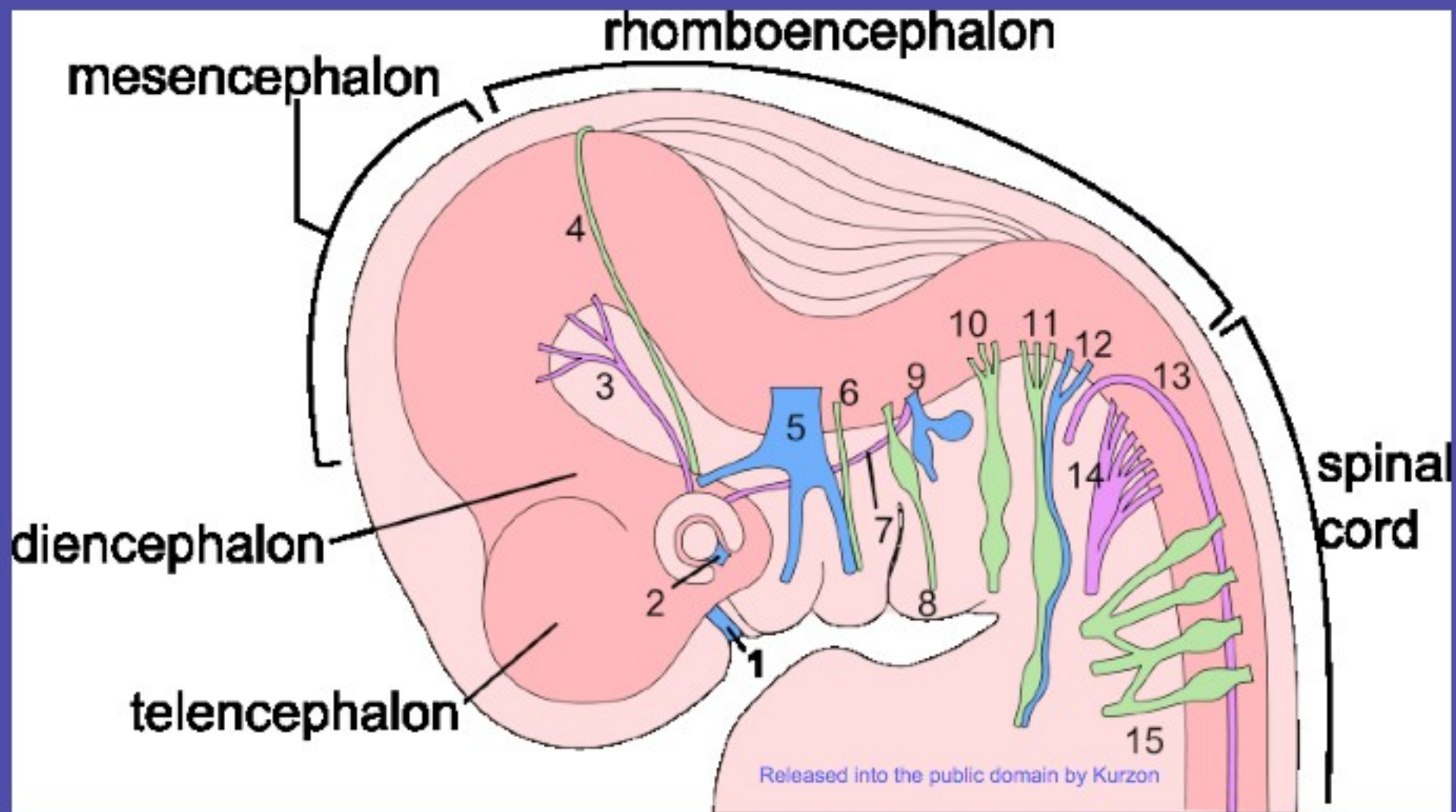


Trigeminal Nociceptive Facilitation

Slide Show by
Mary Louise Muller
M.Ed, RCST®, RPP
www.LifeShapes.org

File:Head deep facial trigeminal.png
Patrick Lynch- Medical Illustrator
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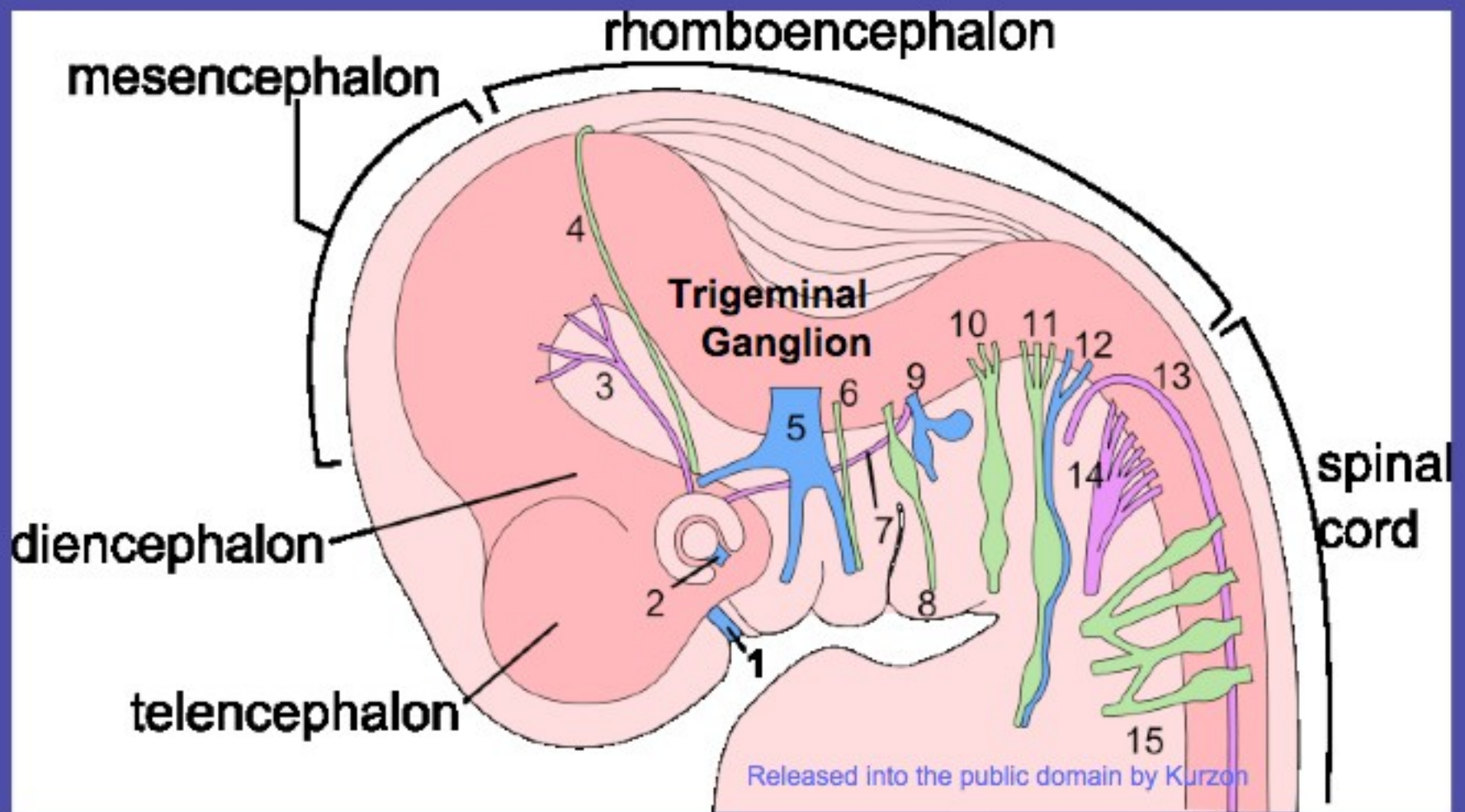
Embryology of the Trigeminal Nerve



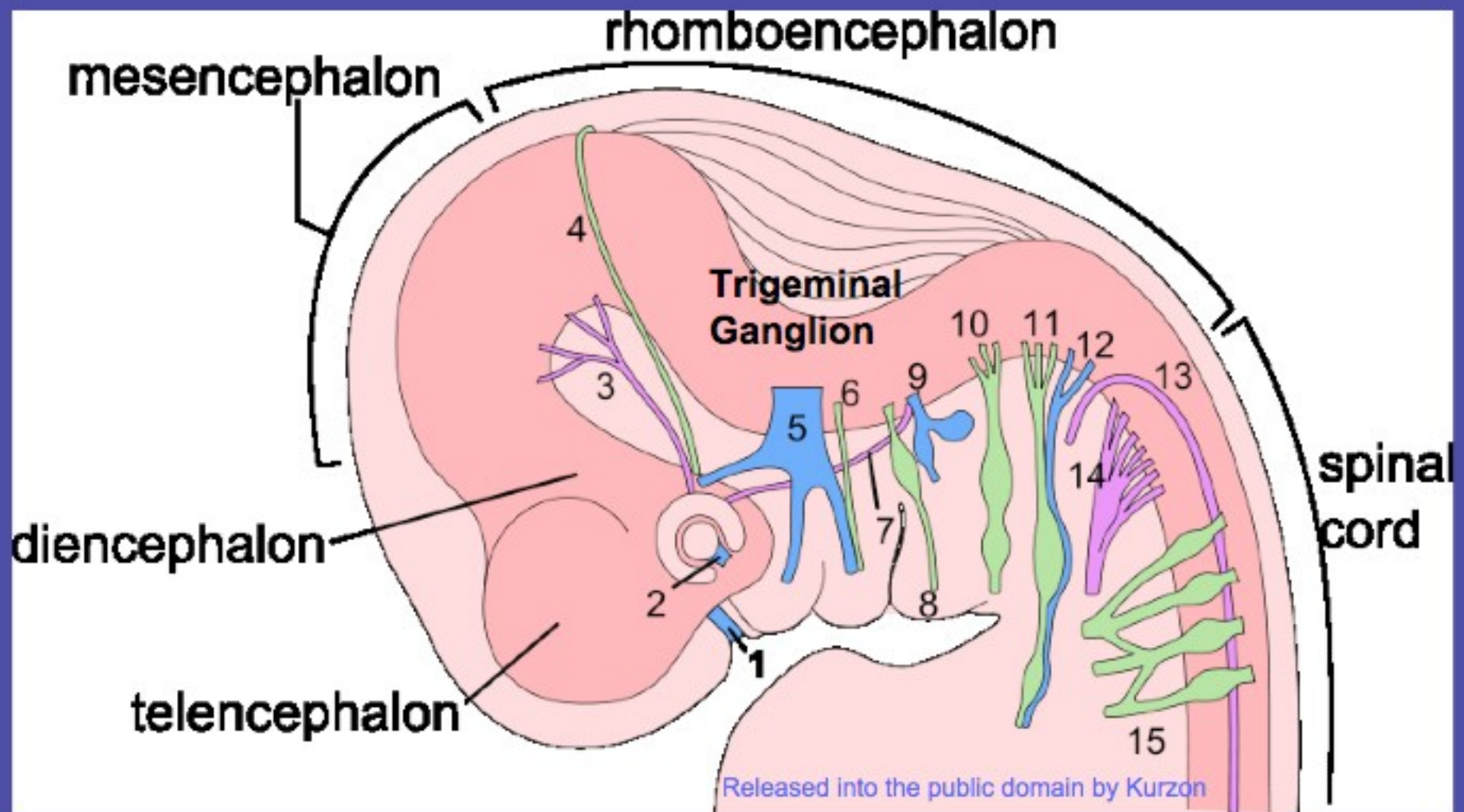
A diagram showing the brain and major nerves of a 6 week old human fetus

5- Trigeminal Sensory

6- Trigeminal Motor



6- The **MOTOR COMPONENT** of the trigeminal nerve controls the movement of 8 muscles, the muscles of mastication- masseter, temporal, medial and lateral pterygoids, tensor veli palatini, mylohyoid, tensor tympani and anterior belly of the digastric



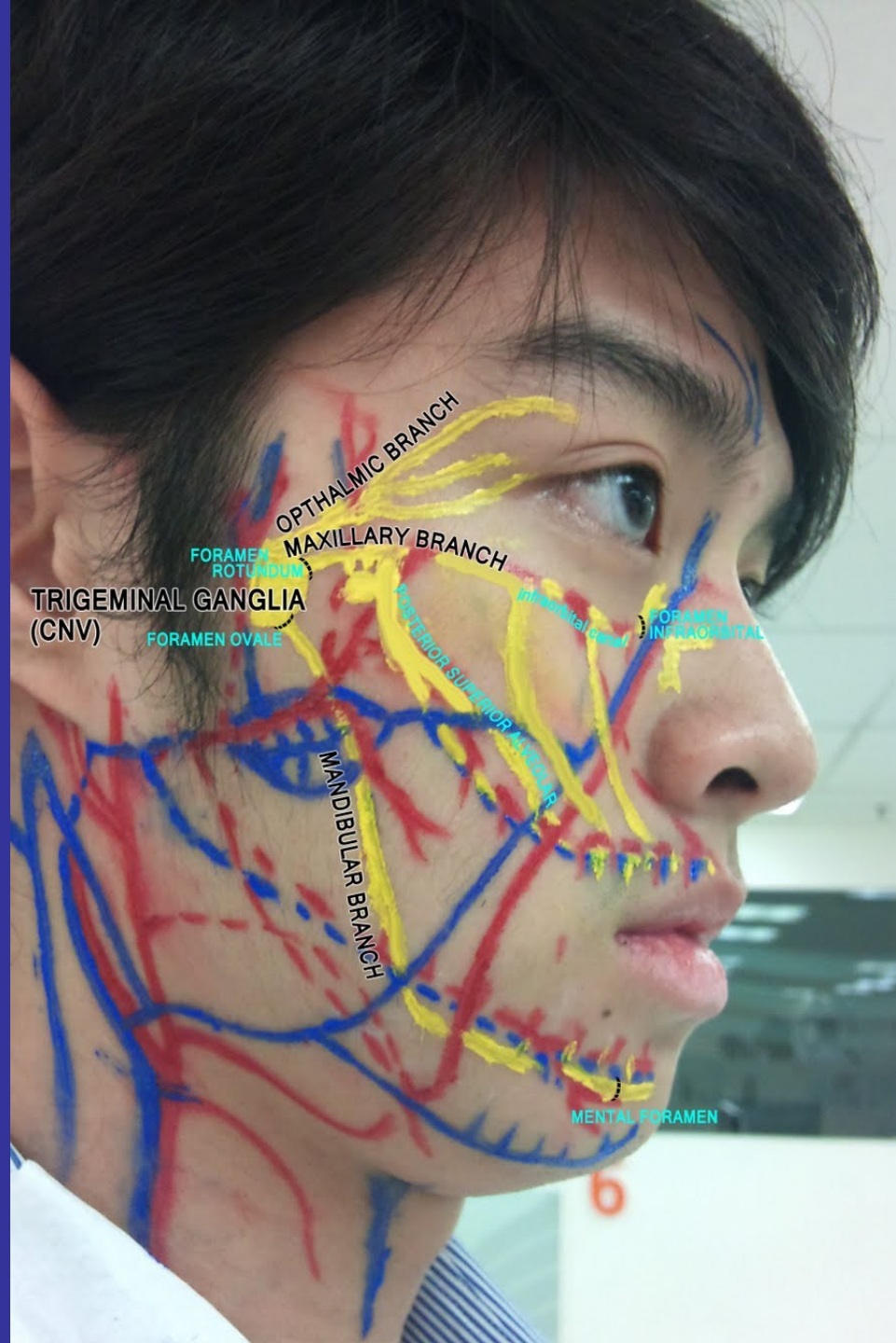
5- The **SENSORY BRANCH** has touch-position and pain-temperature related fibers.

Touch-position related information is carried by myelinated fibers and is immediate.

Pain-temperature information is conducted by unmyelinated or slow-conducting fibers.

When we step on a pin, the awareness of stepping on it is immediate, but pain is delayed.

Pathway of the Trigeminal Nerve



OPHTHALMIC BRANCH

MAXILLARY BRANCH

MANDIBULAR BRANCH

TRIGEMINAL GANGLIA (CNV)

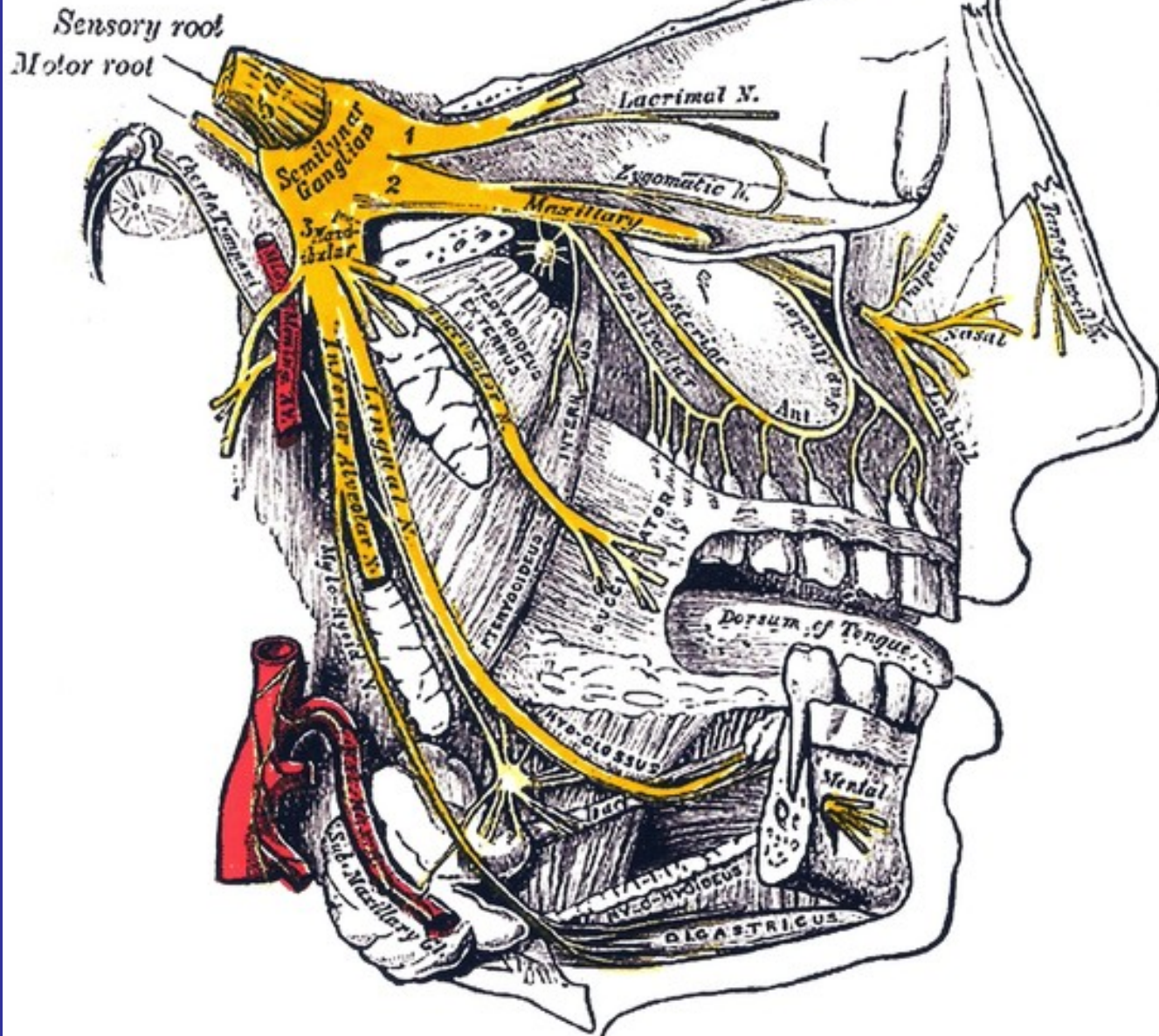
FORAMEN ROTUNDUM

FORAMEN OVALE

FORAMEN INFRAOBITAL

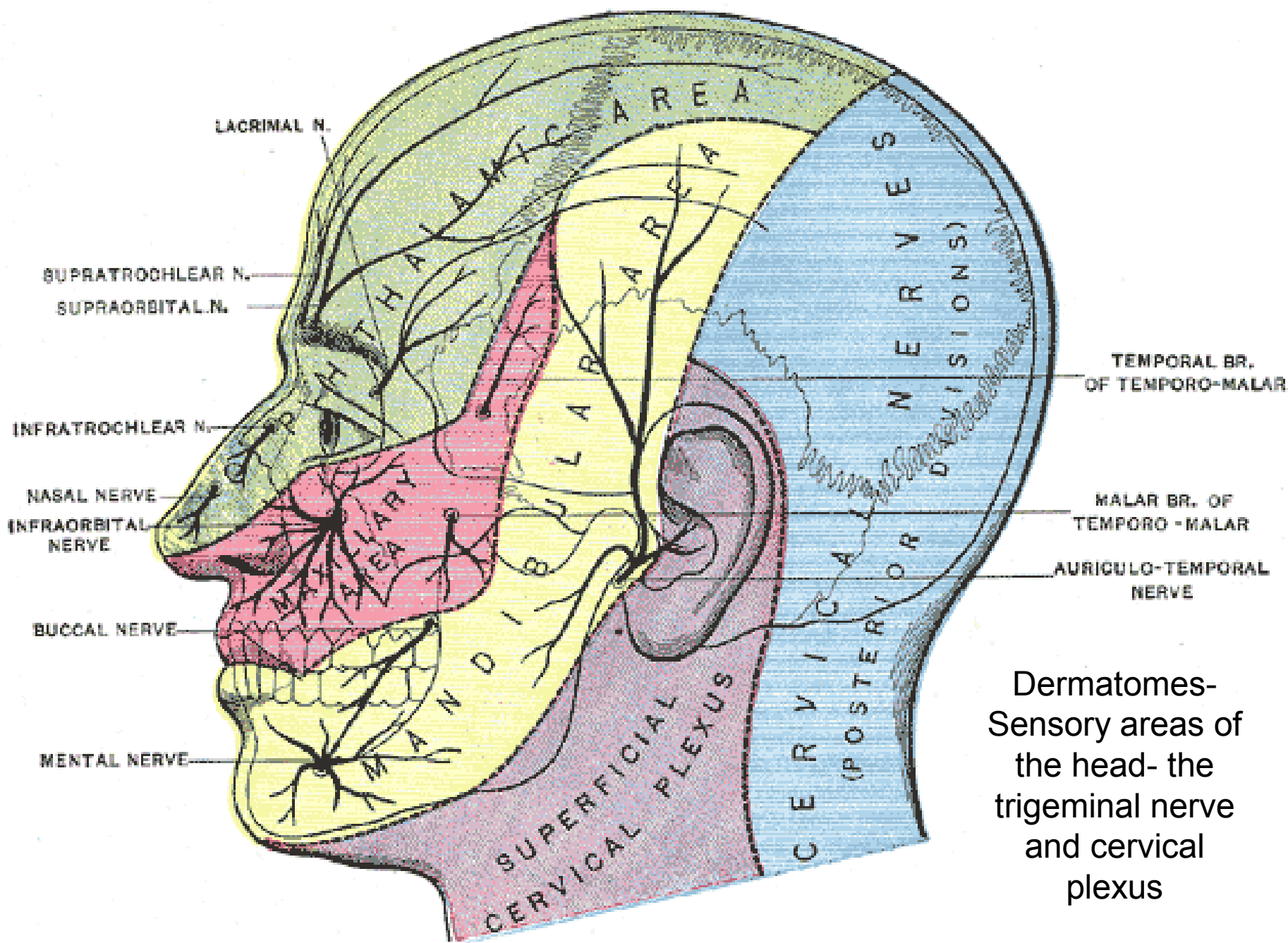
POSTERIOR SUPERIOR AURICULAR

MENTAL FORAMEN



The trigeminal nerve receives sensory input from many areas including:

- oral cavity, teeth and TMJ**
- nasopharynx and nasal cavity**
- most of the face and the scalp**
- eyeballs and conjunctiva**
- ear pinnae and external ear canal**
- lacrimal glands(tears)**
- meningeal membranes of the anterior and middle cranial fossae**
- portions of the superior tentorium**



Dermatomes-
 Sensory areas of
 the head- the
 trigeminal nerve
 and cervical
 plexus

Three branches of the trigeminal nerve enter the skull through three different foramina in the sphenoid bone:

The Mandibular Branch (V3) enters through the foramen ovale.

The Maxillary Branch (V2) enters through the foramen rotundum.

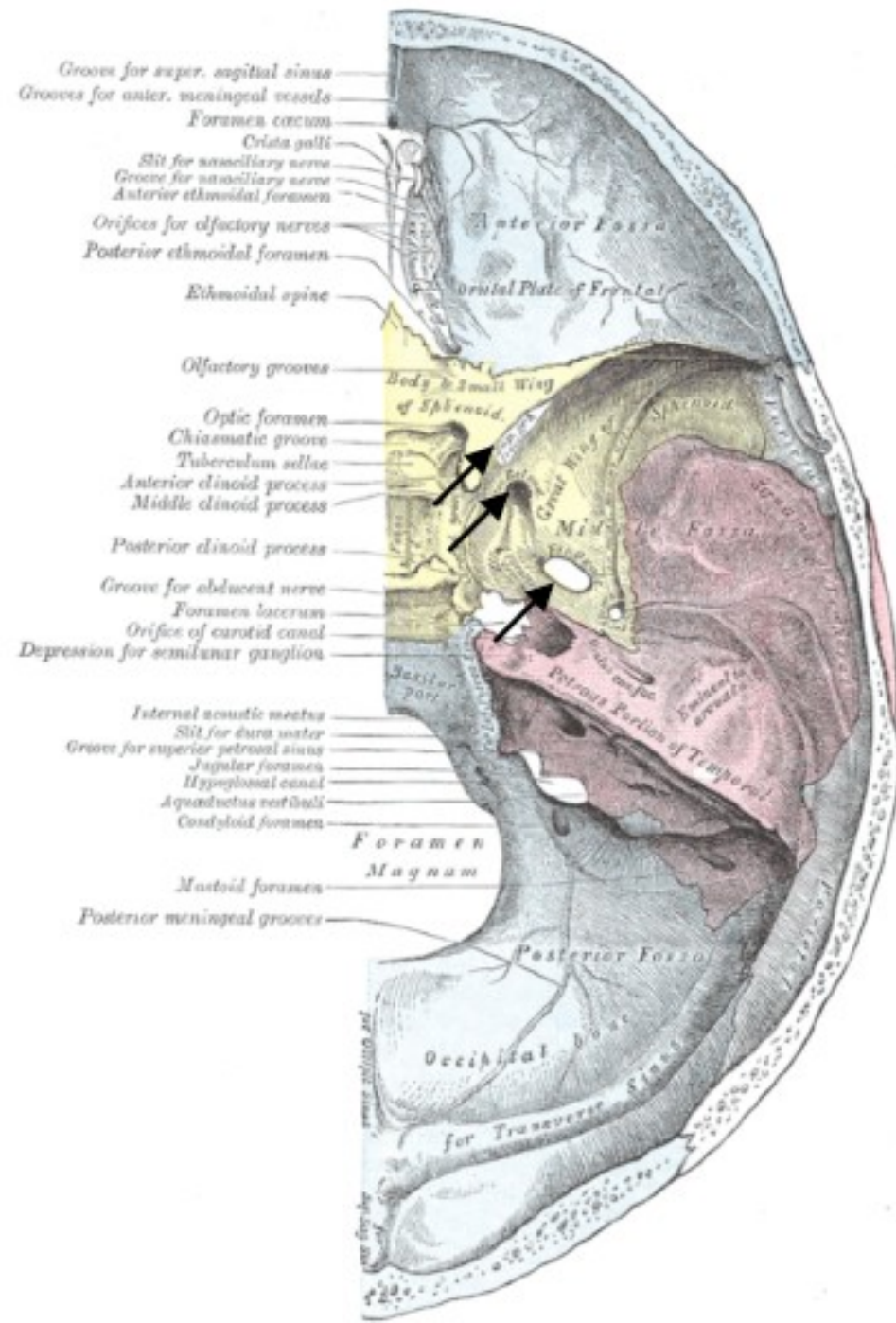
The Ophthalmic Branch (V1) enters through the superior orbital fissure.

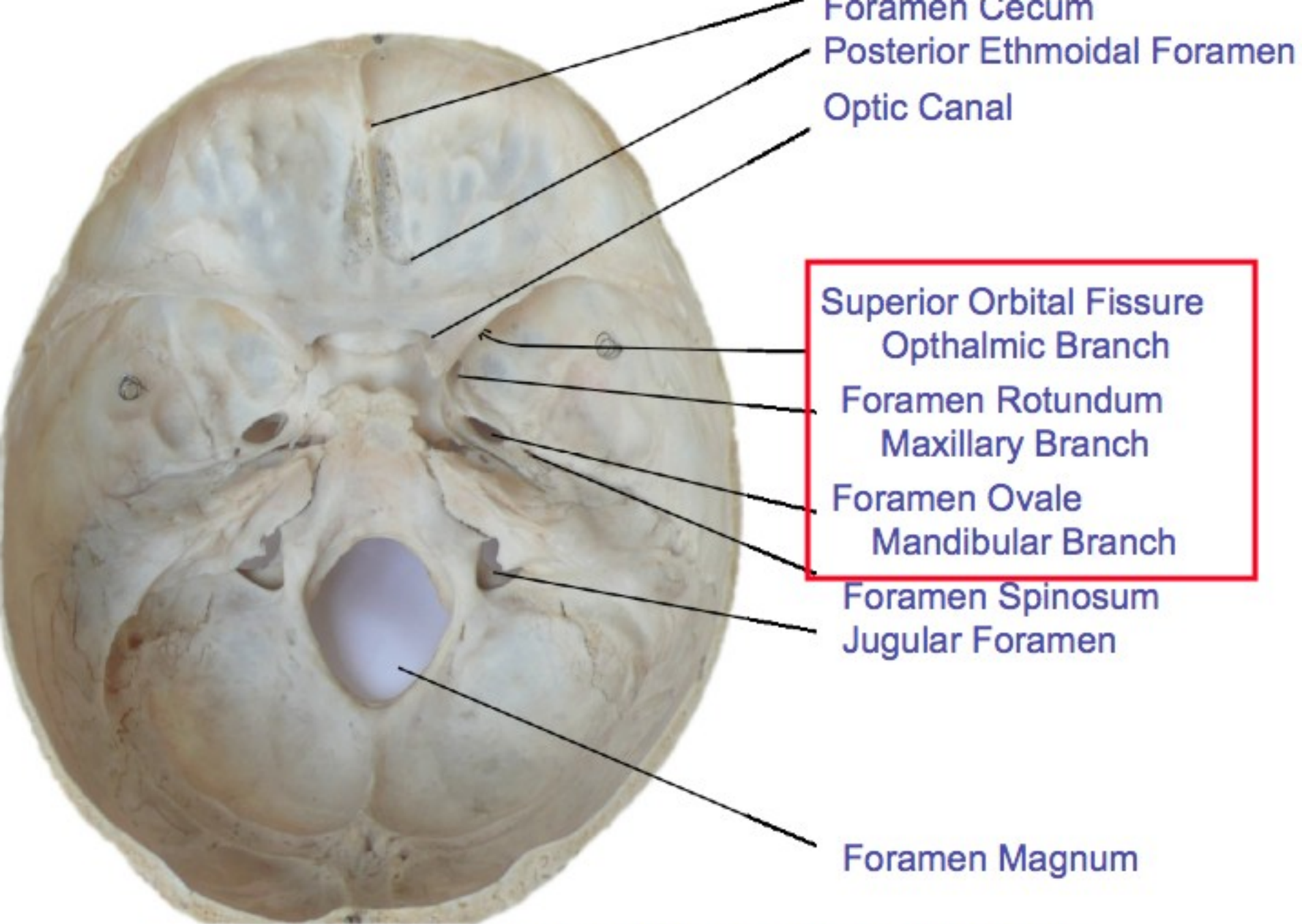
Foramina of the Trigeminal Nerve Branches

1- Ophthalmic Branch
Supraorbital Fissure

2- Maxillary Branch
Foramen Rotundum

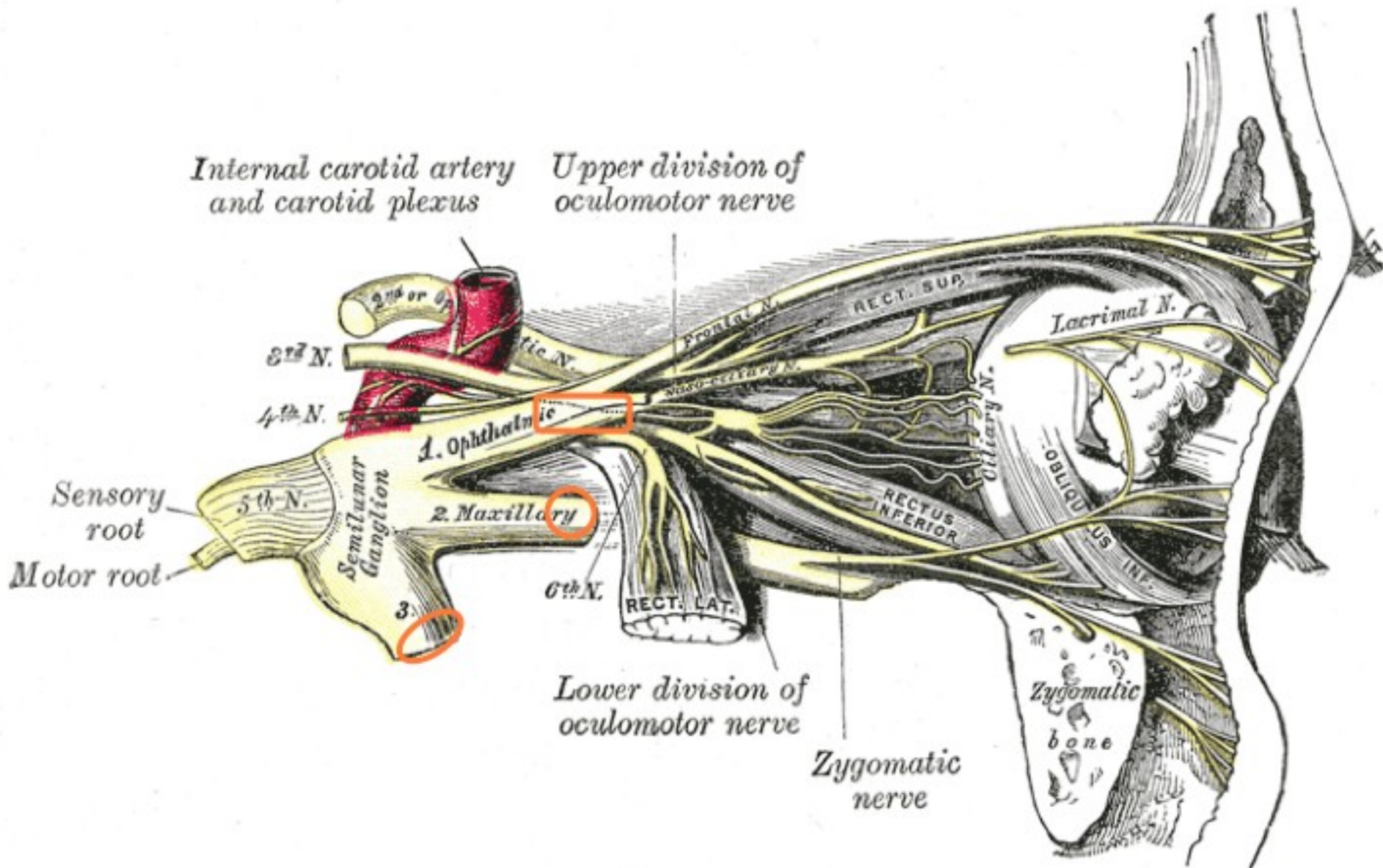
3- Mandibular Branch
Foramen Ovale





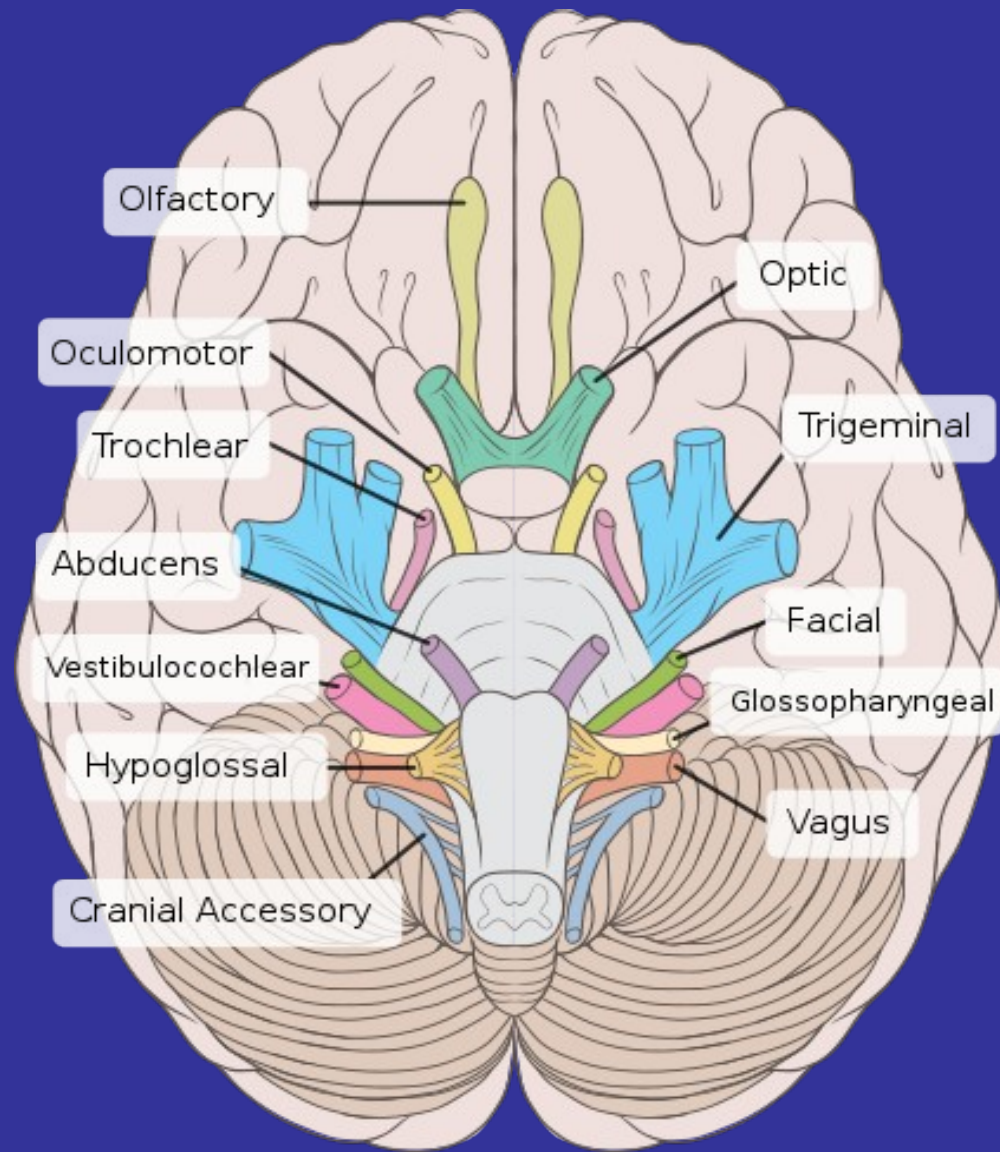
*Internal carotid artery
and carotid plexus*

*Upper division of
oculomotor nerve*

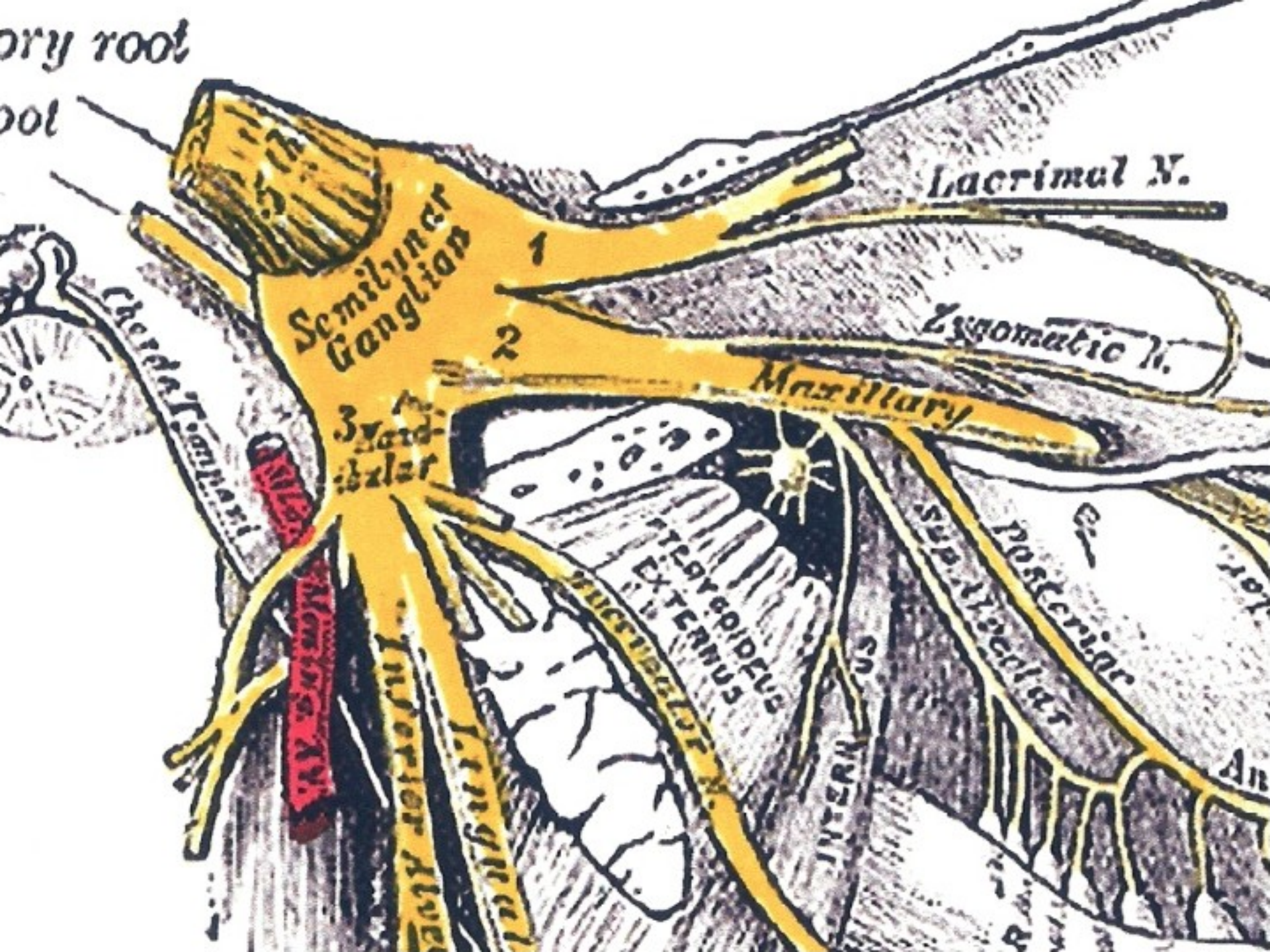


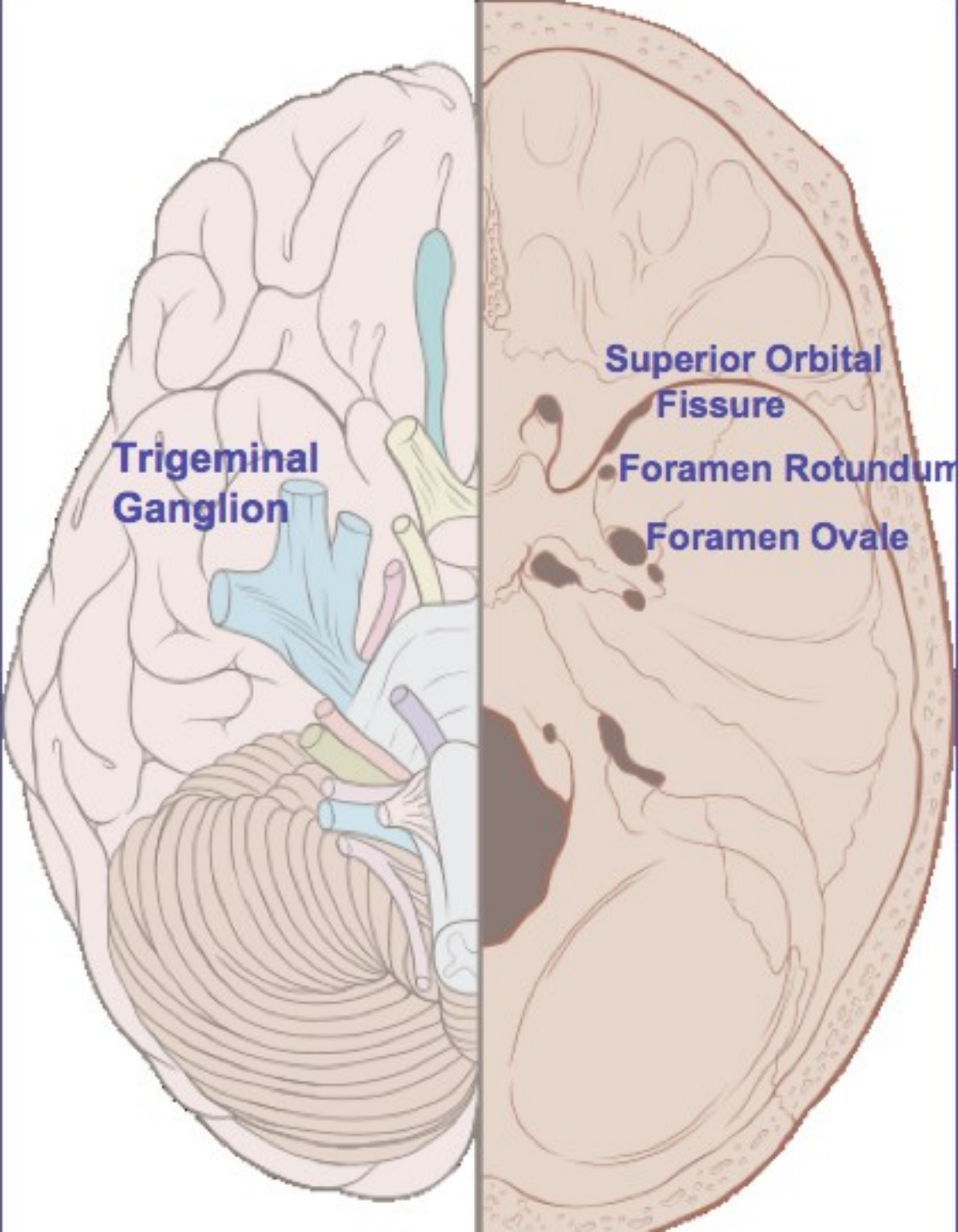
Midway between the
peripheral nerves
and trigeminal nuclei
in the brain stem,
there is a ganglion
or junction

**The trigeminal ganglion is located
near the apex of the petrous
portion of the temporal bone
and is surrounded by
cerebrospinal fluid
and nested in an
arachnoid pouch**



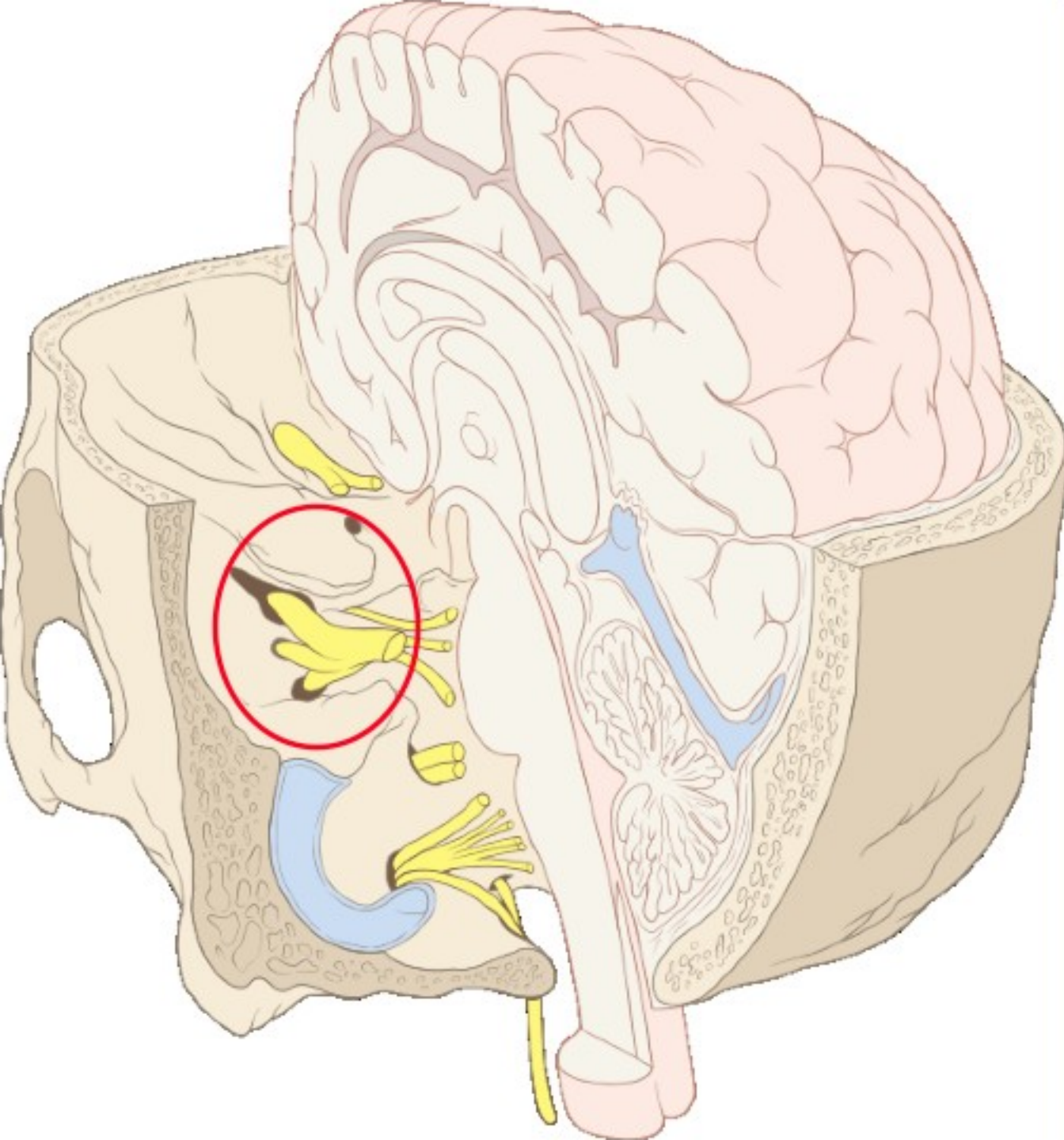
Patrick Lynch- Medical Illustrator • Creative Commons Attribution 2.5 License 2006 • Inferior view of the brain showing the cranial nerves





If you fold over the brain onto the foramina, you can see where the peripheral trigeminal nerves of the three branches enter through the 3 named foramen

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The branches of the trigeminal nerve come through the superior orbital fissure, the foramen rotundum and the foramen ovale to connect to the trigeminal ganglia

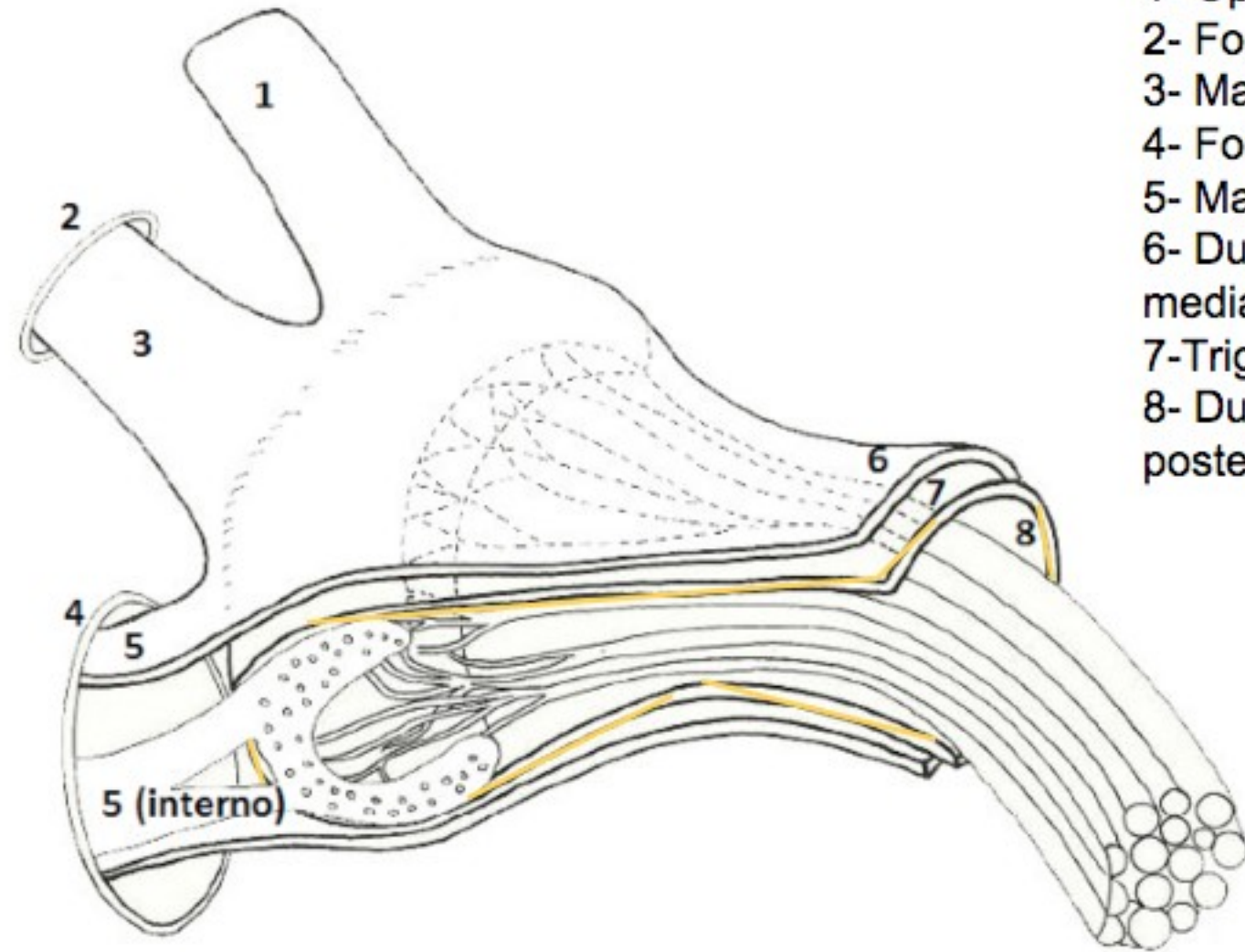
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The Trigeminal Cave is also known as Meckel's Cave.

It is an arachnoidal pouch containing cerebrospinal fluid

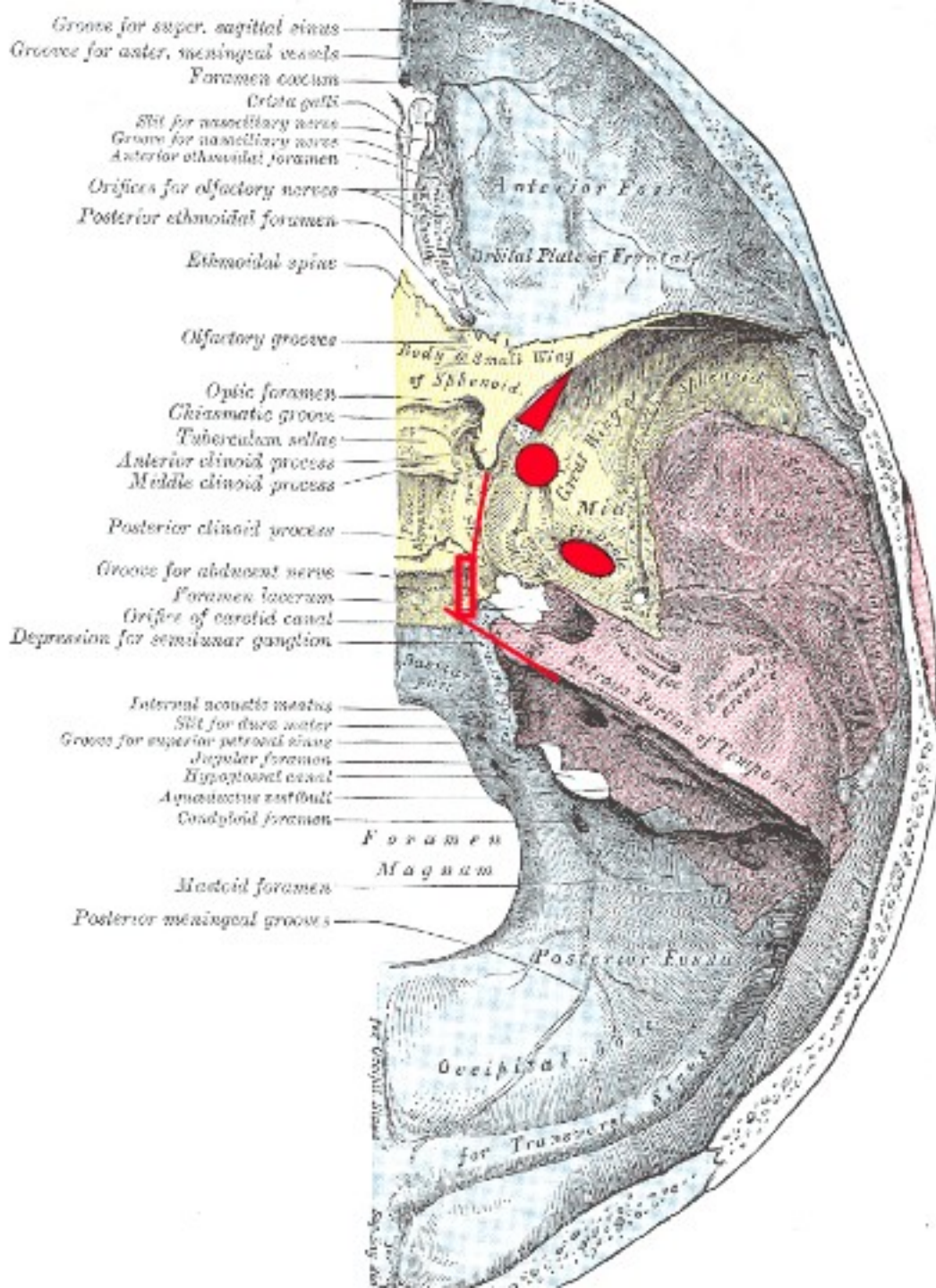
formed by two layers of dura mater which are part of an evagination of the tentorium cerebelli

- 1- Ophthalmic Branch V1
- 2- Foramen Rotundum
- 3- Maxillary Branch V2
- 4- Foramen Ovale
- 5- Mandibular Branch V3
- 6- Dura mater from the medial cranial fossa
- 7- Trigeminal Cave
- 8- Dura mater of the posterior cranial fossa



The Trigeminal Cave
envelops the
trigeminal ganglion.

It is named for
Johann Friedrich Meckel the Elder.



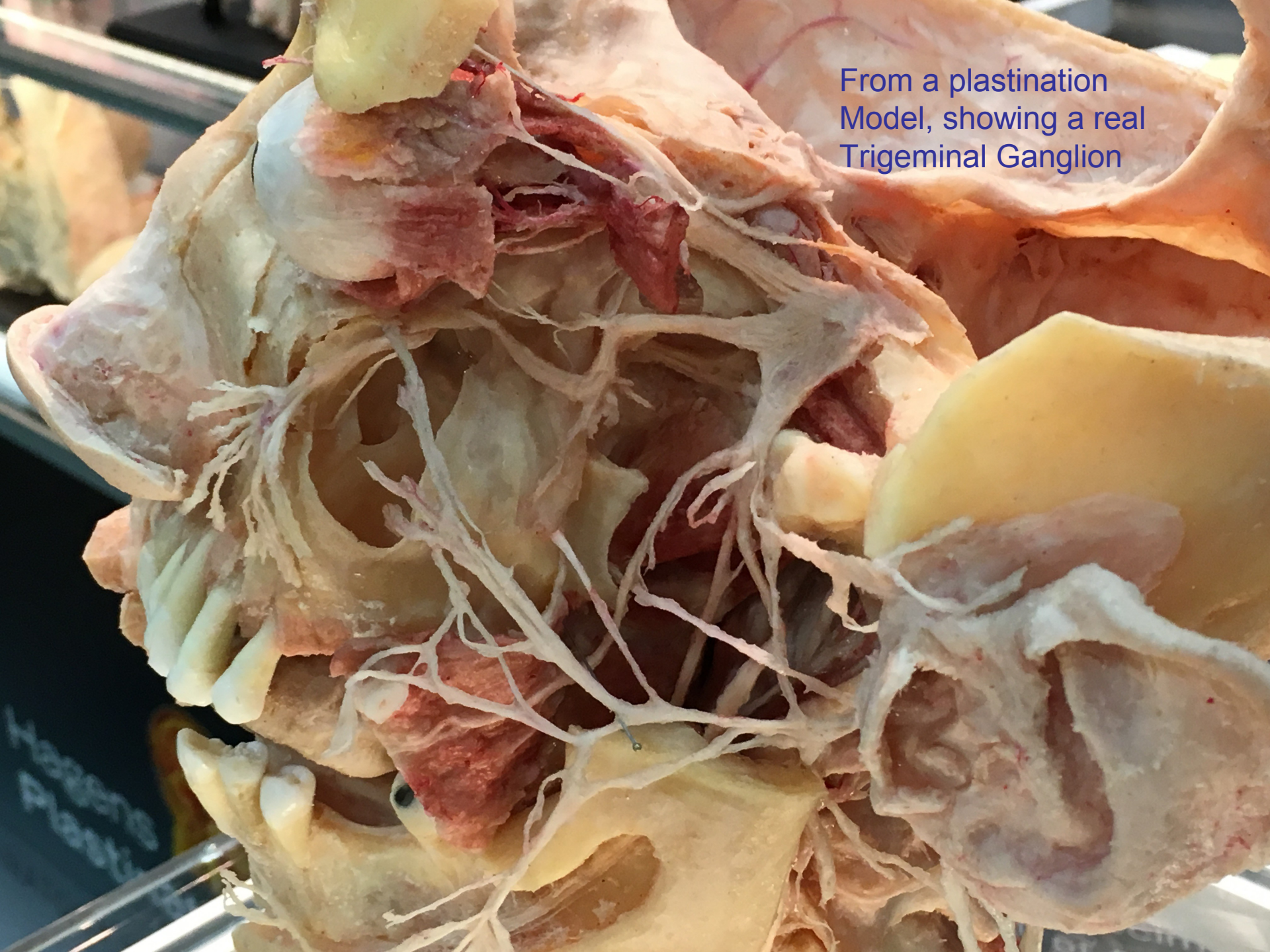
Borders of Meckel's Cave

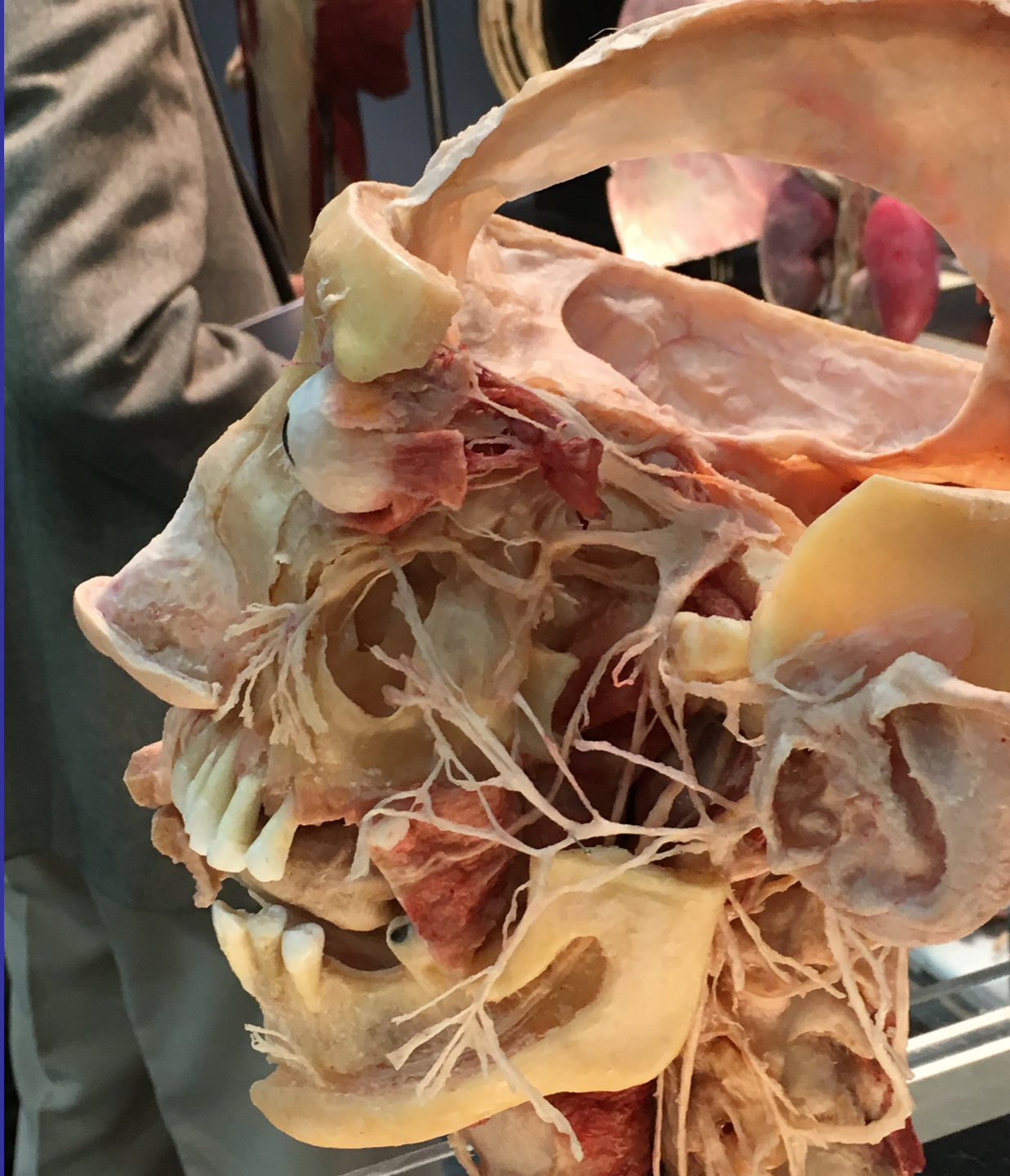
- 1- Lateral Wall of the Cavernous Sinus
- 2- Edge of the Clivus
- 3- Posterior Petrous Face
- 4- Tentorium above

From a plastination model where the Trigeminal Ganglion is made of plastic



From a plastination
Model, showing a real
Trigeminal Ganglion









**There is about a 2 cm
connection from the trigeminal
ganglion
to the trigeminal nucleus**

OPTIC NERVE

**INTERNAL
CAROTID
ARTERIES**

**OCULOMOTOR
NERVE**

PONS

CEREBELLUM

**TRIGEMINAL
NERVE V1**

**MAXILLARY
NERVE V2**

**MANDIBULAR
NERVE V3**

**TRIGEMINAL
GANGLION**

MOTOR ROOT

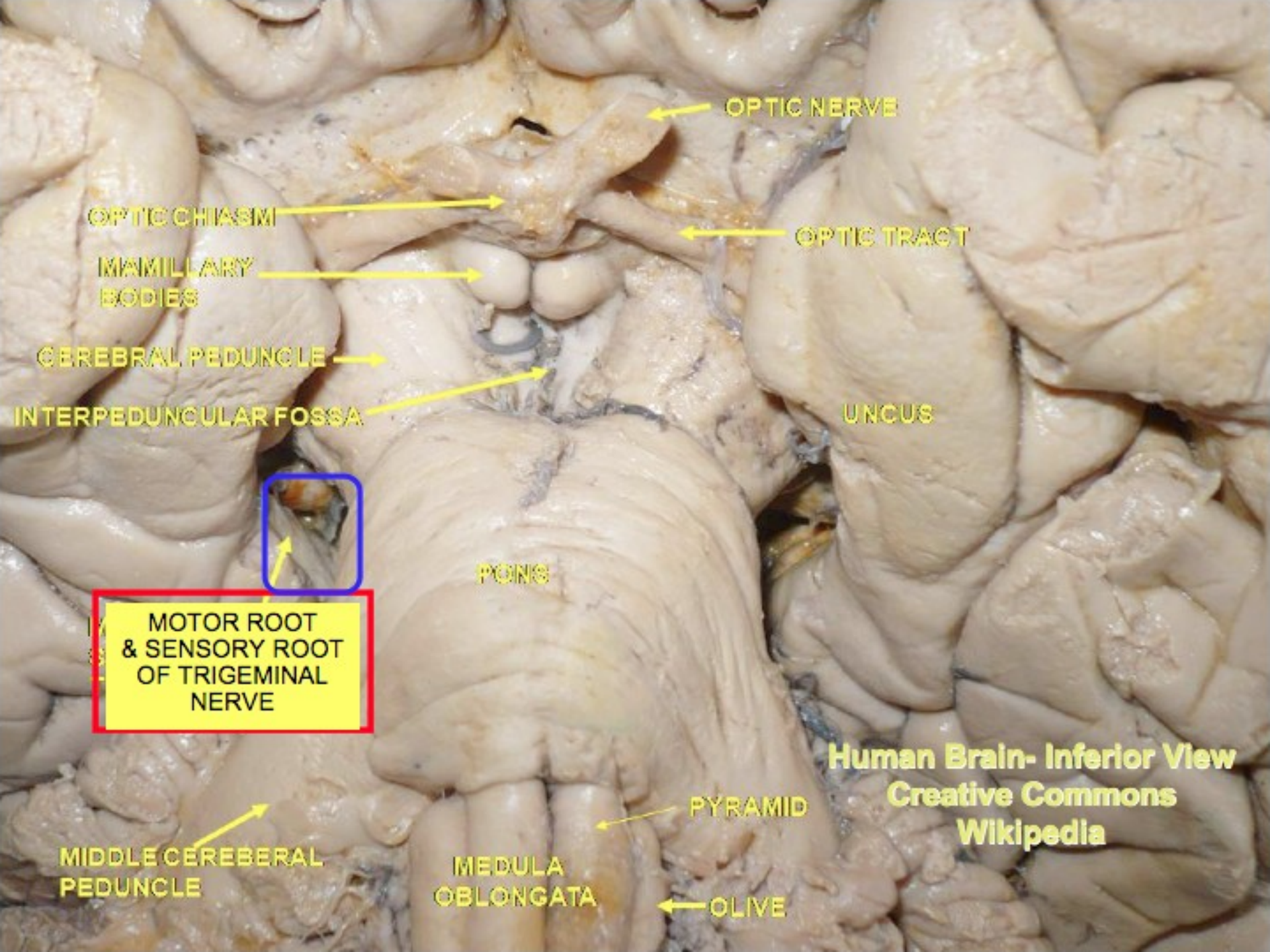
SENSORY ROOT

FACIAL NERVE

VESTIBULOCOCHLEAR NERVE



Human Brain- Inferior View
Uploaded by Anatomist 90
Wikipedia



OPTIC NERVE

OPTIC CHIASM

OPTIC TRACT

MAMILLARY BODIES

CEREBRAL PEDUNCLE

UNCUS

INTERPEDUNCULAR FOSSA

PONIS

MOTOR ROOT & SENSORY ROOT OF TRIGEMINAL NERVE

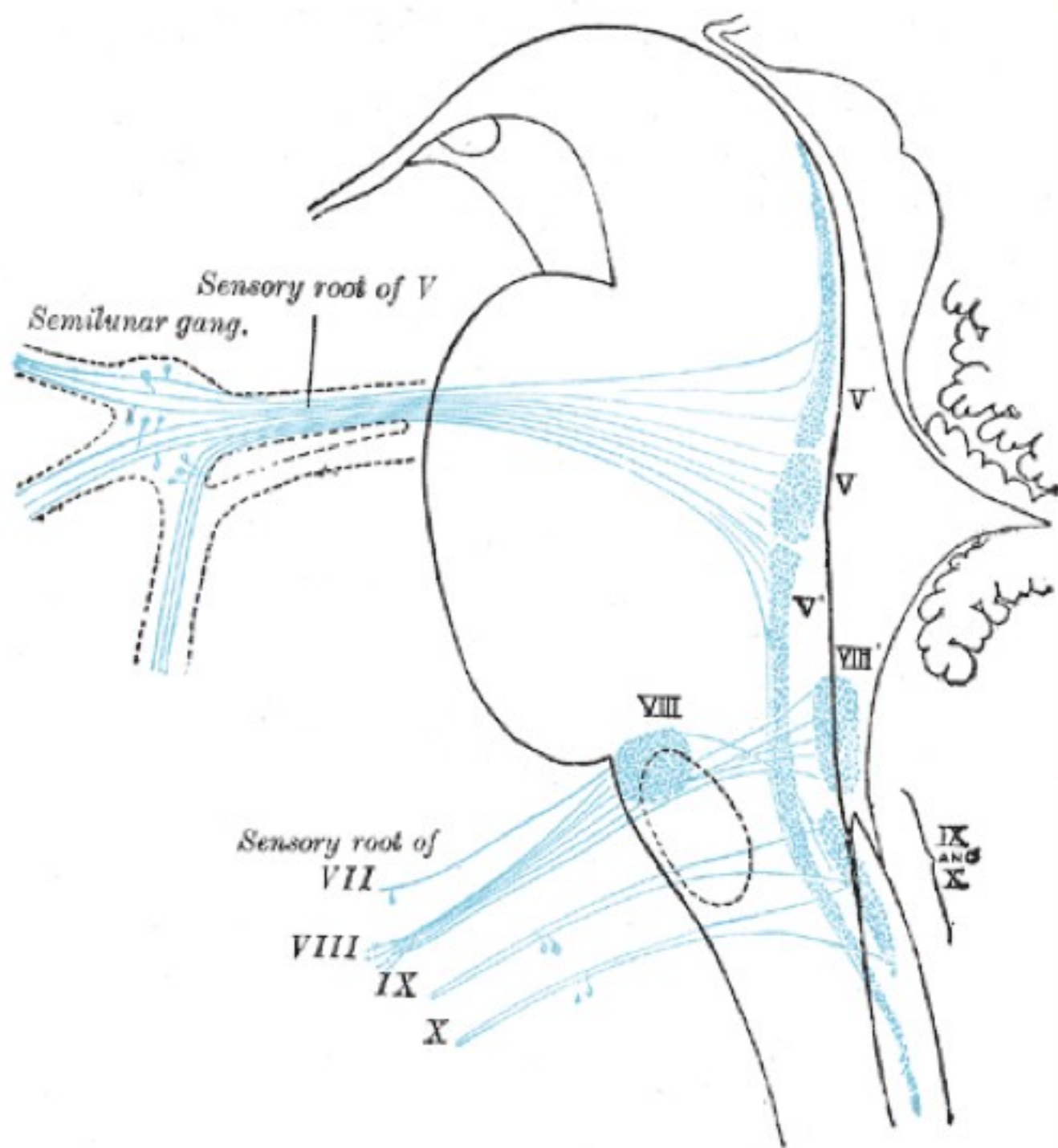
Human Brain- Inferior View
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MIDDLE CEREBRAL PEDUNCLE

PYRAMID

MEDULLA OBLONGATA

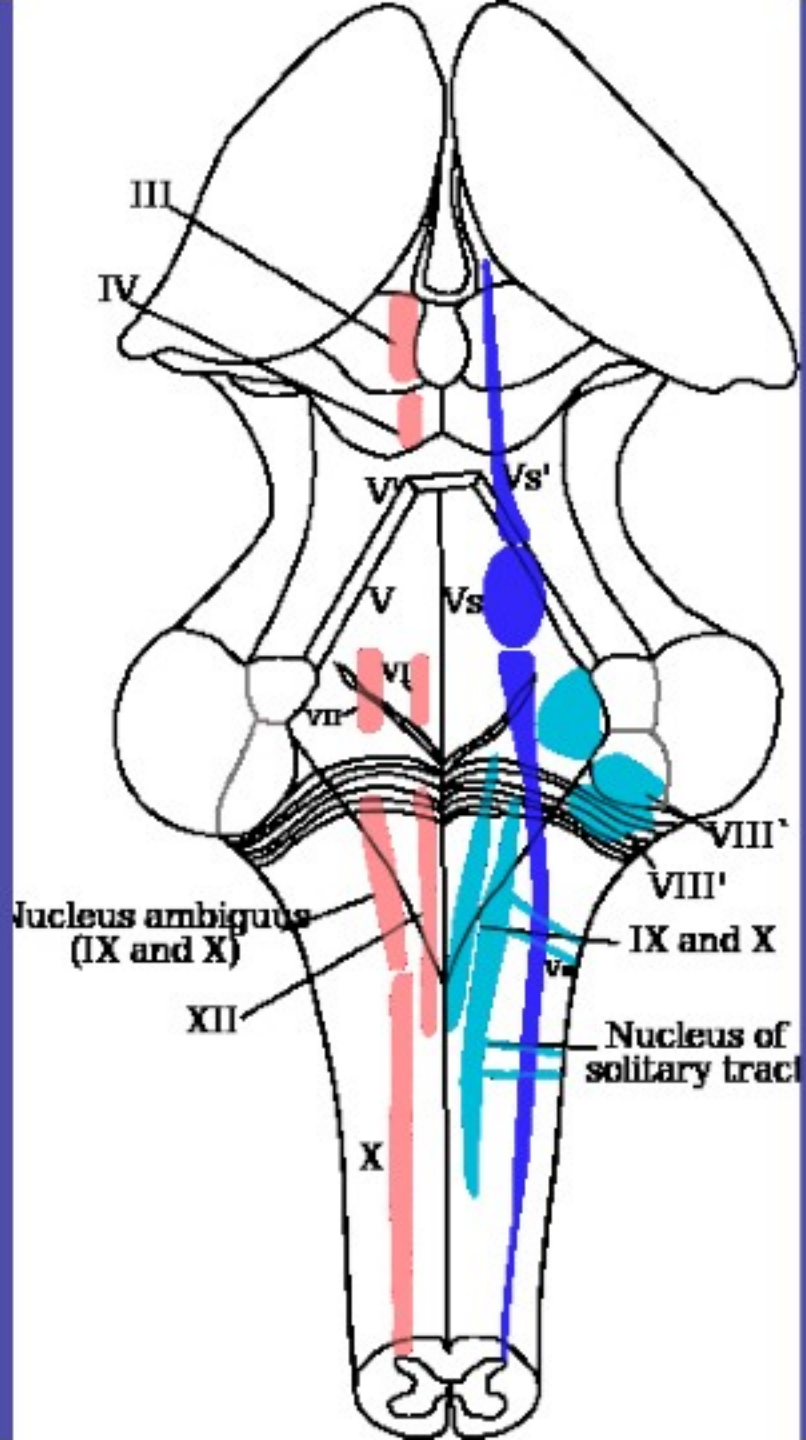
OLIVE



Gray 698
Public Domain

Henry Gray-
Anatomy of the
Human Body
1918

**The
Trigeminal Nucleus
in the
Brain Stem**



Based on Gray 696
Creative Commons

The trigeminal nucleus is divided anatomically into three parts, visible in microscopic sections of the brainstem.

From caudal to rostral going up from the medulla to the midbrain they are:

- 1- The spinal trigeminal nucleus**
- 2- The main trigeminal nucleus**
- 3- The mesencephalic trigeminal nucleus.**

The three parts of the trigeminal nucleus receive different types of sensory information:

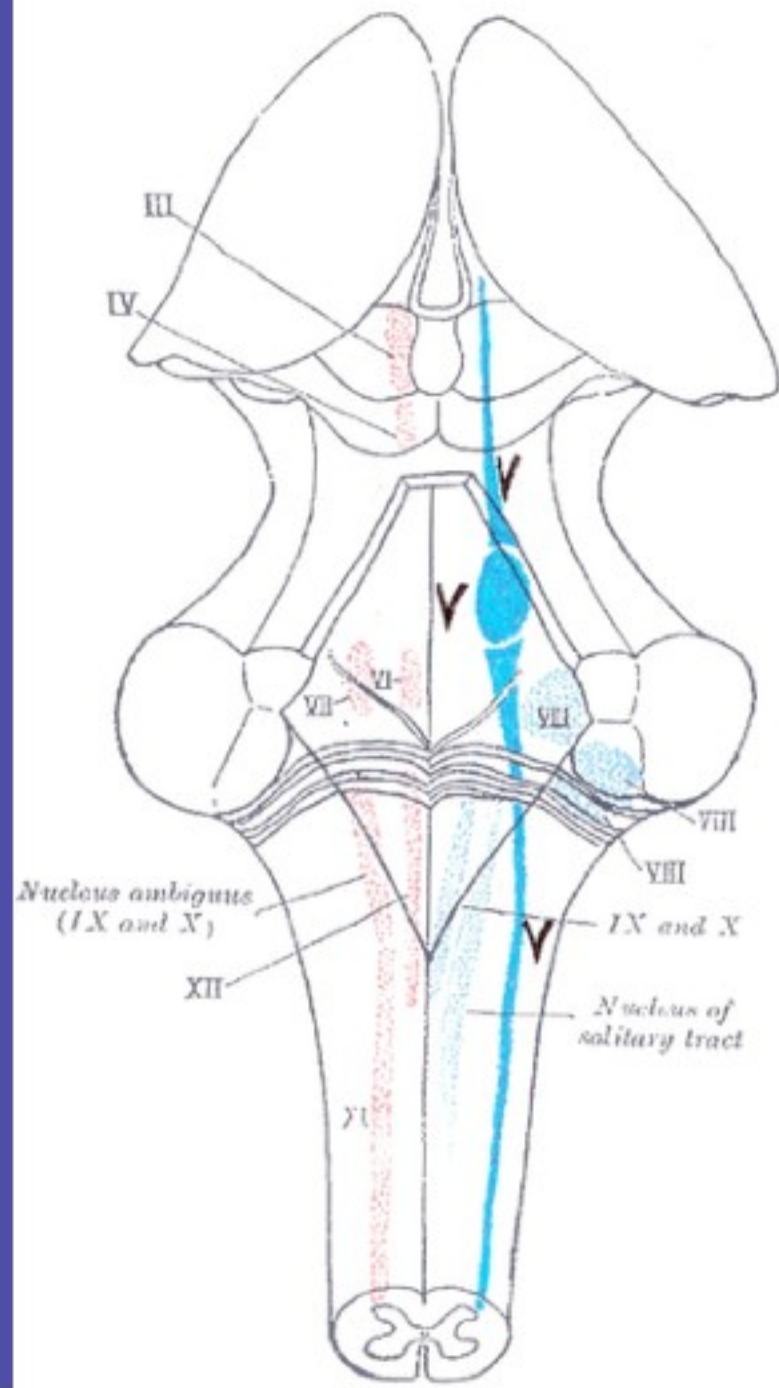
1- The spinal trigeminal nucleus (lowest) receives **pain/temperature fibers.**

2- The main trigeminal nucleus (middle) receives **touch/position fibers.**

3- The mesencephalic nucleus (highest) receives **proprioceptor and mechanoreceptor**

fibers from the jaws and teeth.

The
Trigeminal
Nucleus runs
the length of
the brain stem



**It is not widely appreciated
that all sensory information
from the face (all touch/position
information and all
pain/temperature information) is
sent to the
trigeminal nucleus.**

In classical anatomy, most sensory information from the face is carried by the fifth (trigeminal) nerve.

Sensation from certain parts of the mouth, certain parts of the ear and certain parts of the meninges is carried by

**"general somatic afferent" (GSA)
fibers in cranial nerves
VII (the facial nerve)
IX (the glossopharyngeal nerve) and
X (the vagus nerve).**

**Without exception, however,
all sensory fibers from these nerves (VII,
IX, X) terminate in the trigeminal nucleus.**

**On entering the brainstem,
sensory fibers from V, VII, IX, and X
are sorted out and sent to the
trigeminal nucleus, which thus contains a
complete sensory map of the face and mouth.**

The trigeminal nucleus extends throughout the entire brainstem, from the midbrain to the medulla, and continues into the cervical cord. It contains a sensory map of the face, mouth and relates to cranial membranes.

The trigeminal nucleus merges with the dorsal horn cells of the spinal cord which contain a sensory map of the rest of the body.

The coverings of the brain are called meninges and consist of the dura, arachnoid and pia. The dura in particular has a lot of pain receptors and may be responsible for many headaches. As a neurosurgeon I have seen this first hand during awake brain surgery when we open the dura.

The patient usually doesn't report any pain when you drill a hole in their skull. However, they start to report dull pain or headache when you stimulate or touch the dura.

Brain Surgeon response

**Not only is the trigeminal nerve (V)
feeding information
into the trigeminal nucleus,**

**but also sensory information
related to cranial nerves VII, IX, and X.**

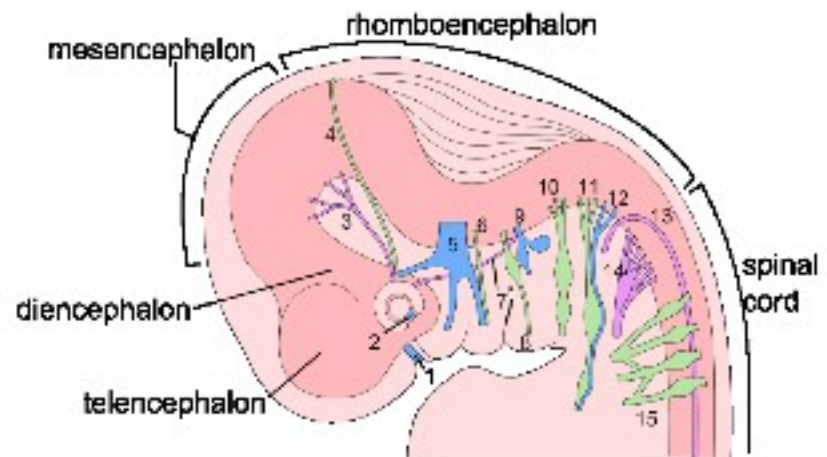
**All four of these nerves are part of
Porges Polyvagal Theory**

Also called the Social Engagement Nervous System

All are derived
from the
pharyngeal
arches
embryologically



Pharyngeal Arches



Facial and Trigeminal Nerves

Trigeminal Nerve carries sensation from the face and the mouth.

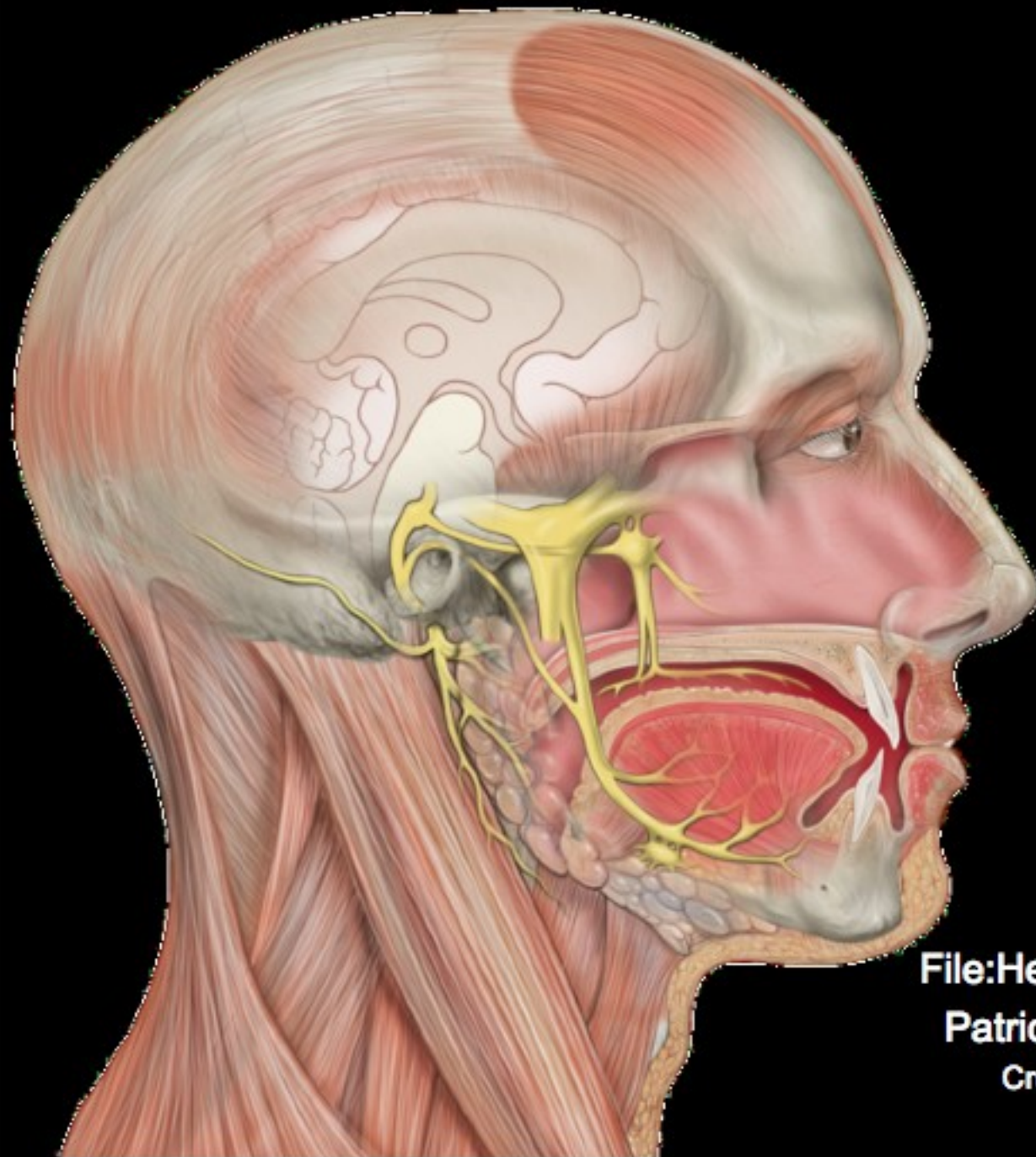
Facial Nerve carries sensation from soft palate and nasal cavity, skin of posterior ear.

File:Head deep facial trigeminal.png

Patrick Lynch- Medical Illustrator

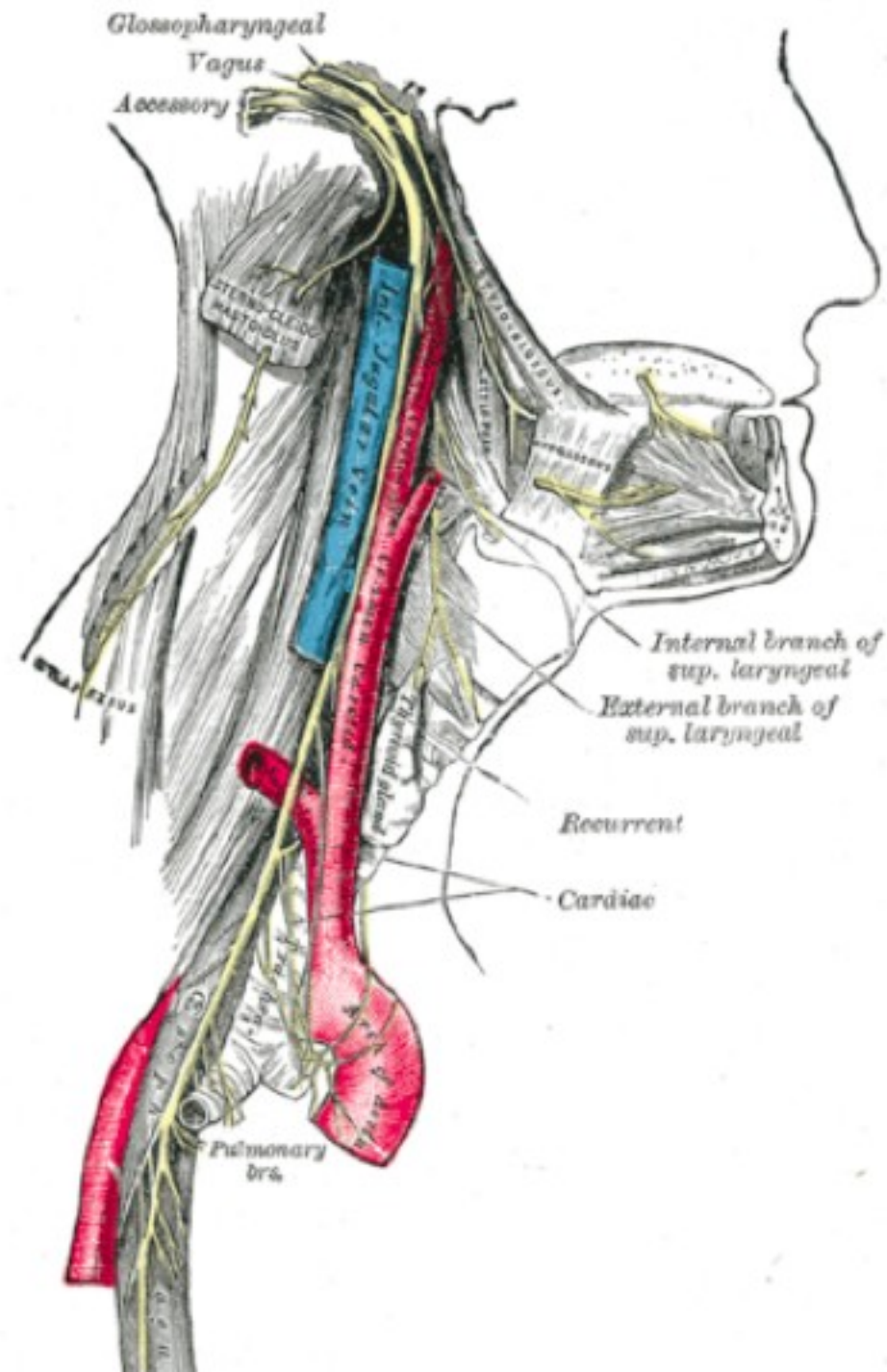
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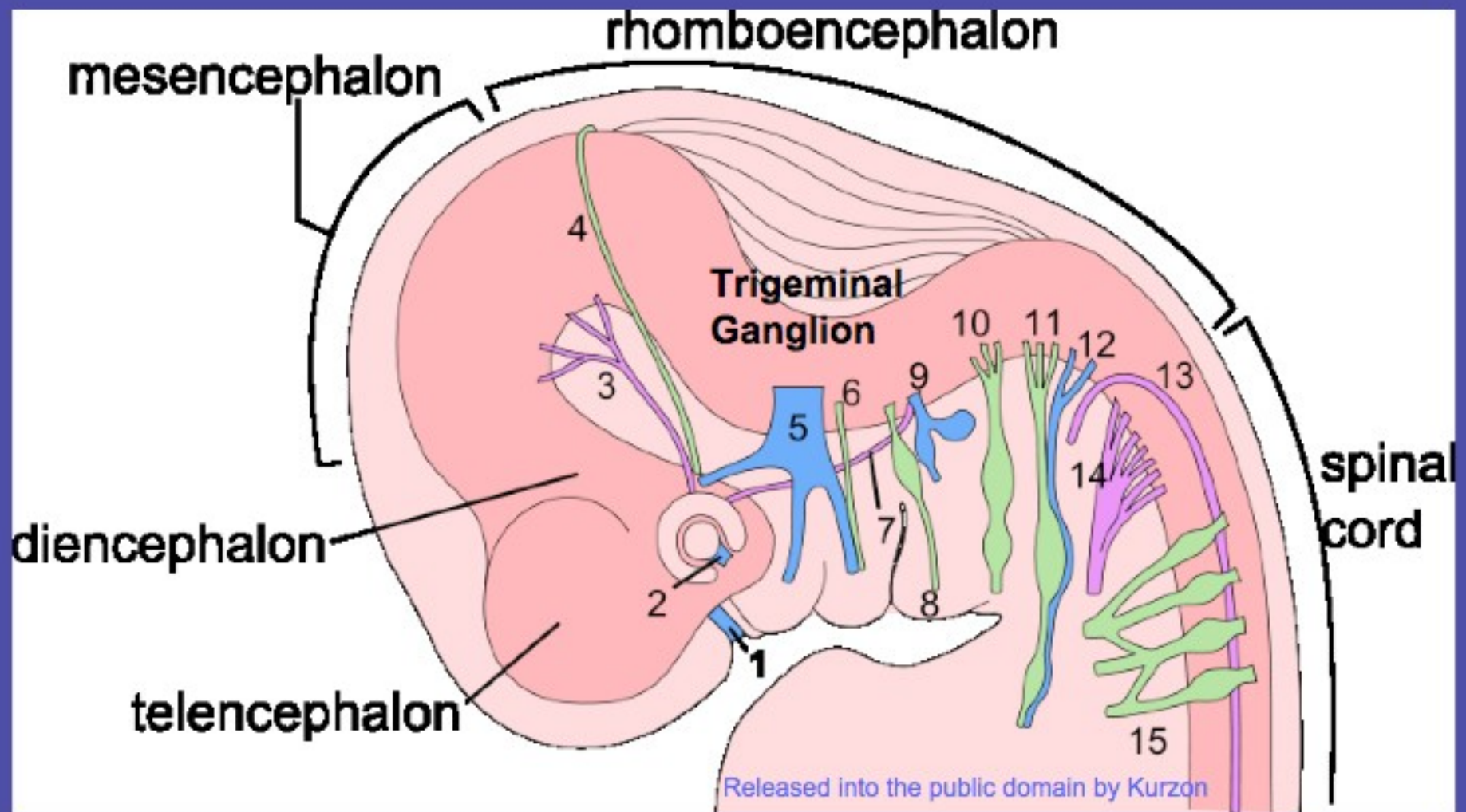


The Vagus Nerve-
Carries sensation
from the external
auditory meatus and
tympanic membrane.

The
Glossopharyngeal
Nerve carries
sensation
from the tonsils,
pharynx, middle ear,
carotid sinus, carotid
body



Pain related to the Trigeminal Nerve



5- The **SENSORY BRANCH** has touch-position and pain-temperature related fibers.

Touch-position related information is carried by myelinated fibers and is immediate.

Pain-temperature information is conducted by unmyelinated or slow-conducting fibers.

When we step on a pin, the awareness of stepping on it is immediate, but pain is delayed.

A headache or cephalalgia is pain anywhere in the region of the head or neck. It can be a symptom of a number of different conditions of the head and neck. The brain tissue itself is not sensitive to pain because it lacks pain receptors.

Rather, the pain is caused by disturbance of the pain-sensitive structures around the brain.

Nine areas of the head and neck have these pain-sensitive structures, which are the

- Cranium (The periosteum of the skull)
- Muscles
- Nerves
- Arteries and veins
- Subcutaneous tissues
- Eyes
- Ears
- Sinuses and mucous membranes

The complex processing of pain-temperature information in the thalamus and cortex reflects a phylogenetically older and more primitive sensory system relative to the simple processing of touch-position information.

Pain is an individualized sensation that varies among people and is conditioned by memory and emotion.

All information from touch-position and pain-temperature receptors is sent to the primary somato-sensory cortex.

However, pain-temperature information is communicated with more cortical centers than the touch-position fibers.

It communicates with:

- the medial dorsal thalamic nucleus which projects to the anterior cingulate gyrus.
- the ventromedial nucleus of the thalamus which is then sent to the insular cortex.
- some fibers are sent from the intralaminar nucleus of the thalamus via the reticular formation.

Trigeminal Neuralgia

TN is a severe neuropathic chronic pain disorder affecting the trigeminal nerve.

There is intense pain along the trigeminal nerve divisions.

Evidence indicates it is caused by a loss of myelin from the sensory fibers within the nerve root itself.

In type 1, it is characterized by sudden severe pain along the trigeminal nerve itself.

Sometimes in type 2, there is constant pain that varies from dull to excruciating.

Experts say this is one of the most painful medical conditions possible.

Dental work and herpes zoster may be contributing factors.









Trigeminal Nociceptive Facilitation



LifeShapes Institute
Powerpoint by Mary Louise Muller
www.LifeShapes.org