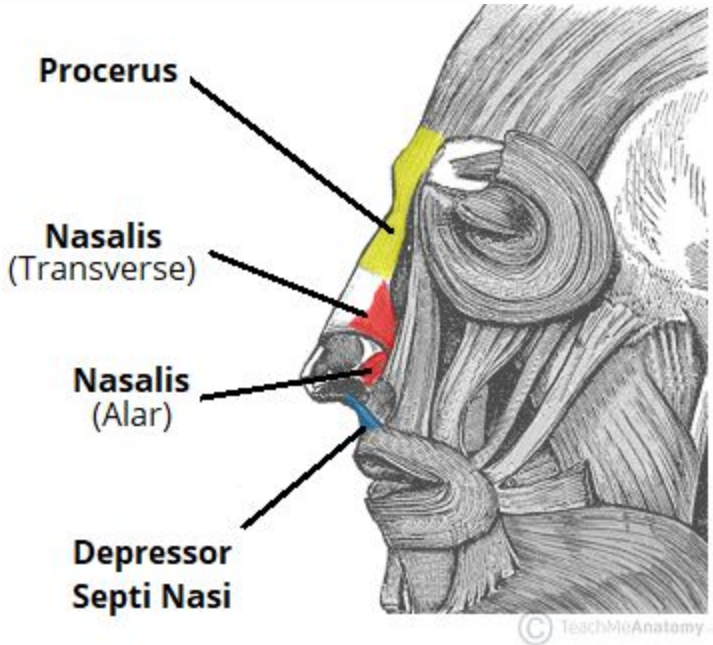
Origin – Maxilla

Insertion – Cartilage of nose and opposite side Nasalis muscle

Action – Flares the nostril, constricts the nostril

Nerve- Facial





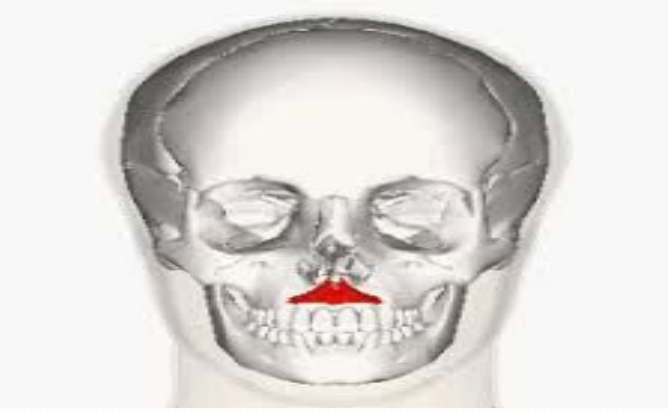
Depressor Septi Nasi

Origin – Maxilla

Insertion – Cartilage of the nose

Action – Constricts the nostrils

Nerve - Facial nerve



Mouth
Levator labii Superioris

Origin – Maxilla

Insertion- Upper Lip

Action – Elevates upper lip

Nerve - Facial Nerve

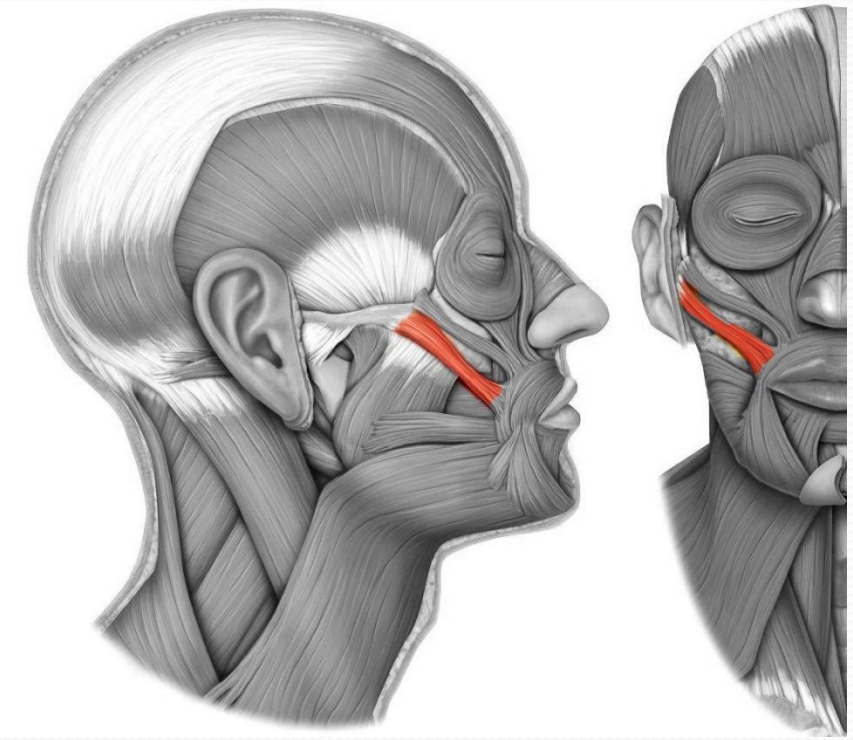
Zygomaticus Minor

Origin – Zygomatic Bone

Insertion – Upper lip

Action – Elevates upper lip

Nerve- Facial Nerve



Zygomaticus Major

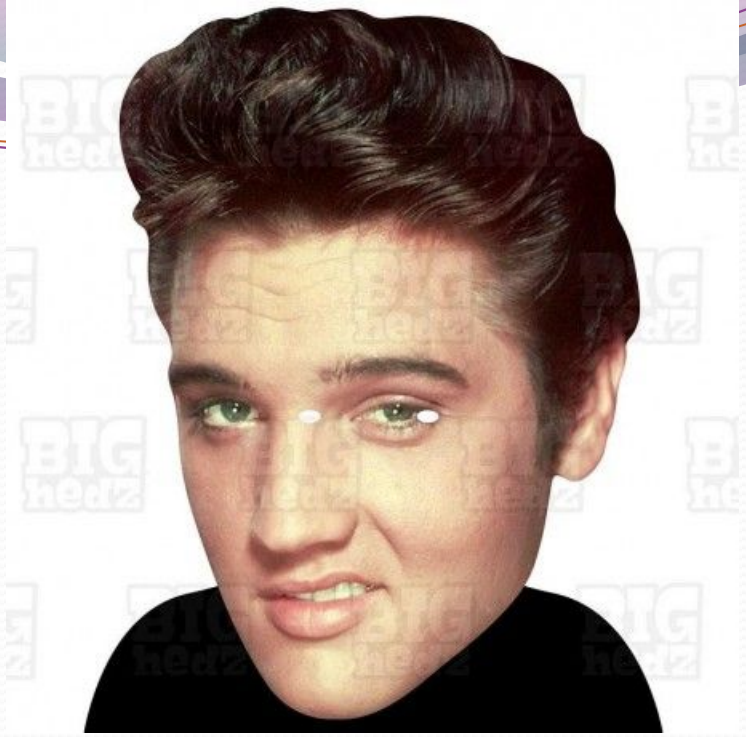
Origin – Zygomatic bone

Insertion – Angle of mouth

Action – elevates the angle

Nerve – Facial Nerve

Levator Anguli Oris



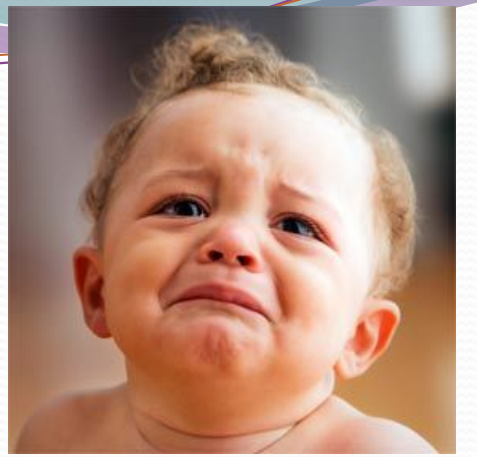
Origin – Maxilla

Insertion – Angle of the mouth

Action – Elevates the angle of the mouth

Nerve- Facial Nerve

Depressor Anguli Oris



Origin – Mandible

Insertion – Angle of the mouth

Action – Depression of the angle of the mouth

Nerve – Facial Nerve

Depressor Labii Inferioris

Origin – Mandible

Insertion –Lower lip

Action – Depress lower lip

Nerve – Facial Nerve

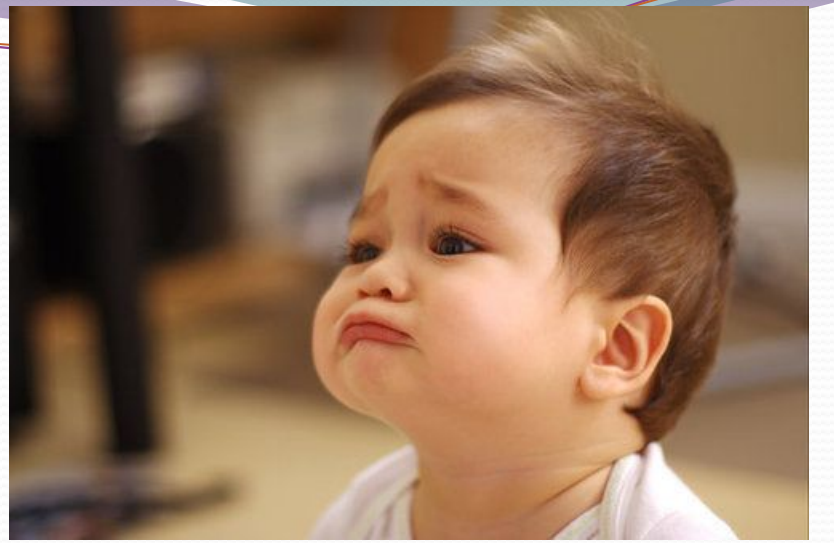
Mentalis

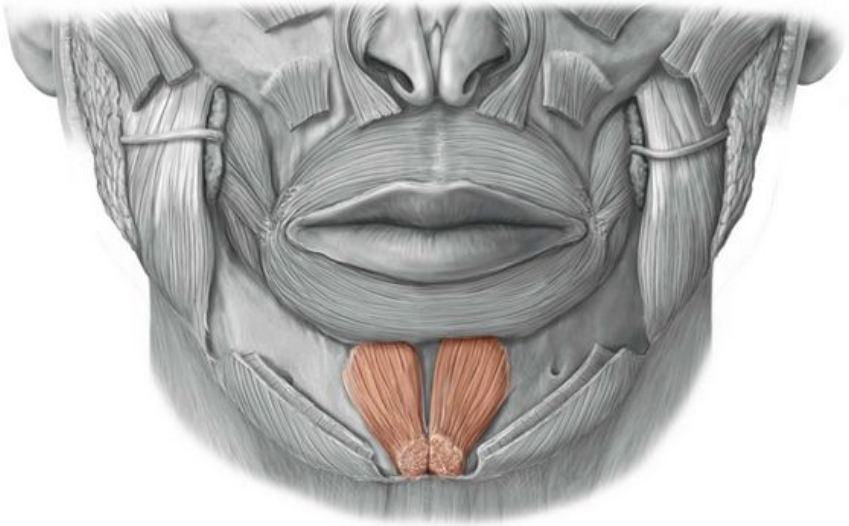
Origin – Mandible

Insertion – Fascia and skin of the chin

Action – Elevates lower lip, Everts and protracts lower lip

Nerve – Facial Nerve





Buccinator

Origin – Maxilla and the Mandible

Insertion – Lips

Action – Compresses cheeks against the teeth

Nerve- Facial Nerve

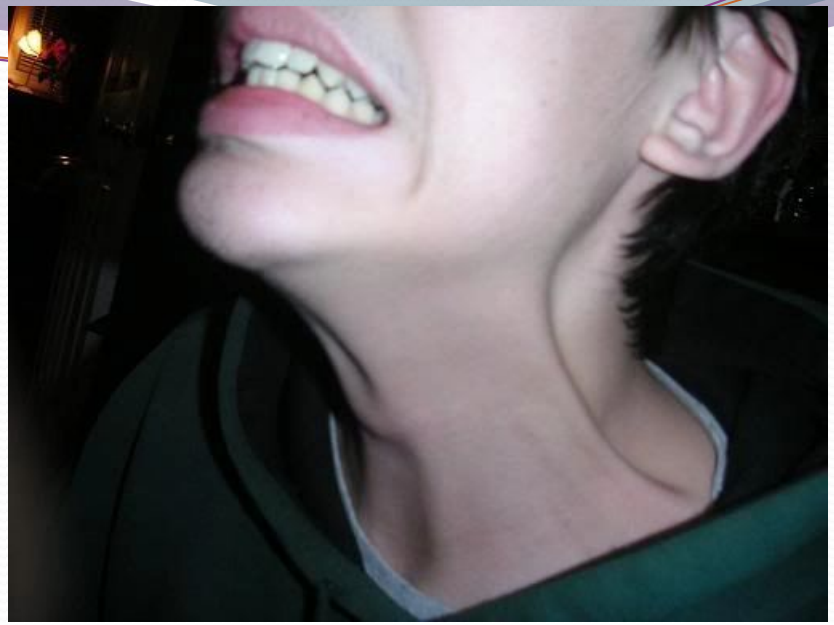
Orbicularis Oris

Origin and insertion – Surrounds the mouth

Action – Closes the mouth, Protracts the lips

Nerve – Facial Nerve

Platysma

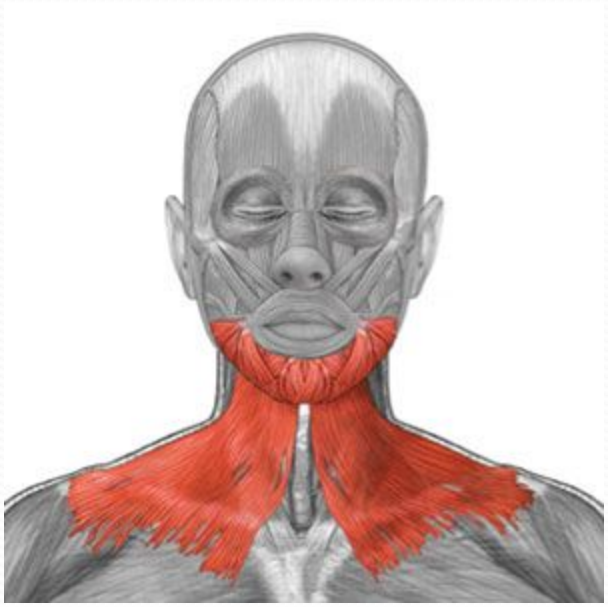


Origin – Subcutaneous Fascia of the superior chest

Insertion – Mandible and subcutaneous Fascia of the lower face

Action- Draws up the skin of the superior chest and neck

Nerve – Facial Nerve



TMJ

- TMJ is a **modified hinge joint** (synovial)
- Articulation is **between the condyle of the mandible and articular tubercle of the temporal bone and the mandibular fossa of the temporal bone**
- Joint capsule is **loose and there are 2 synovial membranes** (one superior to the disc and one inferior to the disc)
- The **articular disc divides the TMJ into 2 separate compartments** the **disc is attached to the postglenoid tubercle and to the posterior fibres of the lateral pterygoid muscle**
- **Gliding movements of protrusion and retrusion occur in the superior compartment**
- **Hinge movements of depression and elevation occur in the inferior compartment**

TMJ Ligaments

- There is a lateral thickening of the joint capsule that forms an intrinsic ligament called the lateral ligament
- There are 2 extrinsic ligaments that connect the mandible to the cranium:
  - **Stylomandibular** – a thickening of the fibrous capsule of the parotid gland, runs between styloid process and the angle of the mandible
  - **Sphenomandibular** – from the spine of the sphenoid to the lingual of the mandible (Lingual= raised bump around the mandibular foramen)

TMJ Movements

- TMJ movements are produced mainly by 4 muscles of mastication:
  - Temporalis, Masseter, Medial and Lateral pterygoids
- Depression of the mandible is mainly produced by gravity

Muscles of Mastication

Temporalis

Origin – Temporal Fossa

Insertion – Coronoid Process of the Ramus of the mandible

Action – Elevates Mandible at TMJ

Nerve – Trigeminal Nerve

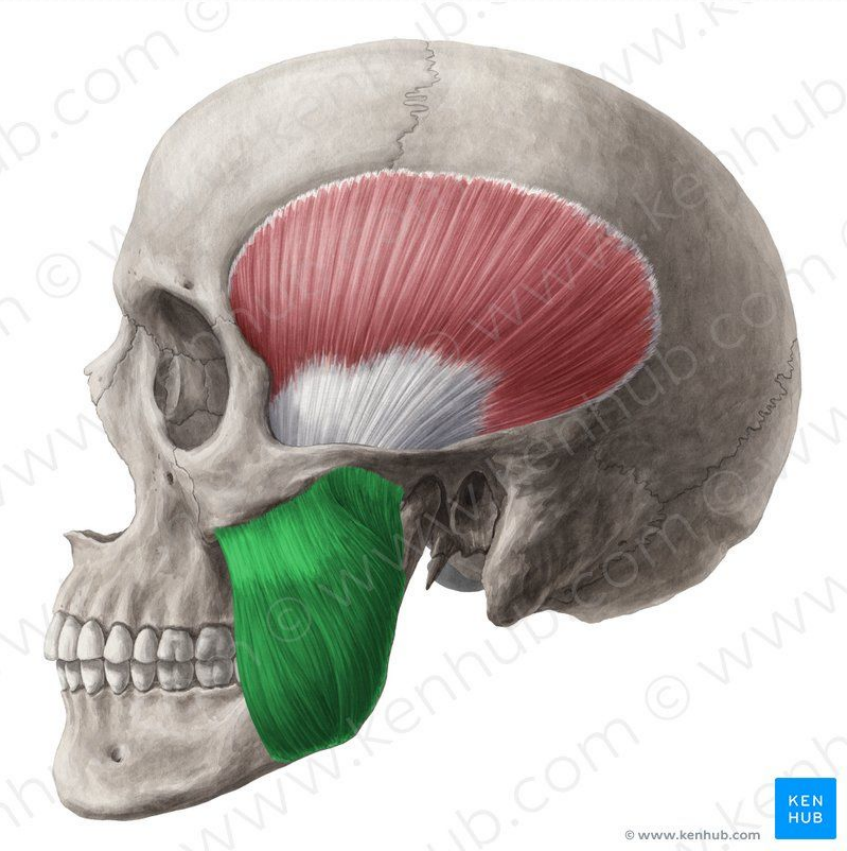
Masseter

Origin – Inferior Margin of zygomatic bone and zygomatic arch

Insertion – angle, ramus and coronoid process of the mandible

Action – Elevates Mandible at TMJ

Nerve- Trigeminal Nerve



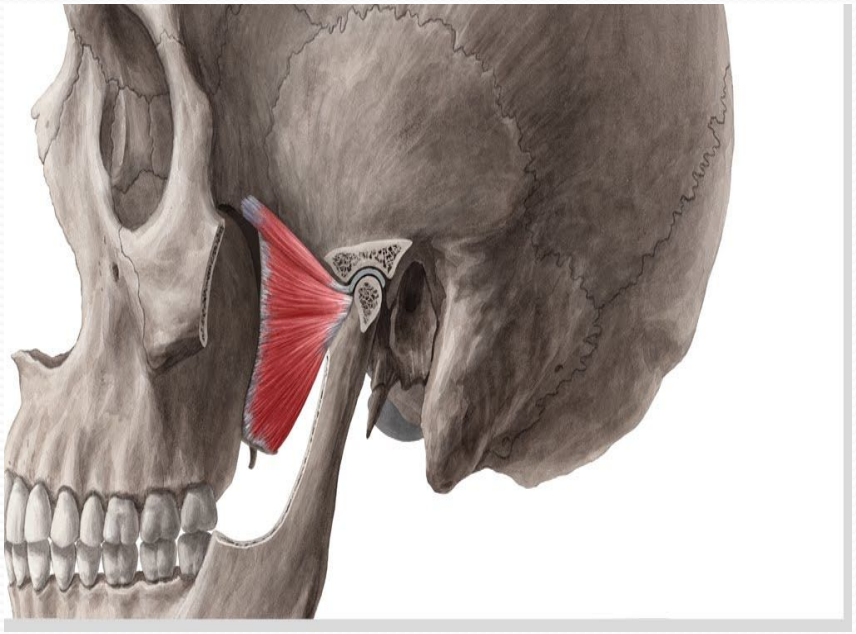
Lateral Pterygoid

Origin – Entire Muscle – Sphenoid Bone

Insertion- Mandible and TMJ

Action – Protraction and contralateral deviation of mandible at TMJ

Nerve – Trigeminal Nerve

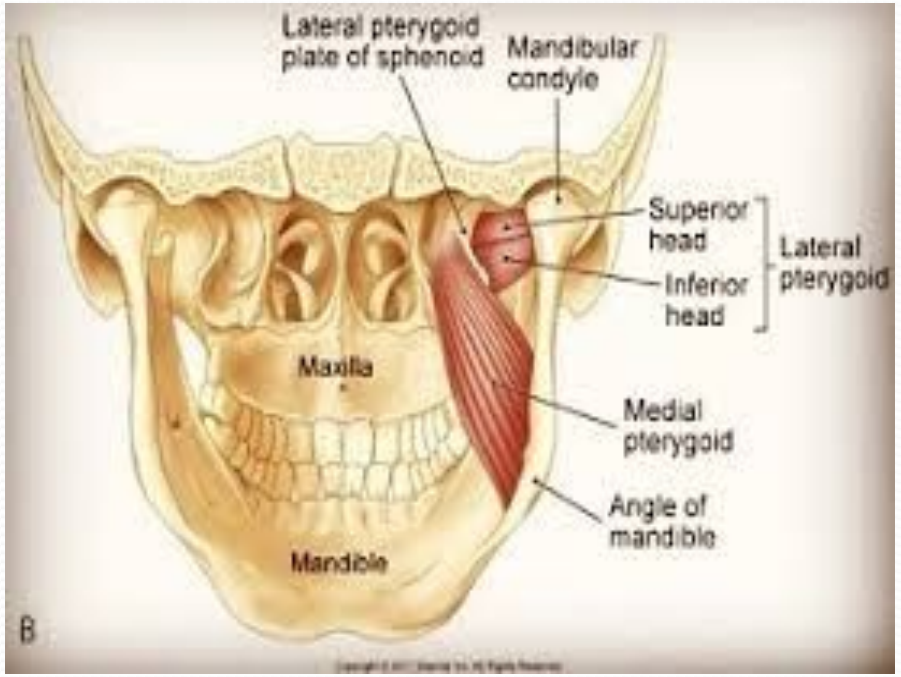


Medial Pterygoid

Origin – Entire Muscle – Sphenoid Bone

Insertion – Internal surface of the Mandible

Action – Elevates, protracts and Contralateral deviation of mandible at TMJ



Hyoid Muscles

- Review Hyoids

https://www.youtube.com/watch?v=W032hvnsOBc