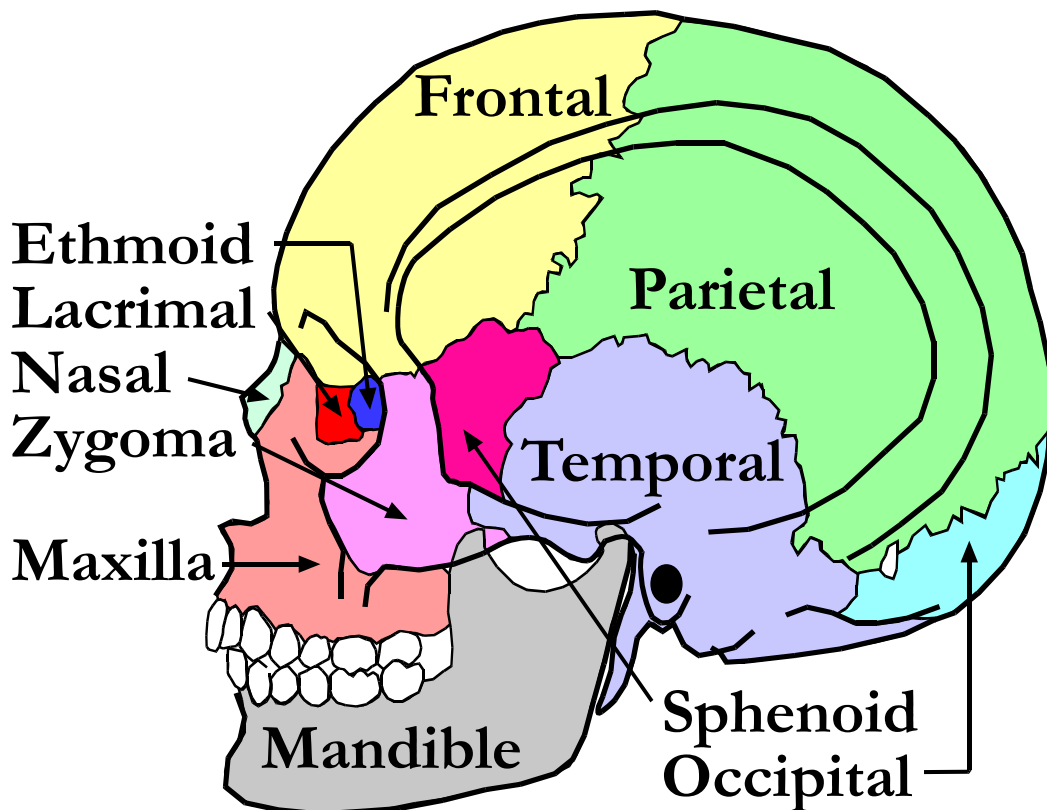




# 1<sup>st</sup> BDS

## Centre of Anatomy & Human Identification

### Semester 1 Dissector



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## ADULT SKULL WORKSHOP I

BY THE END OF THE COURSE YOU NEED TO BE ABLE TO RECOGNISE AND NAME ALL LISTED FEATURES! BY THE END OF TODAY – Parts I, II & III and be familiar with Parts V & VI.

This is the First of 2 Workshops to help you to learn the osteology of the Head & Neck.

The Staff here think that following the attached list and identifying each bone, bony process and ‘hole’ is the most educationally sound approach, because you discover for yourselves. Please use the available reference books together with the skull to help you identify and name the listed items.

The old workshops, with the associated mass of cards and pictures were often a major ‘turn off’. Now it is the SKULL & its bones that is the subject – simply learn the details of each bone!

We have a good ratio of Demonstrators/Students (probably the best in the UK) – please make good use of the Small Group Teaching opportunity that this gives you.

### ITEMS TO IDENTIFY ON THE ADULT SKULL (refer to Grants Atlas; Chapter 7, figs 7.1 to 7.4)

Follow the list below in conjunction with the Atlas, Illustration cards & Bones supplied.

Students should be able to identify, on the dry skull [or on appropriate models / illustration] the features listed below. In addition students should be able to name the major structures that pass through the foramina that they can name. [See text for Practical 2 for the details.]

**At the end of this first practical you MUST be able to identify all the features in Tables I, II and III and have started to become familiar with individual bone foramina (Table VII).**

**The bony skeleton is the foundation for all anatomical knowledge – please work at this – do not put it off, or you risk having a very steep learning load a little later in the course!**

#### I) Bones [M=formed in Membrane] [E=endochondral bone] [M\*=M with 2<sup>o</sup> Cart]

FRONTAL (1) M	LACRIMAL (2) M
NASAL (2) M	Inf. NASAL CONCHA (2) E
MAXILLA (2) M	PARIETAL (2) M
ETHMOID (Complex – 5 parts) E	TEMPORAL (2) E+M
SPHENOID (Complex – 5+ parts) E+M	OCCIPITAL (1) E+M
ZYGOMATIC (2) M	MANDIBLE (1 in adult Primates) M*
VOMER (1) M	HYOID (1) E
PALATINE (2) M	CERVICAL VERTEBRAE (7) E

**II) Sutures / Joints**

CORONAL SUTURE	SAGITTAL SUTURE
LAMBDOID SUTURE	SQUAMOSAL SUTURE
MEDIAN PALATINE SUTURE	FRONTO-MAXILLARY SUTURE
ZYGOMATICO-FRONTAL SUTURE	
ZYGOMATICO-MAXILLARY SUTURE	
ZYGOMATICO-TEMPORAL SUTURE	
TEMPOROMANDIBULAR JOINT	
OCCIPITAL CONDYLES	
ATLANTO-OCCIPITAL & ATLANTO-AXIAL JOINTS	

**III) Major Surface Features (which may involve more than one bone)**

SUPRAORBITAL FORAMEN or NOTCH & SUPRAORBITAL MARGIN	
ORBITAL SUTURES	PTERYGOID HAMULUS
ZYGOMATIC ARCH	PTERYGOMAXILLARY FISSURE
TEMPORAL FOSSA	PTERYGOPALATINE FOSSA
INFRATEMPORAL FOSSA	STYLOID PROCESS
ANTERIOR NARES [N. apertures]	MASTOID PROCESS
POSTERIOR NARES [N. apertures]	SPINE of SPHENOID
HARD PALATE [2 bones!]	SULCUS TUBAE AUDITIVAE
TEMPORAL LINES	EXTERNAL ACOUSTIC MEATUS
NEUCHAL LINES	Ext. OCCIPITAL PROTUBERANCE
VERTEBRAL FORAMINA on CERVICAL VERTEBRAE	

**IV) Interior of Skull**

ANTERIOR CRANIAL FOSSA	CRISTA GALLI
ANTERIOR CLINOID PROCESSES	CRIBRIFORM PLATE
SUPERIOR ORBITAL FISSURE	OPTIC FORAMEN
POSTERIOR CLINOID PROCESSES	SELLA TURCICA
MIDDLE CRANIAL FOSSA	INFERIOR ORBITAL FISSURE
CAVUM TRIGEMINALE	FORAMEN ROTUNDUM
FORAMEN LACERUM	FORAMEN OVALE

MIDDLE MENINGEAL GROOVES	FORAMEN SPINOSUM
POSTERIOR CRANIAL FOSSA	FORAMEN MAGNUM
GROOVES for SIGMOID SINUSES	JUGULAR FORAMEN
GROOVES for Trans. SINUSES	HYPOGLOSSAL CANAL
GROOVE for Sup. SAGITTAL SINUS	INTERNAL ACOUSTIC MEATUS

### V) Nasal Cavity

Horizontal PLATE of PALATINE	Perpendicular PLATE of PALATINE
INFERIOR NASAL CONCHA	INFERIOR MEATUS
OPENING of NASOLACRIMAL CANAL into INFERIOR MEATUS	
MIDDLE NASAL CONCHA	MIDDLE MEATUS
MAXILLARY SINUS OPENING	FRONTAL SINUS OPENING
ETHMOIDAL SINUS OPENINGS	SUPERIOR MEATUS
SUPERIOR NASAL CONCHA	SPHENOETHMOIDAL RECESS
SPHENOIDAL SINUS OPENINGS	VOMER

### VI) Features of Individual Bones

#### ETHMOID BONE

LAMINA ORBITALIS	ETHMOIDAL AIR CELLS
CRIBRIFORM PLATES	CRISTA GALI
PERPENDICULAR PLATE	Sup & Mid CONCHAE

#### FRONTAL BONE

FRONTAL AIR SINUS	ORBITAL PLATE
SUPERCILIARY RIDGES	METOPIC SUTURE

#### MAXILLA

MAXILLARY SINUS	PALATINE PROCESS
ORBITAL PLATE	ZYGOMATIC PROCESS
FACIAL SURFACE	FRONTAL PROCESS
NASAL SURFACE	ALVEOLAR PROCESS
PTERYGOID SURFACE	INCISIVE CANAL

**MANDIBLE**

BODY	HEAD of CONDYLE
RAMUS	NECK of MANDIBLE
ANGLE	CORONOID PROCESS
ALVEOLAR PART	CORONOID (Mandibular) NOTCH
MENTAL PROTUBERANCES	LINGULA
MENTAL SPINES	MANDIBULAR FORAMEN
LOWER BORDER	MYLOHYOID LINE & GROOVE

**SPHENOID BONE**

BODY	SPHENOIDAL SINUS
GREATER WINGS	PTERYGOID FOSSA
LESSER WINGS	CLIVUS
PTERYGOID PLATES	

**TEMPORAL BONE**

PETROUS PART	SQUAMOUS PART
MASTOID PROCESS	TYMPANIC RING
OTIC PART	ARTICULAR PART
TYMPANIC FISSURE	ZYGOMATIC PROCESS

**OCCIPITAL BONE**

BASI OCCIPUT	FORAMEN MAGNUM
CONDYLAR PART	INTERPARIETAL SQUAMOUS
INTERPARIETAL PART	PART

**VII) Identify these 25 Foramina**

- |                             |   |
|-----------------------------|---|
| 1 FORAMEN MAGNUM            | 2 HYPOGLOSSAL CANAL<br>(ANTERIOR CONDYLAR F.) |
| 3 JUGULAR FORAMEN           | 4 CAROTID CANAL                               |
| 5 FORAMEN OVALE             | 6 FORAMEN SPINOSUM                            |
| 7 FORAMEN LACERUM           | 8 FORAMEN ROTUNDUM                            |
| 9 STYLOMASTOID FORAMEN      | 10 SPHENOPALATINE FORAMEN                     |
| 11 EXTERNAL AUDITORY MEATUS | 12 INTERNAL AUDITORY MEATUS                   |
| 13 MANDIBULAR FORAMEN       | 14 GREATER PALATINE FORAMEN                   |
| 15 MENTAL FORAMEN           | 16 INCISIVE FORAMEN                           |
| 17 CRIBRIFORM PLATE         | 18 OPTIC FORAMEN                              |
| 19 SUPERIOR ORBITAL FISSURE | 20 INFERIOR ORBITAL FISSURE                   |
| 21 SUPRAORBITAL FORAMEN     | 22 INFRAORBITAL FORAMEN                       |
| 23 ANTERIOR ETHMOIDAL F     | 24 POSTERIOR ETHMOIDAL F                      |
| 25 NASOLACRIMAL CANAL       |   |

This is a fairly complete list, with which you will have to be totally familiar by the end of the course, but not all of which you will have to know by the end of the first week.

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**H&N Week 1 Targets**

By the end of this practical sessions students should be able to identify:-

on Thursday: Parts I, II & III of this list; be familiar with the names of the Foramina (Part VII)

by Tuesday next: Part IV of this list and also the names the parts of the Sphenoid, Temporal & Occipital bones [in Part VI].

Be able to identify the component parts of the Orbits, Anterior & Posterior Nares, Zygomatic arches and palate.

Be able to name the Bones & Fontanelles of the fetal skull, and all major Sutures and Synchondroses.

**Later Targets**

Before the Lectures on the Cranial Nerves: (usually in week 9) Be able to identify all of the major foramina of the skull and be aware of the major structures which pass through these.

Note that Part V of this list is included for completeness and is not required in detail yet. It will, however, be required by the Spot Exam at the end of Semester 1.

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## ADULT SKULL WORKSHOP II

There are Workshops, supported with card based texts, photographs and models, which are available to you for private study in the Anatomy Museum should you wish to look at them. Specific arrangements have to be made with the Technical Staff in charge of this area for access to the material.

Some of the Cards for Workshop II are presented today; to help you understand the Neonatal skull. You are encouraged to push yourselves intellectually to learn and recall the names and contents of the 25 most important foramina/canals. Do this using the form provided.

### ITEMS TO DO

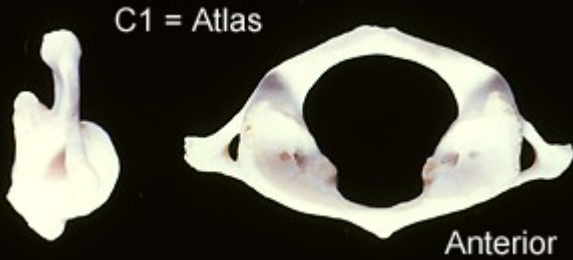



- Compare the neonatal and adult skulls and try to envisage the four growth processes involved in the increase in size of the child's skull, and also the time scales through which the growth driving processes operate
- This is a chance to revise your knowledge of the adult skull bones and particularly be able to recognise and name the 25 most important foramina. THIS IS 'CORE' KNOWLEDGE !
- Study the 7 cervical vertebrae (a mounted skeleton gives the best view). At the end of the class you should be able to:-
  1. describe a 'typical' cervical vertebra,
  2. name and describe the two cervical vertebrae (1<sup>st</sup> and 2<sup>nd</sup>), which vary greatly from this typical pattern,
  3. recognise that the 7<sup>th</sup> vertebra is not entirely typical (long, non-bifid spine).

Note that there are usually 33 vertebrae in man – 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused to form the sacrum = 1 bone) & 4 coccygeal (fused into the coccyx = 1 bone).

- Be able to list the 22 bones which form the head and ascribe each to a functional group [Neurocranium (Dermatocranium/Chondrocranium) / Viscerocranium].
- Be aware that there are 2x3 further bones in the middle ear.
- Go beyond being able to simply identify a bone by name and progress to be able to describe it in terms of its component sub-parts.

Example The maxillary bone is one of a pair (Left & Right). Each has a pyramidal body (with a base and three faces), with four processes (frontal, zygomatic, palatine & alveolar) extending from the body. It forms in membrane. Through these processes and faces each maxilla articulates with 10 other cranial bones (1 being its mirror image).

**Cervical Vertebrae**

 <p>C1 = Atlas</p> <p>Anterior</p>	<p>The <b>FIRST</b> Cervical Vertebra is called the ‘<b>ATLAS</b>’, after the hero in mythology who carried the world on his shoulders, because the head looks like a sphere.</p> <p>It is an atypical vertebra because it has <b>NO BODY</b> and no (bifid) spine.</p> <p>It articulates with the Occipital condyles. This joint is principally responsible for <b>NODDING</b> movements [signals YES].</p>
 <p>Axis = C2</p> <p>Dens</p> <p>Ant</p>	<p>The <b>SECOND</b> Cervical Vertebra is called the <b>AXIS</b>. This is because it facilitates side-to-side, rotatory movements [signals NO].</p> <p>The <b>DENS</b> of C2 is derived from the body of C1. Much of the side-to-side rotation takes place between C1 &amp; C2, round the Dens.</p> <p>C2 has a bifid spine, which typifies a cervical vertebra.</p>
 <p>C4 = typical cervical</p> <p>Ant</p>	<p>A <b>TYPICAL</b> Cervical Vertebra</p> <p>The vertebrae C3 – to C6 (inclusive) are considered to be ‘typical’. The special features include:-</p> <ul style="list-style-type: none"> <li>• bifid spine (for ligamentum nuchae)</li> <li>• a foramen transversarium</li> <li>• anterior and posterior tubercles on the transverse processes, &amp;</li> <li>• a large vertebral foramen.</li> </ul>
 <p>C7 = long, non bifid spine</p> <p>Ant</p>	<p>The <b>SEVENTH</b> is only slightly atypical.</p> <p>The atypical features include:-</p> <ul style="list-style-type: none"> <li>• a long, non-bifid spine. It is the first major bump that you can feel if you run your fingers down the top part of the spine, &amp;</li> <li>• a small foramen transversarium because the vertebral artery often does not run in it</li> </ul>

**What is contained in or passes through these FORAMINA ?**

1	ANTERIOR ETHMOIDAL FORAMINA	
2	CAROTID CANAL	
3	CRIBRIFORM PLATE	
4	EXTERNAL AUDITORY MEATUS	
5	FORAMEN LACERUM	
6	FORAMEN MAGNUM	
7	FORAMEN OVALE	
8	FORAMEN ROTUNDUM	
9	FORAMEN SPINOSUM	
10	GREATER PALATINE FORAMEN	
11	HYPOGLOSSAL CANAL (ANTERIOR CONDYLAR FORAMEN)	
12	INCISIVE FORAMEN	

13	INFERIOR ORBITAL FISSURE	
14	INFRAORBITAL FORAMEN	
15	INTERNAL AUDITORY MEATUS	
16	JUGULAR FORAMEN	
17	MANDIBULAR FORAMEN	
18	MENTAL FORAMEN	
19	NASOLACRIMAL CANAL	
20	OPTIC FORAMEN	
21	SUPRAORBITAL FORAMEN	
22	POSTERIOR ETHMOIDAL FORAMINA	
23	SPHENOPALATINE FORAMEN	
24	STYLOMASTOID FORAMEN	
25	SUPERIOR ORBITAL FISSURE	

By the end of Semester 1 you MUST be able to recognise all of these. You should know what passes through all except 10, 12, 13 & 23 by the Christmas break.

## SUPERFICIAL DISSECTION of the NECK & LOWER FACE

DISSECT the SKIN from the NECK & LOWER TWO THIRDS of FACE

Free the *Platysma muscle* inferiorly, fold it upwards & forwards to its attachment to the mandible.

Define the *Superficial Veins of Neck & Face*, especially the *External Jugular* veins.

Note that the Facial and External Jugular veins penetrate the Deep Fascia at two points only. The *Retromandibular Vein* is somewhat atypical, in that it branches (diverges) on its way back towards the heart. Please try to find and retain it as it emerges from the *Parotid fascia*.

Find the *Facial Artery* and the *Submandibular Gland* [both WITHIN a DEEP FASCIAL SHEATH].

Define the edges of SCM muscle and identify the *Great Auricular Nerve* [C2, C3 (Cervical plexus)].

Examine the superficial *Muscles of Facial Expression* and find multiple branches of the *Facial*

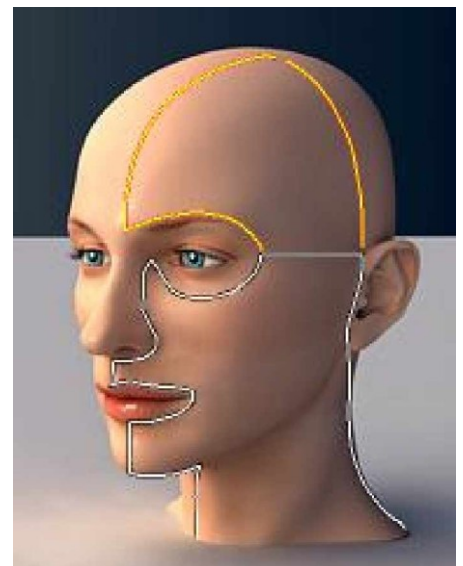
Dissection Objectives are to demonstrate

- SKIN STRUCTURE / ATTACHMENT
- PLATYSMA MUSCLE
- SUPERFICIAL VEINS, particularly External Jugular system in detail plus the Facial crossing mand
- PAROTID FASCIA, GLAND & DUCT
- Presence of FACIAL ARTERY and SUBMANDIBULAR GLAND
- SUPERFICIAL (Spinal nerve) INNERVATION / GREAT AURICULAR NERVE [C2,C3]
- FACIAL (Motor) NERVE BRANCHES & MUSCLES of FACIAL EXPRESSION

### Superficial Dissection

TO REMOVE THE SKIN FROM the NECK and FACE

- Make a midline incision from the root of the neck to the vermillion border of the lower lip.
- Incise round the lips.
- Make a midline incision from the middle of the lip philtrum to the base of the nasal septum.
- Incise round the nose to the medial canthus of the eye.
- Cut round the lower margin of Orbicularis oculi and then along the zygomatic arch to just in front of the ear.
- Extend the incision downwards, in front of the ear to the mastoid process, and then along the anterior free edge of trapezius muscle to the point of the shoulder.
- Start removing the skin at the root of the neck, in the midline, and work upwards.
- It is not necessary to remove the skin in one piece. Multiple small pieces are OK.
- Remember that skin is a two layered structure [epithelium + lamina propria] which is normally sited over the superficial fascia, and has a combined thickness of less than 2 mm. So only remove a thin layer in the first instance. Skinning this part of the body is best done using blunt dissection. Place the closed points of a pair of scissors between the skin and superficial fascia and then open the blades, so separating the skin from the fascia. Repeat the process multiple times!



As you remove the skin [using blunt dissection] you should become aware of nerve fibers passing through the superficial fascia, to be distributed into the lamina propria. These are the superficial cutaneous branches of the *Cervical Nerve Plexus*. At least four nerves radiate out from a small area,

about half way down the posterior border of Sternocleidomastoid muscle. The biggest of these nerves is called the **Great Auricular** and it runs upwards to supply the skin over the angle of the mandible and much of the ear. It is the only spinal nerve [C2 & C3] to supply any tissue in facial / dental region. All the rest of the face and anterior mouth region is supplied by **cranial nerve V [Cn V]**, the **Trigeminal**.

## THE NECK

**Platysma muscle** is located within the superficial fascia; once the skin is removed you will be able to clean the muscle surface and see the bundles of muscle fibers. Platysma ‘flows’ up the neck (helping to give it a smooth contour) and becomes integrated into the **Orbicularis oris muscle complex**, or attached to the lower border of the mandible. A part of Platysma, which inserts at the angle of the mouth, when contracted can help with smiling. If the muscle pulls the corner of the mouth down it is called **Sardonicus**, if it simply helps form a grinning smile it is called **Risorius**. Once Platysma has been defined it can be separated from the fascia beneath it to reveal the superficial veins of the neck below it and the deep [or Investing] fascia below that. The freed muscle sheet may be folded upwards and forwards. You will find that it is tightly attached to the anterior part of the lower border of the mandible.

Identify the **External Jugular Vein**, carefully clean it of its fascia support and look for tributaries. The vein runs obliquely across [superficial to] the SCM muscle before penetrating the deep fascia in the lower **Posterior Triangle**, usually in the region of the **Supraclavicular Triangle**, before draining into the **Subclavian vein**. The Ext Jugular vein is formed by two smaller veins coalescing. These are a posterior branch of the **Retromandibular vein** and the **Posterior Auricular vein**. This arrangement is fairly constant, but there is much variability in the neck veins and some other veins may be bigger & more important than the Ext Jugular.

Veins return blood to the right heart. The usual arrangement is that smaller venous tributaries coalesce to give progressively bigger and bigger veins as the vena cava is approached. The one exception to this rule is the Retromandibular vein. As it leaves the **Parotid fascia** it BRANCHES. We have just seen that the posterior branch contributes to the formation of the Ext Jugular vein. The anterior branch joins with the **Facial vein** to form a **Common Facial Vein**. The Common Facial vein penetrates the deep fascia in the **Carotid Triangle**, to drain into the **Internal Jugular vein**. Thus the superficial venous system penetrates the deep fascia in only two places. This helps to isolate superficial injuries / infections from the more critical deep structures – a good design feature! An example of a weakness in the system is that the superficial veins may not have any valves, so blood may flow in any direction. Associated with the lack of valves is a thicker vessel wall. This, combined with the fascia support may prevent injured veins from collapsing when damaged, and may result in an air embolism (air sucked in).

Do not get involved in a detailed dissection of the Facial Artery & Vein today – just do not damage them. The main subjects for today are the superficial vessels of the neck + Platysma muscle and the general arrangement of the muscles of facial expression.

Most bodies will also have an **Anterior Jugular vein** and a **Communicating vein**. Look for these. In this part of east Scotland the Communicating vein [**Ant Jugular to Common Facial**] may be the biggest of the superficial neck veins.

**THE FACE**

Continue the dissection onto the face. Notice that the deep fascia encapsulates the **Parotid Salivary Gland**, covers the **Masseter muscle** and attaches to the **Zygomatic Arch**. Also notice that there is no deep fascia anterior to the **Masseter**, and that through a haze of subcutaneous superficial fascia in this area the **Muscles of Facial Expression** may be seen. .

Superficial Musculature

Note that these facial muscles are stacked in layers – with PLATYSMA in the lower third of the face and ORBICULARIS OCULI upper face – occupying the most superficial layer. ORBICULARIS ORIS [itself consisting of multiple layers] starts in the next layer down. The most superficial part of Orbicularis oris is DEPRESSOR ANGULI ORIS muscle. The deepest of the Orbicularis oris complex are LEVATOR ANGULI ORIS muscles and the INCISIVE SLIPS. Start to define the edges of the muscles of facial expression, beginning with the most superficial. Do not cut off the overlaps, but rather dissect the overlapping layer to free it, and fold the overlap away to see the under layer. As you free the muscle layers you will find **Facial nerve** [Cn VII] branches entering the under surface of the muscle to provide its motor innervation. The Facial nerve branches are said to be distributed across the face [like the digits of a hand] from a locus just deep to the ear lobe.

Define the anterior edge of the **Parotid gland** and locate the **Parotid Duct** as it crosses the **Masseter muscle**. The duct then turns to run medially towards the mouth, penetrates **Buccinator muscle** and enters the **Oral Cavity** in the **buccal vestibule**, opposite the upper second permanent molar tooth. Do not dissect today, just be aware of its presence, encapsulated in deep fascia. You may have to pick away large amounts of adipose tissue from the **Buccal Fat Pad** to be able to follow the duct.

If time permits, extend the skin removal up to the **vertex** of the skull and start to define the superficial muscles of the forehead.

**CHECK LIST**

Skin	Epidermis Superficial fascia	Dermis Subcutaneous nerves [C2+C3+C4]
Sternocleidomastoid muscle [SCM]	Superficial lymph nodes	
Facial vein	Forms Common Facial with Retromandibular vein	
External Jugular vein	Formed from Retromandibular & Post Auricular	
Submandibular gland [superficial part]	Facial nerve [Cn VII] supplying muscles of Face	
Facial artery [superficial part only]	Parotid fascia	
Parotid salivary gland	Parotid duct	
Platysma muscle	Risorius / Sardonius muscle	
Orbicularis oris muscle complex	Orbicularis oculi muscle complex	
Masseter muscle	Buccal fat pad	
Zygomatic arch	Temporal fascia	
Frontalis / Occipitalis muscle complex	Scalp tendon sheet	

## BELOW the DEEP FASCIA of the NECK

*Please see more details in Grant's Dissector (13e) – pp 176-180 for Neck triangles*

Free the lower end of SCM muscle & fold it upwards and backwards. Find the **Great Auricular nerve** root coming from [the Posterior Triangle] below and behind the middle third of SCM and the **Spinal Accessory Nerve** [associated with Cn XI] entering the underside of the muscle.

In the Infrahyoid region - Dissect the **Strap Muscles**. Note the thickened band of fascia [deep to SCM] causing the **Omohyoid Muscle** to change direction.

Find and retain the motor nerve fibers entering the strap muscles from the **Carotid Sheath** region.

In the Suprahyoid region – Dissect out the **Digastric & Stylohyoid** muscles and expose the **Mylohyoid** muscle [if necessary remove the superficial part of the Submandibular Gland]. Find the **Hypoglossal Nerve** [Cn XII], crossing the Carotid Sheath and disappearing below the **Digastric Tendon / Stylohyoid** muscle. Do not clean this nerve at this stage as there are pseudo-branches to be retained for future identification.

For a Future Dissection

### Dissection Objectives are to demonstrate

- STERNOCLEIDOMASTOID MUSCLE [SCM] & ACCESSORY NERVE [Spinal XI]
- STRAP MUSCLES of NECK
- MOTOR BRANCHES of CERVICAL PLEXUS and ANSA CERVICALIS
- SUPERIOR THYROID ARTERY
- SUPRAHYOID MUSCLES
- SUBMANDIBULAR GLAND & FACIAL ARTERY
- CERVICAL / MARGINAL MANDIBULAR BRANCHES of FACIAL NERVE [Cn VII]
- FACIAL VEIN & COMMON FACIAL VEIN
- RETROMANDIBULAR VEIN & BRANCHES
- HYPOGLOSSAL NERVE & DESCENDENS HYPOGLOSSI

### Muscles of the Neck Triangles

The SCM muscle is the posterior boundary of the **Anterior Triangle**. The midline is the anterior boundary. Reflect the already detached SCM muscle from its sternal end to show its motor nerve, the **Spinal Accessory**. Having done this you should rediscover the superficial sensory distribution of the **Cervical Plexus**, in particular the **Great Auricular** nerve [C2 + C3], exiting between **Scalenus Anterior & Medius** muscles.

### The Muscular Triangle contains the 4 Strap Muscles

The next stage in your dissection is to define the 'strap muscles' of the neck. These are:-

- **Sternohyoid** &
- **Omohyoid**, in an outer plane and
- **Sternothyroid** &
- **Thyrohyoid** in a deeper plane. The latter 2 are essentially one muscle, tied to the Thyroid cartilage.

All the strap muscles may have been detached from their sternal origin [result of thorax dissection]. The more deeply placed Sternothyroid and Thyrohyoid muscles are really a continuation of the one muscle [running from sternum to hyoid] but it is tied down to the oblique line of the thyroid cartilage [with a change of name] part way along its course.

These muscles cover the **Larynx & Trachea**, and also the **Thyroid gland**. Do not at this stage dissect the contents of the **Carotid Sheath**, but do note that there are multiple motor nerves running into these strap muscles from a parent loop of nerves [**Ansa cervicalis**] that is tightly integrated into the **Carotid sheath**!

As you dissect the strap muscles you will find the **Thyroid gland**, plus **Superior Thyroid Arteries** and **Veins**, both of which give Laryngeal branches, together with **Laryngeal branches of the Vagus nerve**. Please make every effort to retain these features [undamaged!] for dissection in S2.

## Suprahyoid Triangles

One of the important landmarks in the neck is the **Hyoid Bone** – a ‘U’ shaped structure – derived from Pharyngeal Arches II & III. It is located at about C2 level. It forms the upper border of the **Muscular triangle** and the base of the **Suprahyoid triangles**.

The Suprahyoid part of the Anterior Triangle is subdivided into **Sub Mental** and **Sub Mandibular triangles** by the **Digastric muscle** and the midline. The roof of these triangles is also the Floor of the Mouth and is largely formed by the **Mylohyoid muscle**. To visualize the Submandibular triangle properly much of the superficial part of the Submandibular gland will have to be removed. Running into the Submandibular region, deep to **Posterior Belly of Digastric**, is the **Hypoglossal nerve** [Cn XII], the motor nerve to all but one of the tongue muscles. Try to find this nerve but be careful NOT to tear off the fine branch(es) it gives under cover of the **Intermediate tendon of Digastric** [see **Ansa cervicalis** below].

## Carotid Triangle

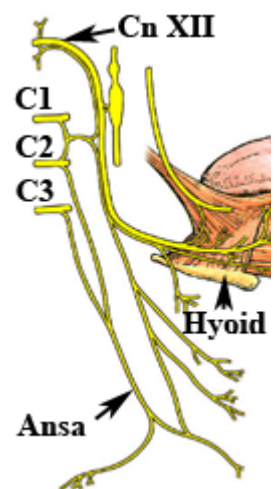
Below the posterior belly of the Digastric and behind the Strap Muscles is the **Carotid Triangle** which contains the **Carotid Sheath**.

## Carotid Sheath

The Carotid Sheaths are cylindrical tubes of fascia [left & right], which extend from the base of the skull [Temporal / Occipital bones] to the mediastinum, situated just lateral to the **Cervical Viscera** [Larynx & Trachea / Pharynx & Oesophagus / Thyroid gland]. Their contents are NOT to be dissected today. The **Common Facial vein** penetrates the deep fascia and carotid sheath fascia to join the **Internal Jugular vein**.

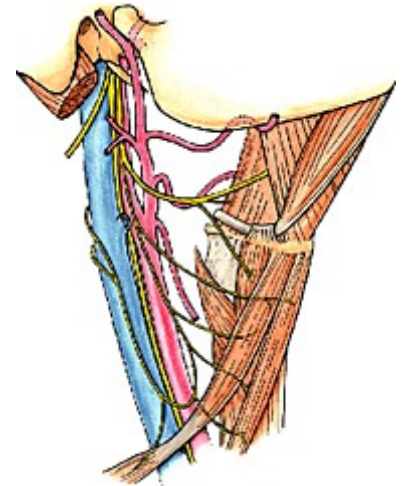
### Dissection to Display the Ansa cervicalis

Go back to the strap muscles [start with **Omohyoid**] and find motor nerves running to it from the Carotid Sheath region. Trace these nerves back and in the process free an extensively branched nerve loop from the carotid fascia. The anterior strand of this loop will run up the anterior aspect of the carotid sheath [or be within the fascia of the upper limb of Omohyoid muscle] and appear to be a branch from the **Hypoglossal nerve** [Cn XII], appearing under cover of the **Digastric Tendon**. It is, however, formed by C1 [spinal nerve] fibers which have just been accompanying [riding “piggy-back” with] Cn XII for greater security. The posterior strand of the nerve loop contains fibers of C2 & C3. These run in the posterior margin of the carotid sheath



and also communicate with the bunch of superficial sensory nerves [*Great Auricular, Transverse Cervical & Supra-scapular*] that initially showed about halfway down the posterior border of SCM muscle. This posterior strand passes out into the neck between the Scalenus anterior and medius neck muscles.

The nerve loop is called *Ansa cervicalis*; the anterior limb is *Descendens hypoglossi* [C1 fibers] and the posterior is *Descendens cervicalis* [C2, C3 fibers].



### External Carotid Artery Branches

The *External Carotid artery* gives a total of 6 branches in the neck. Three of these pass forwards and three are directed (more or less) backwards. You will not see all of these until the Carotid Sheath contents are dissected out in the next session. Only more peripheral parts of two of the forward directed branches – *Superior Thyroid* and *Facial* will have been demonstrated today.

#### CHECK LIST

Sternocleidomastoid muscle [SCM]	Spinal Accessory nerve	
Strap muscles	Omohyoid Sternothyroid	Sternohyoid Thyrohyoid
Superior Thyroid artery	Laryngeal branch of Sup Thyroid art	
Vagus nerve	Superior Laryngeal branch of Vagus	
Suprahyoid muscles	Ant Belly of Digastric Stylohyoid	Post Belly of Digastric Mylohyoid
Submandibular gland [superficial part]	Facial nerve [Cn VII] marginal mandibular branch	
Retromandibular vein	Ant branch to join Facial vein, forming Common Facial	Post branch joined by Post Auricular forming Ext Jugular vein
Facial vein	Forms Common Facial with Retromandibular vein	
Hypoglossal nerve [Cn XII]	Deep to Digastric tendon, superficial to Hyoglossus m	
External Carotid artery [6 branches in neck]	Sup thyroid Lingual Facial [deep to submand g]	Ascending pharyngeal Occipital Posterior Auricular
Submandibular gland [superficial part]	Facial nerve [Cn VII] marginal mandibular branch	
Lingual artery	Similar course to Cn XII, but deep to Hyoglossus m	

## CAROTID SHEATH DISSECTION

*Please see more details in Grant's Dissector (13 e) – pp 176 - 180*

### Revision

Trace the motor nerve twigs from the Strap Muscles back into the Carotid Sheath. In the process define a motor nerve loop, hidden in the fascia, - called the **Ansa Cervicalis**. The anterior limb of this loop is made up of **C1** fibers that can be seen to diverge from the Hypoglossal nerve [with which they first traveled]. The posterior loop contains **C2 & C3** motor fibers which emerge from between Scalenus anterior and Scalenus medius muscles [along with the Great Auricular sensory fibers].

### New

Within the lower part of the Carotid Sheath you will find the **Internal Jugular Vein**, the **Vagus Nerve** [Cn X] and the **Common Carotid Artery**.

In the upper part of the Sheath the **Carotid Sinus & Body** and the **Internal and External Carotid Arteries** have replaced the single Common Carotid. Branches of the **Glossopharyngeal Nerve** [Cn IX] are also found.

The External Carotid gives 6 branches in the neck – try to define all of these. The upper branches are given off deep to the Posterior Belly of Digastric / Stylohyoid muscle group. In order to see the artery branches you will have to remove some of the [lower] Parotid Gland. Please try to conserve the **Great Auricular** nerve, **Facial Nerve** branches, the **Retromandibular vein** and the continuation into the head

### **Dissection Objectives are to**

- RETAIN [if possible] the RETROMANDIBULAR VEIN & the GREAT AURICULAR NERVE
- Also to demonstrate the
- ANSA CERVICALIS free from the CAROTID FASCIA
- INTERNAL JUGULAR VEIN & TRIBUTARIES
- COMMON CAROTID ARTERY & CAROTID SINUS
- INTERNAL CAROTID ARTERY, the SINUS NERVE & CAROTID BODY
- EXTERNAL CAROTID ARTERY & 6 NECK BRANCHES
- VAGUS NERVE & ITS LARYNGEAL BRANCHES
- SUPERIOR CERVICAL SYMPATHETIC GANGLION & SYMPATHETIC TRUNK

## **Carotid Sheath**

The **Carotid Sheath** contains the **Internal Jugular vein**, the **Carotid arteries** and the **Vagus nerve** [Cn X], running through its whole length. The **Glossopharyngeal nerve** [Cn IX] lies in its upper part only. The **Spinal Accessory nerve** [XI] is contained briefly in its very uppermost part. The Internal Jugular vein is the most superficial structure within the sheath; the Carotid arteries are the deepest, most anterior content of the sheath, while the Vagus nerve lies between these two vessels and behind the artery.

At about **C4 level** the Common carotid artery divides into **External and Internal Carotid artery** branches. The **Internal Carotid** runs, unbranched to the interior of the skull, via the **Carotid Canal**. The **External Carotid** artery terminates [in the head] as the **Maxillary artery** and gives seven other branches beforehand. Six of these branches are in the neck; the final ones are in the head region. Just prior to branching the Common Carotid forms an expansion – the **Carotid Sinus** – which is a baroreceptor – a pressure sensing structure, and, at the furcation, contains a chemoreceptor – the **Carotid Body** – which monitors the partial pressures of CO<sub>2</sub> & O<sub>2</sub>, and [H<sup>+</sup>] in the arterial blood. The Glossopharyngeal nerve [Cn IX] supplies the afferents for these sensors – the **Sinus nerve**.

## Internal Jugular Vein

Having isolated the Ansa cervicalis: [remember that]

- the anterior limb is called *Descendens hypoglossi* [C1 fibers] and
- the posterior is *Descendens cervicalis* [C2, C3 fibers].

Dissect away the Carotid Sheath [trying to retain the nerve loop] to define the Internal Jugular vein and its tributaries.

You should all expect to be able to find; *Pharyngeal*, *Common Facial* and *Superior Thyroid* tributaries joining the main Internal Jugular. If necessary cut the vein [and tributaries] and fold the ends out of the way in order to see the deeper placed artery and Vagus nerve.

## External Carotid Artery Branches

The External Carotid artery gives a total of 6 branches in the neck.

Three of these pass forwards and three are directed (more or less) backwards.

The forward directed branches (from below) are:-

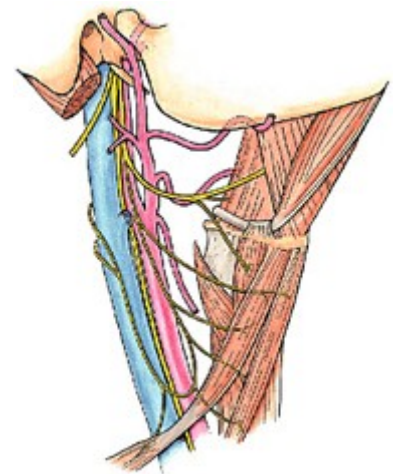
1. *Superior Thyroid*
2. *Lingual*
3. *Facial*

The rearward directed branches are (from below):-

4. *Ascending Pharyngeal* (difficult to find and really a deep vertical branch)
5. *Occipital &*
6. *Posterior Auricular*.

The *Hypoglossal nerve* hooks round a branch [to SCM] of the Occipital artery before it turns and runs forwards towards the tongue [superficial to Hyoglossus muscle] under cover of the *Intermediate Tendon of Digastric*.

The *Lingual artery* runs towards the tongue, but deep to the *Hyoglossus muscle* and more or less parallel to the Lingual artery. These are consistent, landmark features, to be demonstrated today.



## Internal Carotid Artery

The *Internal Carotid artery* [so called because it runs to the inside of the skull] is often more externally placed in the neck than the *External Carotid* when these two branches first form! It gives no branches in the neck, and has three principal terminal branches within the skull [*Ophthalmic*, *Anterior Cerebral & Middle Cerebral Arteries*]. Try to preserve the nerves that run with this vessel.

## Vagus Nerve

This is the longest cranial nerve, supplying visceral structures from the back of the tongue, through the thorax and down the abdominal contents as far as the transverse colon. Within the Carotid Sheath it gives branches to the *Pharynx* and *Larynx*. It provides *Cranial Parasympathetic* outflow and also communicates extensively with the *Autonomic Sympathetic Nervous System* via the *Superior Cervical Sympathetic Ganglion*.

## Cervical Sympathetic Nerve Chain & Ganglia

Lying in the *Prevertebral Fascia*, just deep to and in contact with the *Carotid Sheath Fascia*, is the *Cervical Sympathetic Trunk* and *Ganglia*. The Vagus nerve communicates extensively with the Superior Cervical Sympathetic Ganglion, giving Cardiac and Bronchial branches. The terminal part of the Sympathetic Trunk passes from the upper pole of the Superior Cervical Sympathetic Ganglion, lies beside the Internal Carotid Artery, forming a nerve network round the artery and enters the skull [with the artery] via the *Carotid Canal* [Temporal bone].

All Sympathetic ganglia have postganglionic fibers distributed in three ways:-

- By Spinal nerves
- Through Cardio-pulmonary branches, and
- Via a network of fibers on arterial vessels.

The Superior Cervical Sympathetic ganglion makes the above three connections, plus

- Distribution via Cranial nerves [particularly the Vagus], and
- Contributing to the Pharyngeal and Pulmonary (Bronchial) plexi.

### CHECK LIST

Retromandibular vein	Gt Auricular nerve		
Carotid sheath	Ansa cervicalis	Descendens hypoglossi	Descendens cervicalis
Internal Jugular vein	Pharyngeal vs	Common facial v	Laryngeal vs Sup Thyroid v
Carotid arteries	Common	Internal	External
	Carotid sinus	Carotid body	Sinus nerve
External Carotid branches [In neck]	Inf Thyroid	Lingual	Facial
	Occipital	Ascending pharyngeal	Post Auricular
	[In head]	Superficial Temporal	Maxillary
Vagus nerve	Laryngeal branches (to be preserved)		
Sympathetic nerves	Cervical chain	Superior cervical gang	Pharyngeal plexus brs

## SKELATAL MUSCLE RULES

- Muscles are usually attached directly, or indirectly, to a solid connective tissue – e.g. bone or cartilage – via a combination of tendon, ligament or fascia.
- There are some exceptions to this general rule – most in the HEAD region.
  - Muscles may attach directly to ORGANS [e.g. the eyeball]
  - Muscles may attach directly to skin [e.g. the FACIAL muscles]
  - Muscles may attach directly to mucous membrane [e.g. INTRINSIC TONGUE muscles]
- Muscles have an ORIGIN and an INSERTION
  - The origin is located at the FIXED END.  
The insertion is usually at the MOVABLE END.
  - The origin is usually PROXIMAL (medial) to the insertion which is DISTAL (lateral).
- Skeletal (striated) muscle is described as VOLUNTARY, because in most cases we can elect when and how to move them. However, some contract automatically. Sometimes we can prevent this automatic contraction for a period of time [e.g. in the diaphragm], but there are other skeletal muscles [in the oesophagus] which we cannot control.

Muscles are only capable of CONTRACTION and RELAXATION. They cannot push!

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## MOTOR NERVE SUPPLY

There are 12 Cranial nerves – numbered in Roman characters. (I, II, III, . . . XI, XII)

There are 8 CERVICAL Spinal nerves, but only 7 Cervical vertebrae.

- NECK muscles are supplied by SPINAL NERVES.
  - Except for Platysma, supplied by Cranial nerve VII [Facial].
- Most muscles which have an ATTACHMENT to the Skull (but not to the vertebral column) are supplied by CRANIAL NERVES.
  - Except for Trapezius and Sternocleidomastoid, which are supplied by SPINAL nerves that pretend to be Cranial in origin, and
  - GENIOHYOID - which although attached to the Head is really a neck (strap) muscle and is supplied by a Spinal nerve.
- The muscles in the FRONT of the NECK are supplied by the CERVICAL PLEXUS – the Anterior Primary Rami of spinal nerves - C1, C2, C3 & C4.

## DEFINITIVE DISSECTION OF THE FACE

***The detail [in Grant's Dissector] of the Facial Muscle organisation is not sufficient.  
Please read Grant's Dissector (13e) – pp 152-155 for the background.  
Your lecture notes will give the detail.***

The deep fascia of the neck splits to attach to the **Lower Border** and **Mylohyoid line** of the mandible, it also splits to encapsulate the **Parotid gland** and attach to the **Zygomatic arch**. The deep fascia then extends posteriorly to attach to the **Styloid and Mastoid Processes of the Temporal Bone** before continuing round the **Superior Nuchal Line** at the back of the Skull. The only muscles in the face region to be covered in deep Fascia are the superficially placed **Muscle of Mastication – Masseter & Temporalis**.

This dissection is concerned primarily with the **Muscles of Facial Expression**, which are located in what is technically Superficial Fascia (which is why the muscles can move skin).

These muscles evolved initially as sphincters, to protect a series of facial openings – mouth, nose, eyes and ears. In man only those associated with the mouth and eyes remain as important sphincters.

Some of the muscles groups are more superficial than others. The most superficially placed group is the **Orbicularis oculi complex** [the eye sphincter]. The **mouth sphincter – Orbicularis oris** - is a complex, multilayered structure. The most superficial element of it is derived from **Platysma** muscle fibers integrating into the surface of the complex and merging with **Depressor anguli oris**. Orbicularis oris comprises about five layers in all.

The Parotid gland developed as an outpouching of oral epithelium, which occurred after all the vessels, nerves and muscles had initiated; thus the gland tissue has filled all the potential spaces around the other pre-existing structures. The **Facial nerve** is motor to all the muscles of facial expression, it leaves the skull at the deepest point of the parotid and fans out, like the digits of a hand, to supply these muscles. There is a posterior branch to the **3 Auricular muscles**.

Trace the **Facial artery & vein** across the face and note how they branch and weave in and out of the muscle layers. The **Facial vein** has some important features – leading to it being associated with what is called the **Danger Triangle of the Face**.

Identify the **Jaw Closing Muscles – Masseter & Temporalis** and note that they are covered in **Deep Fascia** and are functionally closely associated with the **Zygomatic arch**.

If you have not already removed the skin from the anterior part of the skull vault, you will have to do so now. Demonstrate the **Frontal belly** of the **Occipito-Frontalis** complex and note that Frontalis does not

### **Dissection Objectives are to demonstrate and define**

- MUSCLES of FACIAL EXPRESSION
- FACIAL NERVE BRANCH DISTRIBUTION
- PAROTID DUCT & BUCCINATOR MUSCLE
- DANGER TRIANGLE of the FACE ~ FACIAL VESSELS
- ZYGOMATIC ARCH & SUPERFICIAL JAW CLOSING MUSCLES
- SCALP ORGANISATION
- OCCIPITO-FRONTALIS MUSCLE & EPICRANIAL APONEUROSIS

## Muscles of Facial Expression

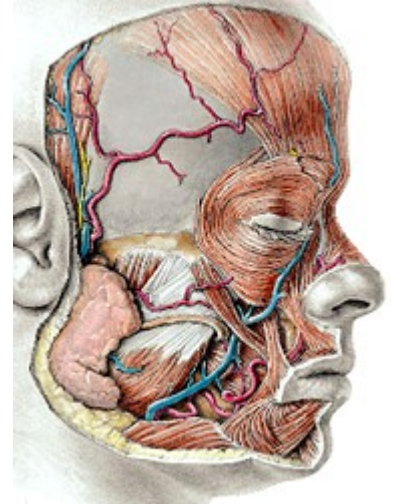
Carefully remove any subcutaneous fat/superficial fascia to reveal the muscles. Trace the Facial Artery and Vein across the mandibular border and over the face, detecting branches, but do not removing any muscles at this stage.

### Orbicularis oculi

Start by freeing the lateral, outer margin of this ‘horse shoe’ shaped muscle complex. In the process you will find branches of the **Facial Nerve** [Cn VII] supplying its motor innervation. You may trace some of these nerves back, through the Parotid, towards the ear.

There are two parts to **Orbicularis oculi**

- An outer, horseshoe shaped, coarser part, which originates from bone at the inner aspect of the orbit, loops around the whole eye, and reattaches to bone at the inner aspect again. When it contracts it ‘screws’ the eye shut. It is known as the **Orbicular part**.
- An inner, paler and finer part, which runs directly horizontally from the inner orbital margin, across the eyelids [both upper & lower] to the outer margin. It is rapid reacting and ‘blinks’ the eyelids when contracted. This is known as the **Palpebral part**.



### Orbicularis oris

Just deep to the lower margin of Orbicularis oculi [sometimes woven into it] are a series of four muscles, which act to raise the upper lip. This group is called the **Quadratus superioris (of the Orbicularis oris)**. They arise from the bone, medial to, below and lateral to the orbital margin. The individual muscles are (from medial to lateral):- **Levator labii superioris alaequae nasi**, **Levator labii superioris**, **Zygomaticus major & Zygomaticus minor**. Again, as you define these muscle fibers you will find Facial nerve branches, which may be traced back, through the Parotid gland towards the ear. Just deep to **Depressor anguli oris** [on the lower lip], and acting like an inverted version of Quadratus superioris, is **Depressor labii inferioris**. Both ‘depressor’ groups take origin from the External Oblique Line of the mandible (or its continuation).

The **Orbicularis oris muscle** itself is the next deepest layer and is continuous [through the **Modiolus**] with **Buccinator** muscle.

The deepest of all the muscles which give fibers that flow round the mouth opening is the **Levator anguli oris**. It takes its origin from a bony hollow [Canine fossa], on the maxilla, just below the **Infra orbital foramen**.

The final two groups of muscle associated with the complex are firstly **incisive slips**, little ‘roots’ which locate the sphincter to the jaw bones, close to the midline, and finally intrinsic fibers which hold the whole complex together, running through the lips from the skin lamina propria to the intra-oral submucosa.

## Facial Nerve Fibers

As you trace the Facial nerve fibers back towards the Tragus of the Ear define the outline of the **Parotid Salivary Gland**, find the **Parotid Duct** and any accessory gland tissue associated with the duct. The Facial nerve leaves the skull through the **Stylomastoid Foramen** and directly enters the deepest part of the gland. The nerve usually bifurcates immediately, often recombines and then rebranches, to give 5 named major facial distribution paths. The Parotid gland often seems to consist of a broader, flatter, superficial part [that spreads across the Masseter] and a deeper, narrower wedge, located in the “**Parotid Bed**”. Many of the Facial Nerves seem to exit in the plane between these two parts.

### Parotid Duct and Buccinator Muscle

The Parotid gland is a multi-lobed, tightly encapsulated structure, on and in which lymph nodes are located & through which the **Facial Nerve**, branches of the **Auriculotemporal nerve**, the **External Carotid** artery and **Retromandibular vein** run. Define the encapsulated outline of the Parotid. Locate the Parotid [Stenson’s] duct leaving the anterior edge of the gland. Define the anterior border of Masseter muscle and note that the duct turns round this edge and runs medially, through a mass of fat, towards the mouth. Remove the **Buccal Fat Pad** by simply picking away clumps of the adipocytes. This will reveal the **Buccinator** muscle which forms the mobile lateral wall of the cheek. The Parotid duct penetrates Buccinator muscle to enter the **Buccal Vestibule** of the mouth, opposite the upper second permanent molar in the adult. As you remove the fat it is likely that the **Deep Facial Vein** and branches of the **[Long] Buccal Nerve** will be defined. You will rapidly learn the difference between easily pulling out a clump of fat and the extra resistance of a nerve or blood vessel. Frequently there is some **accessory Parotid** glandular tissue sitting on the duct, just anterior to the main body of the gland. Histologically the **Parotid is a compound, tubulo-alveolar, merocrine gland**. It is the largest of the major salivary glands, produces a **serous secretion**, with a viscosity of about 1 [relative to water]. Under stimulated conditions it gives the greatest flow rates of the major glands. Under ‘resting’ conditions the **Submandibular gland** produces the most salivary flow.

### Danger Triangle of the Face

The Facial Vein is unusual in that it has a thicker wall than you would expect from a vessel of this size. When injured, most superficial veins will collapse. However, an injured facial vein may remain partially open, and as a result air may be ‘sucked’ into the vascular system. [Look up “air embolism”] Most veins have valves in them to ensure that the blood flow is unidirectional – towards the heart. The Facial vein has no valves, so blood may reflux.

The Facial vein connects, via several routes, to deeper veins. These deeper veins, in turn, communicate with the intracranial veins. For instance it is possible, when ‘picking’ a facial pimple, to release bacteria into the venous blood stream, which are carried to the Cavernous sinus at the base of the brain, where they settle and grow. [Look up “infective thrombophlebitis” and “cavernous sinus thrombosis”.]

#### CHECK LIST

Facial artery	Facial vein	Deep connections of Facial vein	
Orbicularis oculi	Orbicular part	Palpebral part	
Platysma muscle	[links into Orb oris] Sardonicus / Risorius		
Orbicularis oris [including the intrinsic fibers]	Depressor anguli oris [links to Sardonicus]		
	Quadratus superioris	Lev labii sup alaequae nasi	Lev labii superioris
		Zygomatic major	Zygomatic minor
	Depressor labii inferioris		Levator anguli oris
Incisive slips	Modiolus	Buccinator	
Parotid gland	Parotid duct	Accessory Parotid gland	
Facial nerve [branches]	Temporal	Zygomatic	Buccal
	Mandibular	Cervical	
Lymph nodes - parotid	Lymph nodes - buccal	Danger Triangle of Face	
Scalp	Occipito-Frontalis muscle	Epicranial Aponeurosis	

## The TRIGEMINAL NERVE // SCALP STRUCTURE

*Please see more details in Grant's Dissector (13e) – pp 156-157 for Scalp incisions*

**SCALP** – Define the 5 layers of the Scalp.

Make a cruciform series of incisions, over the skull vertex, with sagittal and coronal extensions. Extend the anterior sagittal cut forwards to the root of the nose.

*Please see more details in Grant's Dissector (13e) – pp 155-156 for Cn V outflow*

### TRIGEMINAL SENSORY OUTFLOW

#### ABOVE the ORBIT

- STRIP the FRONTALIS MUSCLE FORWARDS to where it INTERMIXES with the ORBICULAR PART of ORBICULARIS OCULI
- SEPARATE FRONTALIS MUSCLE from the PERICRANIAL PERIOSTEUM
- FIND the SUPRA ORBITAL & SUPRA TROCHLEAR BRANCHES of V<sub>a</sub>

#### BELOW the ORBIT

- DETACH QUADRATUS SUPERIORIS MUSCLES from the ORBITAL MARGIN & ZYGOMATIC BONE and FOLD DOWN
- EXPOSING V<sub>b</sub>, EXITING the INFRA ORBITAL FORAMEN, above LEVATOR ANGULI ORIS MUSCLE

#### IN THE MANDIBLE

- [WORKING FROM BELOW] DETACH PLATYSMA from the MANDIBLE
- DETACH DEPRESSOR ANGULI ORIS & DEP. LABII INFERIORIS from the EXTERNAL OBLIQUE LINE of the MANDIBLE and LIFT UP
- SO EXPOSING V<sub>c</sub>, EXITING FROM the MENTAL FORAMEN, between the PREMOLAR

### Scalp

Examine the cut edges of scalp in the midline. Separate the soft tissues to *define the five scalp layers*.

**S**kin **C**onnective tissue (subcutaneous) **A**poneurosis **L**oose connective tissue **P**ericranial periosteum

### Trigeminal Sensory Outflow

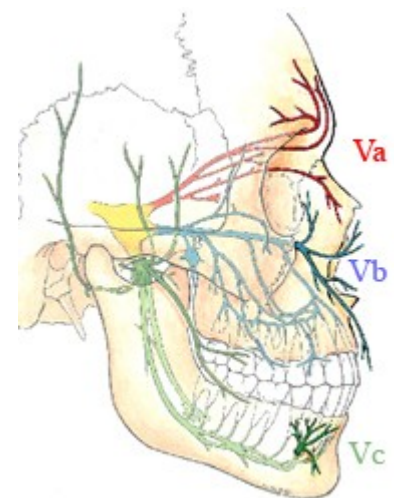
The sensory nerve to the face is Cranial nerve five [Cn V] – the **Trigeminal nerve**.

[*Tri* means three and *Geminal* means having the same genes – so this is the **Triplet nerve**.]

It has three main, *afferent* branches from the face; known as

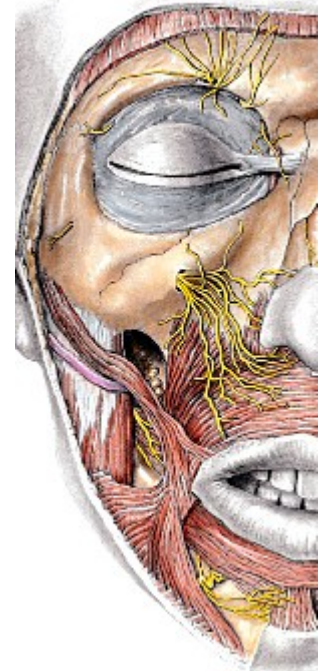
- **Ophthalmic** / V<sub>1</sub> / V<sub>a</sub> – via Frontal bone.
- **Maxillary** / V<sub>2</sub> / V<sub>b</sub> - via Maxillary bone.
- **Mandibular** / V<sub>3</sub> / V<sub>c</sub> - - via Mandibular bone.

These nerves enter/exit the bones through notches/foramina which are in a vertical line, one below the other.



### Dissection for Va

Dissect the whole of the Orbicularis oculi complex free of the eyelids and the fatty tissue in front of the **Orbital Septum**. Separate the **Frontalis Muscle** from the **Frontal Bone**. Notice that Frontalis muscle does not attach to bone directly. Its fibers interlace with those of Orbicularis oculi (which does attach to bone at the **Medial Canthus of the Orbit**) or it attaches to the Bridge of the Nose region through **Procerus Muscle**. Separate the Frontalis / Orbicularis muscle from the Periosteum round the superior orbital margin to find the **Supraorbital & Supratrochlear Neurovascular Bundles** [NVBs] exiting. These contain branches of the **Ophthalmic Division of the Trigeminal Nerve** [Cn Va] – the **Supraorbital, Supratrochlear & Infratrochlear** nerves - and of the **Ophthalmic Artery** [a terminal branch of the Internal Carotid artery].



### Dissection for Vb

Cut the Quadratus superioris muscles at their origins and fold downwards and forwards. This will reveal the whole of Levator Anguli Oris muscle in the canine fossa of the maxilla, with the **Infraorbital Foramen & its NVB** exiting the skull. These are branches of the **Maxillary Division of the Trigeminal Nerve** [Cn Vb] and the **Maxillary Artery** [the terminal branch of the External Carotid]. The **Infraorbital** nerve has **Inferior palpebral, Lateral nasal** and **Superior labial** branches.

### Dissection for Vc

Working from lower border of the lateral aspect of the mandible, detach Platysma muscle from the bone. Lift the sheet of muscle up and see the fairly delicate attachment of **Depressor anguli oris & Depressor labii inferioris** to the outer aspect of the body of the mandible (on a continuation of the External Oblique Line). The **Mental Foramen** will be seen, transmitting branches of the **Mandibular Division of the Trigeminal Nerve** [Cn Vc] and the **Inferior Alveolar Artery** [branch of Maxillary Artery].

### Dissection for Facial Vessels

Trace the branches of the **Facial Artery**, cutting muscles as necessary to follow the major branches. In particular you should follow the **Superior and Inferior Labial Arteries** and try to find the **Nasal Septal Artery** branching from the **Superior Labial**.

Follow the whole course of the Facial Vein. In particular try to find its deep connections. Look for a **Deep Facial Vein** [near the Parotid duct] which connects to the **Pterygoid Venous Plexus** and for deep connections to the **Ophthalmic Veins**, through the orbital septum. The Facial Vein is unusual in a number of respects. [See HNp6 to revise the detail.]

**TRIGEMINAL NERVE**

**OPHTHALMIC DIVISION**

**Supraorbital**

**Supratrochlear**

**Infratrochlear**

Lacrimal & Superior palpebral

**Nasal**

**MAXILLARY DIVISION**

**Infraorbital**

**Inferior palpebral**

    **Lateral Nasal**

    **Superior Labial**

**Zygomatic**

**Zygomatico-facial**

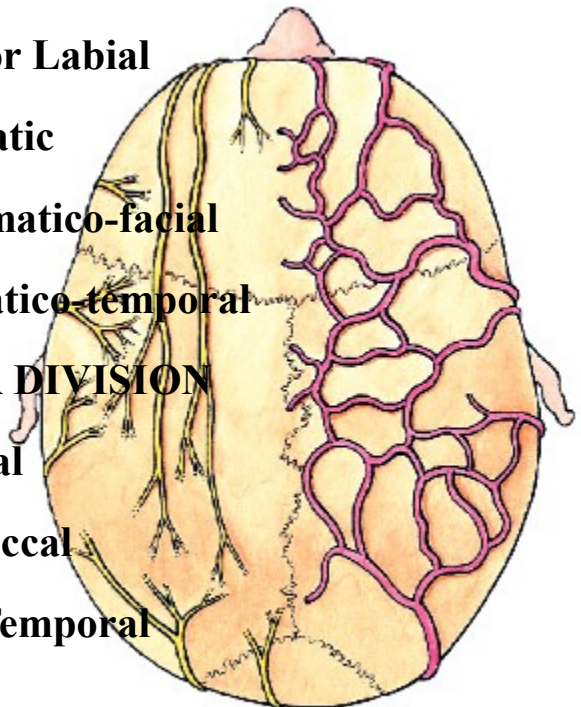
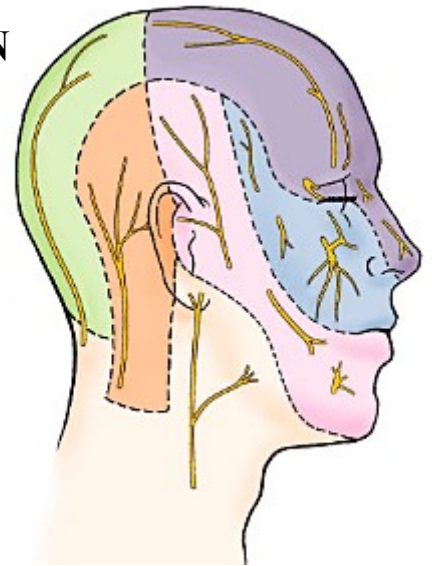
**Zygomatico-temporal**

**MANDIBULAR DIVISION**

**Mental**

**Long Buccal**

**Superficial Temporal**



**ARTERIES**

**OPHTHALMIC**

**Supratrochlear**

**Supraorbital**

**EXTERNAL CAROTID**

**Superficial Temporal**

**Posterior Auricular**

**Occipital**

### Dissection preparatory to Brain Removal

Remove the remaining skin from the rest of the scalp, back to the **Nuchal Lines**. In the process find the **Occipital Belly of Occipito-Frontalis**. Remember that the Frontalis muscle does not attach to bone directly, but intertwines with Orbicularis oculi. However, Occipitalis muscle does - this is why we can raise our eye brows and wrinkle our foreheads.

The Occipital Belly of the complex attaches to the **Occipital Bone** at the **Highest Nuchal Line**.

Strip all the scalp tissue off the cranial vault – to leave a clean expanse of **Calvarium** – except in the temporal region, where **Temporalis Muscle** should be retained, covered by the **Temporal Fascia**.

Remove the rest of the muscles from the remainder of the Occipital Bone and in the process expose the **Superior & Inferior Nuchal Lines** and the Posterior Margin of the Foramen Magnum.

The Superior Nuchal line gives origin to the **Trapezius muscle** [also to **SCM** & more deeply to **Splenius capitis**].

#### CHECK LIST

Facial artery	Superior & Inferior labial branches	Nasal septal branch	
Facial vein	Deep facial vein [Pterygoid plexus]	Ophthalmic vns [Cavernous sinus]	
Scalp layers	1 Skin	4 Loose tissue layer	
Diploic bone	2 Connective tissue	5 Pericranial periosteum	
Venous emissary foramina	3 Aponeurosis		
Trigeminal sensory outflow [Cn V]	Ophthalmic division – Va	Supraorbital notch/foramen	
	Maxillary division – Vb	Infraorbital foramen	
	Mandibular division – Vc	Mental foramen	
Va region	Orbicularis oculi	Frontalis muscle	Occipito-frontal aponeurosis
	Supraorbital NVB	Supratrochlear NVB	Terminal branches of Ophthalmic A
Vb region	Quadratus superioris	Canine fossa of Maxilla	Terminal brs of Maxillary Art
	Orbicularis oris complex forming upper lip muscles		– Modiolus – Buccinator muscle
Vc region	Platysma	Mental foramen	Alveolar process / Premolar teeth
	External oblique line of Mandible		Terminal branches of Inf Alv Art
Posterior skull	Nuchal lines	Trapezius muscle origins	

## PAROTID REGION // TEMPORALIS & MASSETER MUSCLES

*Please see more details in Grant's Dissector (13e) – pp 184-185 for Parotid region*

Follow this instruction set, but supplement with illustrations from the 'Dissector'.

- DEFINE DEEP FASCIA EXTENT and ZYGOMATIC ARCH
- DEMONSTRATE TEMPORALIS MUSCLE ORIGINS
- TEMPORAL FASCIA [Gillies approach to deep aspect of Zygomatic arch]
- TEMPORAL FOSSA
- PAROTID GLAND & DUCT – SUPERFICIAL DISSECTION
- DISSECT PAROTID BED, RETAINING FACIAL NERVE ROOT & PAROTID DUCT
- IDENTIFY RETROMANDIBULAR VEIN & EXTERNAL CAROTID Art + BRANCHES
- DISSECT MASSETER MUSCLE – ORIGINS and INSERTIONS

Study an isolated Mandible

### Temporal Fascia – Origin & Insertion

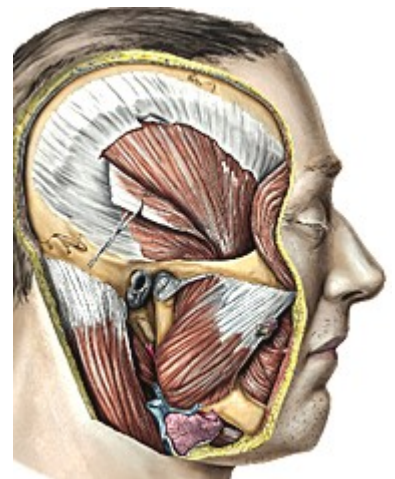
Having 'scalped' your cadaver you will be able to see the *Temporal Fascia* [an extension of the Deep Investing Fascia] covering *Temporalis muscle*. The fascia is inserted onto the *Superior Temporal Line* on the side of the skull and took its origin from the *Zygomatic Arch*.

### Temporalis Muscle

Cut the fascia along its attachment to the *Superior Temporal Line*. Then try to peel the fascia back down towards the Zygomatic arch. You will find that there are temporal muscle fibers attaching to the underside of the fascia – making the peeling process more difficult than expected. Stop peeling once you have seen this feature.

Temporalis is a bipennate muscle, the superficial fibers take origin from the under surface of the fascia, the deep fibers take origin from the bones of the *Temporal Fossa*. The superficial and deep fibers then converge on to a more central *tendon sheet*, which is offset towards the surface. The tendon takes its origin from the *Inferior Temporal Line*. [Both the Temporal Lines are technically linear traction epiphyses.]

Temporalis muscle is 'fan' shaped. The anterior fibers run vertically upwards. The posterior fibers run almost horizontally backwards. Temporalis inserts onto the *Coronoid Process* of the Mandible and a small area of the lateral ramus, adjacent to the Coronoid. The muscle also inserts onto a larger area of the inner aspect of the Coronoid and the anterior border of the ramus, down almost as far as the *Retromolar Triangle*. The (Long) Buccal nerve reaches the mouth supported by Temporalis fascia running down the anterior edge of ramus.



### Zygomatic fracture

A relatively common [simple] facial injury is a depressed fracture of the zygomatic arch, which interferes with the free movement of the Coronoid process of the mandible in normal jaw movements. The surgery to elevate the bone is quite simple – and one which competent house surgeons may be allowed to do – using a tool just like a small tire lever.

## Temporal Fossa

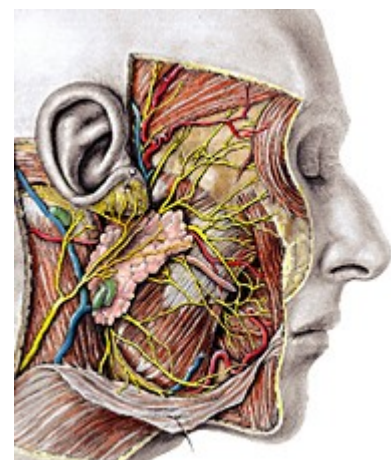
Strip the muscle from the bony hollow at the side of the head and cut it off level with the top of the zygomatic arch. The hollow is the Temporal Fossa.

## Parotid Gland & Duct – Superficial Dissection

Cut the **Parotid Duct** just as it leaves the gland and fold it forward. Detach the remains of the superficial Parotid Gland from the surface of Masseter Muscle and carefully clean up the muscle surface. Remove gland tissue, trying to retain the Facial Nerve fibers, many of which run in the ‘interface’ between the superficial and deep parotid parts. If you still have **Great Auricular** nerve fibers present, try to preserve them also.

## Parotid Bed

Finally dissect the deep Parotid. The base of the parotid bed is formed from the deep leaf of the investing fascia which encapsulated the gland. That fascia attached to the posterior border of the ramus of the mandible, the Styloid and Mastoid Processes. The fascia extending from the mandibular angle to the Styloid is thickened and called the **Stylo-Mandibular Ligament** [although it is not technically a ligament]. Continue to remove gland tissue, trying to retain the important structures which ran through the gland – **External Carotid Artery** and its terminal branches – **Maxillary Artery & Superficial Temporal Artery** the **Retromandibular Vein** and **Roots of the Facial Nerve**. Forming the floor of the parotid bed, deep to the fascia are **Stylohyoid & Posterior Belly of Digastric Muscles**. Deep to these is the **Buccopharyngeal Fascia**. The Parotid Bed is limited posteriorly by the Mastoid Process [Temporal bone]. This is a longer, more tedious process than the length of this paragraph would suggest.



## Masseter muscle

The muscle may be divided into at least two parts. A larger, more superficial part, whose fibers run obliquely upwards and forwards, and a deeper part with vertically directed fibers, mostly covered by the oblique part (except postero-superiorly). The muscle inserts into almost all of the lateral aspect of the mandibular ramus. The oblique fibers originate from the lower border of the anterior two thirds of the Zygomatic arch. The vertical fibers originate from the inner aspect of the arch and from the lower border of the posterior third of the arch.



The nerve supply to the muscle and some of its blood supply come from the **Infratemporal Fossa**, via the **Mandibular Notch**. Try to identify these as you dissect the superficial part of the muscle. Detach the superficial part of Masseter muscle from the lower border, angle & lower part of the posterior border of the ramus and lift the muscle mass upwards and forwards. In most cases there should be a natural plane of separation between this and the deeper muscle part.

Look for the main vessel and nerve passing through the deep Masseter into the underside of the superficial part that you are elevating. Look for accessory vessels entering the muscle from the External Carotid. Detach the nerve and vessels from the Superficial Masseter, continue freeing the muscle and detach it from its origin on the Zygomatic Arch.

Free the nerve & vessels passing through the deep Masseter from any attachments to the muscle and then remove the muscle. You should now be able to see the insertion of Temporalis muscle onto the Coronoid Process of the Mandible, the tissue encapsulating the TMJ and some parts of **Lateral Pterygoid Muscle** inserting into the joint disk and **Pterygoid fovea**. On the inner aspect of the mandible the **Medial pterygoid muscle** forms a mirror image mass of muscle that balances that of the Masseter on the outside. You should be just aware of this muscle when detaching Masseter.

### CHECK LIST

Zygomatic arch	Deep fascia	Masseter muscle	Temporalis fascia
Temporal lines	Temporal fossa	Temporalis muscle	Coronoid process
Condylar process	Mandibular Ramus	Mandibular angle	Mandibular notch
Retromolar triangle	Parotid fascia	Parotid duct	Parotid gland
Stylomandibular lig.	Great Auricular nerve	Facial nerve root	Stylomastoid foramen
Retromandibular vein	External Carotid art	Maxillary artery	Superficial temporal a
Medial Pterygoid m	Buccopharyngeal fascia	Stylohyoid muscle	Digastric muscle
Lateral Pterygoid m	Infratemporal fossa	Nerve to Masseter [Vc]	Temporomandibular jnt.

## REMOVAL of the BRAIN

*Please see Grant's Dissector (13e) – pp 158-160 for overview*  
*Please see Grant's Dissector (13e) – pp 161-163 for details of Brain removal*

- REMOVE CALVARIUM
- REMOVE OCCIPITAL BONE WEDGE
- EXAMINE MENINGES
- EXPOSE FOURTH VENTRICLE & REMOVE PART OF CEREBELLUM
- DETACH FALX & TENTORIUM
- SECTION the INFUNDIBULUM & CRANIAL NERVES
- REMOVE BRAIN

### Catch-up

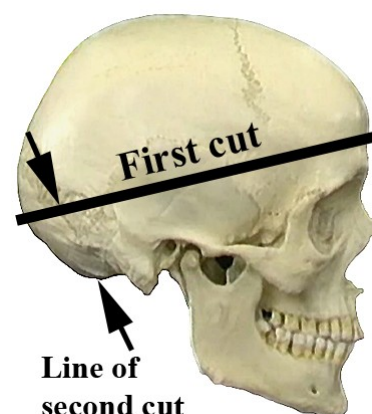
At the end of Practical 7 you should have “Stripped all the scalp tissue off the cranial vault – to leave a clean expanse of *Calvarium*”. You should also have removed all of the rest of the muscles from the remainder of the *Occipital bone* and exposed the posterior margin of the *Foramen Magnum*. If you have not reached this stage you MUST catch-up now!

### Removal of Calvarium

In order to get good access, to be able to remove the brain, the Calvarium should be cut [sawn] off. The bone is cut using an oscillating blade power saw. This type of saw is very much safer than conventional rotary blade saws, or even a jig saw. However, it is still possible to cause injury with them – so exercise sensible precautions please when using them.

You are strongly advised to wear eye protection when cutting bone!  
 There are 2 saw cuts to be made [figs 7.17, 7.18 & 7.19 in dissector, (13e)]

1. The first cut will have been made for you (by the Demonstrators) just to save time. Please carefully inspect the skull bones to try to identify *Venous Emissary Foramina*. What is the clinical significance of these holes?
2. You have to make the second cut. It runs from where the *Lambdoid suture* intersects the first cut, through the Occipital bone, to the lateral margin of the *Foramen magnum*.  
 If in any doubt get your Demonstrator to set up your the first use.



### Brain Membranes – Examine the Meninges

The brain is contained [wrapped] in 3 sets of membranes, called the *Meninges*.

- The *Dura mater* is the tough outer membrane consisting of two sheets. An outer, periosteal layer and an inner, protective coat round the brain. *It is the only membrane to be innervated and vascular.*
- The *Arachnoid mater* is the intermediate zone. It is attached to the inner aspect of the Dura and sends fine ‘spidery’ strands to link to the innermost layer. With these strands it forms a real space – the *Subarachnoid space* – through which the *Cerebro Spinal Fluid* [CSF] circulates. The Arachnoid forms projections – *Arachnoid Granulations* - that penetrate the Dura, to lie within cranial venous sinuses [especially the *Superior Sagittal*] and through which CSF can drain into the vascular system.

These two outer layers cover the brain in a general sort of way.

- The ***Pia mater*** is an inner, delicate wrapping, which closely follows every subtle change of the brain surface contour. Covering ***Gyri*** and dipping into the ***Sulci***. It also accompanies blood vessels as they enter/leave the brain tissue.

### **Dura – demonstrate the 2 layers of the dura.**

- The outer layer forming the ***Pericranial Periosteum*** on the inside of the skull
- The two layers splitting to form the ***Cranial Venous Sinuses***
- The inner layer ‘wrapping’ the brain
- Folds of the inner layer forming a double sheet to give extra support – e.g. ***Falx, Tentorium***

### **Arachnoid – demonstrate the Subarachnoid space.**

- See the spidery filaments of Arachnoid coming from the under surface of Dura to the Pia
- Be aware that the Arachnoid ‘crosses’ from ***Gyrus*** to ***Gyrus*** so that the space is accentuated in the Sulcular regions

### **Pia – see the delicate membrane following the brain surface.**

This membrane faithfully [piously] follows the brain contour, from gyrus crest to sulcal depth.

## **Removal of the Brain**

It is important to detach the dural sheets that hold the brain in position, to cut the arteries and then to section the nerve roots [and pituitary stalk], so that the delicate nerve tissue can be removed atraumatically.

### **CHECK LIST**

Calvarium	Post vertebral muscle	Venous emissary for.	Diploic bone
Frontal bone	Parietal bone	Occipital bone	Lambdoid suture
Meninges	Dura mater	Arachnoid mater	Pia mater
Falx cerebri	Tentorium cerebelli	Falx cerebelli	Sagittal sinus
Foramen magnum	Cerebral gyrus	Cerebral sulcus	Cerebro-spinal fluid
Arachnoid granulations	Lateral lakes	Cerebral arteries	Vertebral arteries
Pituitary stalk	Cranial nerves I to XII	Cranial venous sinuses	Cerebellum
Mid brain	Pons	Brain stem	Ventricles
Choroid plexus	Frontal lobe	Temporal lobe	Occipital lobe

## DISSECTION of the CRANIAL FOSSAE

*Please see Grant's Dissector (13e) – pp 164-168 for details*

There are 3 Cranial Fossae – Anterior, Middle & Posterior.

- EXAMINE the ANTERIOR CRANIAL FOSSA + CRIBRIFORM ETHMOID
- EXAMINE the MIDDLE CRANIAL and PITUITARY FOSSAE
  - DISSECT the TRIGEMINAL CAVE
  - INVESTIGATE the PETROSAL and CAVERNOUS VENOUS SINUSES
  - LOOK FOR the GREATER & LESSER PETROSAL NERVES
- EXAMINE the POSTERIOR CRANIAL FOSSA
- DISSECT the POSTERIOR CRANIAL FOSSA and JUGULAR FORAMEN

Please ensure that you understand the venous circulation in the *Dural Sinuses* and where and how these communicate with the veins draining the face. In particular revise the *Danger Triangle of the Face* and find out about the *Pterygoid Venous Plexus*.

Make a point of identifying the *Greater Petrosal Nerve* and the *Lesser Petrosal Nerve* because these provide a pre-ganglionic, parasympathetic, secretomotor nerve supply to many glandular structures in

### Anterior Cranial Fossa

This fossa is formed largely from the orbital plate of the *Frontal bone*, but with a significant contribution from the *Ethmoid [Crista gali & Cribriform plates]* bone and the *Lesser wing of the Sphenoid bone*.

Cranial nerve I – the *Olfactory* – is a short, bipolar nerve, located in the nasal mucosa, whose axon passes through the cribriform ethmoid to communicate with [synapse in] the *Olfactory Bulb*. Second order neurones pass back from here to the brain via the *Olfactory tracts*.

Cranial nerve II – the *Optic* – leaves the skull via the Optic canal, a tunnel (in the root of the lesser wing of Sphenoid) that opens into the Orbit. This nerve is in the interface between anterior and middle cranial fossae.

### Middle Cranial Fossa

The middle cranial fossa is formed mainly from the *Sphenoid bone [Body & Greater wing]* and the Temporal bone [*Petrous part*]. *Pterion* is located in the upper lateral part of this fossa. Make sure that you know the significance of *extradural haemorrhage*. The *Middle Meningeal artery* [a branch of the Maxillary] enters the skull in the middle fossa, via the *Foramen spinosum*. The *Internal Carotid arteries* enter the skull in the middle fossa and give rise to their three terminal branches – *Ophthalmic artery* plus *Anterior cerebral & Middle cerebral arteries*.

This fossa contains the Cranial Nerves II, III, IV, V and VI. It is considered to be the most important for Dental students. Note that the point at which a cranial nerve penetrates the dura may be at a considerable distance from the point at which it leaves the skull. This is particularly true for Cns III, IV, V & VI. The *Abducens nerve* actually penetrates the dura in the Posterior Cranial fossa, crosses the whole of the Middle Cranial fossa within the dura of the *Cavernous sinus*, before exiting into the Orbit.

The Trigeminal [Triplet] nerve is hugely important in Dentistry. It is the main sensory nerve of the face region, through all 3 divisions [Va, Vb & Vc]. It is also the motor nerve to the “**Muscles of Mastication**”, through the Mandibular division only [Vc]. As the Trigeminal nerve enters the **Trigeminal Cave** the Sensory and Motor roots are separate. The motor root does not fuse with the sensory Vc until it passes through the **Foramen ovale**.

## Greater & Lesser Petrosal Nerves

These nerves lie within the **Periosteal layer of the Dura**.

The **Greater Petrosal** is the more medial of the two. It emerges from a groove in the Petrous Temporal bone, located lateral to the Trigeminal Cave, runs below the Trigeminal Ganglion, across the **Foramen Lacerum** [which is NOT a hole in the ‘wet’ skull] to the **Pterygoid Canal**. It contains parasympathetic fibres mostly derived from **Cn VII** [Facial].

The **Lesser Petrosal** is situated antero-lateral to the Greater Petrosal; runs parallel to it, to exit the skull via the **Foramen ovale**, along with Vc and the Trigeminal motor root. It contains parasympathetic fibres mostly derived from **Cn IX** [Glossopharyngeal]. Thus 3 separate structures leave via F. ovale.

A couple of structures enter the skull via F. ovale. These are

- Recurrent meningeal nerves [from Vc] to supply the dura and
- Accessory meningeal arteries.

## Cavernous sinus

The **Cavernous Sinus** connects with the external venous system via **Superior & Inferior Ophthalmic Veins** and [through the Inferior Orbital Fissure] with the **Pterygoid Venous Plexus**.

The Internal Carotid Artery and Cn VI run through the Cavernous sinus. Cranial nerves III, IV, Va, & Vb run on the surface of the sinus [below its dural covering].

## Posterior Cranial Fossa

This fossa is formed by the **Temporal** and **Occipital bones**. It is located below the **Tentorium cerebelli**.

It contains the midline **Foramen magnum** and the left and right **Jugular foramina**. With great economy of design the Jugular foramen is formed by two bones; on the lateral aspect by the **Temporal bone**, and by the **Occipital** on the medial side. The **Deep Petrosal** and **Sigmoid sinuses** become confluent at the Jugular foramen, to form the **Internal Jugular vein**.

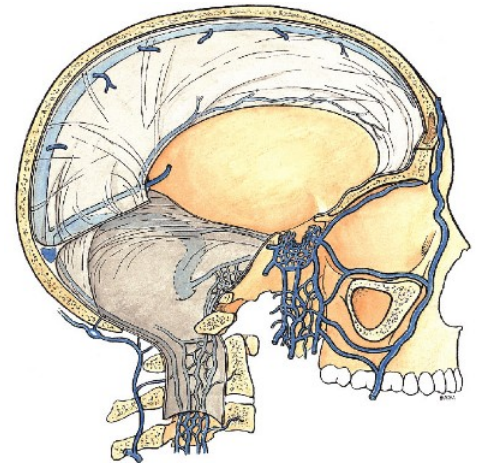
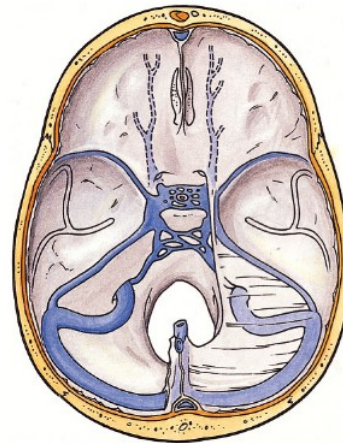
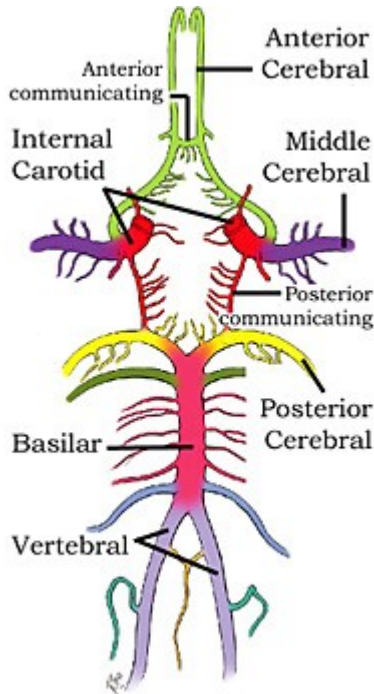
The posterior cranial fossa transmits six cranial nerves.

- Cns VII & VIII, which leave the skull via the **Internal Acoustic meatus**.
- Cranial nerves IX, X & XI, which leave the skull through the **Jugular foramen**. Cn XI leaves the skull on the Temporal bone side of the foramen, often separated by the Deep Petrosal sinus, from Cns X & XI which leave on the Occipital bone side of the Jugular foramen.
- Cn XII leaves the skull via the **Anterior Condylar canal** [Hypoglossal canal] in the Occipital bone.

## CRANIAL VESSELS

### Circle of Willis – Arterial inflow

The Vertebral arteries [L & R] enter the skull via the Foramen magnum. These quickly combine to form the unpaired, **Basilar artery**. This terminates as the left & right **Posterior Cerebral arteries**, which in turn communicate with the cerebral branches of the **Internal Carotid arteries**. The whole complex of communicating arteries is known as the **Arterial Circle of Willis**. [dissector fig 7.26]



### Venous Drainage

In general venous blood from inside the skull drains from anterior to posterior, and from above downwards. Almost all blood leaves via the jugular foramina, but smaller amounts leaving via accessory canals [e.g. posterior Condylar canals, Emissary foramina or via a venous plexus round the Spinal cord, which exits through the Foramen magnum].

Identify the below listed venous sinuses on these diagrams. Also dissector fig 7.24.

### CHECK LIST

Cranial fossae:-	Anterior fossa	Middle fossa	Posterior fossa
Orbital plate of Frontal	Cribriform ethmoid	Crista gali	Lessr wing of Sphenoid
Olfactory bulb	Olfactory tract	Foramen caecum	Optic canal
Sphenoid bone	Body of Sphenoid	Pituitary fossa	Clinoid processes
Gt wing of Sphenoid	Superior Orbital fissure	Foramen rotundum	Foramen ovale
Foramen spinosum	Pterion	Middle meningeal art	Foramen lacerum
Int acoustic meatus	Jugular foramen	Hypoglossal canal	Spinal Accessory nerve
Vertebral artery	Basilar artery	Internal Carotid artery	Ophthalmic artery
Anterior Cerebral art	Ant Communicating a	Middle Cerebral artery	Post Communicating a
Posterior Cerebral art	Cavernous sinus	Petrosal sinuses	Sigmoid sinus
Transverse sinus	Straight sinus	Inf Sagittal sinus	Sup Sagittal sinus
Great Cerebral vein	Cranial nerves I to XII	Great Petrosal nerve	Lesser Petrosal nerve

## **DISSECT ORBITS 1 [Anterior approach]**

*Please see more details in Grant's Dissector (13e) – pp 168-171 + 173*

FOLLOW THIS GUIDE PLEASE, but DO read the General Remarks in the Dissector.

- SKIN the EYELIDS - DISSECT PALPEBRAL PART of ORBICULARIS OCULI
- DEFINE TARSUS of UPPER LID
- DETACH LATERAL PALPEBRAL LIGAMENTS and FOLD LIDS MEDIALY
- DISSECT MEDIAL CANTHUS of EYE – FIND LACRIMAL SAC / CANALICULI
- DEFINE the ORBITAL SEPTUM
- FIND ANTERIOR PART of the LACRIMAL GLAND
- DEFINE the INFERIOR OBLIQUE MUSCLE ORIGIN in FLOOR of ORBIT
- DEFINE the TROCHLEA and SUPERIOR OBLIQUE MUSCLE
- FREE the SUPRATROCHLEAR & SUPRAORBITAL NVBs from the FRONTAL BONE

PREPARE FOR ORBIT 2 DISSECTION

- REMOVE THE SUPERIOR ORBITAL MARGIN [Lat to the TROCHLEA but above the LATERAL PALPEBRAL LIGAMENT]

### **Eyelid Muscles – Palpebral part of Orbicularis Oculi**

The *Palpebral* muscles are responsible for blinking. They are very fast acting. When they contract the eyelids are flicked shut. The muscles have tendinous attachments to the inside of the orbital margins, both laterally and medially. On the medial aspect, the muscle attachments are both in front of and behind the *lacrima sac*. Thus each time we blink the lacrimal sac is squeezed by the muscle action and any tears within it are expelled to the nose. Also, due to the action of the *orbicular part*, any excess of tears on the eye surface will be wiped across the eyeball to be drained [SUCKED] into the lacrimal sac.

### **Detach the Eyelid**

Cut the lateral *Palpebral ligament* and fold the eyelid medially. If your dissection has been done carefully you will also have to cut the *conjunctival reflection* in the *fornix* to mobilise the eyelid. This will expose the anterior part of the eyeball. The conjunctiva is a mucous membrane which lines the inside of the eyelid and the outer, white surface of the eye. The *Palpebral* conjunctiva is continuous with the *Scleral* conjunctiva at the *fornix* – so forming the conjunctival sac. The exposed anterior part of the eyeball is made of a central transparent, curved part – the *Cornea* and a less curved, peripheral, tough, white fibrous part – the *Sclera*. The cornea is not covered in conjunctiva. [See eye histology for details of covering cells.]

At the medial canthus of the eye dissect the Palpebral ligament attachment region to find the *lacrima sac* and to see the relationship of the sac to the ligaments. Try to find the *Lacrima Punctum* in each lid [rel easy], and if possible trace the *Lacrima Canaliculus* from the Punctum to the sac [difficult].

## Eyelid Skeleton

Each eyelid is supported by a piece of [non-ossified] flexible connective tissue, acting as a skeleton – called the **Tarsus**. Find this when you reflect the eyelid. The upper lid has a special muscle, dedicated to lifting it up – to open the eye. This muscle, the **Levator palpebrae superioris**, fans out into the connective tissue of the whole eyelid, as well as attaching to the tarsus. Levator palpebrae superioris is an unusual muscle, because it is made up of both striated (voluntary) muscle and also involuntary, smooth muscle. The lower eyelid only has a few strands of opening muscle in it, running from the tarsus to the epimycium of the **Inferior rectus**.

## Eyelid Glands

The eyelid has glands opening onto its free edge. Embedded in the tarsus are modified sebaceous glands, the **Tarsal glands**, which produce a hydrophobic [waxy] secretion, which stops tears from spilling from the eye at normal secretion rates. More superficially located in the eyelids are the eyelashes [**Cilia**]. Associated with these are **Ciliary glands**, whose function is to produce a secretion that protects and maintains the eyelashes in good condition. It is also a water repellent secretion.

## Orbital Septum

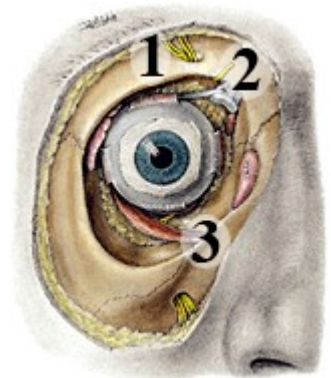
Within the orbit there are **7 extra-ocular muscles**. Six of these ‘steer’ the eyeball, the remaining one lifts the upper eyelid. All of these muscles have a fibrous sheath [Epimycium], which not only helps to link the muscle to its target [eye ball or eyelid], but which also spreads laterally to attach to the orbital margins – just like deep fascia. This sheet of muscle sheath derived connective tissue forms a boundary that separates the orbital contents from the face. It is known as the **Orbital septum** or **Diaphragm**. Between the skin and the orbital septum there are subcutaneous fat deposits. Remove these fatty deposits to find that the superficial part of the **Lacrimal gland** projects in front of the septum; the deep part is behind the septum.

Some authorities also claim that these muscle sheaths may combine to form a suspensory ligament, which acts like a hammock, to support the eyeball within the orbit. This may be clinically relevant, helping to explain why, in some types of facial fracture, the eyeball does not drop as far as expected when the orbital floor is fractured.

## Orbital Muscles

Remove the orbital septum by picking away the connective tissue, to expose the structural fat which supports the eyeball. With very little further dissection you will be able to demonstrate 3 of the 7 orbital muscles.

1. Inserting into the tarsus and connective tissue of the upper lid is **Levator palpebrae superioris**.
2. In the uppermost, medial corner of the orbit is a pulley-like structure: the **Trochlea**. Running through this pulley [and changing the muscle direction] is the **Superior oblique muscle**.
3. On the under side of the eyeball, lateral to the mid-orbital diameter, is the transversely placed **Inferior oblique muscle**. It has no pulley associated with it.



**Preparation for Orbit 2 dissection****Remove the Upper Orbital Margin & Roof of the Orbit**

1. Saw through the superior orbital margin and remains of the Frontal bone, lateral to the trochlea. Take care not to damage Superior oblique muscle or the Supratrochlear / Supraorbital NVBs.
2. Saw through the lateral orbital margin, above the attachment of the lateral palpebral ligament.
3. Free the supraorbital NVB of any bony containment.
4. Break this piece of bone off.
5. Break away the roof of the orbit to reveal the orbital contents contained within its periorbital fascia.

**CHECK LIST**

Orbicularis oculi	Orbicular part	Palpebral part	Palpebral ligaments
Palpebral conjunctiva	Scleral conjunctiva	Conjunctival fornix / Conjunctival sac	
Lacrimal punctum	Lacrimal canaliculus	Plica semilunaris	Lacrimal caruncle
Lacrimal sac	Orbital sclera	Cornea	Orbital septum
Lacrimal gland	Levator palpebrae sup m	Tarsus	Tarsal glands
Eyelashes [Cilia]	Ciliary glands	Trochlea	Superior oblique muscle
Inferior oblique muscle	Periorbital/structural fat	Suspensory ligament	

## **DISSECT ORBITS 2 [Superior approach]**

*Please see more details in Grant's Dissector (13e) – pp 171-173*

- DEFINE the SUPERIOR OBLIQUE MUSCLE and TROCHLEAR NERVE
- DISSECT the UPPER ORBITAL CONTENTS and LACRIMAL GLAND
- REMOVE the LATERAL ORBITAL WALL & upper part of ZYGOMA
- DETACH LATERAL RECTUS MUSCLE from EYEBALL & NOTE ABDUCENT NERVE
- FIND CILIARY GANGLION in a network of fine fibres BETWEEN NASOCILIARY NERVE & INF. DIVISION of OCCULOMOTOR NERVES
- At this stage REMOVE THE EYE for DISSECTION
- SEE the CENTRAL ARTERY of the RETINA [Concept of “End artery”]
- FIND the FACIAL VEIN, communicating with the OPHTHALMIC VEIN at the MEDIAL ANGLE of the ORBIT
- FIND the NASOCILIARY [Ethmoidal], FRONTAL & LACRIMAL ARTERIES branching

### **Upper Orbital Contents**

If the anterior cranial fossa floor was removed carefully the orbital contents will be found to be contained in a connective tissue cone [the *Periorbita*], with all the spaces inside the cone and between the orbital contents filled by structural fat. Precise, three dimensional, vision requires the eye-balls and extra ocular muscles to be accurately located in a vibration free environment. This is what the bone of the orbits plus the structural fat supplies.

Remove the lesser Wing of Sphenoid, to expose the *Superior Orbital Fissure*. Break open the *Optic Canal*. Open into the Periorbita and expose the upper orbital contents.

Without having to remove any fat you should be able to identify the *Superior Oblique muscle* [SO] and the *Trochlear nerve*. Medial to these you should see the *Ethmoidal branches of the Nasociliary* crossing into the nose. The *Frontal nerve*, dividing into *Supraorbital & Supratrochlear* branches lies just below the periorbita and can be traced back to *Trigeminal Va* in the middle cranial fossa. In tracing the Frontal nerve back to the middle fossa you should also find the *Lacrimal nerve*.

Remove, using forceps, fine lobules of fatty tissue to expose the superiorly positioned muscles. The first of these is *Levator Palpebrae Superioris* [LPS], which lifts the upper eyelid. This muscle is special in that it contains both striated and smooth muscle. Frightened people look wide eyed because the sympathetic nervous system causes the smooth muscle in Levator palpebrae to maximally open the eyes. Divide the muscle anteriorly and fold back. Immediately below LPS is the *Superior rectus muscle* [SR]. Divide the muscle anteriorly and fold back. The voluntary motor supply to these two muscles is the *Superior division of Oculomotor* [Cn III], which you should be able to see.

With the LPS & SR muscles folded back and more fat removed you will be able to see more detail of the Superior oblique muscle and also find *Medial rectus* [MR] and *Lateral rectus* [LR] muscles. All of the extra-ocular muscles, except *Inferior oblique* take origin from [or very close to] a tough fibrous cuff, the *Anulus tendinous*, which encircles the *Optic canal* and the medial part of the *Superior orbital fissure*.

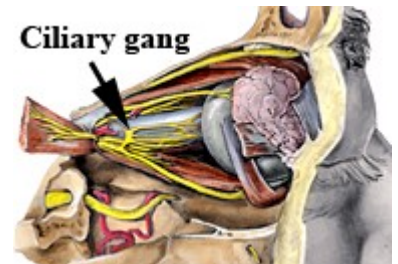
## Lateral Orbital Contents

Remove the lateral wall of the orbit [Greater wing of Sphenoid], including the upper part of the Malar [Zygomatic] bone.

Detach **Lateral rectus muscle** [LR] and fold back to reveal the **Abducens nerve** [Cn VI] applied to the inner surface of the muscle.

Carefully pick away more of the fat to see all the nerves entering the orbit (named from lateral to medial), either through the Superior orbital fissure [Lacrimal, Frontal & Trochlear] or through the Anulus [Superior division of Occulomotor, Nasociliary, Inferior division of Occulomotor & Abducens].

The **Ciliary ganglion**, the synapse site of the parasympathetic outflow of of Cn III, is located far back in the orbit, in a fine network of fibers, located between the Nasociliary nerve [Cn Va] and the Inferior division of the Occulomotor [Cn III]. If you carefully pick away the fat globules the ganglion is what will remain.



## The Eyeball

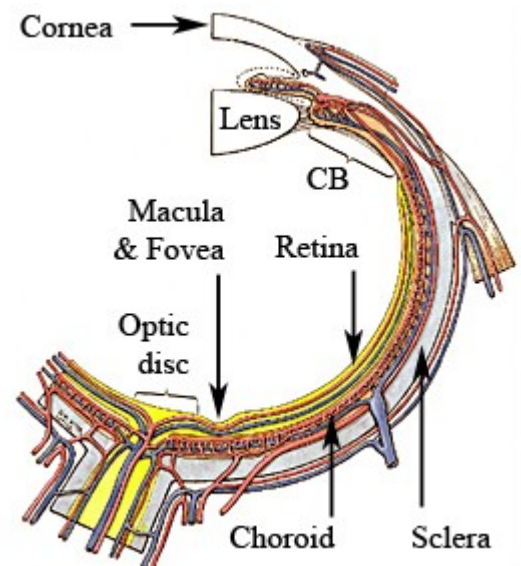
Remove the eye for dissection, leaving a stump of Optic nerve attached. Identify the **Central artery of the Retina**. Understand what is ment by the term **end artery**.

[More dissection info on pp303-304.]

Open the eye in an anteroposterior vertical plane [using a new (sharp) scalpel blade] and identify the two main chambers and the two [solid] light refractive tissues [cornea + lens]. Inspect the **Cornea** [one sixth of the whole globe] and **Lens** [look out for a replaced lens]. Look for the three discrete layers that make up the outer coat of the other five sixths of the eye ball [sclera, cornea & retina].

Find the ciliary body, the suspensory capsule of the lens, the iris, the iridocorneal angle and perhaps the trabecular network [between which the pressureised fluid in the anterior eye chamber drains away to the venous system (canal of Schlemm)].

We used to be able to supply fresh bovid eyes for you to dissect, but, due to the slight dangers of vCJD this is no longer possible.



## Vascular elements in the Orbit

Look for the Facial vein communicating with the **Superior Ophthalmic vein** at the anterior, medial corner of the orbit. Try to trace the ophthalmic vein back, via the superior orbital fissure, to the **Cavernous sinus**.

The ophthalmic artery is one of the three terminal branches if the **Internal Carotid artery**. The ophthalmic artery supplies the anterior, superior parts of the internal nose via the **Ethmoidal arteries**, also the forehead, up to the vertex, via the **Frontal** and **Supratrochlear arteries**. Part of the external nose is supplied by **Infratrochlear arteries**.

## CHECK LIST

Superior oblique musc	Trochlea [pulley]	Cn IV - Trochlear	Ethmoidal NVBs
Cn Va - Frontal nerve	Supraorbital NVB	Supratrochlear NVB	Cn Va - Lacrimal nerve
Lev Palpebrae sup m	Superior rectus muscle	Cn III – Sup division	Cn Va – Nasociliary n
Ophthalmic artery	Medial rectus muscle	Lateral rectus muscle	Cn VI – Abducens n
Long & Short Ciliary n	Cn III – Inf division	Ciliary gang [Cn III]	Inferior rectus muscle
Cn II - Optic nerve	Central artery of Retina	Anulus tendinious	Superior orbital fissure
Ophthalmic veins	Lacrimal gland	Sclera	Cornea
Anterior chamber	Iris	Aqueous humour	Posterior chamber
Vitreous humour	Optic disk	Fovea centralis	Macula lutea
Retina	Ciliary body	Choroid	The Periorbita