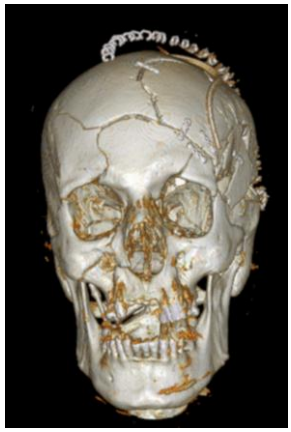
Learning Outcomes

- The Mandible
  - Surface Anatomy
  - Muscle Attachments
- The Floor of the Mouth (FOM)
  - Muscles of the FOM
- The Tongue
  - Muscles of the Tongue
- The Submandibular Region
  - Submandibular Gland
  - Sublingual Gland
  - Lingual Nerve
- The Head & Neck Parasympathetics



Submandibular Region

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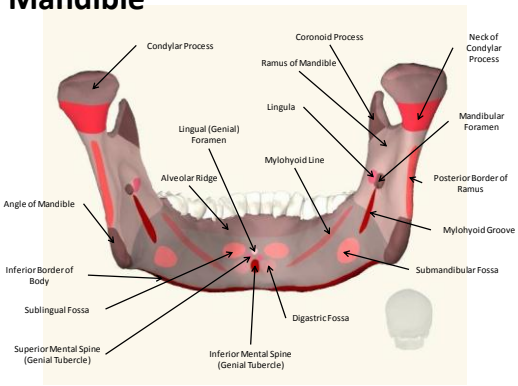
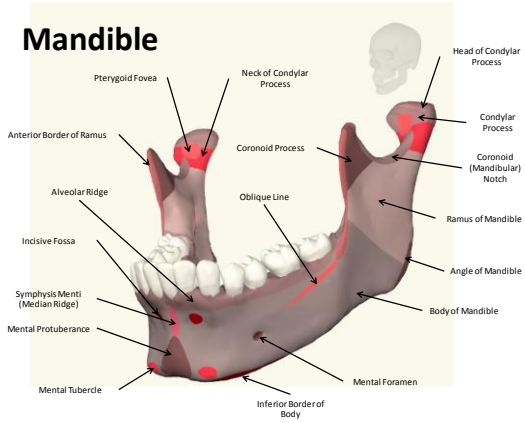
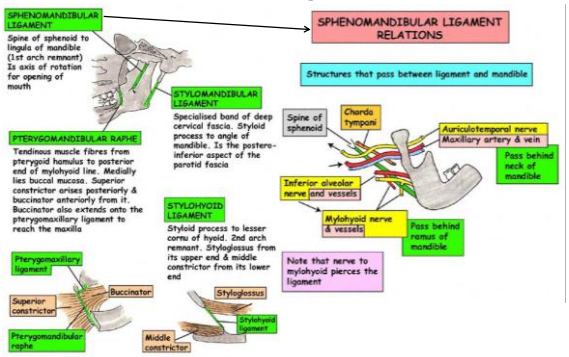
Mandible



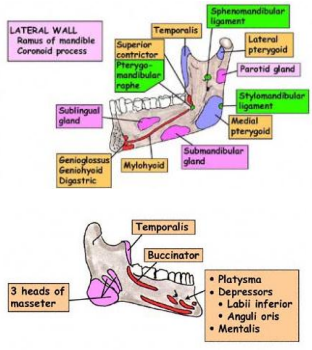
Mandible



Mandible Ligaments



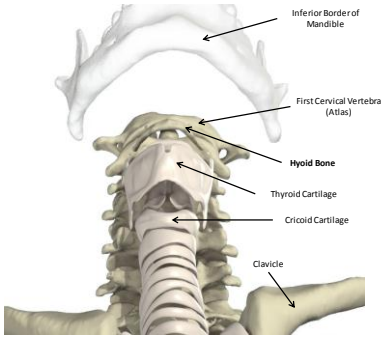
Muscle Attachments



The mental tubercle (a raised prominence at the mental symphysis) is a point of muscular attachment. The external surface of the ramus is covered by the attachment of the masseter muscle. On the inner surface of the body of the mandible, there is a horizontal mylohyoid line, which attaches the mylohyoid muscle. Above it, there is a shallow depression for the sublingual salivary gland and below it a deeper depression for the submandibular gland. At the anterior ends of the mylohyoid lines and superior to them, near the symphysis, there is the genial tubercles. Geniohyoid and Genioglossus attach here. The inner surface of the mandibular ramus is where the medial pterygoid muscle attaches. The sphenomandibular ligament attaches to the lingula (and superiorly to the sphenoid spine).

The coronoid process is a triangular protuberance from the anterosuperior surface of the ramus. The temporalis muscle attaches here, predominantly on the deep surface. The condylar process is one of the important attachments for the lateral pterygoid muscle.

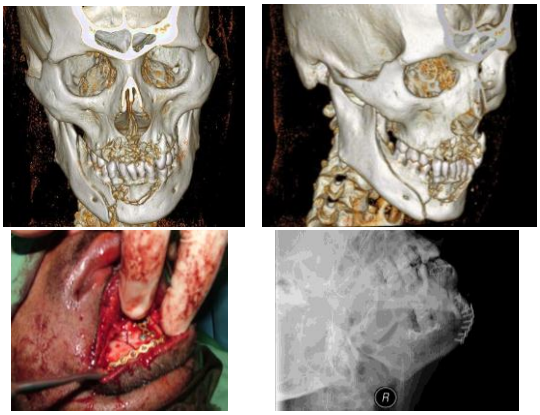
Floor of the Mouth



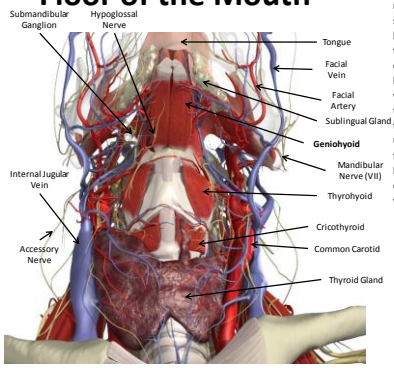
The **hyoid bone** is situated at the level of the third cervical vertebra and is suspended from the styloid processes of the temporal bones by the stylohyoid ligaments. The bone is horseshoe-shaped and consists of a central body spanning the midline, with greater and lesser horns on each side.

Muscles attached to the hyoid bone are: genio-glossus, genio-hyoid, hyo-glossus, chondro-glossus, middle constrictor of the pharynx, mylo-hyoid, omo-hyoid, sterno-hyoid, stylo-hyoid, thyro-hyoid and the levator of the thyroid gland.

Ligaments attached to the hyoid bone are: stylo-hyoid ligaments, thyro-hyoid membrane, hyo-epiglottic ligament, lateral thyro-hyoid ligaments and the median thyro-hyoid ligament.

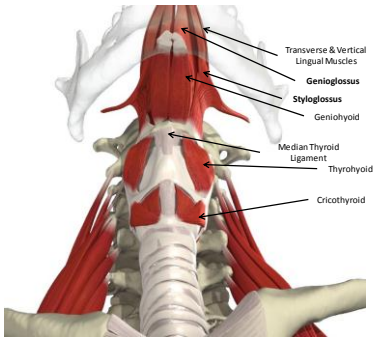


Floor of the Mouth



The **geniohyoid** muscle originates from the inferior genial tubercle, found on the back of the symphysis menti of the mandible, the mental spine of the mandible. It passes backwards and slightly downwards to insert onto the anterior surface on the body of the hyoid bone's body. The innervation is shared with the thyrohyoid muscle, namely the first cervical spinal nerve traveling with the hypoglossal nerve. The blood supply is derived from the lingual artery (sublingual branch). The geniohyoid muscle elevates the hyoid bone and is a weak depressor of the mandible.

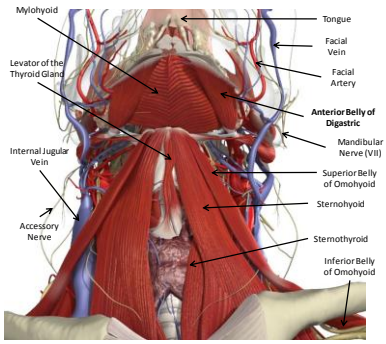
Floor of the Mouth



Genioglossus lies anteriorly near the median plane. It originates from the superior genial tubercle (mental spine) on the mandible. It fans out into the substance of the tongue. The superior fibers of the genioglossus muscle pass upwards and anteriorly towards the tip of the tongue. Genioglossus receives its motor innervation from the hypoglossal nerve. The lingual artery and the submental branch of the facial artery supply this muscle. The genioglossus muscle is a protractor and depressor of the tongue.

Styloglossus arises from the tip of the styloid process and the stylomandibular ligament. The longitudinal & oblique parts of the muscle blend with the inferior longitudinal muscle of the tongue. It continues forwards towards the tip of the tongue. It is supplied by the hypoglossal nerve. The sublingual branch of the lingual artery supplies the muscle. Styloglossus retracts and elevates the tongue.

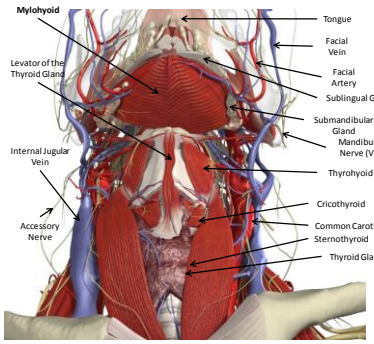
Floor of the Mouth



The **digastric** muscle consists of an anterior belly and a posterior belly connected by an intermediate tendon. The **anterior belly** is attached to the digastric fossa on the inferior border of the mandible. It runs downwards and backwards to the digastric tendon. It develops from the first branchial arch and so receives its motor supply from the mandibular division of the trigeminal nerve. It receives its blood supply from the submental branch of the facial artery. The **posterior belly** arises from the mastoid (digastric) notch behind the mastoid process. The posterior belly passes to the hyoid bone where it becomes the intermediate digastric tendon. The posterior belly of the digastric develops from the second branchial; hence its innervation is derived from the the facial nerve. Its arterial blood supply is from the posterior auricular and occipital arteries.

The digastric muscle is involved in maintaining the stability of the hyoid bone and helps to raise the hyoid bone and the base of the tongue, but its prime function is to assist in depressing and retracting the mandible.

Floor of the Mouth



The **mylohyoid** muscle arises from the mylohyoid line of the mandible. The anterior fibers of the mylohyoid muscle interdigitate with the corresponding fibers on the opposite side to form a median raphe. This raphe is attached above to the symphysis menti of the mandible and below to the anterior surface of the hyoid bone. The mylohyoid branch of the mandibular division of the trigeminal nerve supplies the muscle. The mylohyoid muscle receives its arterial supply from the sublingual branch of the lingual artery, the maxillary artery, the mylohyoid branch of the inferior alveolar artery, and the submental branch of the facial artery. It raises the floor of the mouth during the first stages of swallowing and helps to depress the mandible when the hyoid bone is fixed. Conversely, it aids in elevation of the hyoid bone .

Nerve Supply to the Tongue

TONGUE - SENSATION & TASTE

SUMMARY OF NERVE SUPPLY TO TONGUE

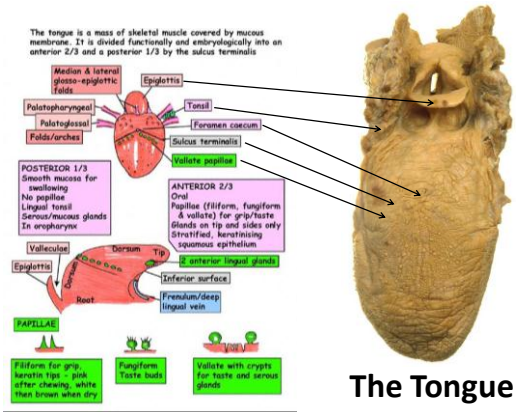
	SOMATIC SENSATION	TASTE	SECRETOMOTOR
ANTERIOR 2/3	Lingual (Vc)	Chorda tympani (VII)	Chorda tympani (VII) (anterior lingual glands)
POSTERIOR 1/3 + vallate papillae	Glosso-pharyngeal (IX)	Glosso-pharyngeal (IX)	Glosso-pharyngeal (IX)
VALLECULAE	Glosso-pharyngeal (IX)	Internal branch of superior laryngeal nerve (X)	Glosso-pharyngeal (IX)

Note: Sympathetic supply to tongue is from superior cervical ganglion via lingual artery

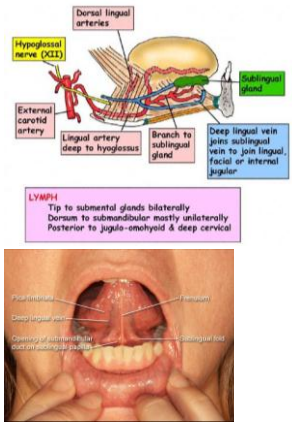
TONGUE - MUSCLES

Hyoglossus
Hypoglossal nerve (XII)
Genioglossus
Hypoglossal nerve (XII)
Styloglossus
Hypoglossal nerve (XII)
Palatoglossus
Pharyngeal plexus (IX, X & sympathetic)
Intrinsic muscles
Superior/inferior longitudinal, transverse & vertical
Not attached to bone
Hypoglossal nerve (XII)

Note: All muscles are supplied by hypoglossal nerve except palatoglossus



The Tongue

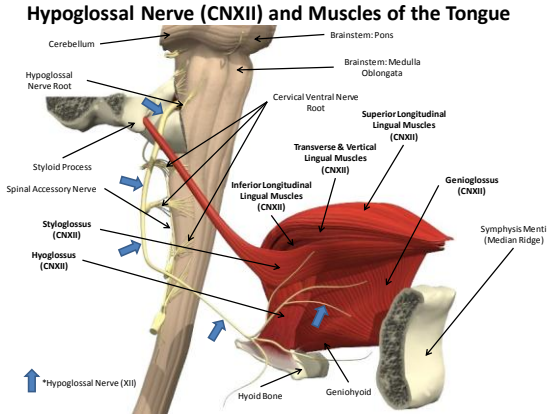


Lingual Artery

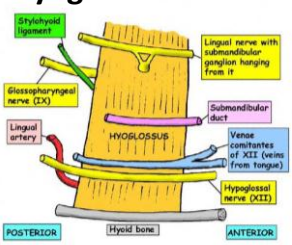
The lingual artery is the main blood supply of the tongue, arising from the external carotid artery and coursing deep to hyoglossus. It branches extensively within the tongue. When resecting the tongue haemorrhage is more marked in the posterior region. Hence laser surgery or diathermy techniques are preferred.

Venous drainage is by the lingual vein (superficial to hyoglossus), draining to the internal jugular vein. The lingual veins may be seen easily on the underside of the tongue, running just beneath the mucosa. These veins tend to become more prominent with age.

Hypoglossal Nerve (CNXII) and Muscles of the Tongue



Hyoglossus

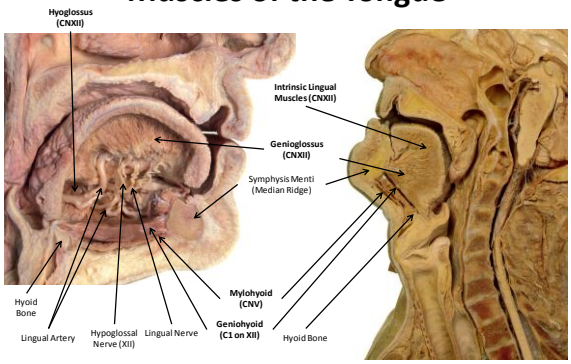


- The mylohyoid muscle (not shown) overlaps the anterior edge of hyoglossus
- Hyoglossus is supplied by the hypoglossal nerve as are all the muscles of the tongue except palatoglossus (pharyngeal plexus)
- Further anteriorly, under the mylohyoid, the lingual nerve passes lateral to the submandibular duct, then dips under it to appear on its medial side to enter the tongue
- The venae comitantes of the hypoglossal nerve pass posteriorly to join the facial vein

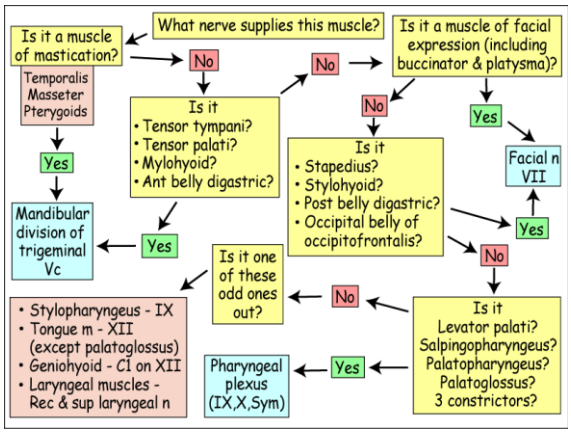
The hyoglossus is a thin, quadrilateral muscle, which provides an important landmark in the floor of the mouth. It originates from the superior border of the greater horn of the hyoid bone. A part of the muscle is attached to the base of the lesser horn of the hyoid bone and has been called 'chondroglossus'. At its origin, the hyoglossus muscle is separated from the attachment of the middle constrictor muscle of the pharynx by the lingual artery. It passes vertically upwards to insert into the side of the tongue. The hypoglossal nerve supplies the hyoglossus muscle. The sublingual branch of the lingual artery and the submental branch of the facial artery supply hyoglossus. Hyoglossus depresses the tongue.

The submandibular duct and lingual nerve crosses hyoglossus as it forms the floor of the submandibular fossa. It is a key landmark in submandibular gland surgery.

Muscles of the Tongue



All Muscles of:	Are supplied by:	Except:	Which is/are supplied instead by:
Pharynx	Pharyngeal plexus (IX, X, symp)	Stylopharyngeus	Glossopharyngeal (IX)
		Cricopharyngeus	Recurrent laryngeal
Palate	Pharyngeal plexus	Tensor palati	Off n to med pterygoid (Vc)
Tongue	Hypoglossal (XII)	Palatoglossus	Pharyngeal plexus
Mastication	Mandibular (Vc)	Buccinator	Facial (VII)
Larynx	Recurrent laryngeal (X)	Cricothyroid	Ext br of superior laryngeal (X)
Facial expression & buccinator	Facial (VII)	Levator palpebrae superioris	Oculomotor (III) & sympathetic
Eye	Oculomotor (III)	Superior oblique	Trochlear (IV)
		Lateral rectus	Abducent (VI)
Strap group	Ansa cervicalis	Thyrohyoid	C1 fibres on hypoglossal



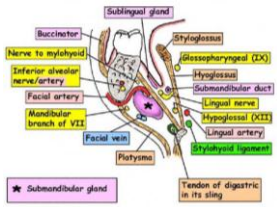
Sublingual Gland

When saliva is retained or is extravasated into the adjacent tissues, mucocoeles (salivary cysts) appear. In the floor of the mouth they are called a ranula because they look like the belly of a frog.

Excessive salivation (sialorrhoea) may appear in patients who have little lip control such as stroke patients or by parasympathetic stimulation. Conversely, sympathetic stimulation such as in the fight or flight response or by sympatheticomimetic drugs such as hyosine (used in motion sickness) causes a dry mouth.

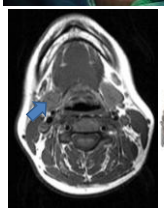
Sublingual Gland

- Mucous gland
- Between mylohyoid and genioglossus
- 15 ducts - 1/2 into submandibular duct
  1/2 into sublingual fold
- Nerve supply - secretomotor via submandibular ganglion
  general sensation via lingual (Vc)
- Blood supply - Lingual artery & branches of submental artery
- Develops from a groove in floor of mouth that becomes a tunnel
  Blind end proliferates (ectodermal) to give secreting acini
- (Note: all salivary glands develop from epithelial lining of mouth)



The paired sublingual glands are about twice the size of an almond. They are mainly mucous and have over a dozen ducts, half of which open into the submandibular gland and half of which open into the sublingual papilla directly.

It lies in front of the anterior border of hyoglossus, between mylohyoid and genioglossus and makes a superficial depression in the mandible.

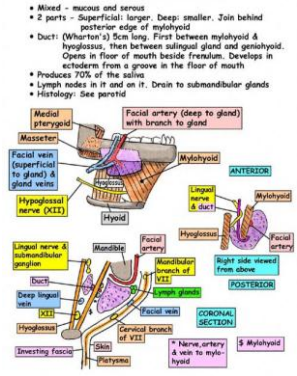


Submandibular Gland

The submandibular gland is subject to all the diseases of the salivary glands including stones that form by precipitation on epithelial debris. They are not always calcific and so do not always appear on radiographs. However, sialography, when a dye is introduced into the gland, will reveal any blockage.

The incision for removal of the gland must also be at least one finger's breath inferior to the lower border of the mandible to avoid damage to the mandibular branch of the facial nerve. Having incised platysma, the facial veins are the next obstacle. They are usually ligated and cut. Occasionally the facial artery requires ligation. It is important to tie off both ends securely as the artery can bleed from both points due to multiple anastomoses along its length. Finally care must be taken to identify the duct correctly and avoid damage to the lingual nerve. It is extremely important to identify the duct correctly before cutting it, because severing the lingual nerve will cause parasthesia of the anterior two thirds of the tongue which may not fully recover.

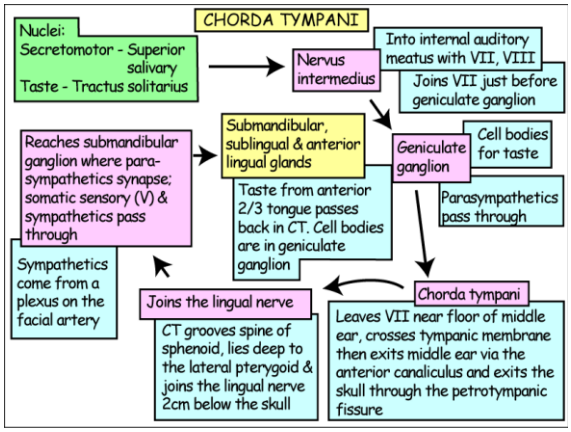
Submandibular Gland

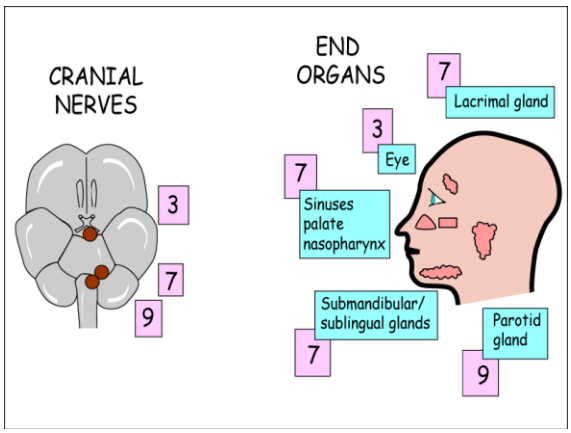


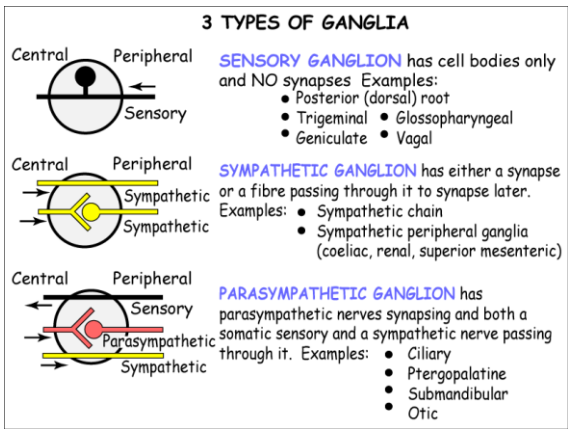
The submandibular gland is irregularly shaped and about 2 x 3 x 3 cm in size. The gland consists of a larger superficial part and a smaller deep part. The two are continuous as they wrap around the posterior free edge of the mylohyoid muscle. The submandibular gland extends anteriorly as far as the anterior belly of the digastric and posteriorly as far as the stylomandibular ligament. Laterally, it lies within the submandibular fossa on the medial surface of the mandible. The submandibular (Wharton's) duct is 4 to 5 cm long. It leaves the deep part of the gland, runs anteriorly on the surface of hyoglossus (and deep to the mylohyoid), and terminates at the sublingual papilla in the floor of the mouth. The submandibular duct is accompanied by the lingual nerve the external surface of hyoglossus. The lingual nerve is crossed by the duct superiorly on its way into the hyoglossus, hence the rhyme:

The lingual nerve takes a swerve,
Around the hyoglossus,
Says Wharton's duct to the nerve,
"I think I'm going to cross it!"

The Parasympathetic Ganglia in the Head



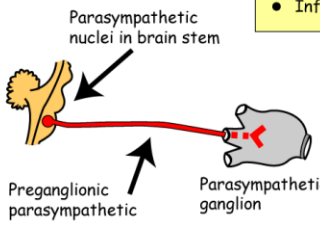


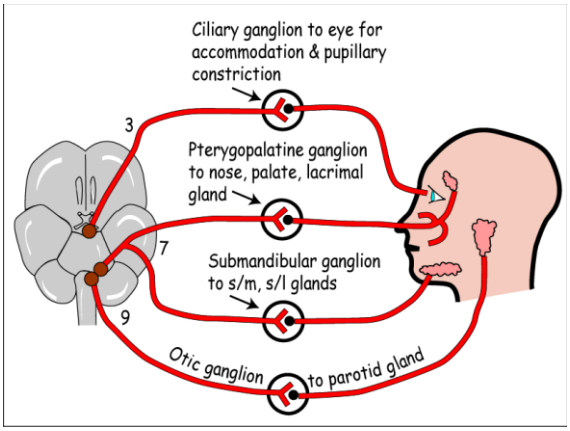


PATTERN OF PARASYMPATHETICS IN HEAD

All the parasympathetic nuclei for the head are in the brain stem and are associated with cranial nerves 3, 7 & 9.
The nuclei are:

- Edinger Westphal (III)
- Superior salivary (VII)
- Inferior salivary (IX)

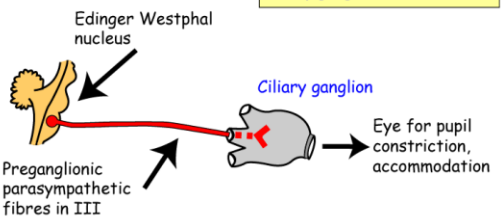




PATTERN OF PARASYMPATHETICS IN HEAD

Edinger Westphal nucleus (III)

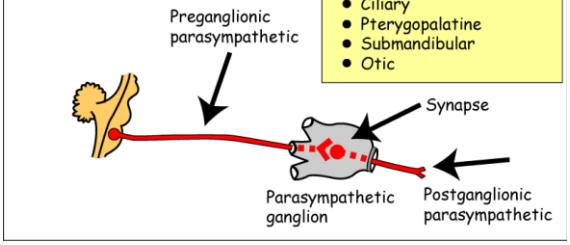
From this nucleus parasympathetic fibres travel with III, into its branch to the inferior oblique muscle to reach the ciliary ganglion



PATTERN OF PARASYMPATHETICS IN HEAD

Unlike somatic nerves, all parasympathetic nerves have two neurones :- pre- and post-ganglionic with a synapse between the two. The vast majority of the synapses in the head are in one of 4 ganglia:

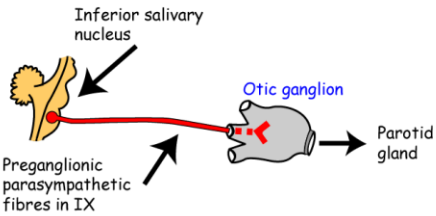
- Ciliary
- Pterygopalatine
- Submandibular
- Otic



PATTERN OF PARASYMPATHETICS IN HEAD

Inferior salivary nucleus (IX)

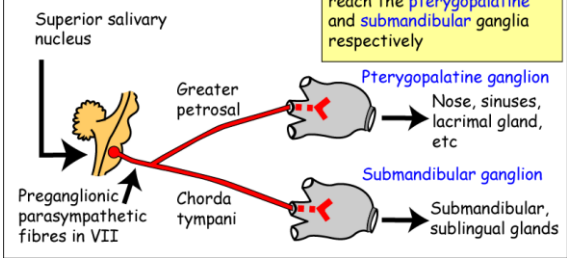
From this nucleus parasympathetic fibres travel with lesser petrosal nerve to reach the otic ganglion

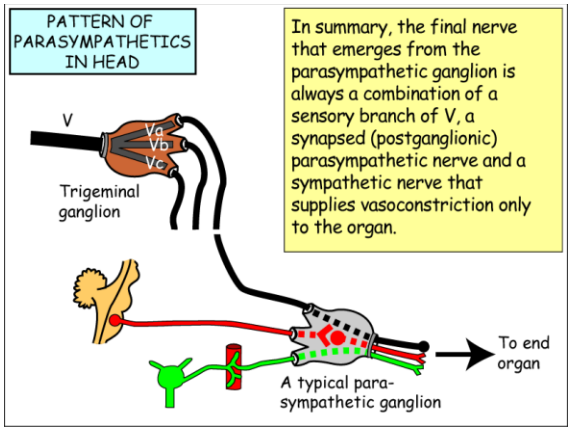


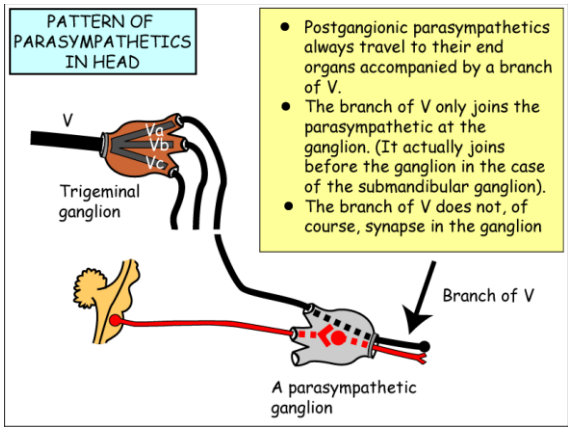
PATTERN OF PARASYMPATHETICS IN HEAD

Superior salivary nucleus (VII)

From this nucleus parasympathetic fibres travel with greater petrosal nerve and chorda tympani to reach the pterygopalatine and submandibular ganglia respectively



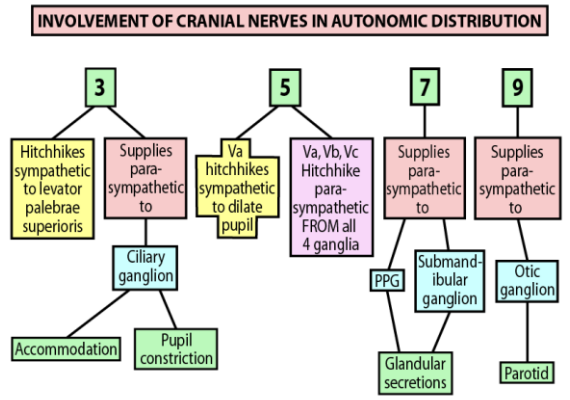




PARASYMPATHETIC PATHWAYS

Cranial nerve	Central nucleus	Nerve carrying preganglionic fibres	Pathway & foramen	Site of ganglion	Name of ganglion	Nerve carrying postganglionic fibres	Organ supplied
3	Edinger-Westphal (mid brain)	III via nerve to inferior oblique	Cavernous sinus to SOF to orbit	Between optic n & lat rectus in apex of orbit	Ciliary	Nasociliary & short ciliary (Va)	Ciliary muscle for accommodation. Circular muscle for pupil constriction
7	Superior salivary (pons)	NI to VII to gtr petrosal to n of pterygoid canal	IAM to middle ear to MCF to pterygoid canal	Pterygo-palatine fossa	Pterygo-palatine	Maxillary brs (Vb) Zygomaticotemporal to lacrimal (Va)	Mucosal glands of nose/nasopharynx soft palate. Lacrimal gland
7		NI toVII to to chorda tympani to lingual n	IAM to middle ear to petro tympanic fissure to ITF	Below lingual n on hyoglossus	Sub-mandibular	Lingual (Vc)	Submandibular, sublingual & ant lingual salivary glands
9	Inferior salivary (medulla)	IX to tympanic br to lssr petrosal	Middle ear to MCF to f ovale	Below f ovale on n to tensor tympani/palati	Otic	Auriculo-temporal (Vc)	Parotid salivary gland
9		Pharyngeal & Laryngeal brs	Direct to oropharynx & post 1/3 tongue	In relevant mucosa			Mucous glands of oropharynx & post 1/3 tongue
10	Dorsal motor (medulla)	X (vagus)	Cardiac brs in neck. Thorax & abdomen	On target organs			Viscera of thorax & abdomen down to transverse colon

SOF = Superior orbital fissure IAM = Internal auditory meatus
NI = Nervus intermedius ITF = Infratemporal fossa MCF = Middle cranial fossa



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