# **Cranial nerves**

# **Organization of the nervous system**

#### 1. Central Nervous System (CNS)

- a. Brain
- b. Spinal cord

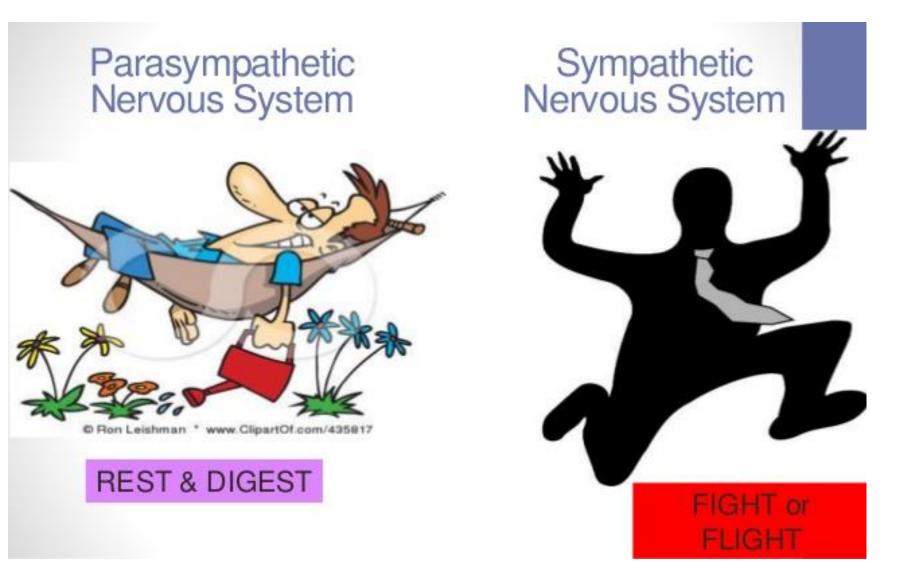
# 2. Peripheral Nervous System (PNS)

- a. Peripheral nerves
- b. Ganglia

# The **peripheral nervous system** is subdivided into the

Somatic nervous system		Autonomous (vegetative) nervous system	
<ul> <li>Sensory:</li> <li>General:</li> <li>Tactile</li> <li>Pain</li> <li>Pressure</li> <li>Vibration</li> <li>Temperature</li> <li>Specific:</li> <li>Vision</li> <li>Hearing</li> <li>Smell</li> <li>Taste</li> <li>Equilibrium</li> </ul>	Motor: - Striated skeletal muscles	<ul> <li>Parasympathetic:</li> <li>Smooth muscles of internal organs</li> <li>Exocrine glands</li> </ul>	<ul> <li>Sympathetic:</li> <li>Smooth muscles of the blood vessels</li> <li>Piloerector (erector muscles of hairs)</li> <li>Sweat glands</li> </ul>

### **Effects of the ANS**



#### **Functional classification of the ANS**

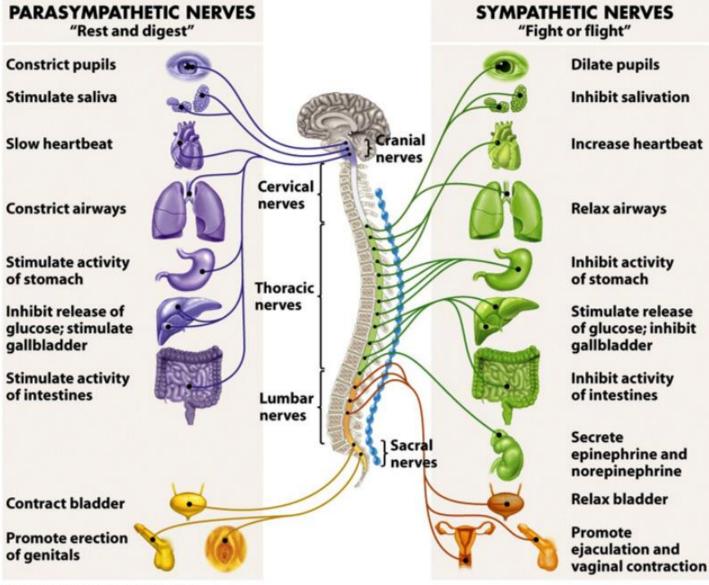
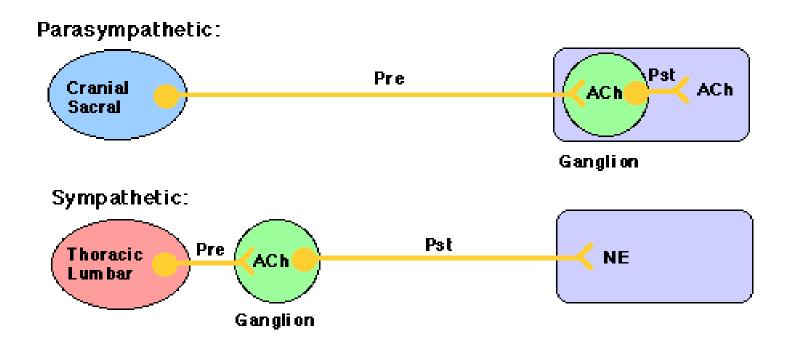


Figure 45-20 Biological Science, 2/e © 2005 Pearson Prentice Hall, Inc.

# The Autonomic Nervous System (ANS) Controls the Body's Internal Environment in a Coordinated Manner

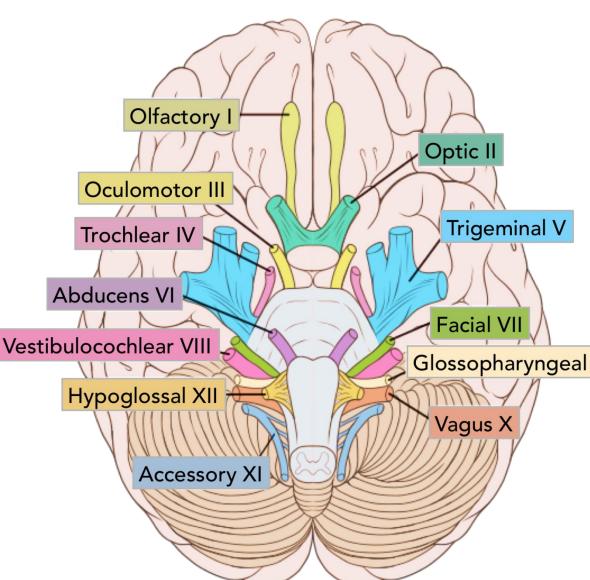
 In the ANS there are 2 nerves between the central nervous system (CNS) and the organ. The nerve cell bodies for the second nerve are organized into ganglia:



# Cranial Nerves Contain Sensory, Motor and Parasympathetic Fibers

# **There are 12 Pairs of Cranial Nerves**

- The 12 pairs of cranial nerves emerge mainly from the ventral surface of the brain
- Most attach to the medulla, pons or midbrain
- They leave the brain through various fissures and foramina of the skull



# **Consequence of the answer**

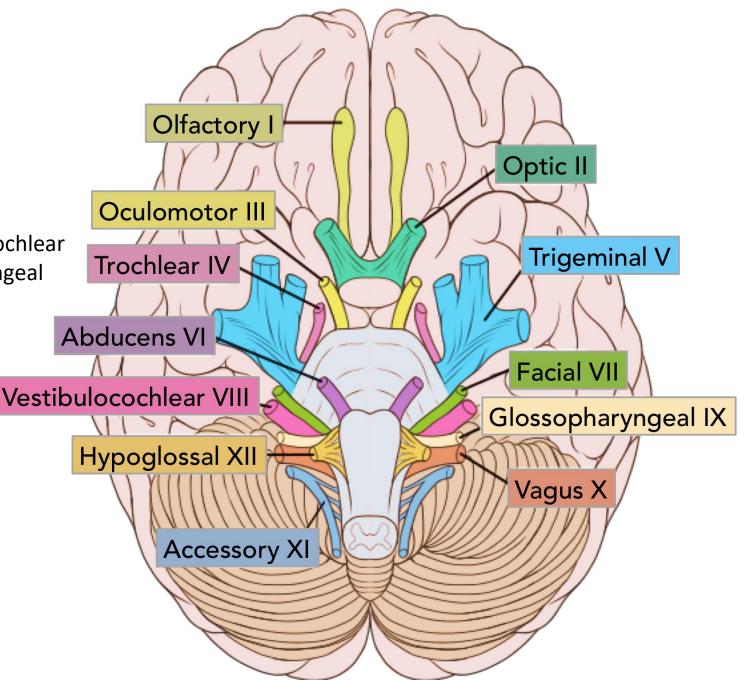
# 1. Name of the cranial nerve (English and Latin), number.

- 2. Nature (sensory, motor, parasympathetic, mixed).
- 3. Nuclei: names, projection to the brain (on rhomboid fossa), nature.
- 4. Emerge from the brain, where they leave the skull.
- 5. Passes of the nerves
- 6. Region of the innervation.

#### **Cranial nerves:**



- II **O**ptic
- III Oculomotor
- IV **T**rochlear
- V **T**rigeminal
- VI Abducens
- VII **F**acial
- $\mathsf{VIII}-\mathbf{V}estobulocochlear}$
- IX Glossopharyngeal
- X Vagus
- XI Accessory
- $\mathsf{XII}-\mathbf{H}\mathsf{ypoglossal}$



# Memory devices for learning the names of the 12 Cranial Nerves

- <u>On</u> <u>O</u>ld <u>O</u>lympus's <u>Towering</u> <u>Tops</u> <u>A</u> <u>F</u>inn <u>A</u>nd <u>German</u> <u>V</u>iewed <u>Some</u> <u>H</u>ops
- <u>Oh</u>, <u>Oh</u>, <u>Oh</u>, <u>To</u> <u>Touch</u> <u>And</u> <u>Feel</u> <u>Very</u> <u>Good</u>
   <u>V</u>elvet, <u>AH</u>!
- The first letters (bold) match up with the first letters of the cranial nerves (for the second phrase use Vestibulocochlear instead of Auditory and plain Accessory instead of Spinal Accessory)

# **Consequence of the answer**

- 1. Name of the cranial nerve (English and Latin), number.
- 2. Nature (sensory, motor, parasympathetic, mixed).
- 3. Nuclei: names, projection to the brain (on rhomboid fossa), nature.
- 4. Emerge from the brain, where they leave the skull.
- 5. Passes of the nerves
- 6. Region of the innervation.

Cranial Nerves Mediate 5 Special Senses: Smell, Vision, Hearing, Taste, Equilibrium

- Smell: nerve *I (Olfactory)*
- Vision: nerve *II (Optic)*
- Hearing: nerve VIII (Auditory part)
- Equilibrium: nerve VIII (Vestibular part)
- Taste: nerves VII, IX, X (minor) (Facial, Glossopharyngeal, Vagus)

# Most of the Nerves Carry Somatic (Skin & Muscle) Sense

- **The trigeminal (V)** is the sensory nerve for the face
- The nerves which are primarily motor also have fibers for muscle sense (proprioception): III, IV, VI, VII, XI, XII

# Three Nerves Are Concerned With Eyeball Movements

- Oculomotor (III): superior rectus, medial rectus, inferior rectus, inferior oblique
- Trochlear (IV): superior oblique
- Abducens (VI): lateral rectus

## Several of the Nerves Innervate Other Skeletal Muscles

- *The Facial nerve (VII)* controls the muscles of facial expression
- The Spinal accessory (XI) stimulates the trapezius and sternocleidomastoid muscles
- Chewing muscles (masseter, temporalis) are innervated by the *Trigeminal (V)*
- Speech muscles (larynx) are under control of the Vagus (X)
- The Hypoglossal (XII) moves the tongue

# CRANIAL





<u>O</u>n Occasion Our Trusty Truck Acts Funny Very Good Vehicle Any How

**Olfactory** (CN\*I) Optic (CN II) Oculomotor (CN III) Trochlear (CN IV) Trigeminal (CN V) Abducens (CN VI) Facial (CN VII) Vestibulocochlear (CN VIII) Glossopharyngeal (CN IX) Vagus (CN X) Accessory (CN XI) Hypoglossal (CN XII)

Sensory Sensory Motor Motor Both\*\* Motor Both Sensory Both Both Motor Motor

Some Say Marry Money But My Brother Says Big Brains Matter More

\*CN = Cranial Nerve \*\*Both = ( Motor + Sensory )

## Temor M. Dourandish

## Four of the Nerves Carry Parasympathetic Fibers

- Oculomotor (III): innervates iris constrictor (causes pupil constriction); also controls ciliary muscle (focuses the lens)
- Facial (VII) and Glossopharyngeal (IX): stimulate salivary glands to secrete
- Vagus (X): the major nerve of the parasympathetic system: goes to most visceral organs (heart, lungs, kidneys, liver, stomach, intestines)

# **Consequence of the answer**

- 1. Name of the cranial nerve (English and Latin), number.
- 2. Nature (sensory, motor, parasympathetic, mixed).
- 3. Nuclei: names, projection to the brain (on rhomboid fossa), nature.
- 4. Emerge from the brain, where they leave the skull.
- 5. Passes of the nerves
- 6. Region of the innervation.

# **Cranial nerves**

#### **NB!** Sensory portion:

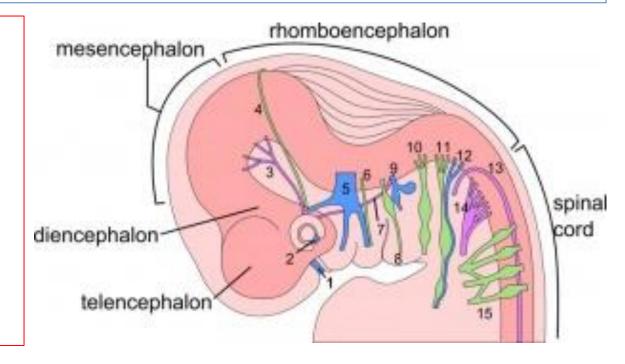
1<sup>st</sup> sensory neurons are in **sensory ganglion** (outside CNS)!

#### Exceptions:

- CN I and CN II develop from anterior brain vesicle (telencephalon).
- CN I and CN II have no sensory ganglion!
- 1<sup>st</sup> sensory neurons are:
- mucous membrane of the nasal cavity (CN I)
- retina (CN II)

#### Parasympathetic portion

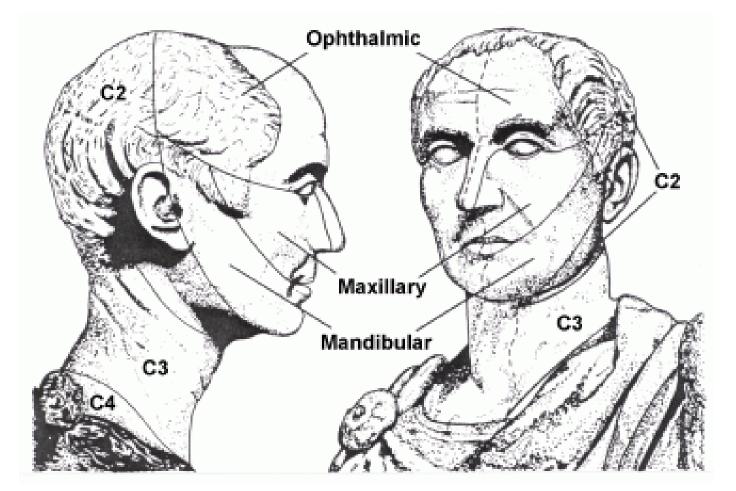
- 2 neurons:
- 1<sup>st</sup> neuron nucleus in CNS
- **2**<sup>nd</sup> **neuron** *parasympathetic ganglion*:
- g. ciliare (CN III)
- g. oticum (CN IX)
- g. pterygopalatinum (CN VII)
- g. submandibulare (CN VII)
   They are only parasympathetic!
   No sensory neurons!



# The Letter Symbols Commonly Used to Indicate the Functional Components of Each Cranial Nerve

Component	Function	Letter symbol		
Afferent Fibers	Sensory			
General somatic afferent	General Sensations.	GSA		
Special somatic afferent	Hearing, balance, vision.	SSA		
General visceral afferent	General sensations from viscera.	GVA		
Special visceral afferent	Smell, taste.	SVA		
Efferent Fibers				
General somatic efferent	Somatic striated muscles.	GSE		
General visceral efferent	Glands and smooth muscles (parasympathetic innervation).	GVE		
Special visceral efferent	Branchial arch striated muscles.	SVE		

# Cranial Nerve V - Trigeminal Nerve (nervus trigeminalis)



The largest of the cranial nerves and contains both sensory and motor fibers.

# Nuclei of the trigeminal nerve (CN V)

#### Sensory nuclei:

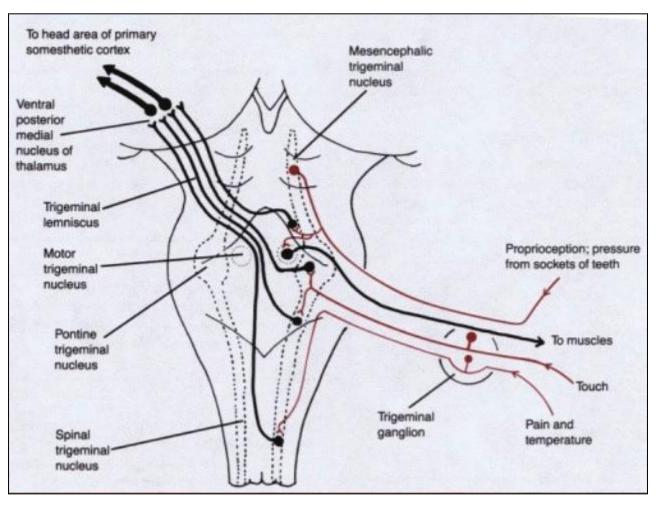
- 1) n. mesencephalicus
- 2) n. pontinus (main sensory nucleus)
- 3) n. spinalis

#### **Motor nucleus:**

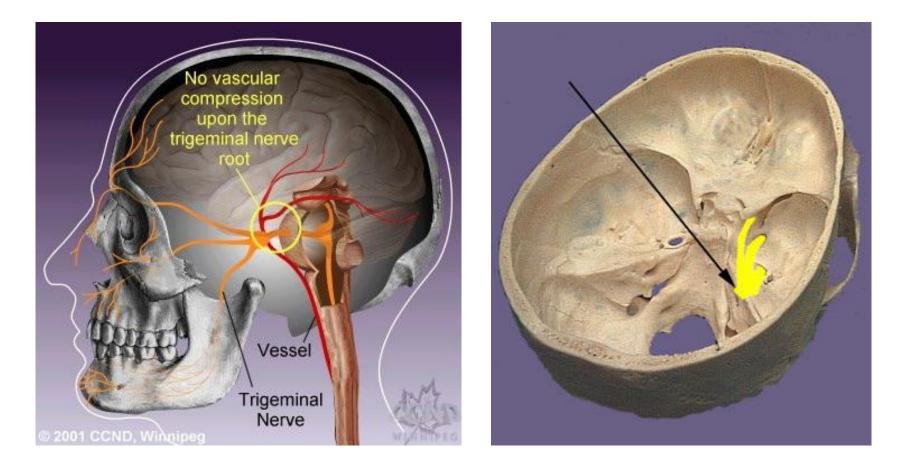
1) Nucleus nervi trigemini

#### 1<sup>st</sup> sensory neurons:

- Trigeminal ganglion



# 1<sup>st</sup> sensory neurons - Trigeminal ganglion



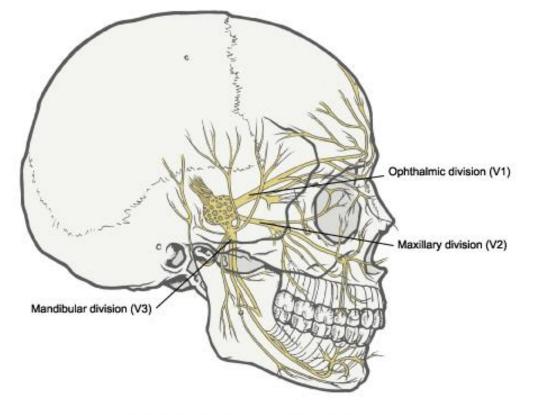
The sensory root carries the trigeminal ganglion which consists of the cell bodies of the sensory axons and lies in a depression on the petrous part of temporal bone.

The sensory root divides into three large branches:

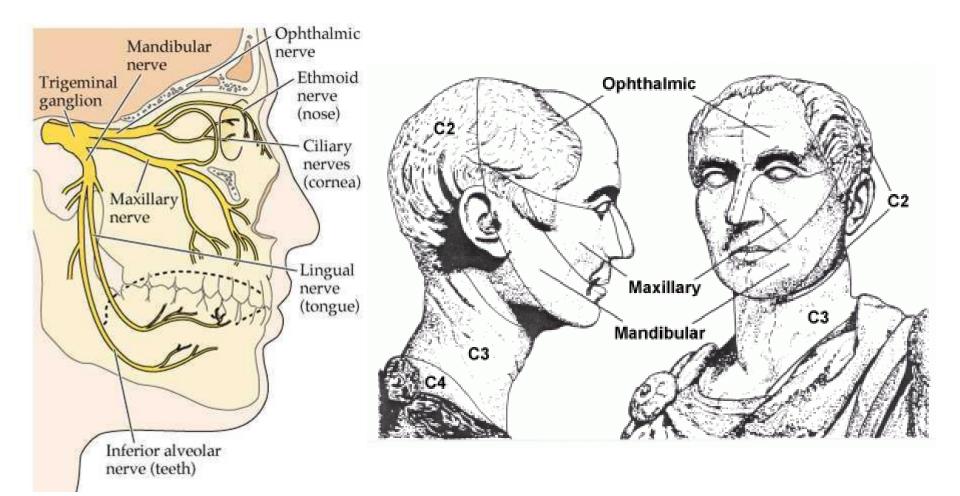
#### 1. The Ophthalmic (V1)

is the smallest division of the trigeminal nerve and is entirely sensory

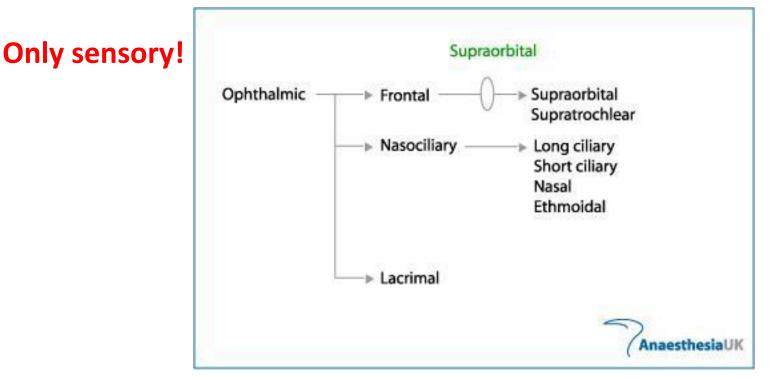
- 2. Maxillary (V2) is entirely sensory
- Mandibular (V3) is both sensory and motor



The Trigeminal Nerve Distribution



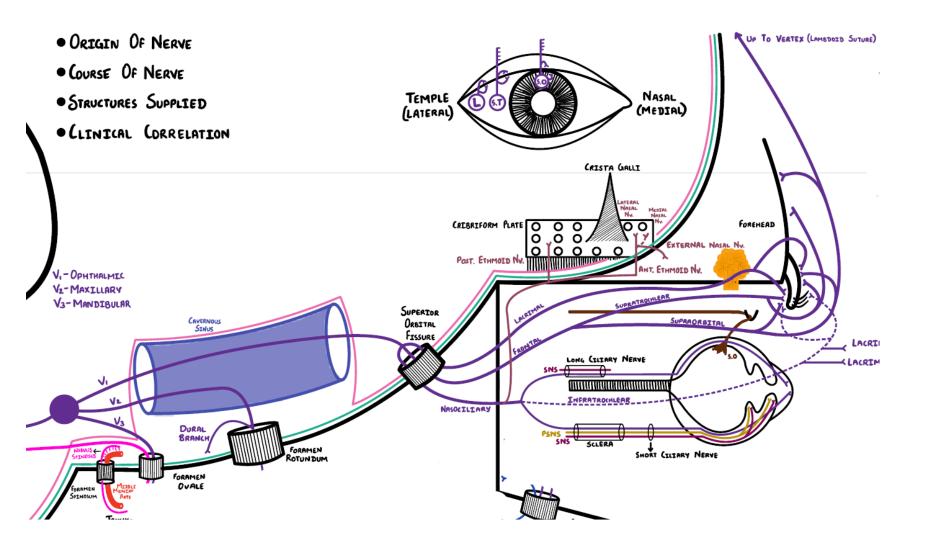
# **CN V – The Ophthalmic division**



- traverses the cavernous sinus and enters the orbit via the *superior orbital fissure* 

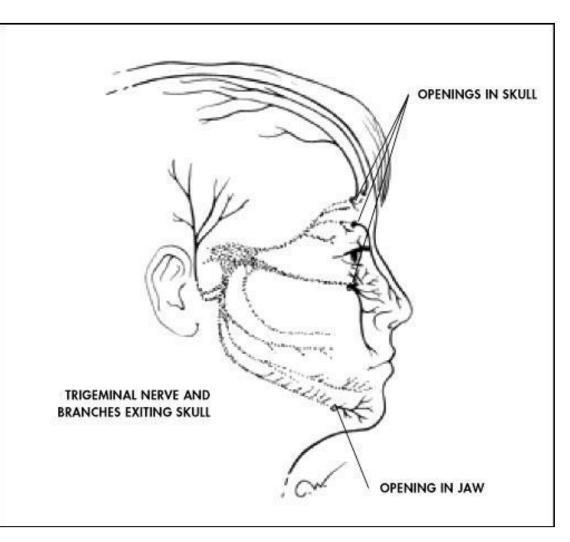
Sensory message from tear gland, upper eyelid, the mucosa of the nasal cavity and the cornea.

#### Ophthalmic division of the trigeminal nerve Branches and structures supplied.



# **Trigeminal nerve (CN V)**

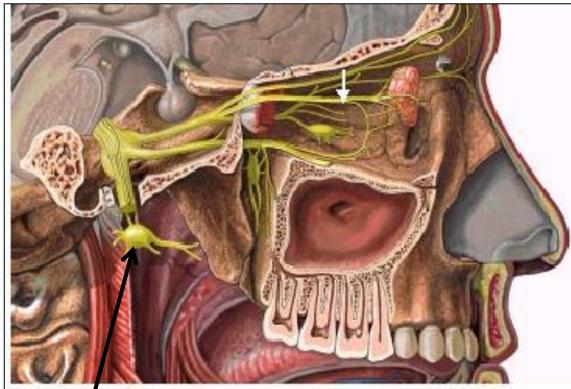
The frontal nerve lies just under the roof of the orbit and divides into supraorbital and supratrochlear nerves which emerge from the orbit and supply the front of the scalp.



# **Trigeminal nerve (CN V)**

The lacrimal nerve lies laterally and supplies the eyelids and face.

It also carries parasympathetic fibers from the pterygopalatine ganglion to the lacrimal gland.

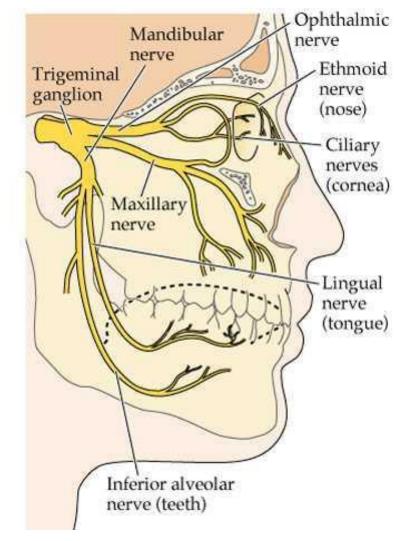


the pterygopalatine ganglion

# **Trigeminal nerve (CN V)**

*The nasociliary nerve* crosses the optic nerve and runs along the medial wall of the orbit to emerge onto the face as the infratrochlear nerve.

It gives off the *ethmoidal nerves*to the ethmoidal sinuses and
the *long ciliary nerves* to the eye
which carry sensory fibers from the
cornea and sympathetic fibers to
the dilatator pupillae.

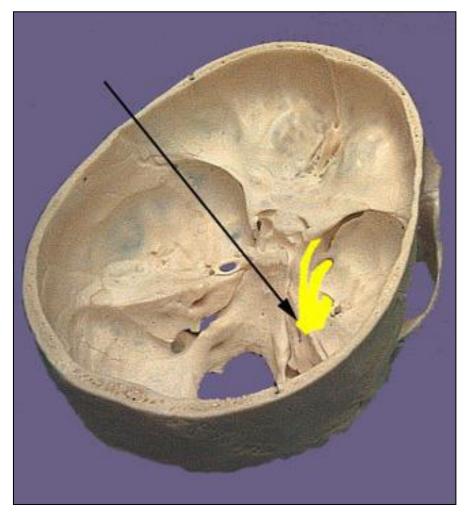


Branches	Structures supplied	
Lacrimal nerve	<ul> <li>Superior temporal palpebra</li> <li>Underline conjunctiva and temple side of the eye.</li> </ul>	
<ul> <li>Frontal nerve</li> <li>Supratrochlear nerve</li> <li>Supraorbital nerve</li> </ul>	<ul> <li>Skin of superior temporal palpebra.</li> <li>Underline conjunctiva.</li> <li>Skin of forehead and scalp.</li> </ul>	
Nasociliary nerve <ul> <li>Short ciliary nerves</li> <li>Long ciliary nerves</li> <li>Ethmoidal branches</li> <li>Infratrochlear nerve</li> </ul>	<ul> <li>Cornea, ciliary muscle and iris.</li> <li>Ethmoid sinuses.</li> <li>Medial and lateral sides of the nasal cavity.</li> <li>Tip of the nose.</li> <li>Medial palpebra and underline conjunctiva, lacrimal sac and lacrimal caruncle.</li> </ul>	

# **CN V – The maxillary division**

#### **Only sensory!**

This leaves the cranial cavity through the foramen rotundum and enters the pterygopalatine fossa.

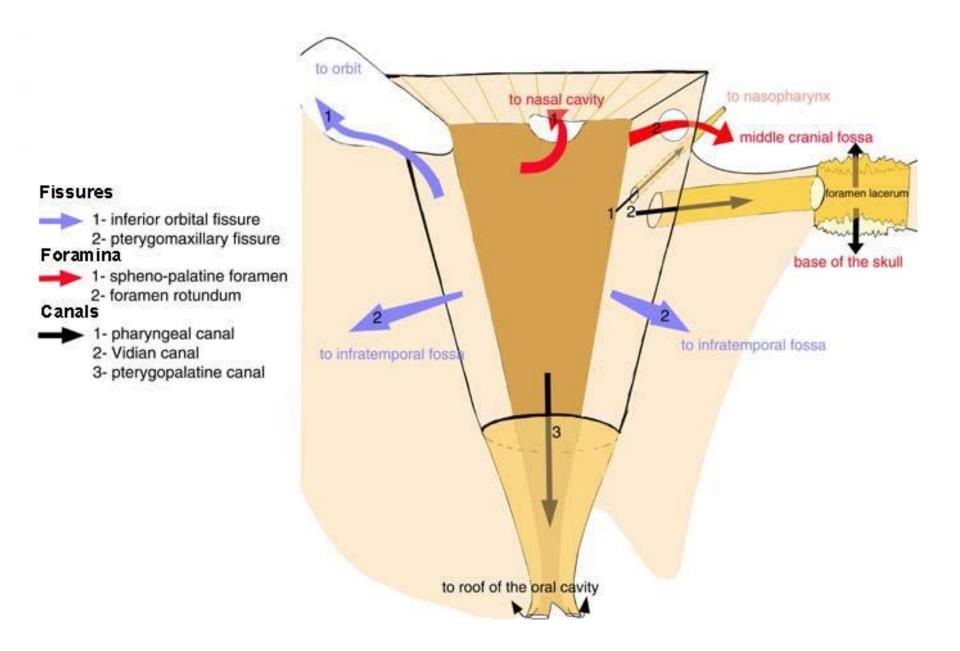


### **TRIGEMINAL NERVE - Maxillary branch**



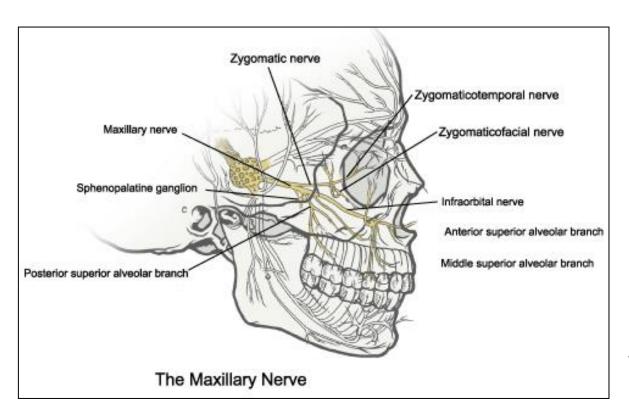
Maxillary Branch

Receives sensory messages from the upper j aw, nose and lower eye lid.



#### **CN V – The branches of the maxillary nerve**

#### **Only sensory!**



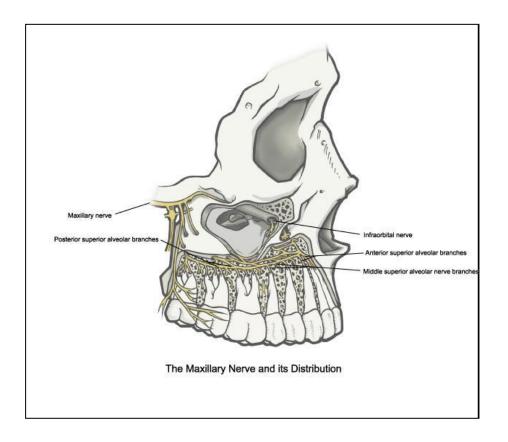
#### -the zygomatic nerve

leaves the pterygopalatine fossa via the *inferior orbital fissure* -the great and lesser palatine nerves to the hard and soft palates, -the sphenopalatine nerve to the nasal cavity and thence via the nasal

septum, to the *incisive fossa* to supply the hard palate.

-the posterior superior dental nerve enters the back of the maxilla and supplies the teeth.

#### CN V – The branches of the maxillary nerve Only sensory!



The maxillary nerve leaves the pterygopalatine fossa via the inferior orbital fissure, travels in the floor of the orbit where it gives the middle and anterior superior dental nerves, and emerges onto the face through the *infraorbital* foramen as the infraorbital nerve.

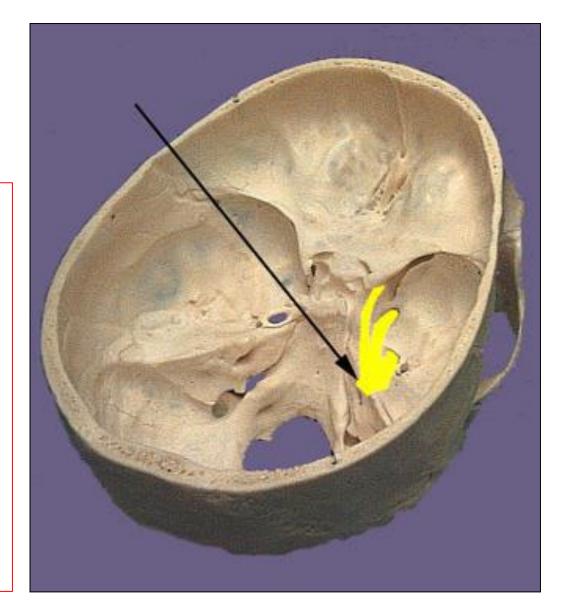
#### **CN V – The mandibular division**

This leaves the cranial cavity through the *foramen ovale* and immediately breaks up into branches.

Innervate the skin and teeth of the lower jaw for sensation.

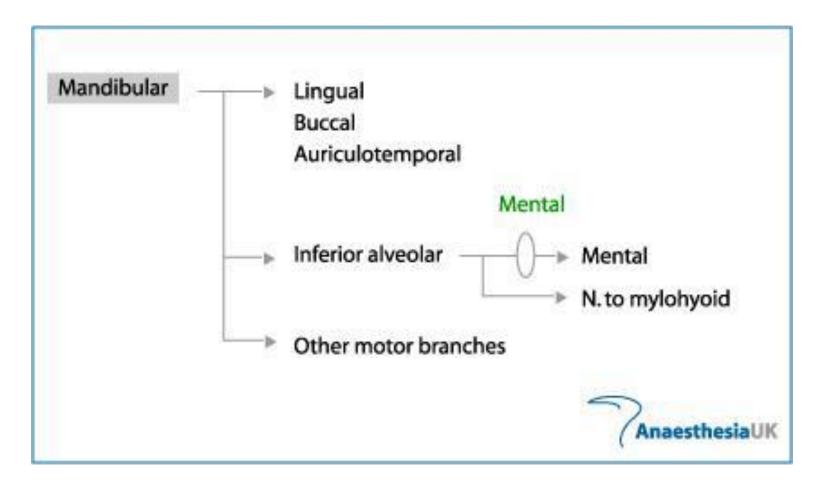
Innervate musticatory muscles (somatic motor):

- m.masseter
- m.temporalis
- m.pterygoideus medialis
- m.pterygoideus lateralis Other muscles:
- m. mylohyoideus
- venter anterior musculi digastrici



Branches	Structures supplied	
Meningeal branch	• Dura mater	
Zygomatic nerve <ul> <li>Zygomatico temporal nerve</li> <li>Zygomatico facial nerve</li> </ul>	● Temple ● Cheek area	
Infraorbital nerve <ul> <li>Inferior palpebra branch</li> <li>Nasal branch</li> <li>Superior labial branch</li> <li>MSAN</li> <li>ASAN</li> </ul>	<ul> <li>Inferior palpebra and underline conjunctiva.</li> <li>Nose.</li> <li>Upper lips.</li> <li>Premolars and gingiva.</li> <li>Canines, central and lateral incisors.</li> </ul>	
Posterior superior alveolar nerve	<ul> <li>Hard palate, molars and gingiva.</li> </ul>	
Pterygopalatine branches <ul> <li>Nasopharyngeal</li> <li>branch</li> <li>Orbital branch</li> <li>Lesser palatine</li> <li>nerve</li> <li>Greater palatine</li> <li>nerve</li> <li>Posterior superior</li> <li>nasal branch</li> </ul>	<ul> <li>Tympanil tube and tubal tonsil.</li> <li>Orbital cavity.</li> <li>Soft palate.</li> <li>Posterior and anterior hard palate.</li> <li>Medial and lateral sides of the nasal cavity.</li> <li>Anterior part of hard palate.</li> </ul>	

#### **CN V – The mandibular division**

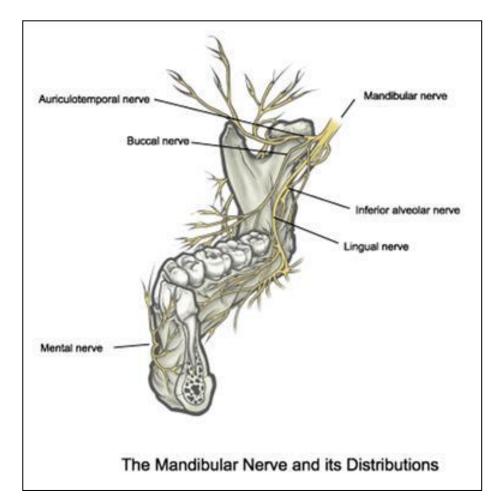


The mandibular division contains both motor and sensory branches.

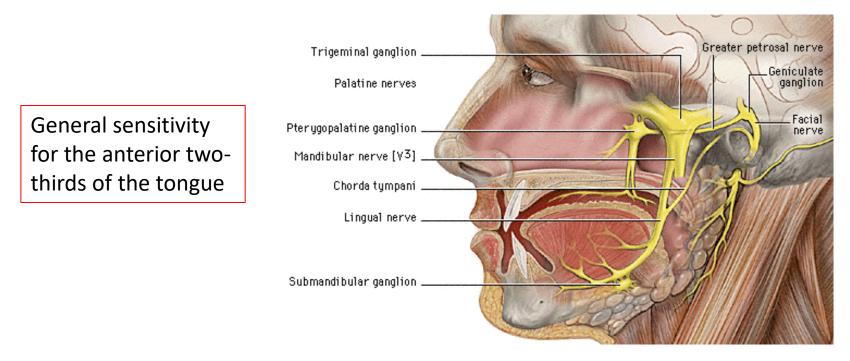
#### **CN V – The branches of the mandibular nerve**

The mainly sensory *inferior alveolar nerve*, which enters the *mandibular foramen* to supply the teeth before emerging onto the face as *the mental nerve*.

•This nerve does have one motor branch, *the mylohyoid nerve*, which supplies the mylohyoid and anterior belly of the digastric.



#### **CN V – Lingual nerve**



*The lingual nerve* lies close to the mandible just behind the third molar and then passes forwards to supply the tongue.

It is joined by the *chorda tympani (CN VII)* which carries taste fibers from the anterior two-thirds of the tongue and parasympathetic secretomotor fibers to the submandibular and sublingual salivary glands.

### **CN V – The mandibular division**

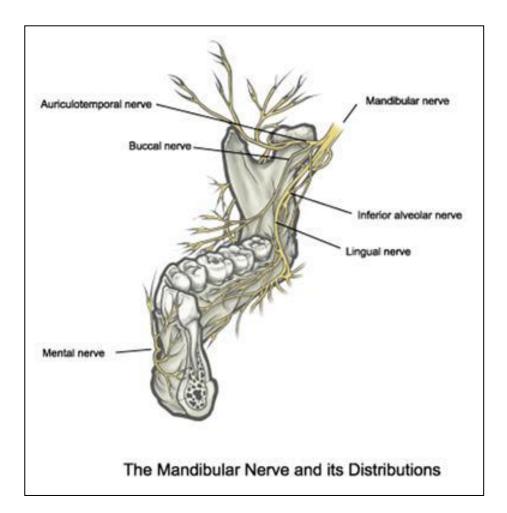
#### The auriculotemporal nerve

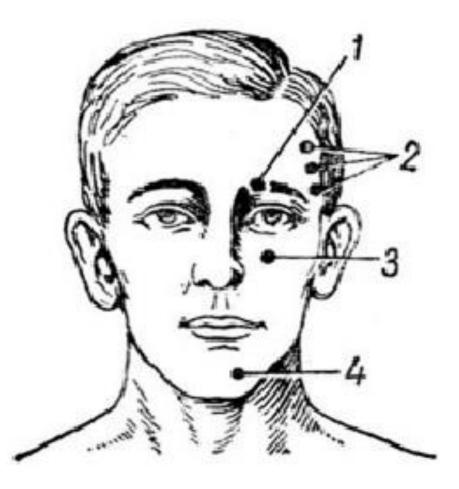
supplies **sensory** fibers to the side of the scalp.

- It also carries

parasympathetic secretomotor fibers, which have synapsed in the otic ganglion, to the parotid gland.

*The buccal nerve* carries sensory fibers from the face. There are *muscular branches* to the muscles of mastication, including the deep temporal nerve which supply temporalis.





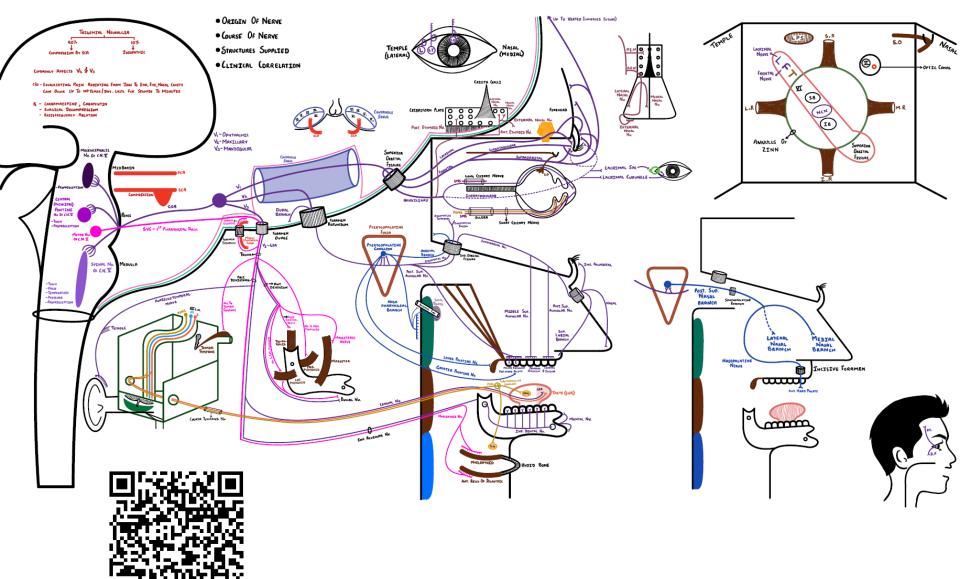
Valleix points - areas, where the Trigeminal nerve arise on the surface of the skull – areas to check CN V neuralgia

V3: Mandibular Division (GSA and SVE fibers)				
	Nervous spinosus (GSA)			
		Dura mater.		
	Auriculotemporal nerve (GSA)			
		External ear and temple.		
	Buccal nerve (GSA)			
		Skin of the cheek.		
	Nerve to medial pterygoid (SVE)			
luurus elistelus essite		Medial pterygoid muscle.		
Immediately exits the skull through the	Anterior division (SVE)			
foramen ovale.	Deep temporal nerve	Temporalis muscle		
	Masseteric nerve	Masseter muscle		
	Nerve to lateral pterygoid	Lateral pterygoid muscle.		
	Lingual nerve (GSA)			
		Sensation of anterior 2/3 of tongue. VII CN runs with lingual nerve to supply taste to anterior 2/3 of tongue.		
	Nerve to tensor tympani (SVE)			
		Tensor tympani muscle.		

#### Damage to Cranial Nerves Causes Many Medical Problems

- Anosmia (loss of smell): sometimes caused by fractures which damage the cribiform plate. This damages the Olfactory nerve as it passes through the plate.
- **Bell's Palsy**: paralysis of the muscles of facial expression on one side. Caused by inflammation of the Facial nerve.
- *Tic douloureux*: severe facial pain caused by inflammation of the trigeminal nerve.
- **Blindness:** caused by damage to optic nerve. Degree of blindness depends upon the location of the damage.

## The full scheme of cranial nerve V

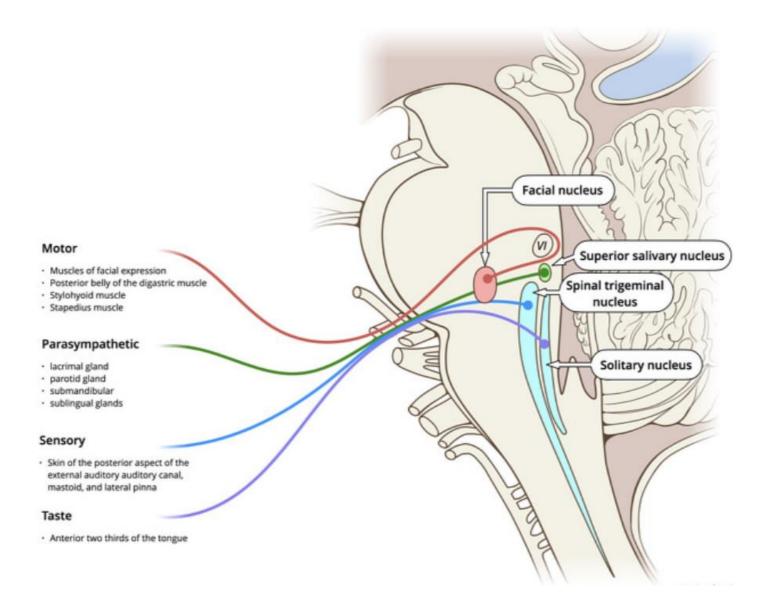


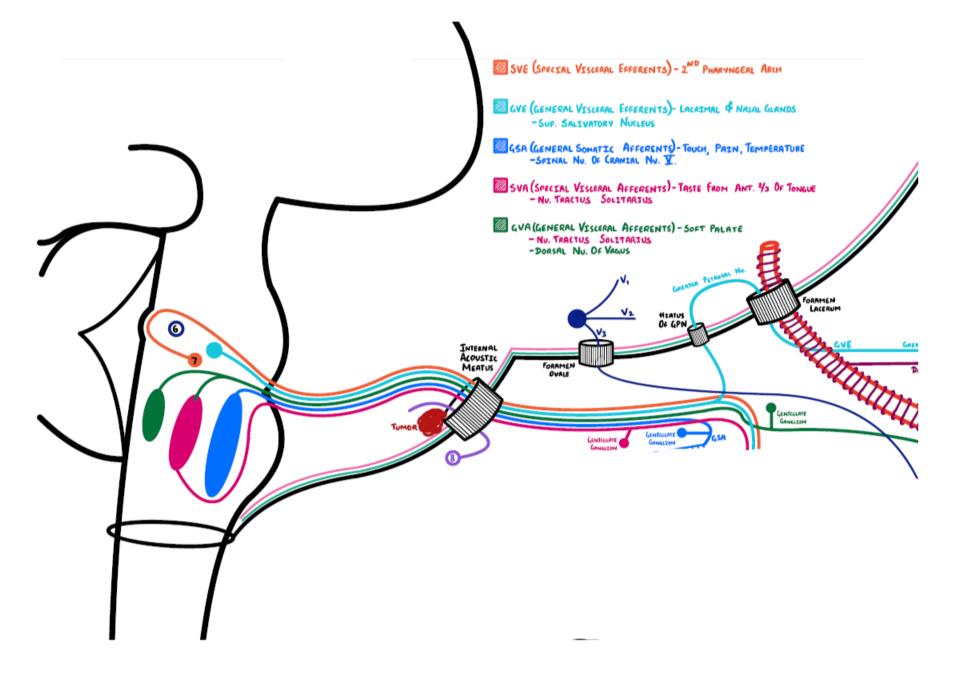
The link to download the scheme

## Cranial Nerve VII - Facial Nerve

The facial nerve has 3 main components with distinct functions

#### **Facial nerve**





## The Letter Symbols Commonly Used to Indicate the Functional Components of Each Cranial Nerve

Component	Function	Letter symbol		
Afferent Fibers	Sensory			
General somatic afferent	General Sensations.	GSA		
Special somatic afferent	Hearing, balance, vision.	SSA		
General visceral afferent	General sensations from viscera.	GVA		
Special visceral afferent	Smell, taste.	SVA		
Efferent Fibers				
General somatic efferent	Somatic striated muscles.	GSE		
General visceral efferent	Glands and smooth muscles (parasympathetic innervation).	GVE		
Special visceral efferent	Branchial arch striated muscles.	SVE		

#### (A) FACIAL NERVE NUCLEUS

- SVE fibers (special visceral efferent).
   Supplies the 2<sup>nd</sup> pharyngeal arch.
  - Muscles of facial expression, digastric posterior belly and stylohyoid muscle.
- Its fibers move around CN VI nucleus and then anteriorly to it, leaving the brainstem lateral to the abducens nerve exit.
- Leaves the skull through the internal acoustic meatus.

#### (B) SUPERIOR SALIVATORY NUCLEUS

- GVE fibers (general visceral efferent).
   Supplies to nasal and lacrimal glands.
- Runs alongside the facial nerve motor fibers through the internal acoustic meatus.

#### (C) SPINAL NUCLEUS OF CN V

GSA fibers (general somatic afferent).
 Touch, pain and temperature of ear.

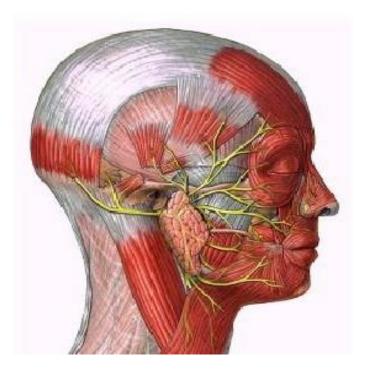
#### (D) NUCLEUS OF TRACTUS SOLITARIUS

- SVA fibers (special visceral afferent) • Taste of anterior 2/3 of tongue.
- GVA fibers (general visceral afferent)

   Sensation of soft palate.

### Somatic motor efferent

 Supplies the muscles of facial expression; posterior belly of digastric muscle; stylohyoid, and stapedius

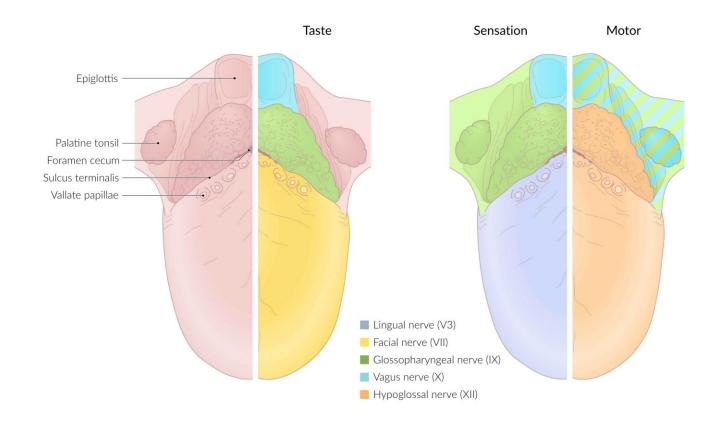


### Visceral motor efferent

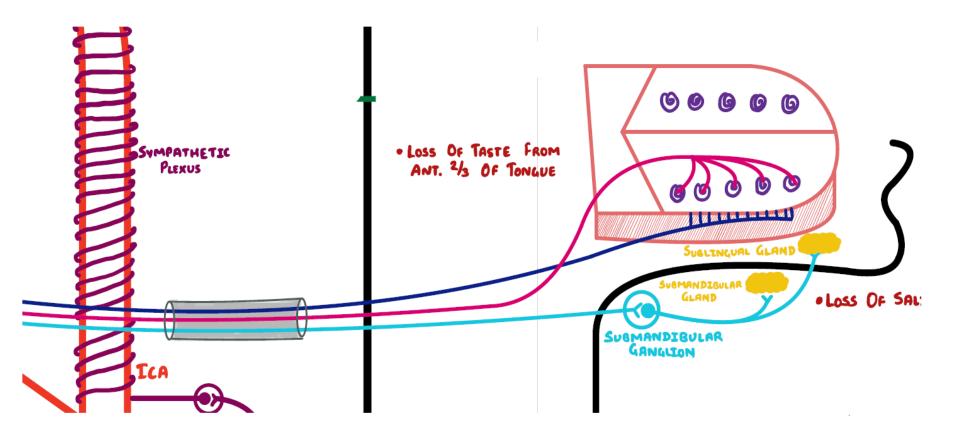
 Parasympathetic innervation of the lacrimal, submandibular, and sublingual glands, as well as mucous membranes of nasopharynx, hard and soft palate.

## Special sensory (special afferent)

## **Taste** sensation from the **anterior 2/3 of tongue**; hard and soft palates.



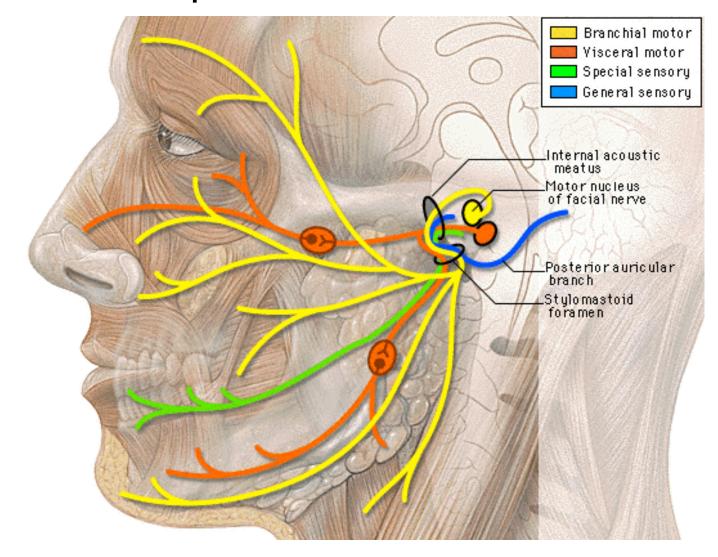
# Tongue and salivary glands innervation by the chorda tympani.



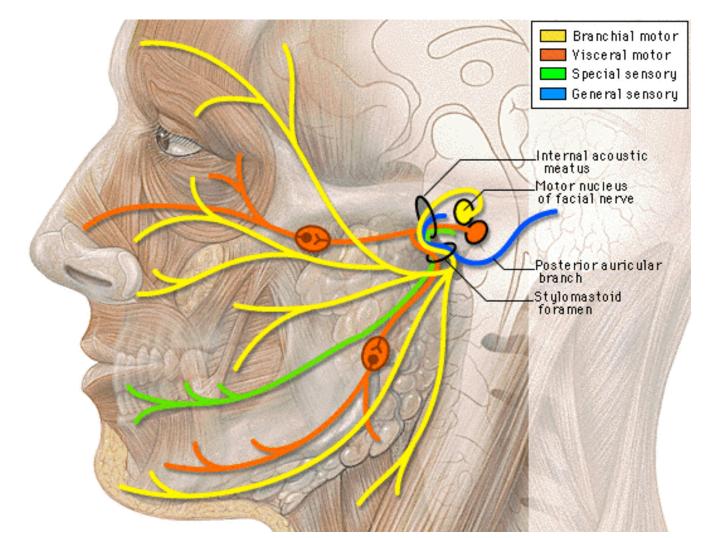
#### Summary of the chorda tympani course:

- 1) V3, one of the main divisions of CN V runs through the foramen ovale and gives off the lingual nerve branch.
   → This supplies touch, pain and temperature fibers to the anterior 2/3 of tongue.
- SVA fibers from CN VII pick up taste from anterior 2/3 of tongue and run alongside the lingual nerve.
- Parasympathetic GVE fibers coming from the superior salivatory nucleus join the SVA fibers and the lingual nerve branch.
  - → They travel together until GVE fibers reach the submandibular ganglion, where they separate from SVA fibers and lingual nerve to supply innervation to the mandibular and sublingual salivary glands.

# **Somatic motor fibers** constitute the largest portion of the facial nerve.

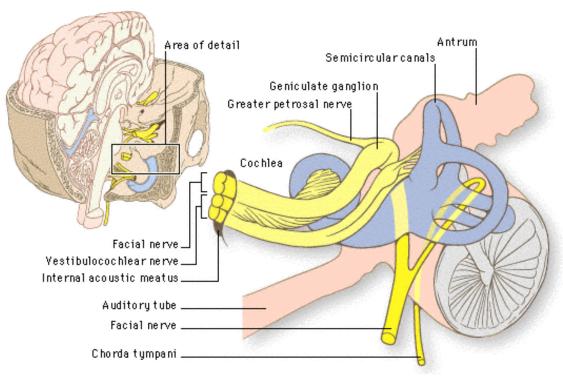


The remaining two components are bound in a distinct fascial sheath from the somatic motor fibers. Collectively these components are referred to as the *nervus intermedius*.



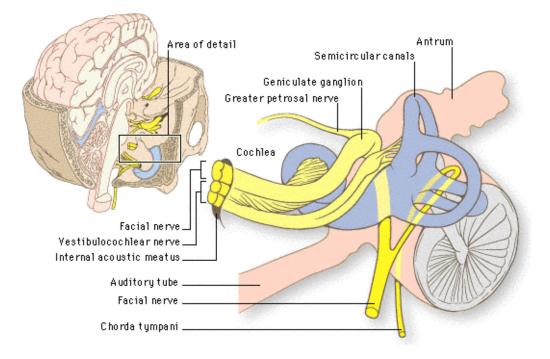
### Intracranial course

 Upon emerging from the ventrolateral aspect of the caudal border of the pons, all of the components of CN VII enter the internal auditory meatus along with the fibers of CN VIII (vestibulocochlear nerve).



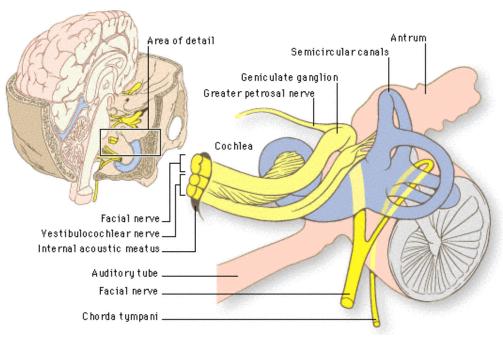
### Intracranial course

- The fibers of CN VII pass through the facial canal in the petrous portion of the temporal bone. The course of the fibers is along the roof of the vestibule of the inner ear, just posterior to the cochlea.
- At the geniculate ganglion the various components of the facial nerve take different pathways.



### Somatic motor efferent

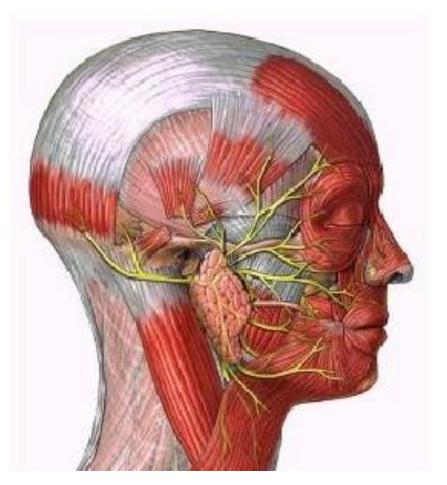
- Fibers of the somatic motor component pass through the geniculate ganglion without synapsing, turn 90 degrees posteriorly and laterally before curving inferiorly just medial to the middle ear to exit the skull through the stylomastoid foramen.
- The nerve to the stapedius muscle is given off from the facial nerve in its course through the petrous portion of the temporal bone.

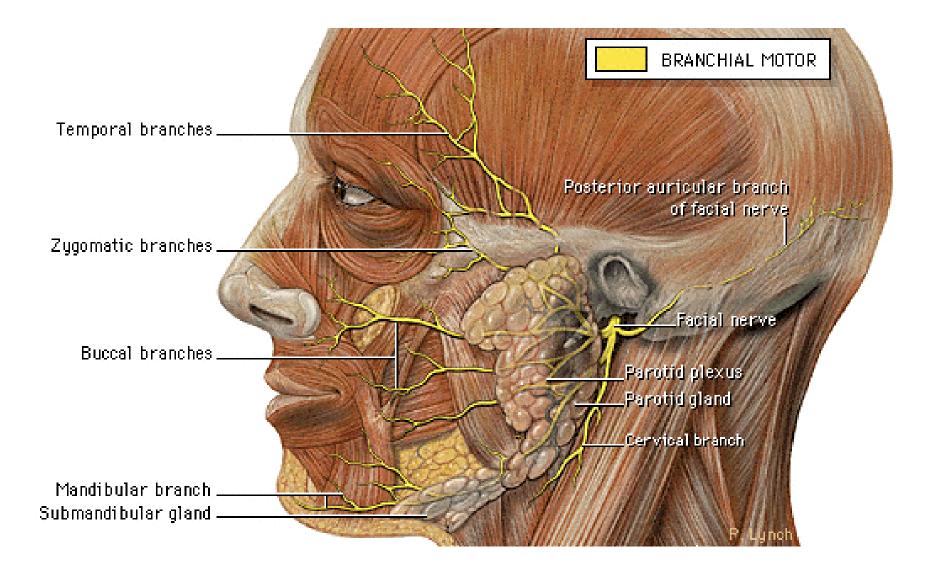


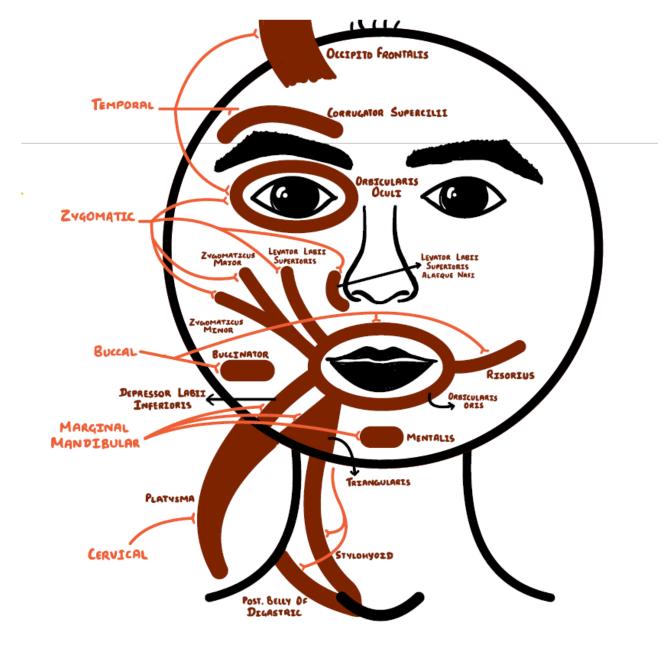
# Extracranial Course and Final Innervation

 The posterior auricular nerve, nerve to the posterior belly of the digastric and the nerve to the stylohyoid muscle are given off upon the facial nerve's exit from the stylomastoid foramen.

The remaining fibers enter the substance of the parotid gland and divide to form the temporal, zygomatic, buccal, mandibular, and cervical branches to innervate the muscles of facial expression.

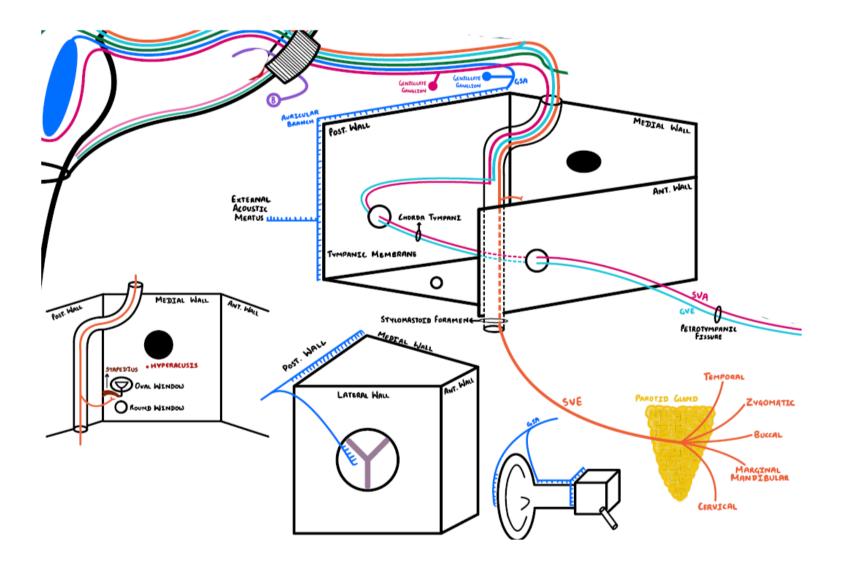






#### Muscles of facial expression innervated by the VII CN

## Structures supplied by GSA fibers of the auricular branches of CN VII



## Lower Motor Neuron (LMN) Lesion

 Results from damage to the motor nucleus of CN VII or its axons.

A LMN lesion results in the paralysis of all muscles of facial expression (including those of the forehead) ipsilateral to the lesion.

 Clinical Correlation - Bell's Palsy

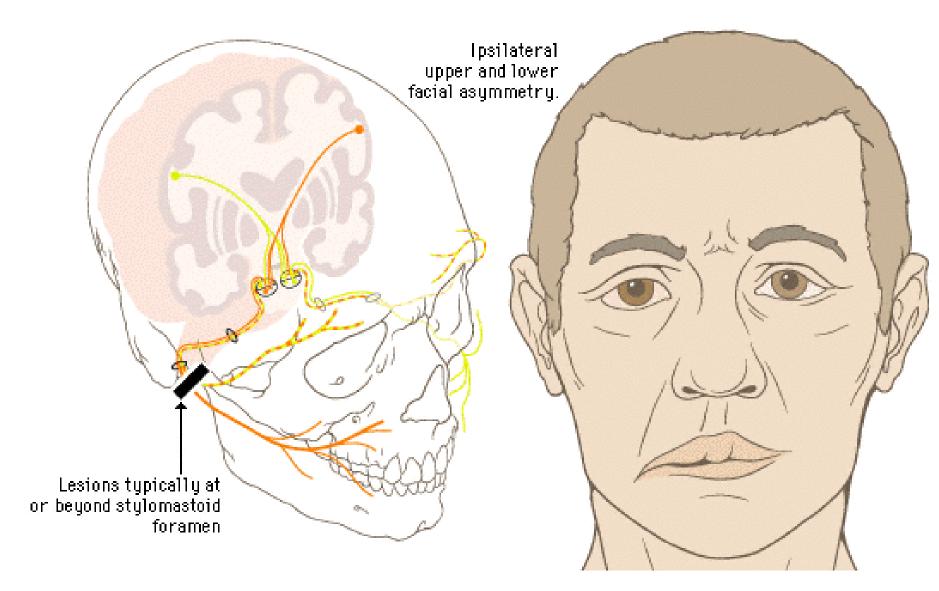
A LMN lesion of CN VII which occurs at or beyond the stylomastoid foramen is commonly referred to as a Bell's Palsy.



## Lower Motor Neuron (LMN) Lesion

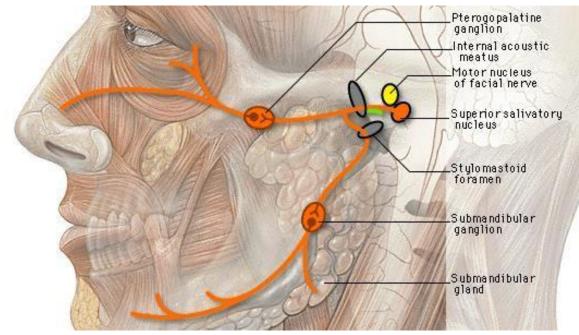
Characteristic indications of a LMN lesion or Bell's Palsy include the following, **on the affected side**:

- Marked facial asymmetry
- Atrophy of facial muscles
- Eyebrow droop
- Smoothing out of forehead and nasolabial folds
- Drooping of the mouth corner
- Uncontrolled tearing
- Loss of efferent limb of conjunctival reflex (cannot close eye)
- Lips cannot be held tightly together or pursed
- Difficulty keeping food in mouth while chewing on the affected side



## Visceral Motor Component

- Parasympathetic component of the facial nerve.
- Consists of efferent fibers which stimulate secretion from the submandibular, sublingual, and lacrimal glands, as well as the mucous membranes of the nasopharynx and hard and soft palates.

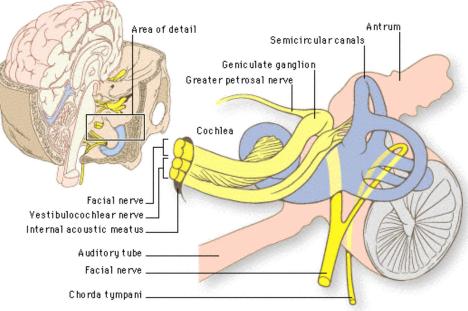


### **Intracranial Course**

 Within the facial canal the visceral motor fibers divide into two groups to become the greater petrosal nerve and the chorda tympani:

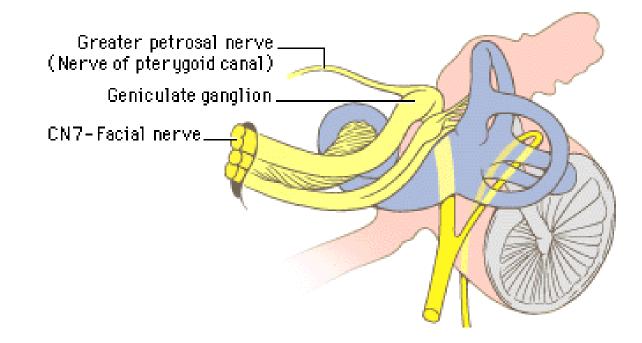
The greater petrosal nerve supplies the lacrimal, nasal, and palatine glands.

The chorda tympani supplies the submandibular and sublingual glands.



# Course of the Greater Petrosal Nerve

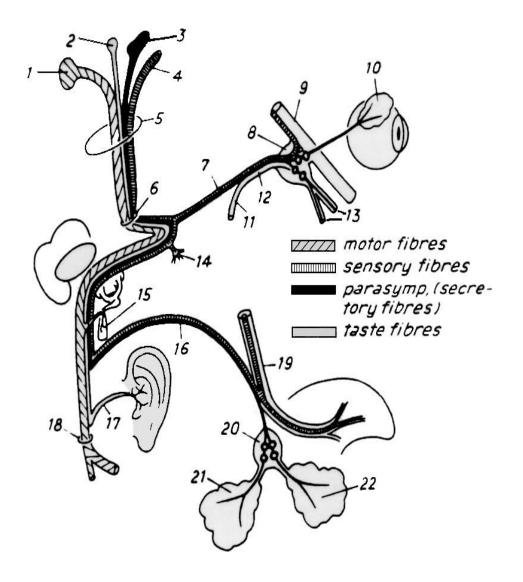
 At the geniculate ganglion the greater petrosal nerve turns anteriorly and medially exiting the temporal bone via the petrosal foramen and entering the middle cranial fossa.

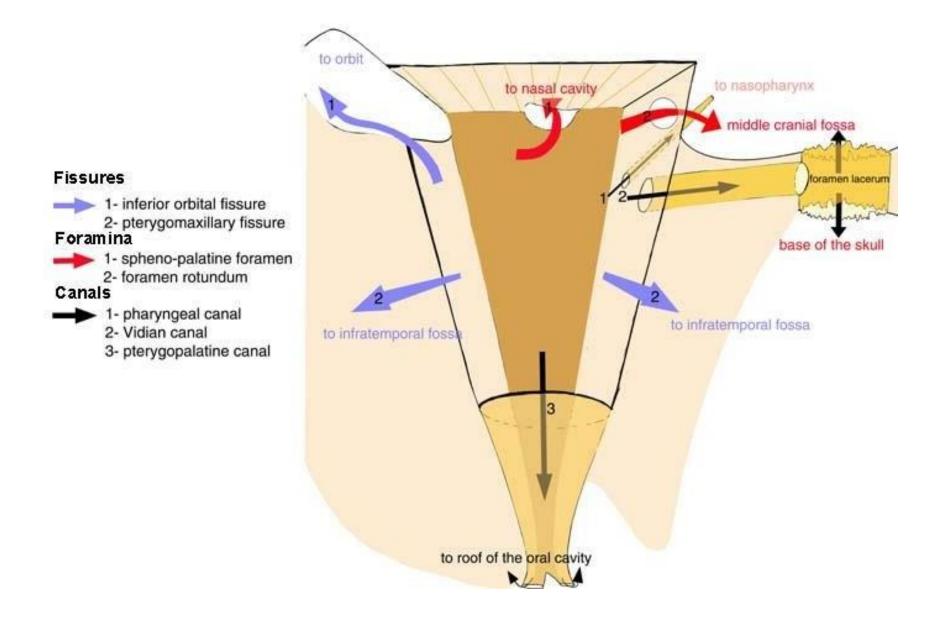


The greater petrosal nerve passes deep to the trigeminal ganglion to enter the foramen lacerum.

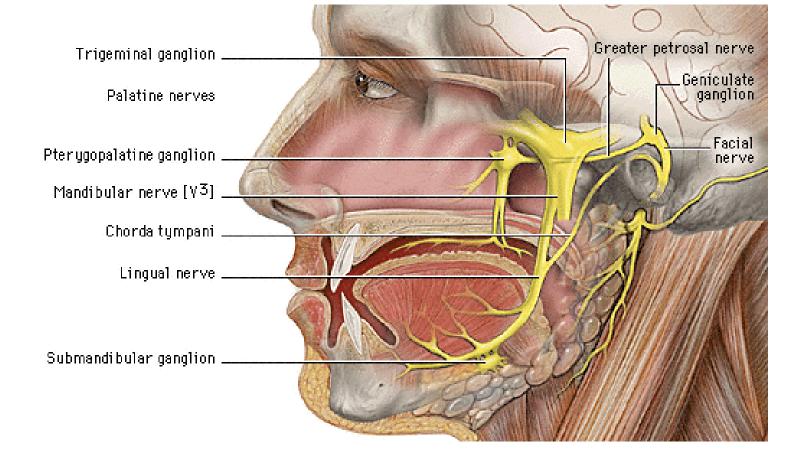
The nerve traverses the foramen and enters a canal at the base of the medial pterygoid plate in conjunction with sympathetic fibers (deep petrosal nerve) branching from the plexus following the internal carotid artery.

The parasympathetic and sympathetic fibers together make up the nerve of the pterygoid canal.

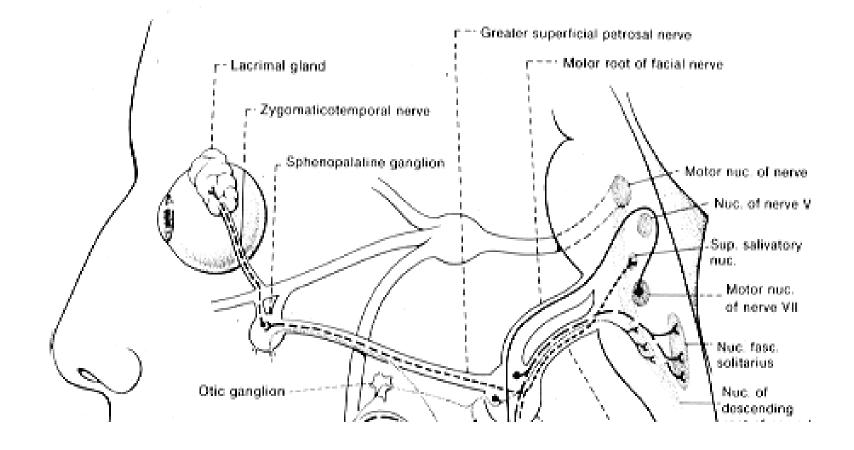




 Upon exiting the pterygoid canal, pre-ganglionic parasympathetic fibers of CN VII synapse in the pterygopalatine ganglion which is suspended from the fibers of the maxillary division of the trigeminal nerve (V2) in the pterygopalatine fossa.



Post-ganglionic parasympathetic fibers then follow the fibers of V2 to reach the lacrimal gland (via the lacrimal nerve) and the mucous membranes of the nasal and oral pharynx.



Greater petrosal nerve. (Nerve of pterygoid canal)

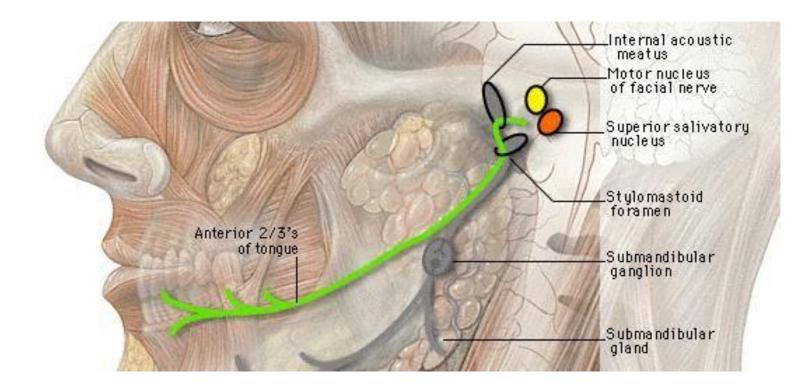
Lacrimal nerve. Pterygo-palatine ganglion. Nasal septum.

Nerves to mucous membranes. of the nasal and oral pharynx (Posterior inferior and inferior lateral nasal nerves)

> Anterior (greater) palatine nerve

## Special Sensory Component

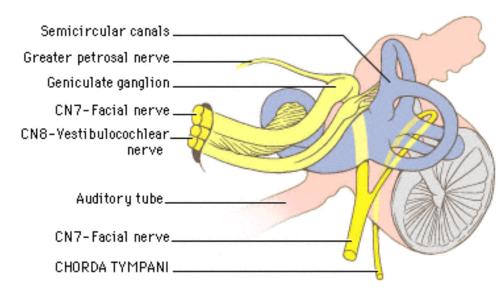
• Consists of afferent fibers which convey taste information from the anterior 2/3 of the tongue and the hard and soft palates.



# Course of the Chorda Tympani

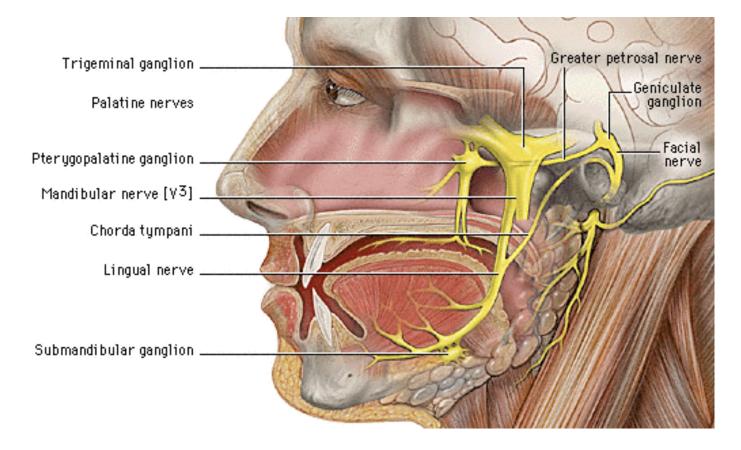
• The pre-ganglionic fibers of the chorda tympani branch from the other fibers of CN VII as they pass through the facial canal just posterior to the middle ear.

The fibers pass through the middle ear in close relationship with the tympanic membrane and exit the base of the skull to enter the inferotemporal fossa:



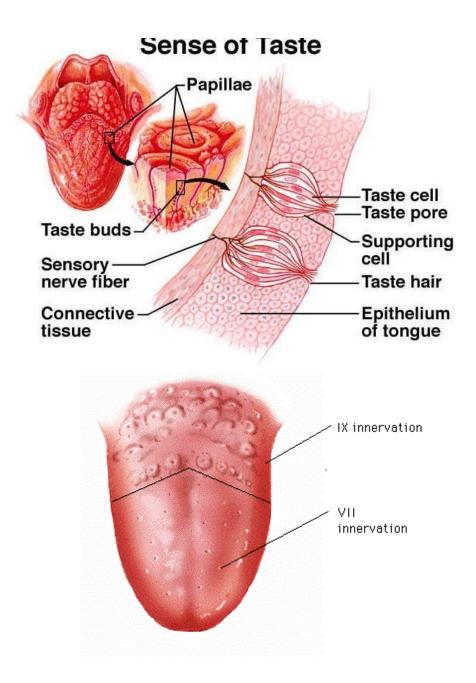
• In the inferotemporal fossa the chorda tympani joins the fibers of the lingual branch of the mandibular division of CN V (V3).

CN VII pre-ganglionic fibers synapse in the submandibular ganglion suspended from the lingual nerve (V3). Post-ganglionic fibers then either enter the submandibular gland directly or again follow the lingual nerve before branching to innervate the sublingual gland:



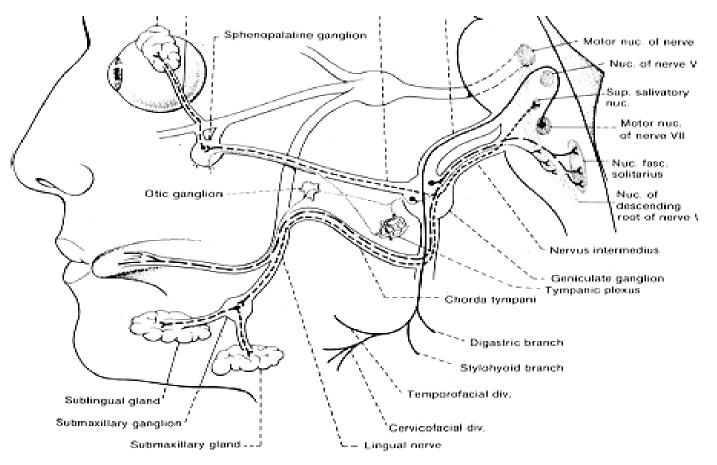
 Chemoreceptors of the taste buds located on the anterior 2/3 of the tongue and hard and soft palates initiate receptor (generator) potentials in response to chemical stimuli.

The taste buds synapse with the peripheral processes of special sensory neurons from CN VII. These neurons generate action potentials in response to the taste bud's receptor potentials. The peripheral processes of these neurons follow the lingual nerve and then chorda tympani to the petrous portion of the temporal bone (similar to the path followed by the efferent visceral motor fibers).



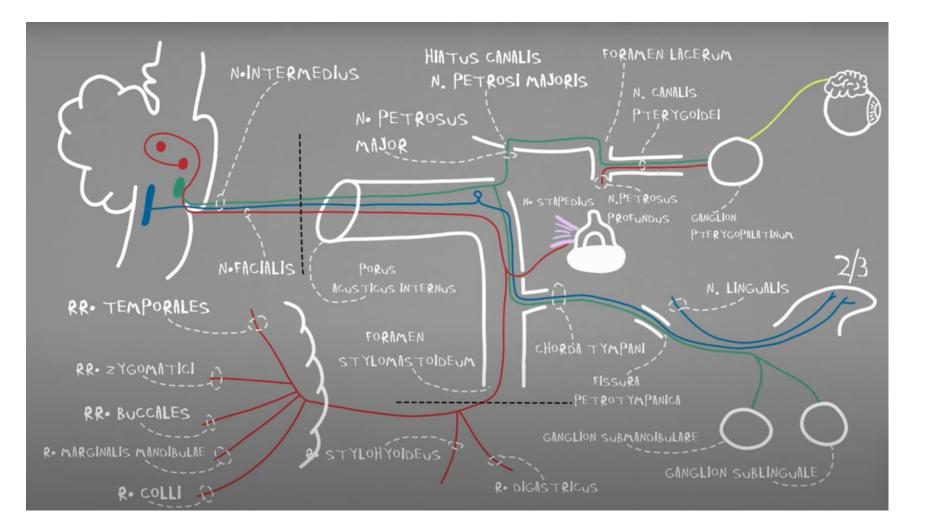
 The central processes of the special sensory neurons pass from the geniculate ganglion through the facial canal and enter the brainstem as part of the nervus intermedius portion of CN VII.

The fibers then join the caudal portion of tractus solitarius and ascend to synapse in the rostral portion of the nucleus solitarius - also referred to as the gustatory nucleus:

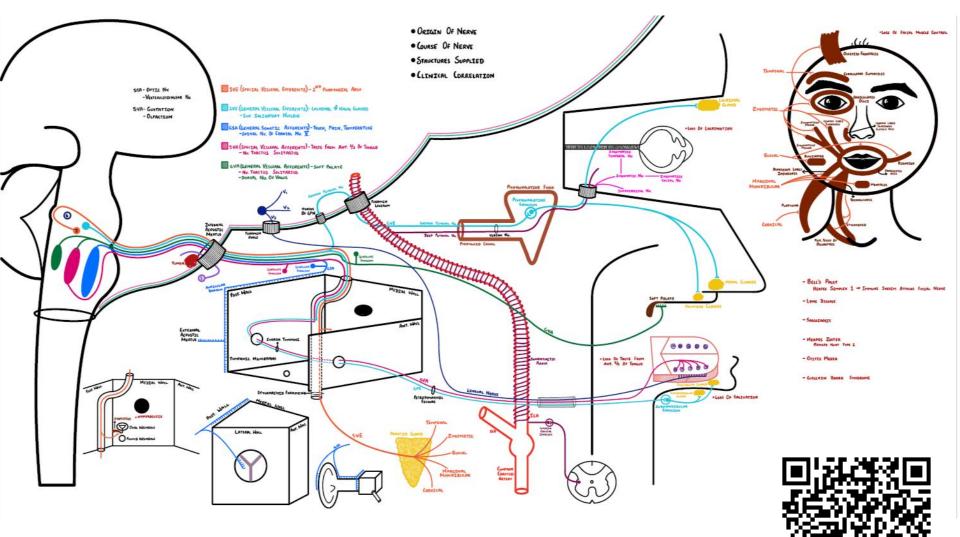


Branch	Origin	Structures supplied	Fiber components	Function	Clinical correlation
Auricular branches	Superior salivatory nucleus	<ul> <li>Tympanic cavity and tympanic membrane.</li> <li>A portion of external acoustic meatus.</li> <li>Skin around the ear.</li> </ul>	GSA fibers	Touch, pain and temperature of the ear.	<ul> <li>Loss of sensation within tympanic cavity and membrane, external acoustic meatus and skin of the ear.</li> <li>Neuropathic pain.</li> </ul>
GVA fibers	Nucleus of tractus solitarius	<ul> <li>Soft palate</li> </ul>	GVA fibers	Sensation of soft palate	<ul> <li>Loss of visceral sensations from soft palate.</li> </ul>
Chorda tympani	Nucleus of tractus solitarius	Anterior 2/3 of tongue	SVA fibers	Taste of anterior 2/3 of tongue	Loss of taste on the anterior 2/3 of tongue.
	Superior salivatory nucleus	Submandibular and sublingual glands	GVE fibers	Parasympathetic innervation to submandibular and sublingual salivary glands.	Change in the amount of saliva produced.
SVE fibers	Facial nerve nucleus	Muscles of facial expression, digastric posterior belly and stylohyoid muscle	SVE fibers	<ul> <li>Movement of muscles of facial expression.</li> <li>Raising of hyoid bone.</li> <li>Controls of amplitude of sound waves to the inner ear.</li> </ul>	<ul> <li>Difficulty to make facial expressions.</li> <li>Weakness or paralysis on one side of the face.</li> <li>Hyperacusis.</li> </ul>
Greater petrosal nerve	Superior salivatory nucleus	Nasal and lacrimal glands	GVE fibers	<ul> <li>Production of tears.</li> <li>Innervation of mucous glands of the oral cavity, nose and pharynx.</li> </ul>	Change in the production of tears.

### The abbreviated scheme of cranial nerve VII

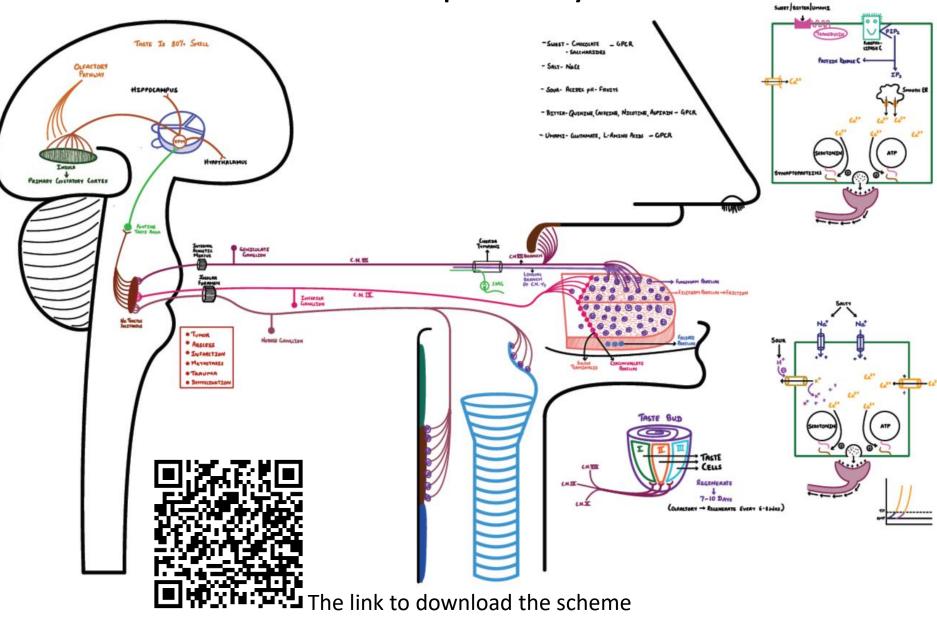


## The full scheme of cranial nerve VII

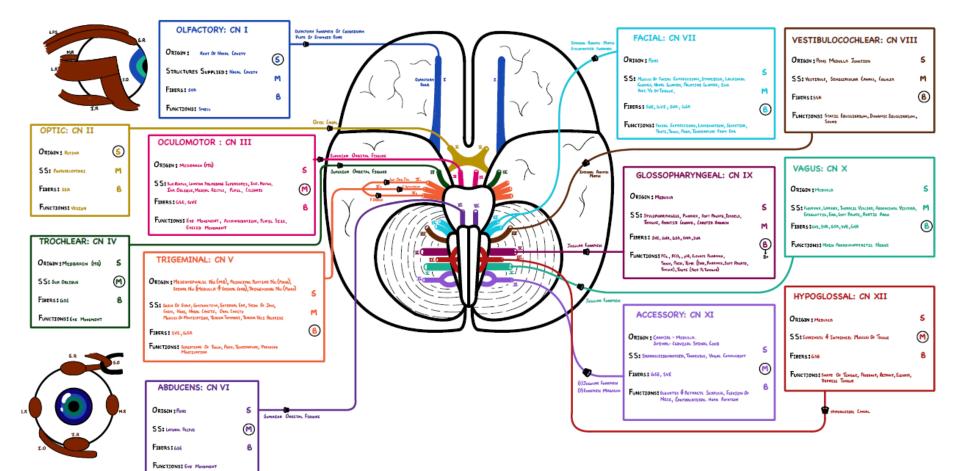


The link to download the scheme

#### Taste pathway



#### **Cranial nerves**



The link to download the scheme