Dental Head and Neck Anatomy

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Lab 1  THE SKULL

Objectives

Be able to identify all major bones of the skull: frontal, temporal, occipital, parietal, maxillary, mandible (also individual parts), in both skulls and basic radiographic films.

Realize the presence of bony sinuses which may not be directly visualized on the intact skull, but may be seen in radiographs.

Know all major foramina through which pass cranial nerves, blood vessels, spinal cord.

External bony landmarks:

Examine your skull and find the following landmarks, using any atlas as a guide:

1. Frontal bone
2. Parietal bones
3. Occipital bone
4. Temporal bone with mastoid process
5. Zygomatic arch
6. Maxilla
7. Mandible

Suture lines are located where the individual bones are joined. Identify the following:

1. Coronal suture-separating the frontal and parietal bones
2. Lambdoid suture-separating the occipital and parietal bones
3. Sagittal suture- separating the two parietal bones
4. Bregma- the point where the coronal and sagittal sutures meet
5. Lambda- the point where the sagittal and lambdoid sutures meet

**Bones of the face**
The face is formed mainly by the maxilla, the zygomatic bone, and the mandible. Above
the orbits is the frontal bone.

A. **Maxilla**- is continuous across the midline under the nose and forms part of the medial
wall and floor of the orbit. It joins laterally with the zygomatic bone. Below the inferior
margin of the orbit is the **infraorbital foramen** through which pass the **infraorbital nerve**
and blood vessels. The upper row of teeth are embedded in the alveolar processes
of the maxilla. Superior to the teeth on the interior of the bone is the **maxillary sinus**, an
air-filled cavity, which has a small opening which connects it with the nasal cavity.

Each maxilla contains 16 maxillary teeth forming the upper, or maxillary, dental
arch: on each side, a central and a lateral incisor, a canine, two premolars, and
three molars. The canine root forms a prominence on the maxilla known as the
canine eminence. Medial to the canine eminence and superior to the two incisors
is the **incisive fossa**, and lateral to the canine eminence is the **canine fossa**.

B. **Zygomatic bone** (cheek bone)-has frontal, maxillary, and temporal processes (where
it joins the zygomatic arch of the temporal bone). It forms the lateral third of the orbit.

C. **Mandible**- consists of a horizontal body and two vertically oriented rami. It has an
alveolar process that surrounds and supports the roots of the lower teeth.
Find the **coronoid and condylar processes**- the temporal muscle (a powerful closer of
the jaw) attaches to the coronoid process.
The **condyle** articulates with the mandibular fossa. The condyle has a head and a neck-
the head is covered with cartilage and is contained in the **temporomandibular joint**.
On the medial side of the mandible is the **mandibular foramen**, the opening of the
mandibular canal, through which the inferior alveolar nerve and vessels pass to supply
the lower teeth. A small bony projection, the **lingula**, just above the mandibular foramen,
serves as the attachment of the **sphenomandibular ligament**. The **mental foramen** is
the opening of the mandibular canal at the chin through which the terminal end of the
inferior alveolar nerve passes and becomes the mental nerve.

The mandible contains 16 teeth on the mandibular dental arch; each side has a
central and lateral incisor, a canine, two premolars, and three molars.
Interior of the skull

Remove the top of the skull and examine the interior. It is divided into three fossae- the anterior, middle, and posterior cranial fossae.

A. The anterior cranial fossa is bordered by the middle cranial fossa at the posterior borders of the right and left wings of the sphenoid bone and the anterior margin of the chiasmatic groove. Identify the 3 bones which form the anterior cranial fossa: the sphenoid bone, crista galli and cribriform plate of ethmoid bone and orbital plate of frontal bone (which forms the roof of the orbit).

B. The middle cranial fossa is composed of 2 bones- the sphenoid bone and the temporal bone. On each side are a series of foramina for passage of cranial nerves and vessels which you will see later in the course.

1. Superior orbital fissure - cranial nerves III, IV, V1, VI, superior ophthalmic vein.
2. Foramen rotundum- nerve V2
3. Foramen ovale- nerve V3, accessory meningeal artery
4. Foramen spinosum - middle meningeal artery

Find the following bony landmarks-
1. Hypophyseal fossa- for the pituitary gland
2. Optic canal - for the passage of the optic nerve and ophthalmic artery, with sympathetic fibers
3. Dorsum sellae - the back edge of the sella turcica (between the two posterior clinoid processes)
4. Carotid groove - for the carotid artery (which runs over the top of the foramen lacerum)
5. Foramen lacerum - normally covered over by cartilage
6. Sella turcica-Turkish saddle (contains the hypophyseal fossa with the pituitary gland)
7. Clinoid processes (4) - above the body of the sphenoid (two anterior and two posterior)

C. Identify the posterior cranial fossa and note its borders. It is composed primarily of the occipital bone, bordered laterally by the temporal bones. At the base of the fossa is the foramen magnum through which the base of the brainstem becomes continuous with the spinal cord. Other important structures passing through the foramen magnum include the vertebral arteries and the anterior and posterior spinal arteries. Identify the grooves in the bone at the location of venous sinuses: the sigmoid sinus, transverse sinus, and petrosal sinuses.

Identify the following openings:
1. Internal acoustic meatus- nerves VII, VIII, labyrinthine artery to cochlea
2. Jugular foramen- nerves IX, X, XI, jugular vein
3. Hypoglossal canal- nerve XII
Inferior aspect of the skull

The base of the skull can be divided into anterior, middle, and posterior regions. The anterior region extends as far back as the hard palate, the middle region ends at the anteriormost edge of the foramen magnum, and the posterior region includes the posterior remainder of the skull.

A. The anterior area:

The anterior region contains the superior alveolar, or maxillary, arch, a U-shaped ridge of bone which supports the 16 maxillary teeth. The hard palate is formed by parts of the maxillary bone and the horizontal process of the palatine bones. An incisive foramen is seen anteriorly at the midline through which passes the nasopalatine nerve (V2) and artery. Posteriorly on the palate are the greater and lesser palatine foramina which transmit the greater and lesser palatine nerves and vessels to the hard and soft palate, respectively.

B. The middle area:

This portion of the base of the skull is composed of parts of the sphenoid, palatine, temporal, vomer, and occipital bones. The lateral and medial pterygoid plates of the sphenoid bone project inferiorly; the lateral and medial pterygoid muscles (muscles of mastication) arise from the lateral and medial sides of the lateral pterygoid plate. The nasal cavities open posteriorly as the choanae and are separated by the nasal septum, a midline bone whose posterior aspect is called the vomer.

The occipital bone meets the petrous portion of the temporal bone, which contains the carotid canal through which the internal carotid artery enters the cranial cavity. The petrous portion of the temporal bone joins anteriorly with the sphenoid forming a groove which becomes the cartilaginous part of the Eustachian tube located anterior to the carotid canal. Lateral to this is the foramen spinosum for the middle meningeal artery, and anterior and medial is the foramen ovale, for the mandibular division of the trigeminal nerve.

C. The posterior area:

This region contains the foramen magnum, the occipital condyles, condylar (hypoglossal) canals, styloid and mastoid processes. The occipital condyle on either side of the foramen magnum articulates with the atlas of the vertebral column. The condylar canals (hypoglossal canals) allow passage of the hypoglossal nerve (XII). Find the jugular foramen which you saw on the interior of the skull. Just lateral to it is the small stylomastoid foramen through which cranial nerve VII leaves the skull.
Lab 2- NECK I

Objectives
- Know the boundaries and contents of the triangles of the neck, especially the submandibular triangle.
- Know the superficial and deep nerves of the neck and what is innervated.
- Know the branches of the external carotid artery.
- Know the relationship of longitudinal structures in the neck to each other.
- Know the fascial planes of the neck.

Introduction to the Neck

The neck has three compartments: a median visceral compartment, continuous inferiorly with the superior mediastinum in the thorax; and two posterior triangles, one on each side, continuous inferolaterally with the axilla. The sternocleidomastoid and scalene muscles form boundaries between these compartments.

Dissect: Make a median vertical incision in the skin, from the chin, to the sternal manubrium. From the upper end of the incision, make a transverse cut along the lower border of the mandible to a point behind the lobule of the pinna. Reflect the skin flaps laterally as far as possible. At that time you may see the thin platysma muscle, situated in the superficial fascia of the neck. Reflect the platysma upwards, taking care not to damage the external jugular vein.

Clean the sternocleidomastoid muscle as it extends obliquely from the mastoid processes behind the pinna to the sternal manubrium and medial third of the clavicle. Observe the external jugular vein as it crosses the sternocleidomastoid obliquely on each side on its way to join the subclavian vein. Notice the size of the external jugular vein in different cadavers.

Fascial layers of the neck

There are several connective tissue, or fascial layers of the neck: one superficial layer and three main deep layers. The superficial layer of fascia forms a thin layer that covers the platysma muscle. The deep cervical fascia is composed of an investing layer, the visceral layer, and the vertebral layer. The visceral fascia divides into two parts. The part surrounding the esophagus and trachea is also called the visceral fascia. The part surrounding the pharyngeal constrictors is called the pharyngeal.
fascia.

The **vertebral fascia** is subdivided into prevertebral and vertebral. The prevertebral fascia attaches between the anterior tubercles of the transverse vertebral processes with intermediate attachments to the body of the vertebrae. The remaining vertebral fascia attaches between the anterior tubercle of the transverse process and the spinous process. A subdivision of the prevertebral fascia is the alar fascia which attaches to the anterior tubercles of the cervical vertebrae. The **carotid sheath** is formed by contributions from the three fascial layers, i.e., deep investing fascia, prevertebral and visceral fasciae.

The **retropharyngeal space** is posterior to the pharyngeal and visceral fasciae and anterior to the alar fascia. The retropharyngeal space is continuous inferiorly to the posterior mediastinum.

Between the alar and vertebral fasciae is the "danger space", which is continuous to the diaphragm. Between the vertebral fascia and the vertebrae is the **prevertebral**

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**Posterior Triangle**

The posterior triangle is the area of the neck bordered by the posterior margin of the sternocleidomastoid muscle, the anterior margin of the trapezius muscle and the intermediate third of the clavicle (removed earlier). The deep (investing) fascia of the neck forms a tough roof for this region; the fascia extends across the posterior triangle from the posterior border of the sternocleidomastoid to the anterior border of the trapezius.

**Dissect:**  

*The spinal accessory nerve* lies below the deep fascia in the posterior triangle. The nerve crosses the triangle obliquely, appearing at the mid-point of the posterior border of the sternocleidomastoid muscle, then passing out of view under the edge of the trapezius muscle close to the lower third of its anterior border. Note the position of the nerve in your atlas and its innervation of the sternocleidomastoid and the trapezius muscles. **What are the actions of these muscles?** Because the nerve frequently lies very deep and can be difficult to locate, please wait and identify it later after reflecting the sternocleidomastoid.

Examine the **greater auricular nerve**, which runs on the sternocleidomastoid, parallel and posterior to the external jugular vein towards the angle of the mandible. The nerve supplies the back of the auricle and the skin from the angle of the mandible to the mastoid process. Look for the **transverse cervical nerve** which runs transversely across the middle of the sternocleidomastoid, and supplies the skin of the anterior triangle of the neck. These two nerves may contribute innervation to the vestibule of the mouth, and occasionally...
Cut the external jugular vein in half and reflect the superior half towards the head and the inferior half downwards. Separate the sternocleidomastoid muscle from the surrounding fascia and cut it in half transversely, about 5cm above the sternum, reflecting one half superiorly and the other inferiorly.

You should now see the posterior (inferior) belly of the omohyoid muscle which passes deep to the sternocleidomastoid muscle. The omohyoid muscle is attached to the hyoid bone in the anterior part of the neck, runs inferiorly and laterally under the sternocleidomastoid muscle, and appears in the posterior triangle immediately above the clavicle, and running parallel to it.

“Omo” refers to “shoulder”; the omohyoid attaches inferiorly to the superior border of the scapula.

Follow the omohyoid muscle from the hyoid bone down to the floor of the posterior triangle. If you have not yet identified the spinal accessory nerve innervating the sternocleidomastoid and trapezius muscles, try to do so now. The spinal accessory should be seen entering the deep surfaces of the sternocleidomastoid and trapezius muscles. Do not spend too much time looking for the nerve, but ask for help from an instructor if you don’t see it.
Anterior Triangle

Observe: The anterior triangles are enclosed laterally by the two sternocleidomastoid muscles; superiorly, by the lower border of the mandible; and medially by the anterior midline of the neck. This area contains the visceral compartment of the neck (containing the larynx, esophagus, and trachea) which freely communicates with the mediastinal compartment of the thorax.

Identify by Palpation: Before beginning your dissection of the anterior triangle, identify the following landmarks, both on yourself and your cadaver. Palpate the soft tissues of the floor of the mouth, starting under the lower border of the mandible at the chin, and continuing posteriorly. Deep in the tissues just below the floor of the mouth, the hyoid bone can be located through firm, but gentle palpation between your index finger and thumb. Note that the bone seems to disappear when you swallow; it is actually elevated and drawn posteriorly during swallowing.

Inferior to the hyoid bone is the upper border of the thyroid cartilage, a bilaminar structure with a characteristic median notch along its superior border. In the midline, just inferior to the notch, is the pronounced thyroid prominence (Adam's apple). The thyroid cartilage also moves up and down during swallowing. Continue to follow the angle of the thyroid cartilage below the prominence until you can feel the space which separates the thyroid cartilage from the cricoid cartilage; the crico-thyroid ligament fills this space between the cricoid and thyroid cartilages. You can feel changes in the height of this space as you change the pitch of your voice over a wide range. Emergency cricothyrotomy can be done by piercing this ligament and introducing a tube to form an artificial airway. Tracheotomy tubes will be provided during class which you should use to try this...
procedure. The classical tracheotomy is performed more inferiorly, by removing tracheal rings under controlled surgical conditions. During this procedure the surgeon must be careful to avoid injury to the arch of the aorta or the brachiocephalic artery.

Inferior to the cricoid cartilage, palpate the rings of the trachea; the isthmus of the thyroid gland lies over the 2nd and 3rd rings.

Subdivisions of the Anterior Triangle

It is customary to subdivide the anterior triangle into two triangles by drawing an imaginary line in the median vertical plane. Structures in the neck are symmetrical on each side of the line. Below the chin there is a single submental triangle which is limited on each side by the anterior bellies of the digastric muscles. The floor of the submental triangle consists of the mylohyoid muscles, fused in the midline, and extending from the mandible to the hyoid bone. The mylohyoid muscles also represent the floor of the oral cavity when approached from that space.

A. Muscular Triangle

Dissect: The space below the hyoid bone is subdivided into two muscular triangles containing the strap muscles arranged in two layers. The superficial layer on each side consists of the sternohyoid medially, and the anterior (superior) belly of the omohyoid laterally. The deeper layer consists of the sternothyroid and thyrohyoid muscles; to expose these deep muscles transect the sternohyoid at its middle, and reflect the cut ends. The strap muscles cover the thyroid gland; they are innervated by the cervical plexus nerves (C1 - C3) through the ansa cervicalis.
B. Carotid Triangle

**Dissect:** This small, bilateral triangle is bounded by the anterior belly of the omohyoid, the sternocleidomastoid, and the posterior belly of the digastric muscles. Major structures located within this triangle include **internal** and **external carotid arteries**, **hypoglossal nerve**, and **internal jugular vein**.

C. Digastric or Submandibular Triangle

**Dissect:** Also bilateral, this triangle is bounded by the anterior and posterior bellies of the digastric muscle, and the lower border of the mandible. It is occupied by the **submandibular salivary gland** which is tightly covered by the deep fascia of the neck, and tucked superiorly under the
inferior border of the mandible. Remove the fascia to expose the gland; raise the gland with your finger to locate the **facial artery** embedded in a deep groove in the gland’s posterior surface. Follow the artery as it loops, from deep to superficial, around the inferior border of the mandible to enter the face. The **facial vein**, running superficial to the artery, appears at the lower border of the mandible, just lateral to the artery. Identify the facial artery and vein as they cross the lower border of the mandible.

The **mylohyoid** and **hyoglossus muscles** can be seen deep in the digastric triangle. Detach the anterior bellies of the digastric muscles from the mandible and expose the mylohyoid muscles arising from the deep surface of the mandible bilaterally, and converging on the **median raphe** which extends from the chin to the hyoid bone. The posterior border of the mylohyoid muscle is free; note that the **hypoglossal nerve** and the **duct of the submandibular gland** pass posteriorly around the margin of the muscle to gain access to the oral cavity. The mylohyoid muscles raise the floor of the mouth and the hyoid bone during swallowing; together with the anterior bellies of the digastric muscles, they are innervated by the **trigeminal (5th) cranial nerve**. The hyoglossus muscle, one of the muscles of the tongue, is innervated by the **hypoglossal (12th) cranial nerve**.

**NECK II**

**Deep Dissection of the Neck**

The deep structures of the neck can best be examined after the sternocleidomastoid muscles have been reflected. This should have already been done.

**Carotid Sheath**

**Dissect:** Examine the contents of the **carotid sheath**, deep to the sternocleidomastoid muscle. The sheath
surrounds the internal jugular vein laterally; the common carotid artery medially; and the vagus nerve posteriorly, in the plane between the vessels. The ansa cervicalis, a loop connecting cervical nerves C2 and C3, usually lies anterior to the sheath; try to locate this plexus of nerves. The ansa carries fibers from the cervical plexus to innervate the strap muscles. (See next page for more details on the ansa cervicalis.)

Carefully remove the connective tissue of the carotid sheath to expose the division at the level of the upper border of the thyroid cartilage of the common carotid artery into internal and external carotid arteries. Observe the carotid sinus, a dilation of the upper end of the common carotid artery where receptors in the wall of the vessel detect changes in blood pressure.

Clean the medial side of the external carotid artery to locate the following branches:

- **superior thyroid artery**, descends along the anterior border of the thyroid gland and supplies the infrahyoid muscles of the neck and the superior half of the thyroid gland, and, via the superior laryngeal artery, supplies the superior half of the larynx and the cricothyroid muscle.

- **lingual artery**, arches over the greater cornu of the hyoid bone, passing deep to the hyoglossus muscle, and supplies structures of the mouth, such as the tongue, mucous membranes, and glands.

- **facial artery**, ascends in the plane deep to the posterior belly of the digastric muscle, crossing over the edge of the mandible, and generally supplies the facial region.

The internal jugular vein, lateral and parallel to the common carotid artery, receives the common facial, lingual, and superior and middle thyroid veins.

The hypoglossal nerve appears in the carotid triangle deep to the posterior belly of the digastric muscle, between the internal jugular vein and internal carotid artery. The nerve then follows a looping path across the superficial surfaces of the internal and external carotid arteries (eventually passing deep to the mylohyoid muscle to enter the oral cavity). You may see the superior root of the ansa cervicalis, descendens hypoglossi,
(fibers from C1 and C2) closely attached to the hypoglossal nerve for a short distance. These fibers leave the area of the hypoglossal nerve and descend inferiorly to join the inferior loop of the ansa cervicalis. Branches from C2 and C3, forming the descending cervical or inferior root of the ansa cervicalis, cross the anterior surface of the inferior jugular vein. The superior and inferior roots join to form the ansa cervicalis. Small nerve branches from the ansa cervicalis innervate the strap muscles of the anterior triangle. Do not spend too much time looking for these individual branches.

Vagus Nerve

Dissect: Clean the vagus nerve, located within the carotid sheath, posterior to the vessels. The superior laryngeal branch of the vagus nerve arises high in the neck, then divides into internal and external laryngeal nerves. The internal laryngeal nerve should be easily seen; it enters the larynx with the superior laryngeal artery by piercing the thyrohyoid membrane and provides sensation above the level of the vocal folds. The external laryngeal nerve innervates the cricothyroid muscle, one of the muscles involved in vocalizing. Do not spend time looking for this nerve.

Sympathetic Trunk

Look for the sympathetic trunk posterior to the carotid sheath: it lies anterior to the prevertebral muscles, under the cover of the vertebral fascia. It has three ganglia which will be more readily seen during a later lab session.

Trachea and Esophagus

Realize: The trachea and esophagus originate anterior to the 6th cervical vertebrae, then descend in the median plane to the superior thoracic aperture and on into the thorax. The path of the recurrent laryngeal nerve in the neck runs in the lateral groove between the trachea and the esophagus.
Thyroid Gland

Dissect: Cut the strap muscles transversely and reflect them from the surface of the thyroid gland to expose the two lobes and isthmus of the gland. The lobes extend superiorly to the oblique line of the lamina of the thyroid cartilage, and inferiorly to the level of the sixth tracheal ring. The trachea and esophagus are adjacent to the medial surface of each lobe.

Expose the **recurrent laryngeal nerve** as it runs superiorly in the gutter between the lateral surfaces of the trachea and esophagus. Superior to the trachea and esophagus, the lateral lobes of the thyroid gland are adjacent to the cricoid and thyroid cartilages of the larynx, and to the inferior constrictor muscles of the pharynx. The posterior border of the gland is related to the carotid sheath. The isthmus of the gland, connecting the two lateral lobes, overlies the 2nd, 3rd and 4th tracheal rings; inferior to the isthmus the trachea is subcutaneous, covered only by loose connective tissue and the inferior thyroid veins. A tracheotomy is usually performed inferior to the isthmus of the gland; however, it is sometimes necessary to split the isthmus to gain access to the trachea.

The **parathyroid glands** are embedded in the connective tissue on the posterior surface of the thyroid gland, usually two on each side superiorly and inferiorly. In the cadaver they are difficult to distinguish grossly from thyroid tissue. Do not spend time looking for them.

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COMPLETE THE REMAINDER OF THE DISSECTION DURING THE NECK LAB OF THE HUMAN BODY COURSE:

Posterior Triangle (continued)
For better exposure of structures in the inferior portion of the triangle remove the intermediate third of the clavicle. Dissect away the fascial floor of the triangle and notice the roots of the brachial plexus as they pass between scalenus anterior and scalenus medius muscles. Find the phrenic nerve; it arises from C4 spinal cord segment (with contributions from C3 and C5), then descends obliquely over the anterior surface of the scalenus anterior muscle, from its lateral border superiorly, to its medial border inferiorly, deep to the investing fascia. Dissect under the posterior edge of the inferior portion of the sternocleidomastoid muscle to find the nerve.

The subclavian artery arches upward and then laterally, posterior to the sternoclavicular joint, then passes posterior to the scalenus anterior muscle.

The subclavian vein (the continuation of the axillary vein) is not seen in the posterior triangle. The vein crosses the 1st rib anterior to the scalenus anterior muscle, and posterior to the medial end of the clavicle and the tendon of the sternocleidomastoid muscle; thus, it is outside of the boundaries of the posterior triangle. After receiving the external jugular vein, the subclavian vein turns inferiorly to enter the mediastinum. The subclavian vein can be reached from below the clavicle for introduction of a central venous catheter.

Root of the Neck

Realize: In the dissection of the thorax, the apices of the pleurae were found to extend into the root of the neck. They are, however, separated from the viscera of the neck by the supracleural membrane, a rigid fibrous septum which prevents displacement of neck viscera during respiration.

The key structure at the root of the neck is the scalenus anterior muscle, arising from the transverse processes of the cervical vertebrae, then descending obliquely to insert at the scalene tubercle of the first rib.
The aim of the following dissection is to conceptually merge the root of the neck with the superior mediastinum. To accomplish this it is beneficial to remove the remaining part of the sternal manubrium, together with the attached medial end of the clavicles, leaving in situ the first rib and the scalenus anterior muscles.

**Dissect:** Cut the costal cartilages of the first rib as close as possible to the manubrium, making sure that your cut is medial to the scalenus anterior muscle attachment. Free the internal thoracic arteries and phrenic nerves from the back of the manubrium and preserve them. Free the inferior thyroid veins and preserve them by pushing the left brachiocephalic vein posteriorly.

Remove en mass the manubrium, clavicles and the inferior portion of the strap muscles. Examine the structures in the root of the neck from superficial to deep, then follow each structure from the neck into the thorax.

The **subclavian vein** crosses in front of the scalenus anterior muscle, joining with the **internal jugular vein** medial to the muscle to form the **brachiocephalic vein**.

Identify the **phrenic nerve** coursing obliquely over the anterior surface of the scalenus anterior muscle deep to its fascia; this path carries the descending nerve across the muscle from its lateral border superiorly, to its medial border inferiorly. Continue to follow the nerve inferiorly, between the subclavian artery and subclavian vein, until it reaches the superior mediastinum.

The **subclavian artery** arches superiorly behind the scalenus anterior, a relationship which provides the theoretical basis to divide the artery into three parts. The **first part** of the artery, medial to the scalenus anterior muscle, has the following branches:

- **vertebral artery**, which ascends through the foramina transversaria of the upper six cervical vertebrae
• **internal thoracic artery**

• **thyrocerival trunk**, gives rise to the inferior thyroid artery which makes an upward loop deep to the carotid sheath before it descends toward the deep surface of the thyroid gland. Close to the gland branches of the artery are intermingled with branches of the recurrent laryngeal nerve.

    The branches of the **second part** of the subclavian artery, located posteriorly to the scalenus anterior muscle, include the **superior intercostal artery** which descends posterior to the apex of the pleura to supply the first two intercostal spaces.

    The **third part** of the subclavian artery is lateral to the anterior scalene muscle; the subclavian artery becomes the **axillary artery** as it crosses the lateral border of the first rib.

**Vagus Nerve**

    **Dissect:** Follow the vagus nerve from the neck into the thorax; it passes between the common carotid and subclavian arteries to reach the superior mediastinum where it can be found with the arch of the aorta on its left side, and the trachea on its right side. Review the path of the right recurrent laryngeal nerve as it hooks around the subclavian artery in the root of the neck, then courses superiorly in the groove lateral to the trachea and esophagus.
Lab 3- THE FACE

Objectives:
Know the major muscles of the face, especially the oral muscles and their functions; know the nerves and arteries of the face.
Know the course of the parotid duct and where it enters the oral cavity.
Be able to locate the pterygomandibular raphe in your cadaver as well as in yourself. Know its importance as a landmark for dental anesthesia.

Observe:
The muscles of facial expression are subcutaneous and innervated by the facial nerve (cranial nerve VII), while the trigeminal nerve (cranial nerve V) supplies sensation over the face and innervates the muscles of mastication. Review the following bony structures on a skull:
• frontal bone
• maxilla
• zygomatic bone
• zygomatic arch
• mandible identify its body, ramus, angle, condyle, and coronoid process.
• temporomandibular joint between the head of mandible and a fossa on the temporal bone.

Dissect: Make the following incisions:
1. In the midline, from vertex to chin, encircling the mouth at the margin of the lips.
2. Start at the nasion and encircle the orbital margins.
3. From the vertex, in front of the ear, down to a point just behind the angle of the mandible.

First reflect the skin between eyebrows and vertex. Notice that the skin is closely adherent to the thick and tough subcutaneous fascia. Leave this fascia intact. The skin of the face is thin, but there may be a considerable amount of subcutaneous fat. Reflect the skin carefully, trying not to damage the thin facial muscles just under the surface. Reflect the skin of the face downward and parallel to the inferior border of the mandible.
Facial Nerve, Vessels, and Related Structures

The platysma reaches down over the clavicle and may have been seen during the neck dissection. Cut it along the mandible and reflect it toward the angle of the mouth.

Identify the masseter muscle which extends from the zygomatic arch to the ramus of the mandible. Identify the parotid duct crossing the lateral aspect of the masseter muscle about 2-2.5 cm inferior to the zygomatic arch. It is empty and flattened and pierces the buccinator (the principal muscle of the cheek) at the anterior border of the masseter. Trace the parotid duct and note the position where it penetrates the buccinator muscle. The parotid duct transmits salivary fluid from the parotid gland and enters the oral cavity near the upper second molar tooth.

Facial nerve.

After emerging from the base of the skull, the facial nerve turns anteriorly and runs through the parotid gland, where it divides into the branches (temporal, zygomatic, buccal, mandibular, cervical) which innervate the muscles of the face.

The facial nerve is the ONLY motor supply to the facial muscles, and is also sensory to the taste buds on the anterior two-thirds of the tongue, as well as providing parasympathetic innervation to the submandibular and sublingual glands. Bell’s Palsy is a common problem of the facial nerve, usually temporary, which causes loss of function of the nerve.

Dissect: To find the facial nerve branches, proceed as follows: Follow the parotid duct posteriorly to the edge of the parotid gland, and lift the anterior border of the gland from the masseteric fascia to find the white flattened branches of the facial nerve. The highest of the radiating branches, the temporal branch, crosses the zygomatic bone. The lowest branch, the cervical branch, runs below the mandible and innervates the platysma. Look above the parotid duct for the zygomatic branch of the facial nerve.

Define the anterior border of the masseter. Anterior to the masseter is a buccal fat pad which must be removed in order to expose the underlying buccinator muscle. Note that two different nerves enter the substance of the buccinator: the buccal branch of the facial nerve (VII, motor), and the buccal branch of the trigeminal nerve (V, sensory). The buccal branch of V penetrates the buccinator to provide sensation to the mucosa inside the mouth, but also branches outside the buccinator to provide sensation to the cheek in that region. The buccinator muscle originates on the maxilla and mandible (the
ridge of the pterygomandibular raphe can be found inside the mouth; it is an important landmark to use for anesthetic injections of the inferior alveolar nerve.

**Facial artery and vein.**

On yourself, palpate the pulse of the facial artery, the main artery of the face, which crosses the mandible at the anterior border of the masseter. The facial vein lies posterior to the artery. Find these vessels on the cadaver and trace them to the medial angle of the eye.

The facial vein provides the major venous drainage of the face. It has important connections with the cavernous sinus (inside the cranial cavity) through the superior and inferior ophthalmic veins, and with the pterygoid plexus (in the infratemporal fossa) through the deep facial vein. Since it has no valves, blood containing potential infection or clots can pass from the facial region to the inside of the cranial cavity.

**Muscles of the mouth.**

The muscles of the mouth are important for moving the lips or changing the shape of the mouth, and we will concentrate on these. Think about movements of the oral muscles and forces which they can generate relative to dentures or orthodontures. Refer to an atlas to define other muscles of the face if there is time.

**Dissect:** Look carefully for fine muscle fasciculi since the facial muscles may not be well defined.

1. **Orbicularis oris**, the important sphincter muscle of the mouth.
2. **Depressor anguli oris** depresses the corner of the mouth
3. **Zygomaticus major** descends from the zygomatic bone to the corner of the mouth, draws angle of mouth upward and backward
4. **Levator labii superioris** from infraorbital margin to upper lip, elevates upper lip
5. **Risorius**, horizontal muscle which pulls corners of the mouth laterally, for smiling

The lower lip is often involved in cancer, often because of sun exposure or irritation from pipe smoking. Cancer cells from the central region of the lip, the floor of the mouth, and the tongue tip spread to submental lymph nodes. Cancer cells from the lateral
Orbital region

Dissect: The circular fibers of the orbicularis oculi. This consists of two portions: a thick orbital part surrounding the orbital margin which is responsible for the tight closure of the eye, and a thin palpebral portion in the eyelids involved in the blinking of the eye. Do not spend time dissecting the palpebral portion unless you have extra time. The levator palpebrae superioris is the muscle which opens the eye by lifting the eye lid. (It is innervated by the oculomotor nerve, III.)

Sensory nerves of the face

Dissect: Examine the sensory nerves of the face which are derived from the three divisions of the trigeminal nerve:

Supraorbital nerve (a branch of the ophthalmic division, V1)
The supraorbital nerve emerges from under the frontalis muscle which may have been cut in order to remove the top of the skull. Reflect the remaining frontalis muscle downward over the eyes to find the nerve emerging from the supraorbital foramen, or notch.

Infraorbital nerve (a branch of the maxillary division, V2)
With a probe, loosen the tissue deep to the levator labii superioris muscle. Carefully cut the muscle horizontally close to the infraorbital margin. Reflect the muscle downward, exposing the nerve.

Mental nerve (a branch of the mandibular division, V3)
Make one midline incision through the thickness of the lower lip and a second incision downward from the corner of the mouth (on one side of the body only). Turn down the flap of tissue and look for the nerve exiting from the mental foramen next to the bone and about 3 cm from the midline. If your cadaver is edentulous, compare the difference in relative location of its mental foramen and that of other cadavers still possessing teeth. Find the body with the largest deviation in location of the mental foramen. If your cadaver is NOT edentulous, examine those of your fellow students which are.
Lab 4 - Cranial cavity

Objectives:
Know the meningeal layers and their arterial supply, location of cranial dural sinuses, and cavernous sinuses.
Know the connections of the dural sinuses and their communication outside the skull, especially between the cavernous sinus and the facial veins.
Be able to locate each of the 12 cranial nerves inside the skull after the brain has been removed and know through which foramina they exit the skull. Know the general function of each cranial nerve.
Know the components of the circle of Willis.

Dissect: This dissection will have been initiated for you by a saw cut around the calvaria (skull cap) at a level just superior to the bony orbital margin anteriorly, and the superior nuchal line posteriorly. Use a chisel to carefully lever the bone free from the underlying dura. The dura performs the function of periosteal lining for the interior of the calvaria, therefore it may not be possible to separate the tightly adherent dura from bone at this time if the bone cut has also been carried completely through the dura.

Observe the superior sagittal venous sinus formed by the dura in the midline on the underside of the calvaria. If the dura is intact over the brain, cut through it about 1/2 inch lateral to the sinus on either side. Next, with scissors, cut the dura mater at the same level as the circular bone cut. Detach the falx cerebri from the crista galli and reflect it posteriorly. You are now ready to remove the brain.

With the fingers of one hand under the frontal lobes of the cerebrum, gently lift the brain and examine the floor of the anterior cranial fossa. Two thin tracts of nervous tissue with slightly bulbous endings, lying alongside the crista galli are the olfactory tracts.

Identify and sever the remaining cranial nerves as you gently lift the brain out of the cranial cavity. The large optic nerves diverge from their partial fusion at the optic chiasm to exit the cranial cavity through the optic canals; cut these nerves between the optic chiasm and their entrance into the optic canals.

Continue posteriorly and identify the internal carotid arteries as they penetrate the dura and course towards the arterial circle of Willis which is located on the base of the brain; cut the two internal carotid arteries.
Just lateral to the internal carotid arteries identify the rather larger oculomotor nerves, and still slightly more laterally the thinner trochlear nerves; cut these nerves on both sides. Also in this general region, identify the single midline infundibulum of the pituitary gland which connects the gland to the hypothalamic region of the brain. If this delicate structure has not already been torn, cut it.

The large trigeminal nerves exit the brainstem at the level of the pons, then enter the dura high in the anterior wall of the posterior cranial fossa. In their subdural course, they run along either side of a median bony ridge in the middle cranial fossa, the **body of the sphenoid bone**. Locate these nerves, and cut them.

Identify the tentorium cerebelli. This dural sheet is firmly attached to the lateral walls of the calvarium, then anteriorly at the boundary between the middle and posterior cranial fossae (the petrous portion of the temporal bone on both sides), and lastly, to the posterior clinoid processes of the sphenoid bone near the midline. A midline opening in the "tent-like" tentorium allows passage of the brainstem. Carefully cut through the bony attachments of the tentorium and expose the **cerebellum and caudal portion of the brainstem**.

Sever the attachments of the remaining cranial nerves and cut the brainstem transversely as far caudally as possible.

Identify the two vertebral arteries as they enter the cranial cavity through the foramen magnum; cut these arteries just before their union at the lower border of the pons, forming the **basilar artery**.

Remove the hemispheres and brainstem in one piece. Examine the following cranial nerves where they exit from the brainstem and where they enter the dura:

- **abducens nerve**, piercing the dura covering the posterior surface of the clivus

- **facial nerve and auditory-vestibular (vestibulocochlear) nerve**, entering the internal acoustic meatus of the posterior cranial fossa, located in the posterior wall of the shelf-like petrous portion of the temporal bone

- **glossopharyngeal, vagus and accessory nerves**, all three nerves utilize the jugular foramen to leave the cranial cavity. The spinal component of the accessory nerve exits the upper part of the spinal cord, then ascends through the foramen magnum to enter the cranial...
cavity. For a very short distance, it joins the cranial component of the accessory nerve to exit the cranial cavity through the jugular foramen. The two components again separate, and the spinal accessory nerve runs independently through the posterior triangle of the neck (note: the CRANIAL portion of the accessory nerve joins the vagus nerve and is distributed with that nerve's branches; some authors consider the cranial portion of the accessory to be part of the vagus).

- hypoglossal nerve, formed from a series of rootlets arising in the medulla, this nerve exits the skull via the hypoglossal canal, located at the base of the skull next to the articular condyles for the joint with the first cervical vertebra.

The Neurosciences program in year II has requested that we preserve the brains form the cadavers for use in that course next fall. Please follow the instructions for removal of the brain, or ask an instructor to assist you.

At the end of the lab period, place the brain from your cadaver into the bucket of fixative provided in each room, unless it is inadequately preserved.

After you have attempted to identify the cranial nerves of the posterior fossa with the brain and brainstem in place, remove the brain and brainstem from the cadaver in the following manner:

- Place several fingers of one hand under the frontal lobe of the brain and lift it off the floor of the cranial cavity until you can see the inclined surface of the clivus upon which the brainstem rests. (This is only possible if you have previously slit open the tentorium cerebelli on each side.)
- Use your other hand to slide a scalpel down the surface of the clivus to the level of the foramen magnum, or slightly more distal into the vertebral canal if possible.
- Use a side-to-side movement of the scalpel to transect the spinal cord.
- Remove the scalpel and lift the brain and brainstem out of the cranial cavity. Use the scalpel to section any remaining attachments of cranial nerves, blood vessels, etc. as you lift the brain out of the cavity. Put the brain aside for any additional study.

Meninges and Dural Venous Sinuses

Realize: When the brain is removed some of the meningeal layers remain attached to the bone of the cranial cavity, while other layers are retained on the surface of the brain. The dura mater usually remains attached to the bone of the cranial cavity, while the pia mater and arachnoid are retained on the surface of the brain.
The **dura mater** consists of two fused layers: the **endosteum** of the cranial cavity and the **dura mater proper**. The two layers are fused, except in certain locations where they form the walls of the dural venous sinuses. These sinuses receive blood from the brain, but they also connect with superficial veins of the scalp and face and veins draining other regions of the head (orbit).

The dural sinuses are lined by a single layer of endothelium as are ordinary veins; the sinuses do not have a muscular wall. The outer layer of the dura, functioning as endosteum, is attached to the bone; the inner layer of the dura, on the other hand, forms folds which act as partitions between different parts of the brain, acting to check undesirable movement of the brain within the cranial cavity. These folds include:

- **falx cerebri**, in the vertical plane between the two cerebral hemispheres
- **tentorium cerebelli**, in the horizontal plane between cerebrum and cerebellum
- **falx cerebelli**, in the vertical plane between the two lobes of the cerebellum

**Examine:** Refer to your atlas to review in the dried skull and cadaver the course of the following major dural venous sinuses.

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**Dural sinuses and veins**
- **superior sagittal sinus**, within the upper border of falx cerebri; it ends posteriorly by joining the transverse sinus of either the right or left side, or by draining into the confluence of the sinuses.

- **inferior sagittal sinus**, contained within the lower border of the falx cerebri; it drains into the straight sinus.

- **cavernous sinus**, located on either side of the hypophyseal fossa (sella turcica), the two cavernous sinuses are connected by intercavernous sinuses across the midline. Each cavernous sinus drains the superior ophthalmic veins, and receives emissary veins from the infratemporal fossa; these connections make it vulnerable to thrombosis resulting from ascending infection. The cavernous sinus drains into the superior petrosal sinus.

- **superior and inferior petrosal sinuses**, located along the margins of the petrous part of the temporal bone; they drain into the sigmoid sinuses.

- **transverse sinuses**, one on either side, occupying the peripheral margin of the tentorium cerebelli. Usually the right sinus receives the superior sagittal sinus, and the left receives the straight sinus which runs along the line of attachment of the falx cerebri to the tentorium cerebelli. The transverse sinus of each side turns inferiorly to run in the posterior cranial fossa as the sigmoid sinus.

- **sigmoid sinus**, an "S" shaped sinus which leaves a deep impression on the interior surface of the temporal bone; all venous sinuses ultimately drain into the sigmoid sinuses. Each sigmoid sinus passes through a jugular foramen where it is continuous with the internal jugular vein. The relations of the sigmoid sinuses are extremely important; they groove the mastoid part of the temporal bone where they are related laterally to the mastoid air cells and middle ear cavity, not uncommonly the sites of infection. The sigmond sinuses receive emissary veins via the mastoid foramen and the posterior condylar canal, connecting them to the scalp and occipital venous plexus.

**Dissect:** Slit open the superior sagittal sinus and examine its interior. Look for the **arachnoid granulations**, the site of return of the cerebrospinal fluid from the subarachnoid space to the venous system. Also look for lateral evaginations of the endothelial lining of the sinus, the **lateral lacunae**, where veins from the cortical region of the brain open into the...
(4th cranial) and the ophthalmic division (first division) of the trigeminal (5th) cranial nerve in the lateral wall of the sinus. The internal carotid artery runs through the cavity of the sinus, together with the abducens (6th cranial) nerve; the nerve is below the artery, and both are separated from the blood by the endothelial lining of the sinus.

The trigeminal ganglion is lodged in a depression on the apex of the petrous portion of the temporal bone, sheltered within a pocket of dura mater, the cavum trigeminale. Slit open the cavum and follow the three divisions of the trigeminal nerve (ophthalmic, maxillary, and mandibular) as they leave the ganglion, then course to their exit from the cranial cavity through the superior orbital fissure, foramen rotundum and foramen ovale, respectively.

Examine the anterior, middle, and posterior cranial fossae in both the cadaver and dried skull, and review the cranial nerves and the location of their bony exits from the cranial cavity. Note that the entrance of the nerves into the dura lining the cranial cavity may be some distance away from their actual entrance into their bony passageways.

Lastly, remove the pituitary gland from its fossa and note its relationship to the optic chiasm; tumors of the gland may press upwards upon the chiasm, creating visual field disturbances.

Examine: Utilize an atlas and dried skull to review the following landmarks and relate them to your cadaver.

Anterior Cranial Fossa

The anterior cranial fossa is superior and anterior to the middle cranial fossa. It is formed by the orbital plate of the frontal bones and the lesser wing of the sphenoid bones, together separating the orbit from the frontal lobe of the brain. In the midline observe the crista galli, cribiform plate of the ethmoid bones, and the anterior part of the body of the sphenoid bone. The olfactory bulbs, resting on the cribiform plates, receive the olfactory nerves from the mucosa of the nasal fossae.

Middle Cranial Fossa

This fossa consists of a median region, containing the hypophyseal fossa, and two lateral regions which house the temporal poles of the brain. On each side the superior orbital fissure connects the fossa to the orbit anteriorly, transmitting nerves and veins to and from the orbit. The petrous portion of the temporal bone separates the middle fossa from the posterior fossa.
nerve, respectively. The foramen lacerum is closed inferiorly by cartilage in the living, transmitting only an emissary vein; however, when viewed from the cranial cavity, the opening of the carotid canal can be seen in the posterior wall of this "false foramen."

The median ridge of bone in the middle cranial fossa is largely composed of the body of the sphenoid bone; it is marked by the following:

- optic canal
- hypophyseal fossa
- anterior and posterior clinoid processes
- dorsum sellae.

Pia-Arachnoid

Realize: The arachnoid is a delicate membrane, loosely covering the surface of the brain, and bridging over the sulci intervening between adjacent gyri. The arteries of the brain run in the subarachnoid space, bathed in cerebrospinal fluid; therefore, subarachnoid hemorrhages can be detected early by examination of the cerebrospinal fluid. The pia mater intimately covers the outer surface of the brain, dipping down into the dividing fissures and sulci.

Arteries and Veins of the Brain

Realize: Veins of the brain are mostly cortical, and drain into the neighboring dural venous sinuses. Veins from the interior of the brain drain into the great cerebral vein of Galen, which empties into the straight sinus posterior to the splenium of the corpus callosum.

The arterial supply of the brain comes from two main sources:
- two vertebral arteries and
- two internal carotid arteries.

The vertebral artery, a branch of the first part of the subclavian artery, ascends through the foramina transversaria of the upper six cervical vertebrae, then enters the cranial cavity through the foramen magnum. The two vertebral arteries unite at the lower border of the pons to form a single basilar artery. The latter divides opposite the upper border of the pons into two posterior cerebral arteries. The posterior cerebral artery winds around the brainstem, supplying the tentorial surface of the hemisphere and the occipital lobe; it is connected to the internal carotid by the posterior communicating
the sinus, gives rise to the **ophthalmic artery**, then divides at the base of the brain into **anterior** and **middle cerebral arteries**.

The **anterior cerebral artery** passes forward and medially, to the median fissure of the brain where it is distributed to the medial surface of the cerebral hemisphere, except for the occipital lobe. It also supplies the orbital surface of the brain, and a small strip of the lateral surface. The two anterior cerebral arteries are connected by the **anterior communicating artery**.

The **middle cerebral artery** enters the lateral fissure of the brain, supplying the cortex of the insula and lateral surface of the brain, except for the occipital lobe, and a strip next to the superior border which is supplied by the anterior cerebral. Therefore, the middle cerebral artery supplies that portion of cortex which controls the opposite side of the body, except for regions controlling the movements of the leg and foot, which are supplied by the anterior cerebral artery.

**Posterior Cranial Fossa**

**Examine:**  This space houses the cerebellum and the caudal portion of the brainstem (pons and medulla, collectively called the hindbrain). The **tentorium cerebelli** separates the contents of the fossa from the occipital lobes of the cerebral hemispheres. The **foramen magnum** lies in the midline, just posterior to the basilar part of the occipital bone. The **jugular foramen, hypoglossal canal, and internal acoustic meatus** are easily identifiable. Identify the grooves for the **transverse and sigmoid sinuses**, just posterior to the lateral margin of the petrous portion of the temporal bone. In this location, the sigmoid sinus is related laterally to the mastoid air cells.

In the cadaver, review the blood supply of the dura mater as follows:

- **middle meningeal artery**, a branch of the maxillary artery, this vessel passes through the foramen spinosum, pierces the outer layer of the dura and proceeds in the plane between the two dural layers, dividing into anterior and posterior branches. The anterior branch of the middle meningeal artery is clinically important as it can be cut by a depressed fracture of the bone, near the pterion, a common cause of extradural hemorrhage.

The **circle of Willis** is a system of anastomotic arteries connecting the internal carotid and vertebral arteries; it consists of the posterior cerebral arteries (from the basilar arteries), posterior communicating arteries, internal carotid arteries, anterior cerebral arteries, and anterior communicating artery(s). It is located at the base of the brain in the **interpeduncular cistern**, an expanded region of the subarachnoid space. These communications are named arterioles in...
Middle Ear and Temporal Bone

It is not necessary to spend a lot of time examining the structures of the temporal bone, but it is instructive to appreciate its organization and main features. Within the mass of the temporal bone are canals for the passage of nerves (for example, internal auditory meatus), blood vessels (carotid canal), or fluid-filled membranes (of the cochlea and semicircular canals). The middle ear is an air space located within the temporal bone; the middle ear is connected to the nasopharynx by the Eustachian, or auditory tube. You will be examining the nasopharyngeal opening of the Eustachian tube later during labs 6 and 7. What would be the consequence of closing the Eustachian tube connection to the middle ear?

Dissect: Use a medium-sized chisel to cut away the superior surface of one temporal bone. Hold the chisel at the opening of the internal auditory meatus and parallel to its plane and to the top of the bone. Have a partner hold the temporal bone steady while you hit the chisel with a mallet. Ask an instructor for help getting started. The cut should expose the cut edges of the cochlea, semicircular canals, mastoid air cells, and the internal auditory meatus. The middle ear cavity should also be visible with the three middle ear bones, the malleus, incus, and stapes. Identify the tympanic membrane to which the malleus is attached on the lateral wall of the middle ear. The auditory tube opening is found on the anterior wall of the middle ear.
Lab 5  PAROTID, TEMPORAL, AND INFRATEMPORAL REGIONS

Objectives:
Be able to identify parts of the skull in the temporal region and mandible.
Know the muscles, arteries and nerves in the region of the parotid.
Know function and destination of the facial nerve branches emerging from the parotid gland.
Know the venous routes to the interior of the skull.
Know the organization of the muscles of mastication (temporal, masseter, medial and lateral pterygoids) and their actions.
Know the organization of the temporomandibular joint and its movements.
Know the limits and contents of the infratemporal fossa, including its arterial supply. Know the organization and course of the trigeminal nerve branches to upper and lower teeth.

Skull review

Review on a skull the following landmarks:
  **temporal bone**- styloid process, mastoid process, external acoustic meatus, mandibular fossa (for the head of the mandible), articular tubercle
  **mandible**- head, neck, angle, ramus and mandibular notch
  **base of skull** (exterior)- stylomastoid foramen (foramen through which VII exits the skull)
  **zygomatic arch**- composed of the zygomatic process of the temporal bone and the temporal process of the zygomatic bone
  **temporal fossa**- space formed by several bony components: parietal and frontal bones, squamous part of temporal bone and greater wing of sphenoid bone

Parotid gland

**Dissect:** The parotid gland should be cut away carefully as much as possible to expose, embedded in it, the trunk of the facial nerve, the terminal part of the external carotid artery, and the retromandibular vein. To find the facial trunk, clean the sternocleidomastoid up to the mastoid process. Reflect it and push the remaining parotid gland forward. Hold it in this position and mush upward
posterior belly of the digastric and the stylohyoid.

Notice the proximity of the external ear canal to the parotid gland. Painful swelling of the parotid gland (as in mumps) typically pushes the earlobe up and outward.

**Observe:** After emerging from the **stylo mastoid foramen** the facial nerve gives rise first to a small **posterior auricular** branch, and then to a branch which descends to supply the **stylohyoid muscle** and **posterior belly of the digastric.** Don't spend much time looking for these small branches. The trunk of the facial then subdivides into two trunks which give rise to the 5 terminal branches seen in a previous dissection. The **retromandibular vein** is formed in the region of the root of the zygomatic arch by the union of the **superficial temporal** and **middle temporal veins.**

Ascending from the carotid triangle of the neck deep to the stylohyoid and posterior belly of the digastric, the **external carotid artery** becomes embedded in the deepest part of the parotid gland where it is crossed externally by the **facial nerve.** It ascends behind the posterior border of the ramus of the mandible and divides into **maxillary** and **superficial temporal arteries.** The maxillary artery will be seen in more detail after the mandible has been removed.

The **auriculotemporal nerve** is a cutaneous nerve derived from the **mandibular division** of the trigeminal. It emerges from behind the condyle of the mandible and is distributed over the skin of the auricle and greater part of the temporal region.

**Temporal and Masseteric Regions**

**Dissect:** Remove the remains of the masseteric fascia and clean the masseter. Detach the posterior third of the muscle from the zygomatic arch. In order to reflect the masseter downward with its bone of origin proceed as follows: Pass a probe or closed forceps deep to the zygomatic arch to protect the underlying soft structures. Saw obliquely through the zygomatic bone as far forward and backward as possible. Turn down the section of the zygomatic arch together with the attached masseter muscle. Detach the muscle fibers of the masseter from the ramus and the coronoid.
Observe: Now with the temporal fascia exposed, note that the temporal muscle arises partly from the fascia, and inserts into the coronoid process of the mandible.

Infratemporal Region

The infratemporal fossa contains muscles of mastication (the medial and lateral pterygoids), branches of the mandibular nerve (V3), and the maxillary vessels. The lateral wall of the fossa is the ramus of the mandible, which will need to be removed in order to gain access to the space.

Observe: Begin by reviewing the following bony landmarks on a skull:

1. On the inner aspect of the mandible:
   - coronoid process
   - lingula for the attachment of the sphenomandibular ligament
   - mandibular foramen for the inferior alveolar nerve and vessels
   - mylohyoid groove, for the nerve and vessels to the mylohyoid and anterior belly of the digastric

2. In the infratemporal fossa (after removing the mandible from the skull):
   - lateral pterygoid plate of sphenoid bone
   - pterygopalatine fossa, a cleft for passage of nerves and blood vessels

Grant’s 10th, fig. 7.62; Clemente’s 4th, figs. 750-754; Netter’s 2nd, fig. 9.
**Dissect:** Make three saw cuts through the mandible according to the diagram. After cut one, reflect the coronoid process upward with the attached temporal muscle, looking deep to the muscle for nerves and arteries. The second saw cut must be above the lingula, in order not to cut the inferior alveolar nerve and vessels, which enter the foramen below the lingula on the medial aspect of the center of the ramus (see figure below).

Identify the **inferior alveolar nerve** and artery within the infratemporal fossa. Trace the nerve downward (with the inferior alveolar artery) to the mandibular foramen and canal, and upward to the lower border of the lateral pterygoid muscle. Locate the mental nerve and artery exiting from the mental foramen. Starting at the mental foramen use the hand drill to remove the outer table of the mandible over the mandibular canal and expose the nerve and as much of the inferior dental plexus to the teeth as possible. Note the branches of the nerve and arteries.

Find the **lingual nerve** which runs anterior to the inferior alveolar nerve; trace it back to the lower border of the lateral pterygoid muscle where it emerges next to the inferior alveolar nerve.

Trace the **maxillary artery** (a branch of the external carotid) through the infratemporal region. In most cases it is superficial to the lateral pterygoid, but one third of the time it is deep to the muscle. The **pterygoid plexus** of veins surrounds the maxillary artery. Cut away the veins as you clean the other structures.

The pterygoid veins communicate either directly or indirectly with veins over a wide area, including those of the cranial cavity, cavernous sinus, nasal cavity, orbit, paranasal sinuses, facial veins, and angular (located at the corner of the eye) veins.

To obtain a complete view of the infratemporal region, the **lateral pterygoid muscle** must be removed. Note that the muscle has two heads; one arises from the roof of the fossa, the other from the lateral pterygoid plate and the tuberosity of the maxilla. The fibers of both heads converge to a tendon which attaches to the front of the neck of the mandible. A few fibers go into the **articular capsule** and disc. Use the handle of the scalpel to free the upper border of the lateral
pterygoid from the roof. Then define the lower border of the muscle by inserting the handle between the lateral and medial pterygoids, where the inferior alveolar and lingual nerves emerge. Free the muscle from the lateral pterygoid plate. Finally, sever the muscle close to its insertion into the neck of the mandible and into the articular disc and remove the muscle completely.

Now clean the **medial pterygoid muscle**. It arises from two heads, one from the maxillary tuberosity and palatine bone, the other from the pterygoid fossa. The muscle runs downward and laterally to be inserted into the medial side of the ramus of the mandible.

Now examine the structures in the infratemporal fossa in detail:
- **ininferior alveolar** and **lingual** nerves, branches of the trigeminal, carrying sensation generally from the mandibular teeth and tongue, respectively
- **chorda tympani**, a branch of the facial nerve carrying taste fibers from the tongue; it joins the lingual nerve from behind
- **buccal nerve**, its branches pierce the **buccinator** to supply the buccal mucosa with sensory fibers
- **maxillary artery**, identify two branches, the inferior alveolar artery and the middle meningeal artery
- **muscular branches of maxillary a.** to muscles of mastication (most of these have probably been torn or cut)
- **posterior superior alveolar nerve** and artery, pass through foramina on the maxilla. The nerve originates from the main trunk of the maxillary nerve just before it enters the **infraorbital canal**. One branch of the nerve may remain external on the bone, continuing downward to innervate the buccal gingiva in the maxillary molar region and nearby facial mucosal surfaces, and another enters the posterior superior alveolar canal to travel through the maxillary sinus and innervate its mucous membrane. This branch continues on to provide sensation to the maxillary first, second, and third molars.
  - **branches in the infraorbital canal** - these cannot be seen now, but are the origin of the **middle** and **anterior superior alveolar nerves**.

The middle superior alveolar nerve (MSA) provides sensation to the two maxillary premolars and possibly the mesiobuccal root of the first molar as well as the periodontal tissues, buccal soft tissue, and bone in the premolar region. When this nerve is absent (about 30-50% of individuals), these areas are supplied by branches of the anterior superior alveolar nerve (ASA). The ASA nerve branches off the
and lateral incisors and the canine as well as sensory innervation to periodontal tissues, mucous membranes of these teeth, and the buccal bone. The ASA nerve communicates with the MSA and gives off a small nasal branch that innervates the anterior part of the nasal cavity along with branches of the pterygopalatine nerves.

**Temporomandibular Joint (TMJ)**

Although the superior portion of the mandibular ramus has been removed, the head and neck of the mandible are still intact. The TMJ is a diarthrodial joint where the condyle of the mandible articulates with the mandibular fossa of the temporal bone. The capsule of the joint is thickened laterally to form the **temporomandibular, or lateral, ligament**. Identify the sphenomandibular ligament, which is a thin fibrous band running from the lingula of the mandible to the spine of the sphenoid. Manipulate the head of the mandible to verify the types of movements permitted at this joint: hinge movements, protraction and retraction.

**Dissect:** Enter the point of the scalpel into the mandibular fossa close to the bone, and open the upper cavity of the joint. Remove the articular disc together with the head of the mandible and note the following:

1. **The insertion of the severed lateral pterygoid.** The remains of the muscle are attached to the neck and articular disc.
2. **Open the lower cavity of the joint by cutting the disc anteroposteriorly.**

There are two types of movements in this joint, one on each side of the disc. In the lower cavity, simple hinge movements between...
Lab 6  PREVERTEBRAL REGION, PHARYNX, LARYNX, AND NASAL CAVITIES

Objectives:
Be able to identify structures located around the pharynx (nerves, arteries).
Know the fascial spaces of the neck.
Know the pharyngeal constrictor muscles and their attachments.
 Know the structures of the nasal cavity and the openings which connect the nasal fossae to the different sinuses.
Know the arterial supply and innervation to the nasal mucosa, and the contents and location of the pterygopalatine fossa.
Know the muscles and nerves involved in opening and closing the larynx.

The **major goal** of the following dissection is the separation of the anterior part of the skull, face, pharynx, and larynx from the posterior part of the skull which articulates with the vertebral column. Only then is it possible to complete a thorough study of the visceral compartment of the neck.

**Dissect:**  Refer to the following illustration of the cranial floor to understand the placement of the saw and chisel cuts necessary for separation of the anterior and posterior portions of the cranium.

*When using the chisel, be careful to direct the chisel edge so as to make a vertical cut in relationship to the anatomical position.*
Start by cutting along the suture line between the body of the sphenoid bone and the basilar portion of the occipital bone. Continue the cut laterally on each side, keeping just posterior to the jugular foramen, (jug. for.) until you reach the suture between the temporal bone and the occipital bone. Stay anterior to the foramen magnum (for. magnum). With a saw, cut the two sides of the skull vertically, posterior to the mastoid process. Use a chisel and hammer to cautiously separate the two parts of the skull; use a scalpel to cut the soft parts (skin and muscle) along a vertical plane passing just behind the mastoid process (be careful to stay behind the neurovascular bundle of the neck and the sympathetic trunks). Reflect the anterior portion of the cranium and attached neck viscera onto the anterior thoracic wall.

The plane of separation should lie in the retropharyngeal space. The prevertebral musculature should remain attached to that portion of the skull still articulated with the vertebral column, and the neurovascular bundles of the neck should remain attached to the posterior surface of the viscera of the neck.

It is now possible to examine the posterior aspect of the viscera of the neck.

**Lateral Pharyngeal Spaces**

**Dissect:** Follow the internal carotid artery, internal jugular vein, and vagus nerve (10th cranial) to the base of the skull. Identify the three ganglia of the sympathetic trunk. The superior ganglion is large, approximately one inch in length; the middle ganglion is usually small and may be absent; the inferior ganglion is usually fused with the first thoracic ganglion, forming the stellate or cervico-thoracic ganglion. The spinal accessory nerve (11th cranial) lies immediately lateral to the vagus at the base of the skull; it runs to the sternocleidomastoid muscle, either through the interval between the internal jugular vein and internal carotid artery or by coursing lateral to the vein. The hypoglossal nerve (12th cranial) can be followed from the digastric triangle toward the base of the skull; it loops across the surface of internal and external carotid arteries, close to the accessory nerve. The glossopharyngeal nerve (9th cranial) is very small; it lies deep in the field, anterior to the internal jugular vein, between internal and external
Pharynx

Dissect: Clean the posterior surface of the pharyngeal constrictor muscles and observe the pharyngeal plexus of nerves. The plexus derives its fibers from three sources:

- **pharyngeal branches of the vagus nerve**, provide motor fibers to the constrictors of the pharynx
- **glossopharyngeal branches**, are sensory to the mucosal lining of the pharynx
- **sympathetic branches**, are vasoconstrictor.

The constrictors of the pharynx (superior, middle, and inferior) are incomplete anteriorly, and overlap each other posteriorly. The muscular part of the pharynx is, therefore a "U" shaped tube completed anteriorly by attachment of the constrictor muscles to the maxilla, mandible, hyoid bone, and thyroid and cricoid cartilages. The muscles of the two sides are inserted posteriorly into a **median raphe** which extends superiorly from the **pharyngeal tubercle**, a point on the base of the skull in the midline between the nasal cavity and the foramen magnum, to the esophagus inferiorly. Open the pharynx by making a vertical cut in the constrictors along the median raphe. Observe the anatomical features of each part of the pharynx as

Grant’s 10th, fig. 8.34-.36; Clemente’s 4th, fig 888, 891; Netter’s 2nd, fig. 61-62.
follows:

- **laryngopharynx**, the portion of the pharynx located posterior to the larynx, it merges with the esophagus anterior to the 6th cervical vertebra. Its anterior wall is marked by the leaf-like **epiglottis**, situated posterior to the tongue. The epiglottis guards the obliquely positioned aperture of the larynx. Extending inferiorly along each side of the laryngeal aperture are the piriform fossae. Two branches of the vagus, the **internal** and **recurrent laryngeal nerves**, pierce the walls of the laryngopharynx to innervate the larynx. These nerves lie deep to the mucosa in the piriform fossae and will be examined later.

- **oropharynx**, the part of the pharynx posterior to the oral cavity; it can be shut off from the nasopharynx by the elevation of the soft palate, an action normally occurring during swallowing of food or fluid with the contraction of the **levator veli palatini** muscle. In the oropharynx, observe the **palatoglossal** and **palatopharyngeal folds**, (overlying the palatoglossal and palatopharyngeal muscles); the palatine tonsil is located in the depressed area between the two folds. Although these tonsils are large and bulging in children, in adults the site of the tonsil is marked by crypts and no bulging should be expected. The bed of the tonsil is related to the superior constrictor muscle, and deeper still to the **facial artery**. The anterior wall of the oropharynx is the posterior portion of the tongue.

Think about the nasopharynx as described here, but realize that most of it will be more visible after you have cut the face in the sagittal plane as outlined in the section “Nasal Fossae” to follow. Proceed to make the sagittal cut and then continue with the nasopharynx examination.

- **nasopharynx**, located posterior to the two nasal fossae and septum, and extending to the base of the skull superiorly. Anteriorly it communicates with the nasal fossae via the choanae (apertures) which are separated from one another by the posterior margin of the nasal septum. The roof of the nasopharynx in children contains aggregations of lymphoid tissue, the **nasopharyngeal tonsil**. The openings of the **auditory tubes** are the main features of the nasopharynx; each opening produces a **tubal elevation** opposite the posterior end.
of the inferior concha of the nasal fossae. Transmission of infection from the nasopharynx to the middle ear along the auditory tube is not uncommon, especially in children; thus, otitis media and mastoiditis can be complications of a common cold.

Nasal Fossae

Dissect: Use a saw to divide the face and cranium in the median (sagittal) plane, then examine the cut surfaces. The two nasal fossae are separated by a median septum which is cartilaginous anteriorly and bony posteriorly. The septum is covered on both sides by the mucous membrane. The upper part of the mucosa is olfactory; the central processes of the olfactory neurons pass through the cribiform plate to enter the anterior cranial fossa where they join the olfactory bulbs beneath the frontal lobes of the cerebrum.

The lateral wall of the nasal cavity presents three bony elevations, the inferior, middle, and superior conchae. Underneath each concha is a groove, or meatus which can be examined when the concha is removed or dislocated. Opening into the meatuses are the paranasal air sinuses, bony cavities lined by mucous membrane which is continuous with the mucosa of the nasal cavity. Inflammation of the nasal mucosa is usually accompanied by inflammation of the paranasal sinus mucosa.

The sphenoid recess, a groove above the superior concha, receives the opening of the sphenoid sinus. The superior meatus, the most superior region of the nasal cavity, receives the opening of the posterior ethmoid sinuses.

Carefully remove the middle concha and note a semicircular depression, the hiatus semilunaris; above it is an elevation, the bulla ethmoidalis. Entrance into the maxillary sinus is through a large, rounded opening in the middle of the hiatus semilunaris; the high position of the opening in the sinus wall relative to the level of the sinus floor results in inadequate drainage of inflamed sinus mucosa.

The frontal sinus opens into the anterior part of the meatus. Pass a probe from the cavity of the sinus through the opening; it will...
emerge just in front of the hiatus semilunaris.

The **anterior and middle ethmoid sinuses** open onto or around the bulla ethmoidalis, an elevation of the bone marking the underlying ethmoid sinuses.

The **nasolacrimal duct** opens into the anterior part of the **inferior meatus**. This duct drains the tears produced by the lacrimal gland inside the orbit.

**MAXILLARY SINUS**

Examine the interior of the maxillary sinus by breaking through the anterolateral wall of the sinus above the premolar teeth; enlarge the opening. Note the size of the sinus and the location of the sinus floor relative to the medial opening into the nasal cavity. The floor is located above the roots of the molar teeth and may extend anteriorly to the premolar teeth, and more rarely to the canine tooth. Look for any bumps on the floor over the roots of the teeth. Examine the mucous membrane of the sinus and its thickness. There is some variability from one body to another, so be sure to examine some of the other cadavers in the lab. Use your hand drill to carefully remove the bone around fine superior alveolar nerve branches.

The **dental plexus of the superior alveolar nerve** is located between the floor of the maxillary sinus and the apices of the teeth. The dental plexus innervates both the teeth and the lower portion of the sinus, so inflammation in either region will give rise to referred pain in the other area.

**Larynx**

The **thyroid cartilage** consists of two laminae, united anteriorly at an angle (laryngeal prominence, or Adam's apple), but open posteriorly. Anteriorly, the thyroid cartilage has a median notch on its upper border. The **thyrohyoid** and **sternothyroid muscles** attach on the lateral surface of each lamina. The **cricoid cartilage** resembles a "signet ring", with the narrow portion of the ring situated anteriorly. The **cricothyroid ligament** connects cricoid
and thyroid cartilages.

The **arytenoid cartilages** are two small pyramidal cartilages whose bases articulate with the large posterior lamina of the cricoid cartilage.

The **epiglottis** is a leaf-like structure fixed to the posterior aspect of the thyroid angle, the hyoid bone, and back of the tongue. It functions as a lid which deflects materials which might otherwise enter the laryngeal aperture.

**Dissect:** Make a shallow median cut in the mucous membrane over the back of the cricoid cartilage and carefully remove the mucous membrane of the laryngopharynx. Dissect free the **recurrent laryngeal nerve** which enters the larynx at the lower border of the inferior constrictor muscle, and passes superiorly and laterally, deep to the mucous membrane of the **piriform fossa**, to innervate the laryngeal musculature.

**Realize:** On the upper border of the cricoid cartilage are located **arytenoid cartilages** on each side of the midline. Each arytenoid cartilage is a 3-sided pyramid with its base resting on the cricoid cartilage. The arytenoid base is triangular; the forward-pointing apex, providing attachment to the **vocal ligament**, is called the **vocal process**; the prominent laterally projecting angle, or muscular process, provides attachment for **lateral** and **posterior cricoarytenoid muscles** which rotate the arytenoids around vertical axes, thereby changing the tension on the vocal ligament during speech.

Fracture the thyroid lamina by pushing it laterally, and disarticulate the joint between its inferior horn and the cricoid ring. With the scalpel, cut the larynx posteriorly along the midline, and open it by fracturing its cartilages. Locate two pairs of anteroposterior folds:

- **vestibular folds**, the superior pair of folds which contains the **vestibular ligaments**.
- **vocal folds**, the inferior pair of folds which contains the **vocal ligaments** and the **vocal portion** of the **thyroarytenoid muscle**

**The glottis** is the region of the larynx at the level of the vocal folds: it consists of the **rima glottidis** (the space between the vocal folds) and the
Lab 7  ORAL CAVITY

Objectives:
Know the bones, nerves, and arteries of the oral cavity and palate.
Know the location and function of the Eustachian tube.
Know the limits of the vestibule and the oral cavity proper.
Know what structures can be palpated around the mouth, both inside and outside.
Know where to locate the major nerves for anesthesia inside the oral cavity (nerves from both maxillary and mandibular trunks of the trigeminal).
Know the spaces of the face and neck which allow passage of infection.
Be able to identify major structures (bones, arteries and nerves, etc.) in cross-sectional drawings of the head through the occlusal plane.
Know the location of the pterygomandibular raphe in yourself and your cadaver, and its relationship to injections of the inferior alveolar nerve.

See the list of structures at the end of this lab description. Before you leave the lab today, find your tutor and demonstrate the structures on your cadavers. (All students should participate in the identification.)

Mouth and Tongue
Observe: The oral cavity consists of the vestibule and oral cavity proper. The vestibule is limited externally by the cheeks and lips and is separated from the oral cavity proper by the teeth and gingiva. An important anatomical feature of the vestibule is the orifice of the duct of the parotid gland, situated at the apex of a slight elevation or papilla opposite the upper 2nd molar tooth. Pass a probe through the parotid papilla and note the course of the duct.

The walls of the oral cavity proper are: laterally and anteriorly, teeth and gingiva; superiorly, hard and soft palates. Inferiorly, the oral cavity is limited by the mylohyoid muscle: the sublingual gland lies under the mucous membrane adjacent to the base of the tongue.
Numerous glands are located under the mucous membranes of the oral cavity, such as **labial glands** on the inside of the lips, and the **palatine glands** under the hard palate.

**Floor of the mouth:**
In the bisected head of the cadaver, examine the muscles of the floor of the mouth and the tongue; the **mylohyoid**, **geniohyoid**, and the large fan-shaped **genioglossus**.

**Dissect:** In order to expose the sublingual gland, make a thin cut in the mucous membrane just medial to the mandible, and lateral and inferior to the tongue and retract the tongue medially to separate the tongue from the mylohyoid muscle. (Do not extend the cut posterior to the second molar.) Now you will be able to expose the sublingual gland, **submandibular gland and duct, lingual and hypoglossal nerves, and extrinsic muscles of the tongue.**

**Identify:**
**Sublingual gland**- identify several short ducts which open at the plica sublingualis.
**Submandibular duct**- runs diagonally across the medial aspect of the sublingual gland. Find the papilla of the duct lateral to the frenulum linguae, then follow the duct posteriorly to the submandibular gland.
**Lingual nerve**- find the nerve behind the last molar running between the ramus of the mandible and the medial pterygoid and trace it forward into the floor of the mouth. It should be followed downward across the muscles of the tongue deep to the sublingual gland where its terminal branches originate. These are sensory nerves to the anterior 2/3 of the tongue. It also carries the taste fibers originating from the chorda tympani (of the VII nerve) for taste on the anterior 2/3 of the tongue.
**Submandibular ganglion**- In the region of the 3rd molar look for the submandibular ganglion which is suspended from the lingual nerve by several short branches.

**Dissect:**
From the lateral side, identify the **mylohyoid muscle** and detach it from the hyoid bone; reflect it superiorly to expose the **hyoglossus muscle**. Identify the **hypoglossal and lingual nerves** from this side. Notice that the hypoglossal nerve is situated between the submandibular gland and hyoglossus muscle, inferior to the lingual nerve. Follow it to the tongue musculature. Locate the **lingual artery** medial to the hyoglossus muscle and follow it to the tongue.
**Tongue**
The tongue has a tip, body, and base. On its superior, or palatine surface observe the V-shaped **terminal sulcus** that separates the body from the base. In front of the terminal sulcus are 8 to 12 **circumvallate papillae**; behind the sulcus, the surface of the tongue appears irregularly folded due to the presence of bumps and depressions representing accumulations of lymphoid tissue, collectively called the **lingual tonsil**.
Note that the lingual tonsil, palatine tonsils, and lymphoid nodules in the thickness of the soft palate form a complete ring of lymphoid tissue around the oropharyngeal isthmus.
In a similar fashion, the nasopharyngeal tonsil in the pharyngeal vault, lymphoid tissue near the opening of the auditory tube (**tubal tonsil**), and lymphoid nodules in the thickness of the soft palate, all contribute to a ring of lymphoid tissue around the choanae (the opening of the nasal cavity into the nasopharynx).

Look for the following features on the tongue of the cadaver, as well as on your own:
- **Sulcus terminalis** - divides the anterior two thirds and the posterior one third
- **Foramen cecum** - at the site of the embryonic thyroglossal duct that was attached to the developing thyroid gland
- **Fungiform papillae** - mushroom-shaped papillae that appear to be red spots in your tongue
- **Filiform papillae** - sensitive to touch
- **Circumvallate papillae** - located anterior to the sulcus terminalis
- **Glossopigglottic fold** - running from the tongue to the epiglottis, with the valleculae located on either side
- **Lingual tonsils** - lymphoid follicles on the posterior third of the tongue

**Palate**

**Review on a skull:**
The base of the nasal cavity is formed by the bony palate, which is composed of, anteriorly, the **palatine process of the maxilla**, and, posteriorly, the horizontal plates of the **palatine bones**. Behind the incisor teeth at the midline of the hard palate

Grant’s 10th, fig. 7.83;
Clemente’s 4th, fig. 860;
Netter’s 2nd, fig. 52.
is the incisive foramen through which the thin nasopalatine nerve exits. Medial to the third molar tooth, locate the greater palatine foramen, which is the opening of the greater palatine canal. Identify the vertical part of the palatine bone which forms part of the lateral wall of the nasal cavity. Examine the skull from the lateral side. Locate the pterygopalatine fossa between the pterygoid process, maxilla, palatine bone, and sphenoid bone. Its sphenopalatine (pterygopalatine) foramen is formed where the notch on the superior border of the palatine bone meets the sphenoid bone and is a passageway for nerves and blood vessels from the pterygopalatine fossa into the nasal cavity.

**Realize:** The palate on your cadaver has anteriorly, a hard portion, and posteriorly, a soft portion. Palatine glands, small mucous glands, are present over the palate, with small ducts open to the surface.

**Dissect:** Find the approximate location of the greater palatine foramen with a dissecting needle. Posterior to it cut through the mucous membrane of the hard palate and peel it off anteriorly to expose the greater palatine nerve and vessels. Next, follow the greater palatine canal superiorly from the greater palatine foramen to observe the greater palatine nerve and artery within the canal and the sphenopalatine ganglion at the opening of the sphenopalatine foramen. To find the canal, insert a 1 1/4 inch needle probe into the greater palatine foramen. Then, using a probe, or small bone rongeurs, open the medial wall of the canal to expose its nerve and vessels. Follow the nerve upwards to the sphenopalatine (pterygopalatine) ganglion which lies deep in the pterygopalatine fossa.

Examine your cadaver from the lateral side. Identify:

1. **Maxillary artery**- giving off the greater palatine artery and sphenopalatine artery
2. **Maxillary nerve**- Passing from the foramen rotundum to the inferior orbital fissure, giving off posterior superior alveolar nerve branches which enter the maxillary bone to innervate upper teeth
3. **Sphenopalatine (pterygopalatine) ganglion**- connected to the maxillary nerve by 2 short branches. The ganglion contains postganglionic parasympathetic cell bodies whose axons follow branches

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Grant’s 10th, fig. 7.111, 7.105; Clemente’s 4th, figs. 833-836; Netter’s 2nd, fig. 35-38.

Grant’s 10th, fig. 8.64-8.65; Clemente’s 4th, fig. 845,846; Netter’s 2nd, fig. 49,54,58-59.
of the maxillary nerve to innervate the lacrimal gland and small glands of the nasal cavity, pharynx, and palate.

**Palatine tonsil**
The palatine tonsils sit on either side of the oropharynx extending partway into the soft palate. As mentioned previously, each tonsil is situated in the depression between the palatoglossal and palatopharyngeal arches covering the muscles, although they are seldom present in our cadavers.

**Pharyngeal wall**
**Dissect:** Remove the mucous membrane from the soft palate, lateral pharyngeal wall and nasopharynx to expose the palatoglossal and palatopharyngeal muscles. The *palatopharyngeus* and the *stylopharyngeus* form the longitudinal portions of the pharynx.

Demonstrate the following structures in the region of the oral cavity to your tutor:
- Lingual artery