

Mnemonics

- **Oh, Oh, Oh To Take A Family Vacation! Go Vegas After Hours!**
- **On Old Olympus' Towering Tops, American, Finn, Scott and German Viewed And Hopped"**
- **Oh Oh Oh To Touch And Feel a Virgin Girl's Vagina And Hymen.**
- **OLD OPie OCCasionally TRIes TRIGonometry And Feels VERY GLOomy, VAGUe, And HYPOactive.**

CRANIAL NERVES

1st part

David Kachlík

— sensory fibres
— motor fibres

Optic (II)
sensory: eye



Olfactory (I)
sensory: nose



Intermediate motor:
submaxillary and
sublingual gland

sensory:
anterior part of tongue
and soft palate

Glossopharyngeal (IX)
motor:
pharyngeal
musculature
sensory:
posterior part
of tongue,
tonsil, pharynx

Trochlear (IV)
motor: superior
oblique muscle



Abducent (VI)
motor: external
rectus muscle

Oculomotor (III)
motor: all eye
muscles except
those supplied by
IV and VI



Trigeminal (V)
sensory: face,
sinuses, teeth, etc.

motor: muscles
of mastication



Facial (VII)
motor:
muscles
of the
face



Hypoglossal (XII)
motor: muscles
of the tongue



Vestibulocochlear (VIII)
sensory:
inner ear

vestibular
cochlear



Vagus (X)
motor:
heart, lungs,
bronchi,
gastrointestinal
tract
sensory:
heart, lungs,
bronchi, trachea,
larynx, pharynx,
gastrointestinal
tract, external ear



Accessory (XI)
motor: sterno-
cleidomastoid and
trapezius muscles



Numeral clasification

- *Claudius Galenus*
(2nd century)

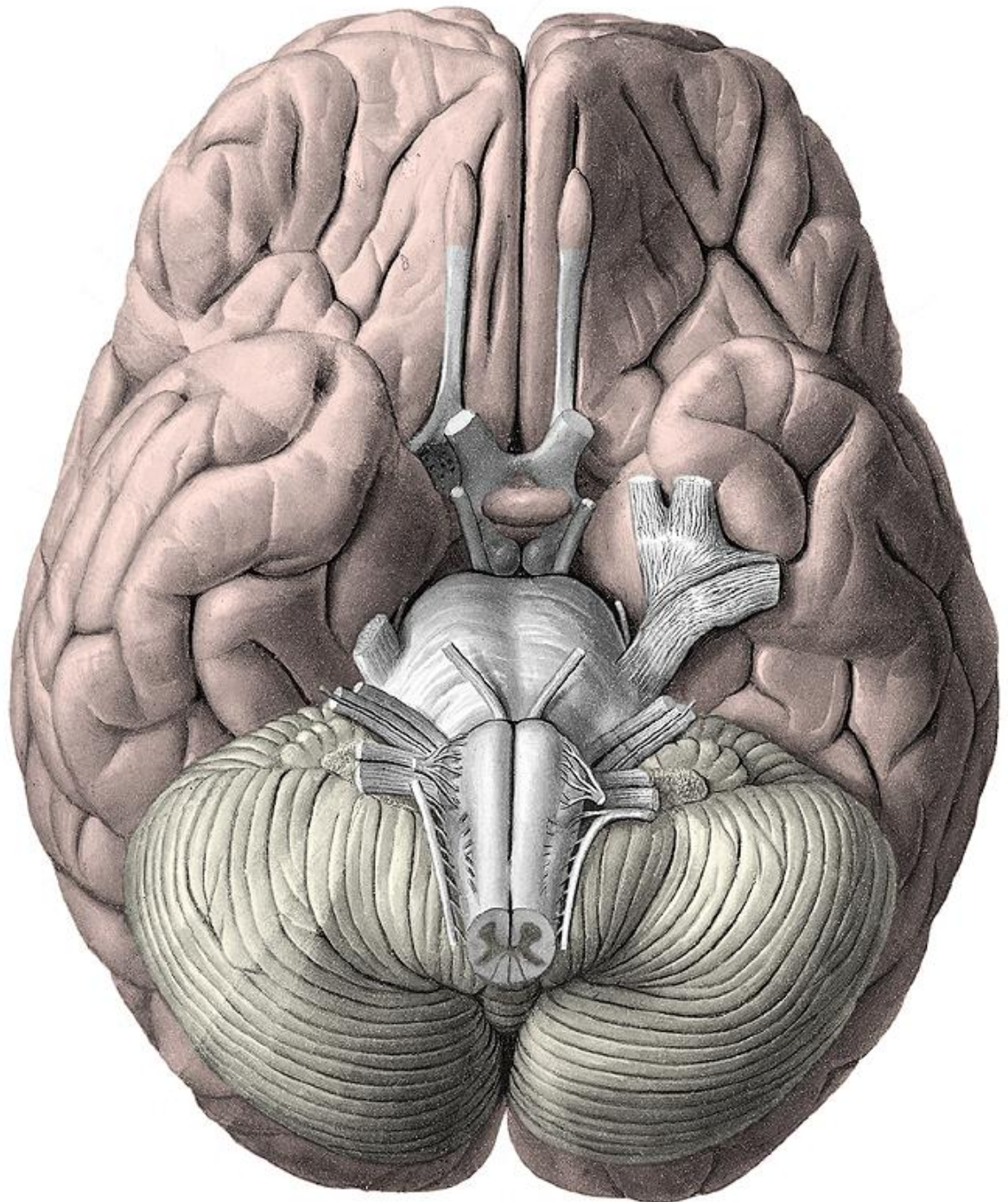
7 pairs

- *Thomas Willis*
(1664)

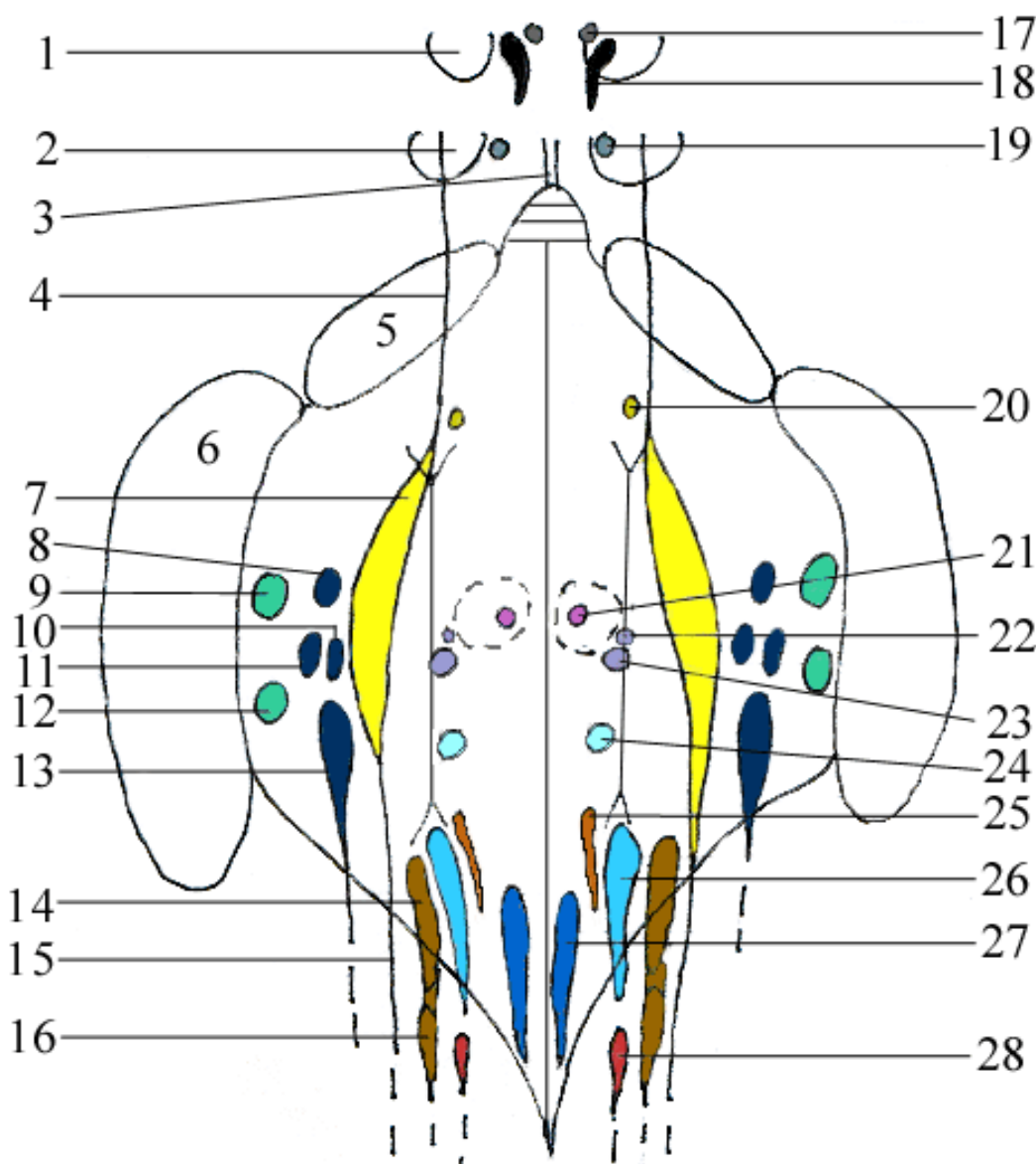
9 pairs

- *Samuel Thomas
von Sömmerring*
(1778)

12 pairs



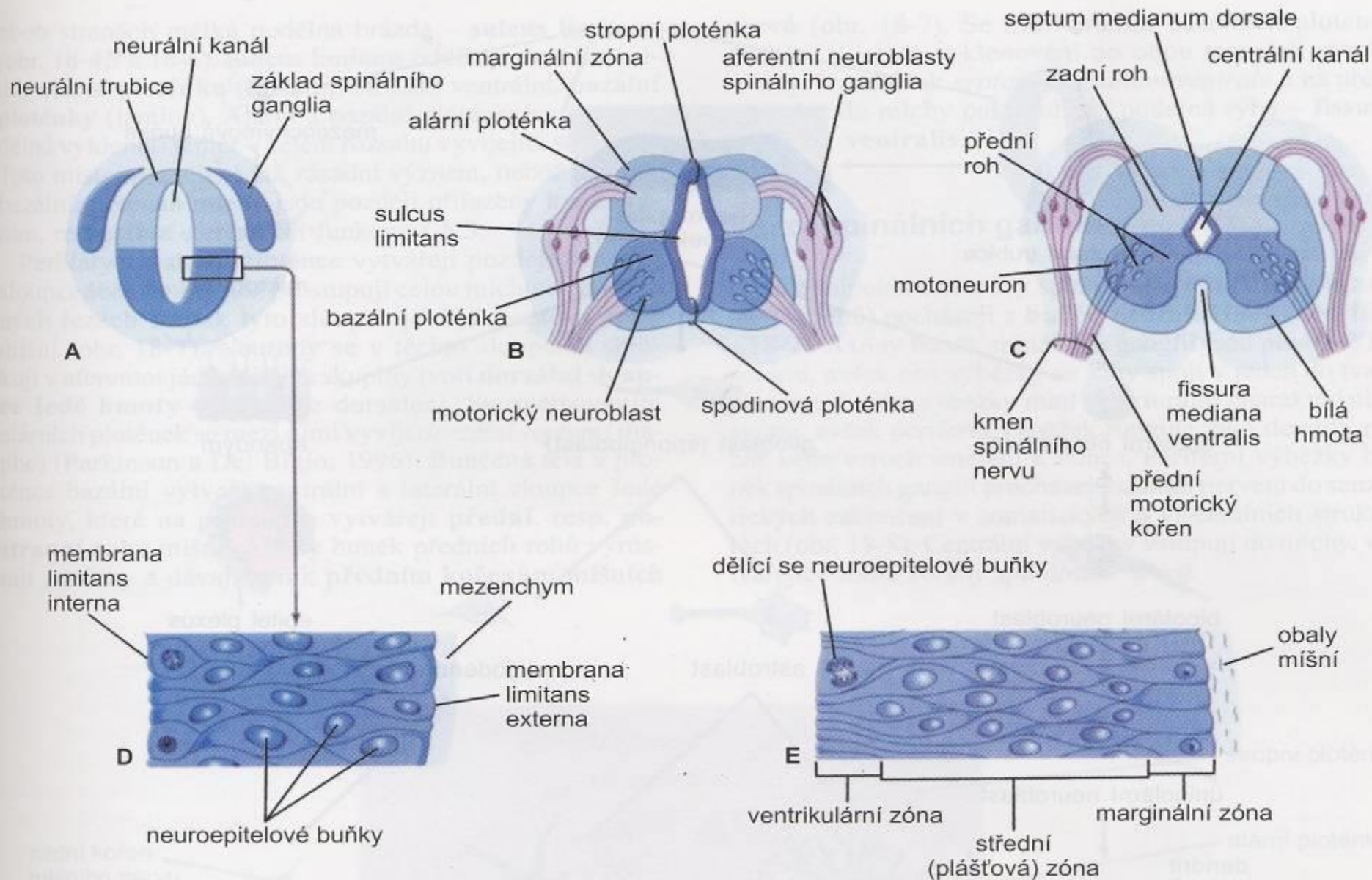
FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANIAL NERVE NUCLEI



- 1 - superior colliculus
- 2 - inferior colliculus
- 3 - frenulum of superior medullary velum
- 4 - mesencephalic tract of n. V.
- 5 - superior cerebellar peduncle
- 6 - middle cerebellar peduncle
- 7 - principal nucleus of n. V.
- 8 - superior vestibular nucleus /*Bechtëtrev*/
- 9 - posterior cochlear nucleus
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- 14 + 16 - nuclei tractus solitarii
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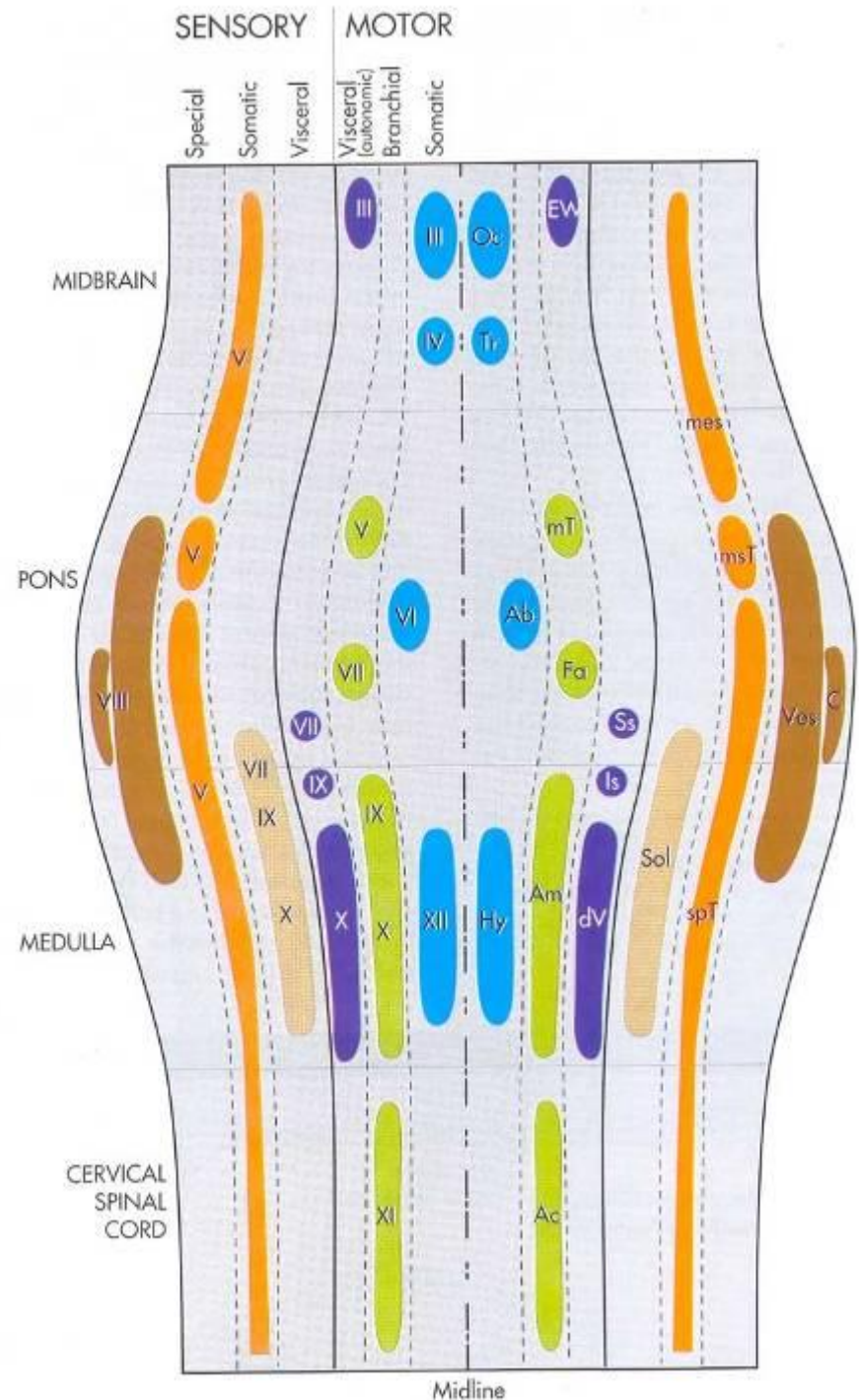
(= part of nucleus ambiguus and retroambiguus)

Basal versus Alar plate

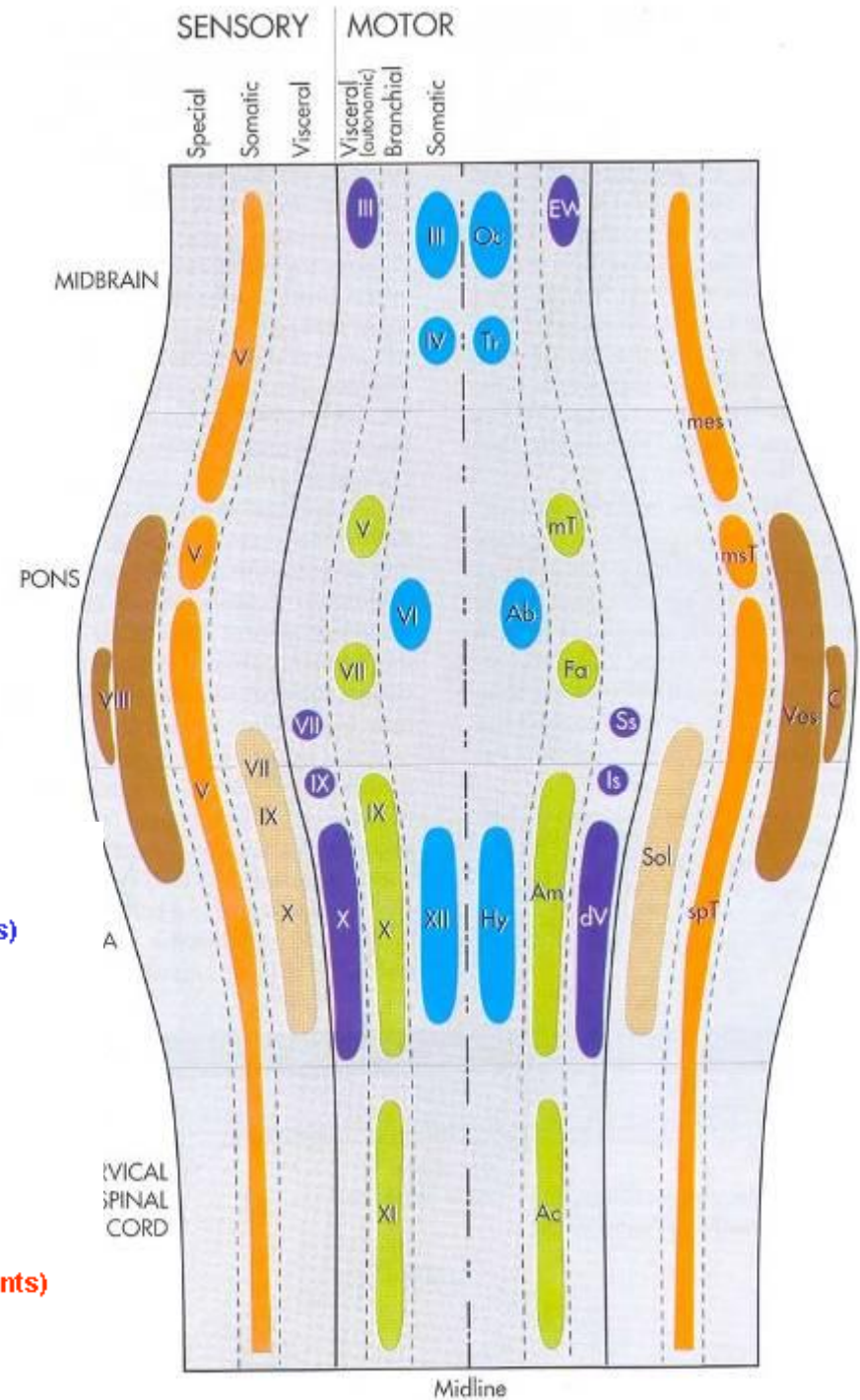
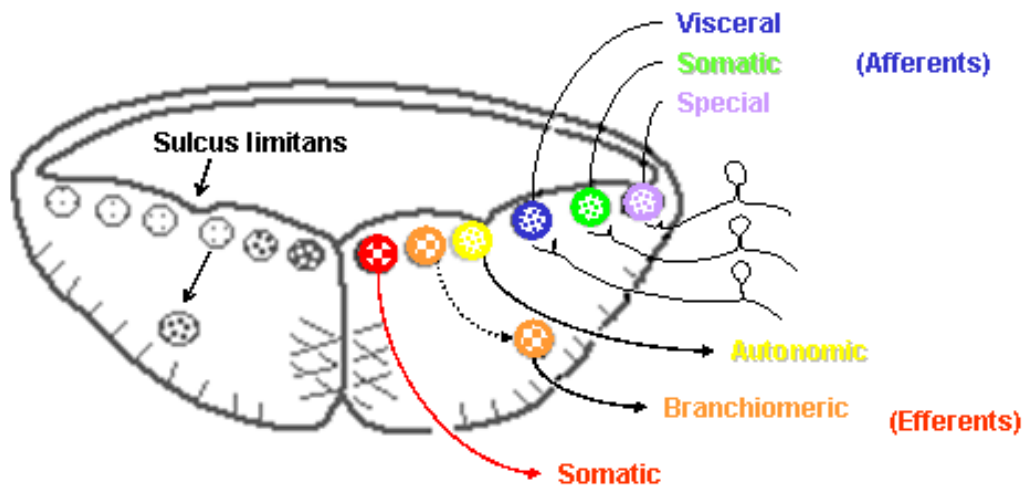


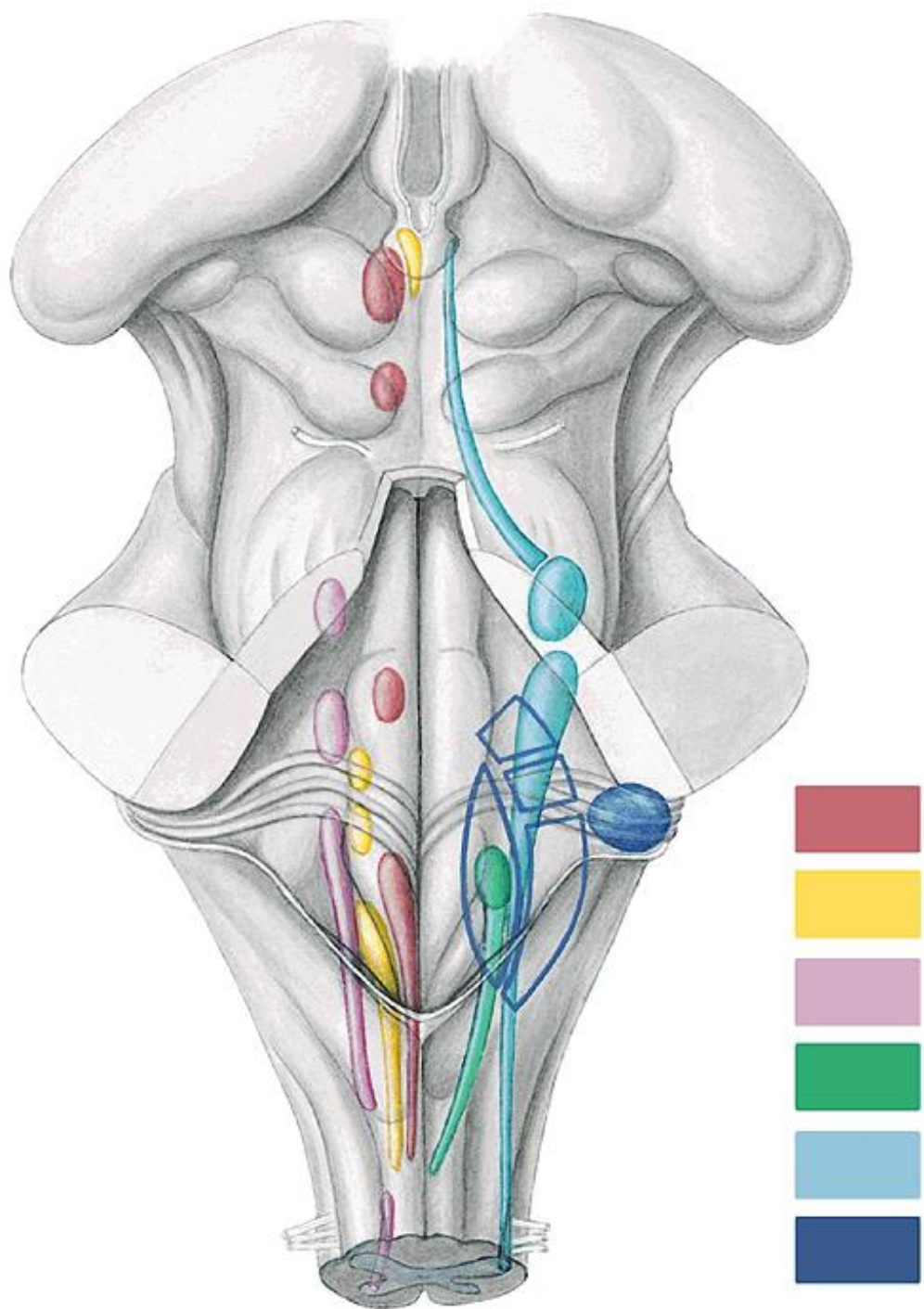
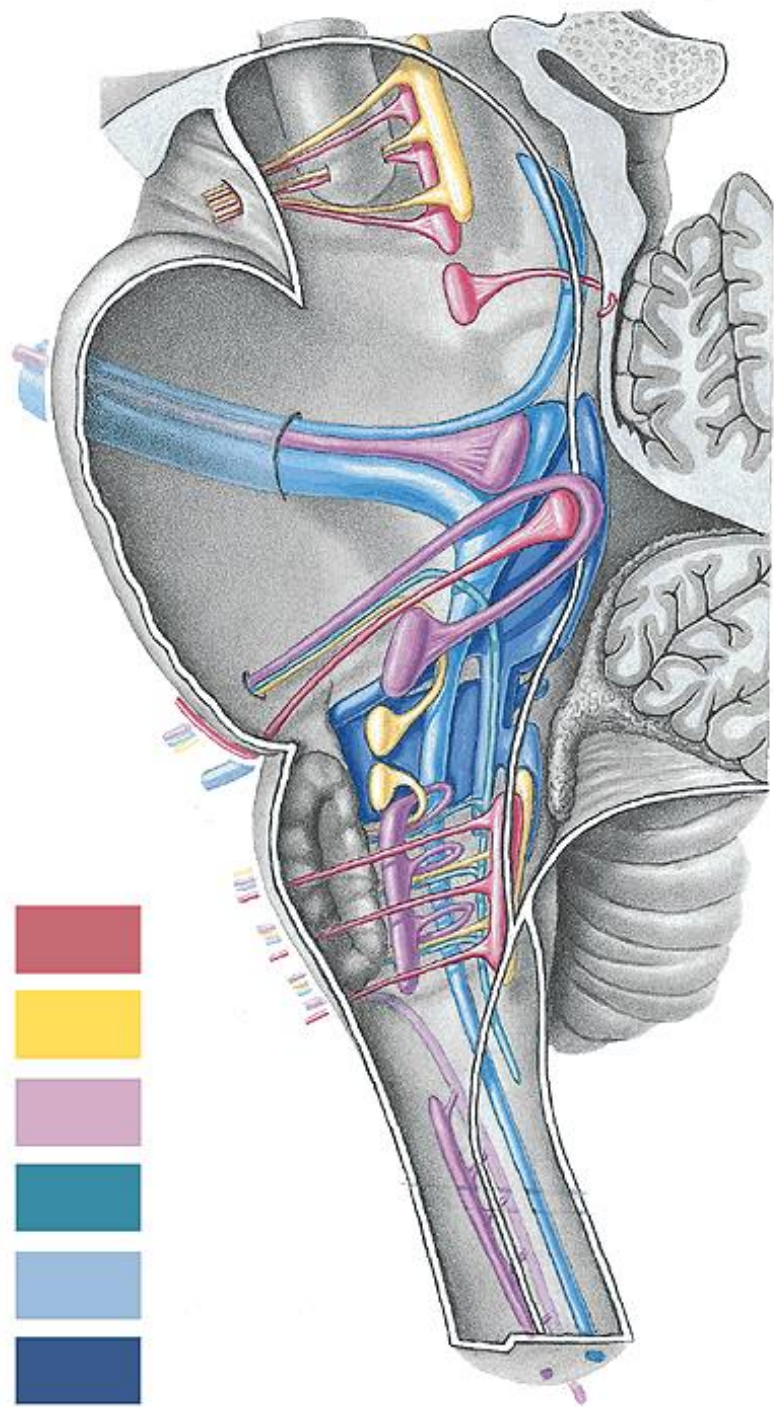
Developmental classification *mediolaterally*

- **somatomotor**
somatic
- **somatomotor**
branchial
- **visceromotor**
- **viscerosensory**
- **somatosensory**
- **special sensory**

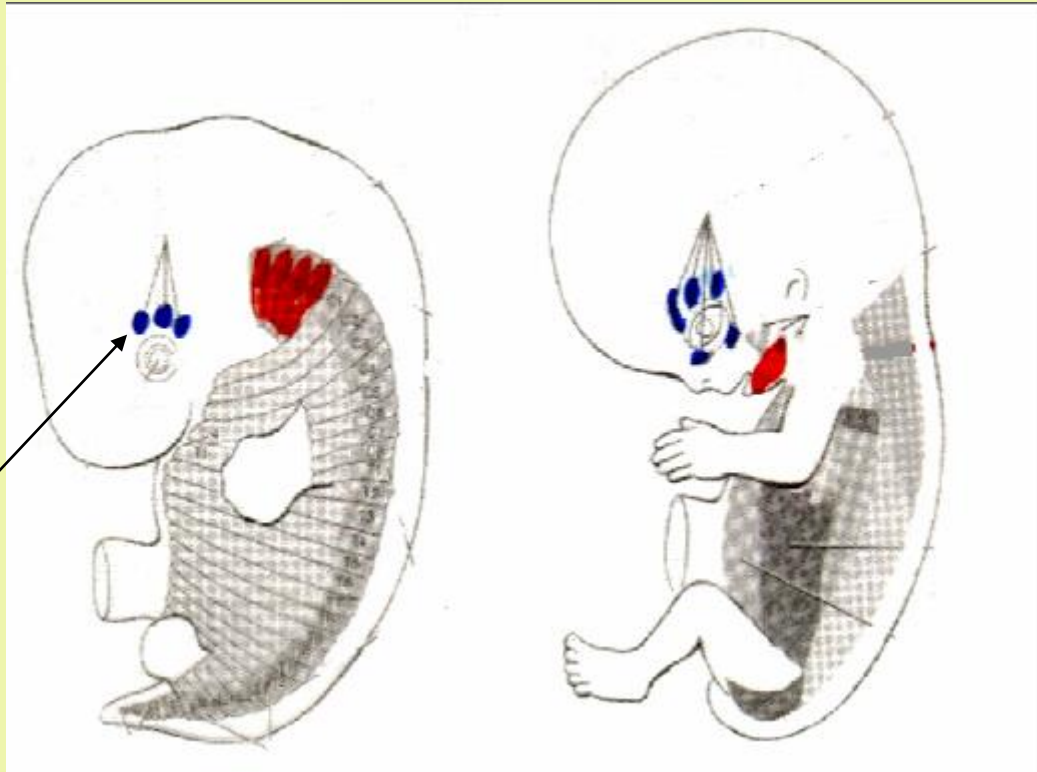


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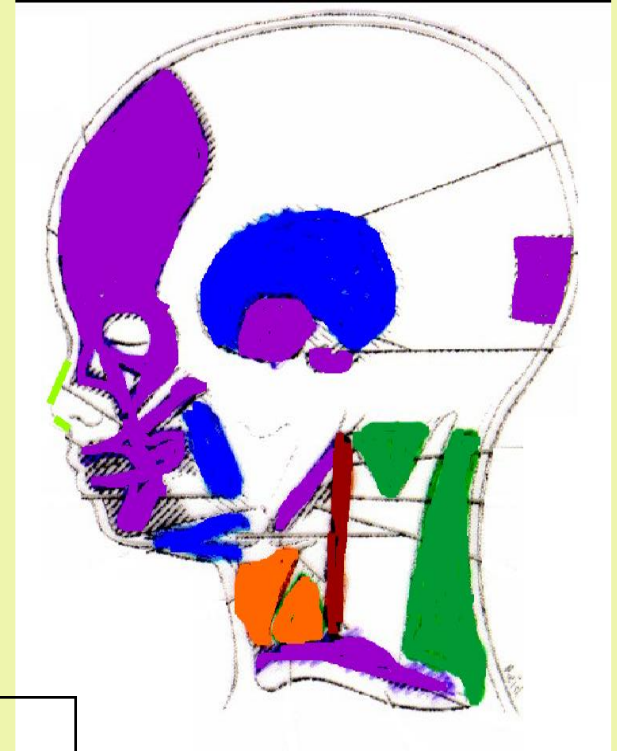
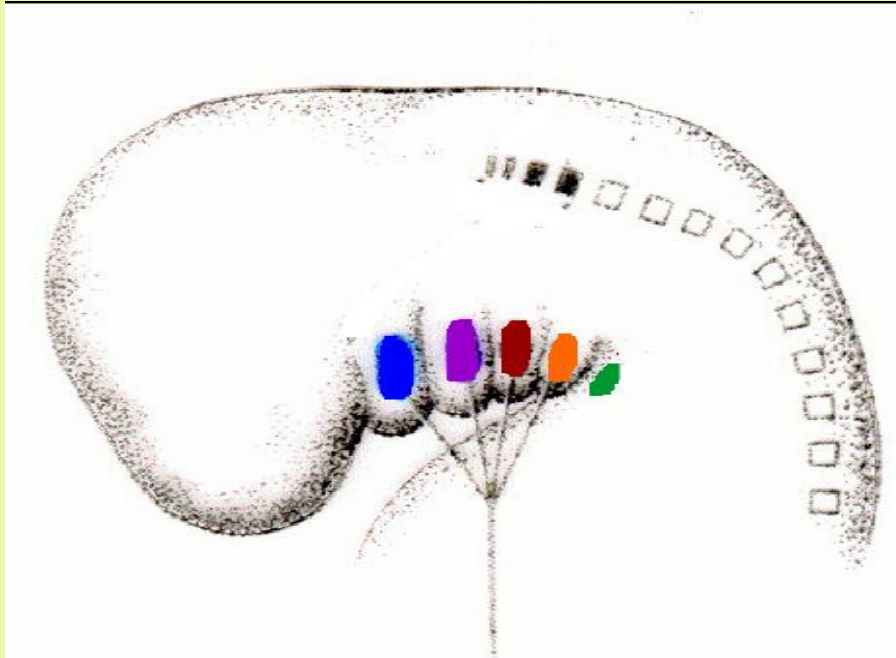


SomatoMotor somatic CN



- **preotic myotoms** (somitomers) form external muscles of eyeball – **n. III, IV, VI**
- **occipital somites** form muscles of tongue – **n. XII**

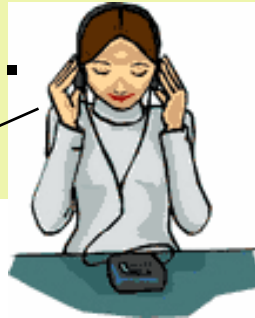
SomatoMotor Branchial CN (BranchioMotor)



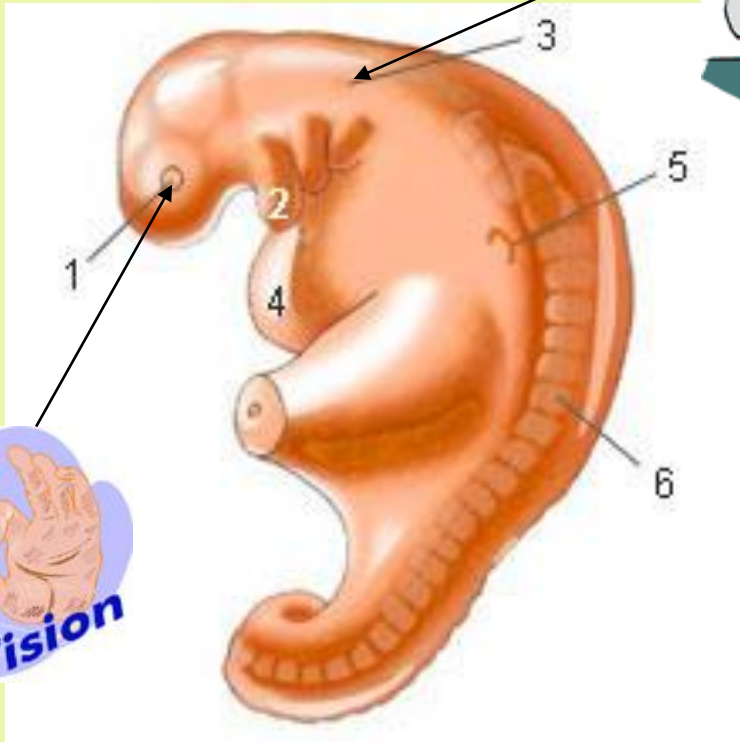
1st arch	V.
2nd arch	VII.
3rd arch	IX.
4th arch	X. – n. laryngeus superior
6th arch	r. int. XI. - n. lar. recurrens

Special sensory CN

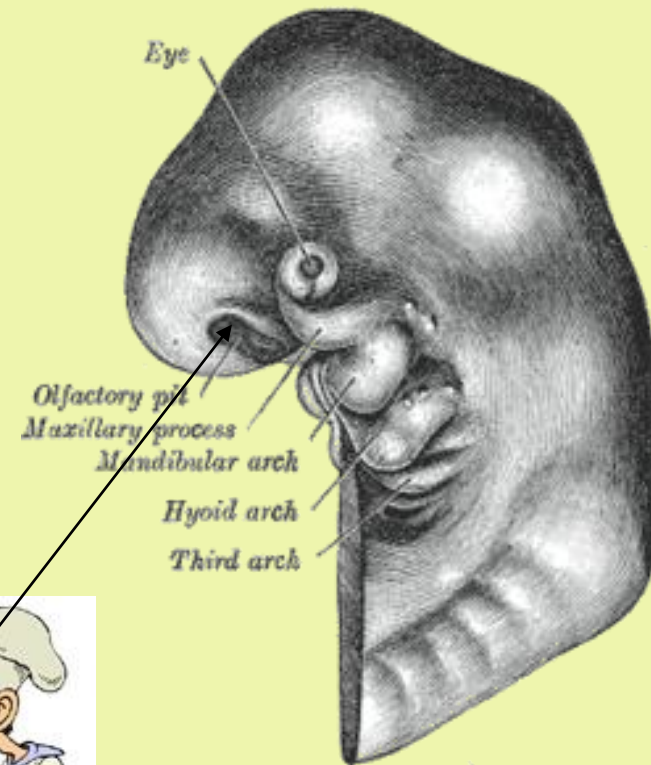
VIII.



II.



I.



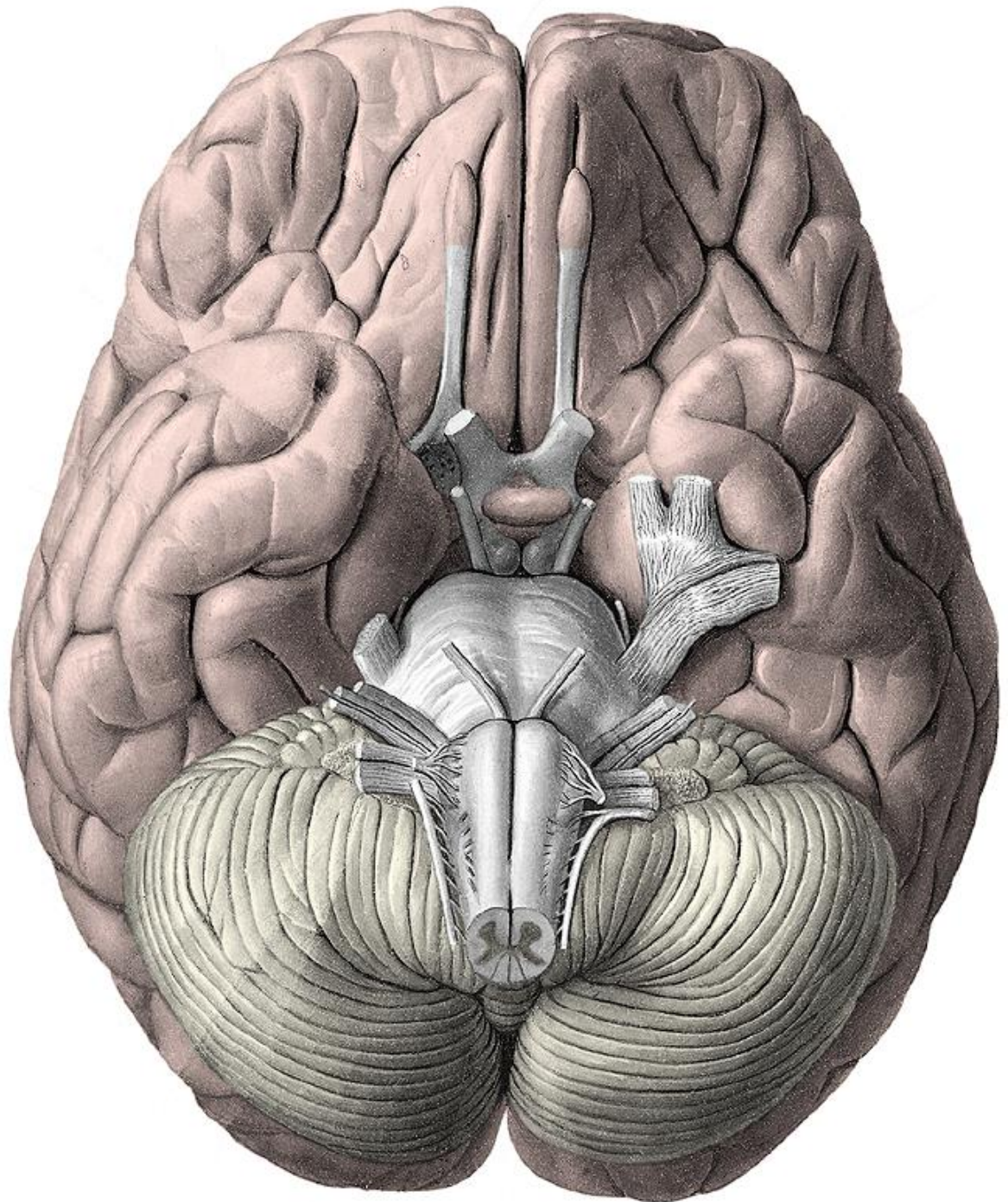
Where CN emerge from brain?

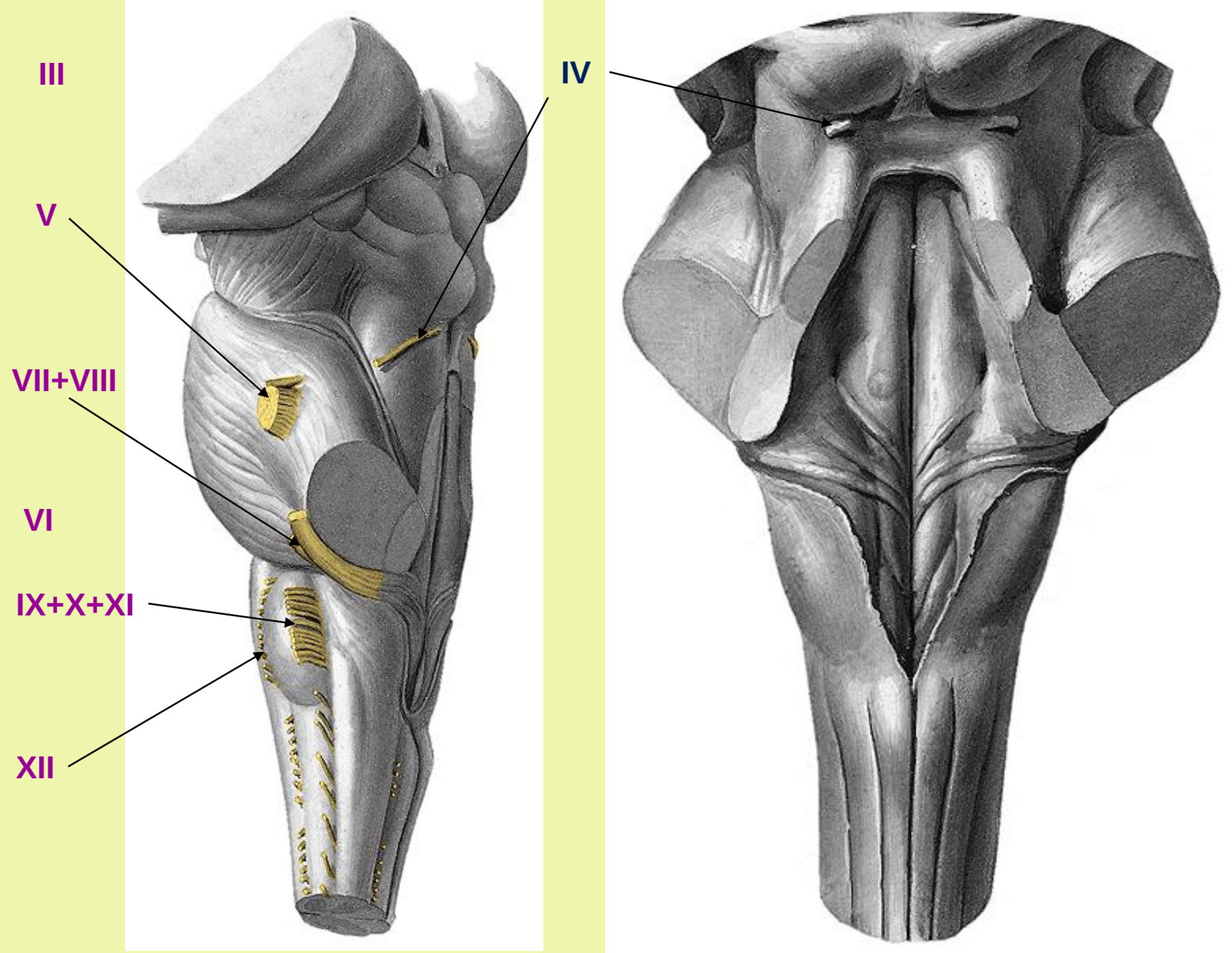
I. – telencephalon

II. – diencephalon

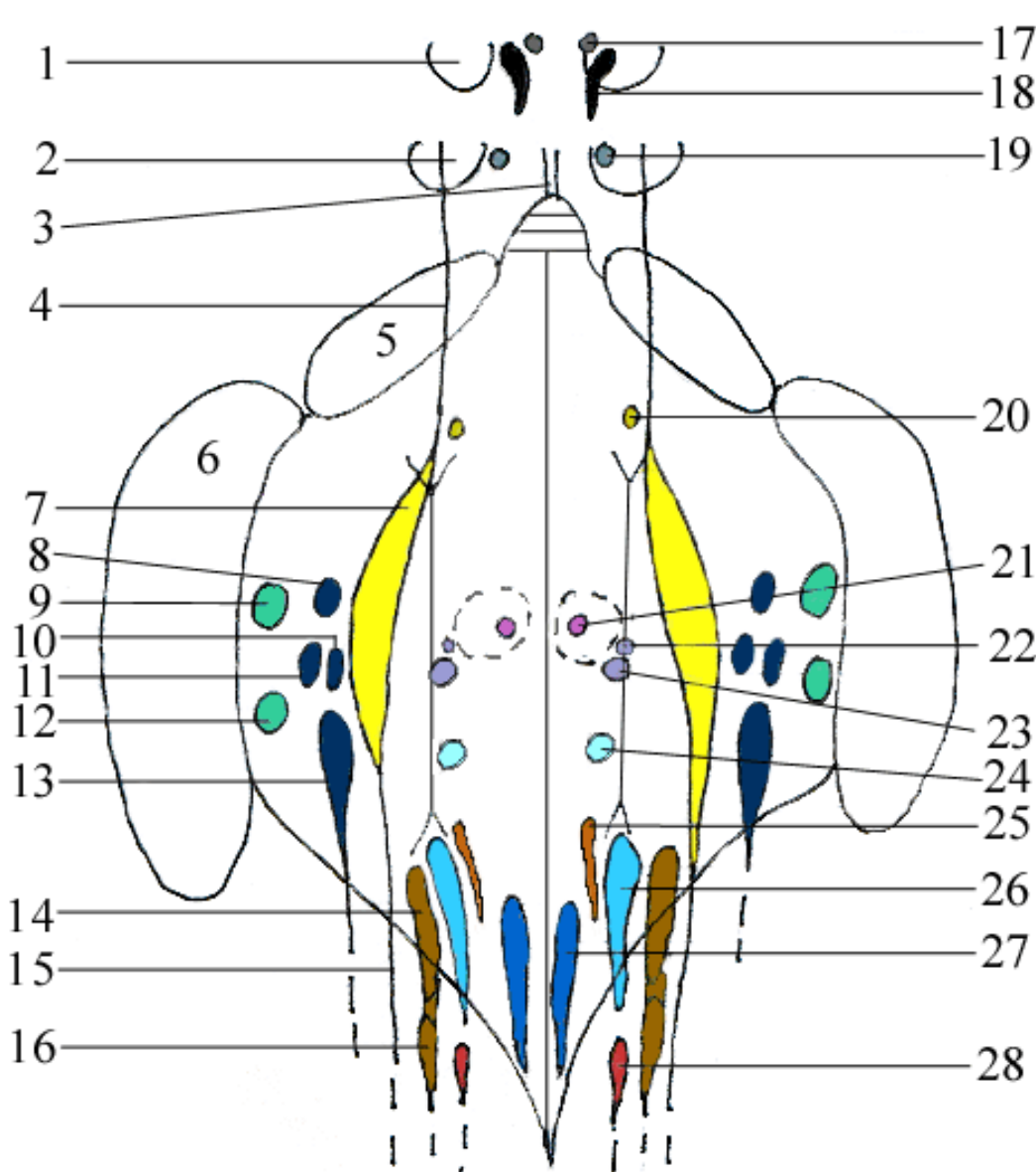
**III.-XII. – brain
stem**

IV. – dorsally !!!





FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANIAL NERVE NUCLEI

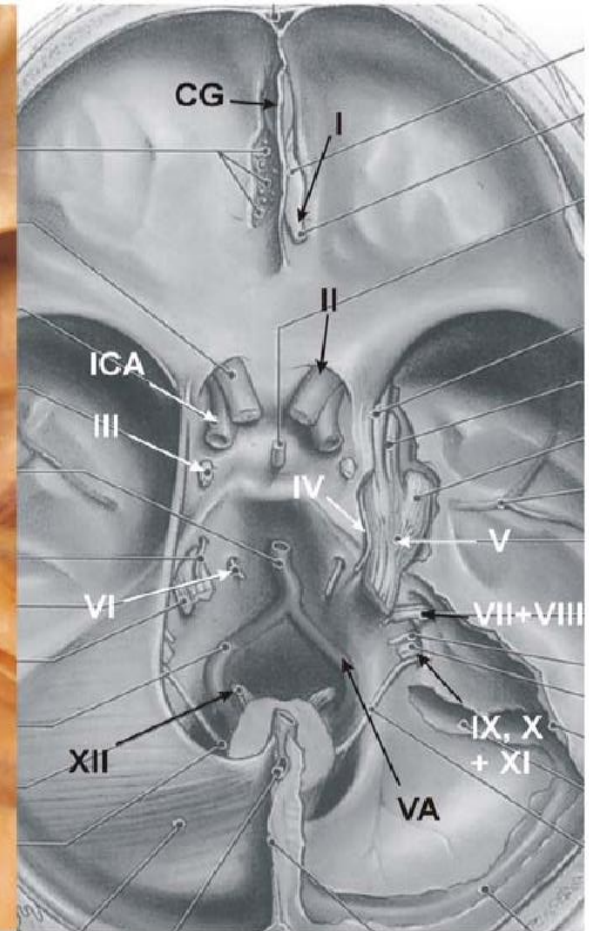
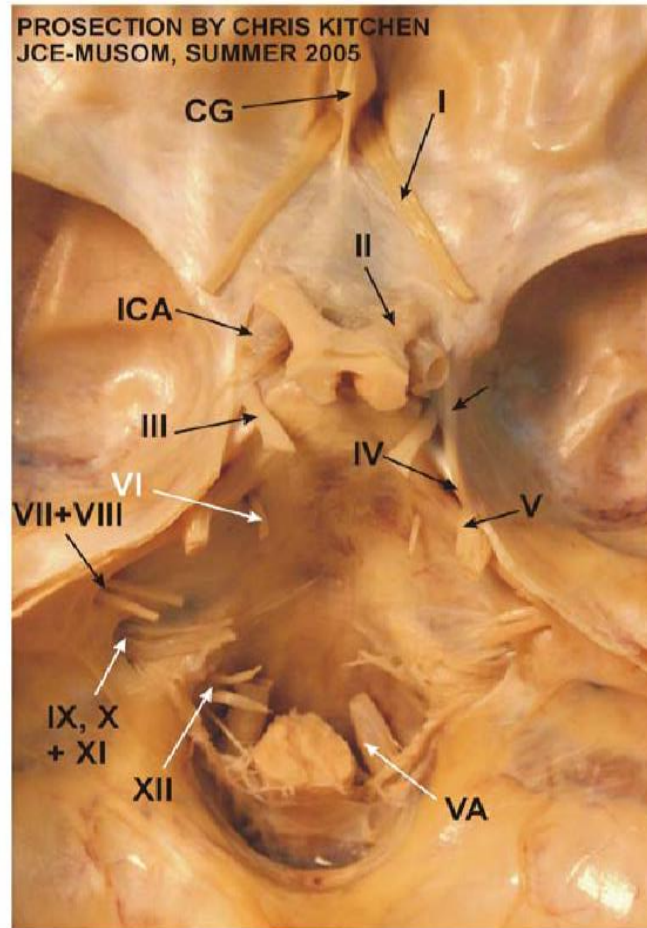


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(= part of nucleus ambiguus and retroambiguus)

CRANIAL NERVES IN CRANIAL CAVITY

PROSECTON BY CHRIS KITCHEN
JCE-MUSOM, SUMMER 2005



Where CN
submerge
into skull?

I - Olfactory Tract
IV - Trochlear Nerve (broken)
VA - Vertebral Artery
CG - Crista Galli
VII - Facial Nerve
VIII - Vestibulocochlear Nerve
IX - Glossopharyngeal Nerve
X - Vagus
XI - Accessory Nerve
XII - Hypoglossal Nerve

ICA - Internal Carotid Artery
II - Optic Nerve
III - Oculomotor Nerve
V - Trigeminal nerve
VI - Abducens Nerve

General scheme for CN studying

1. number, Latin and English term
2. developmental type of CN
3. nuclei + their location
4. transmitted modalities
5. where CN submerge into skull
6. course of CN + topography
7. branches
8. overview of supplied area
9. clinical examination, reflexes
10. palsy = paralysis (plegia) or irritation

0. = N. terminalis = Terminal nerve *

- Gustav Fritsch (1878) – brain of shark
- 1913 – brain of human
- microscopic plexus of non-myelinated fibres inferior to gyrus rectus
- cavitas nasi → lamina cribrosa → nuclei septales mediales et laterales + area preoptica – *control of release of sex hormones and other irresistible feelings (thirst, hunger)*
- fish – pheromons and sexual behaviour

Ventral View

← **Olfactory bulb**

← **Olfactory Tract**

NT (CNO) bilateral plexus

Rectus Gyri

Medial olfactory stria

Olfactory trigone

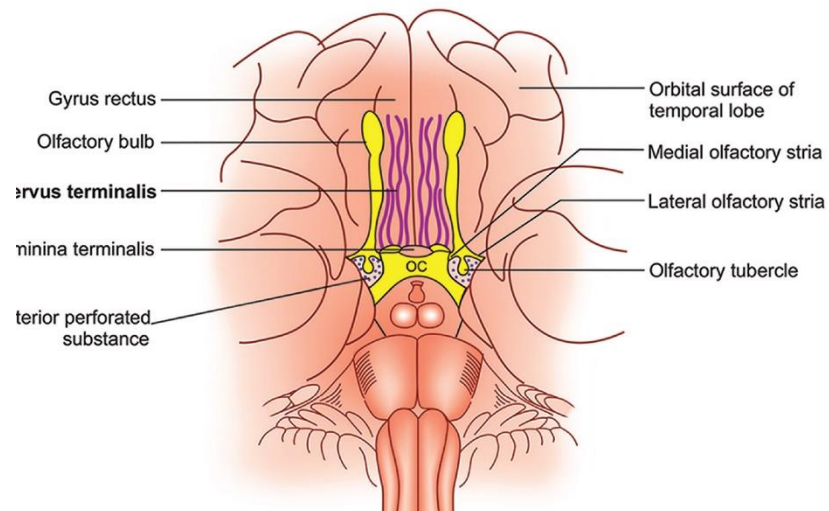
Lateral olfactory stria

APS

OT

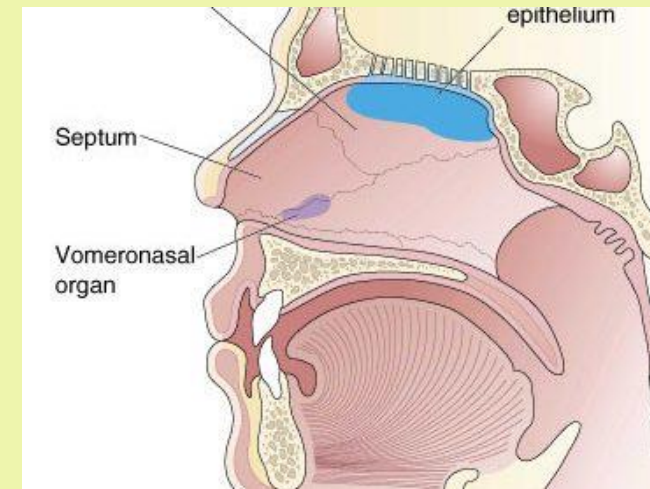
ON

Photo courtesy of Dr. W. López-Giordano

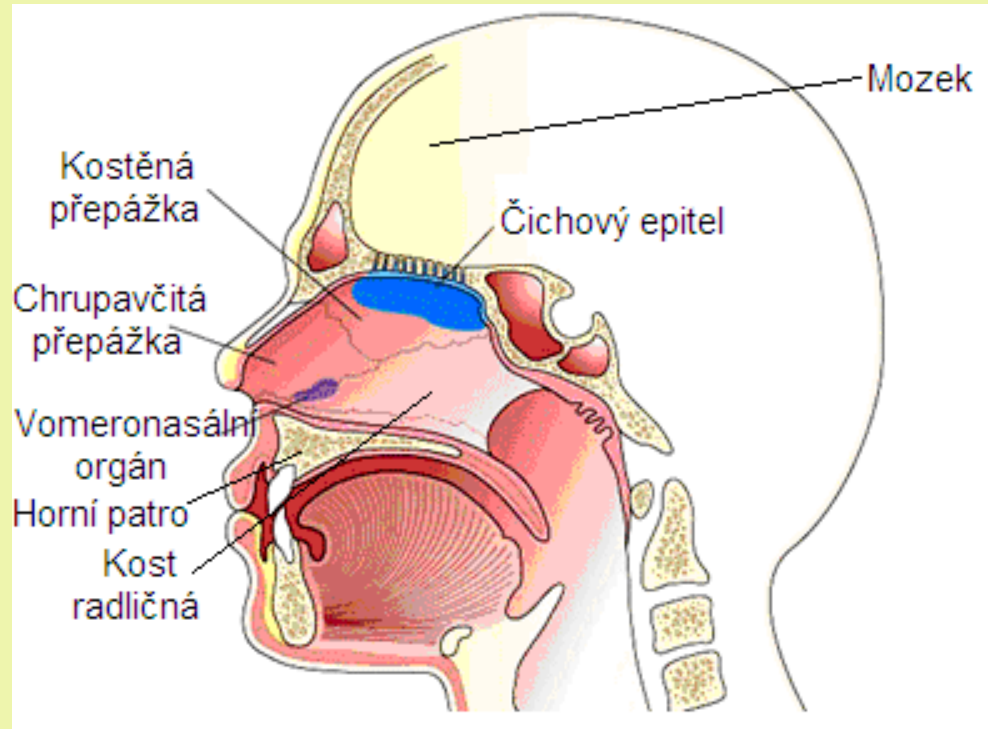
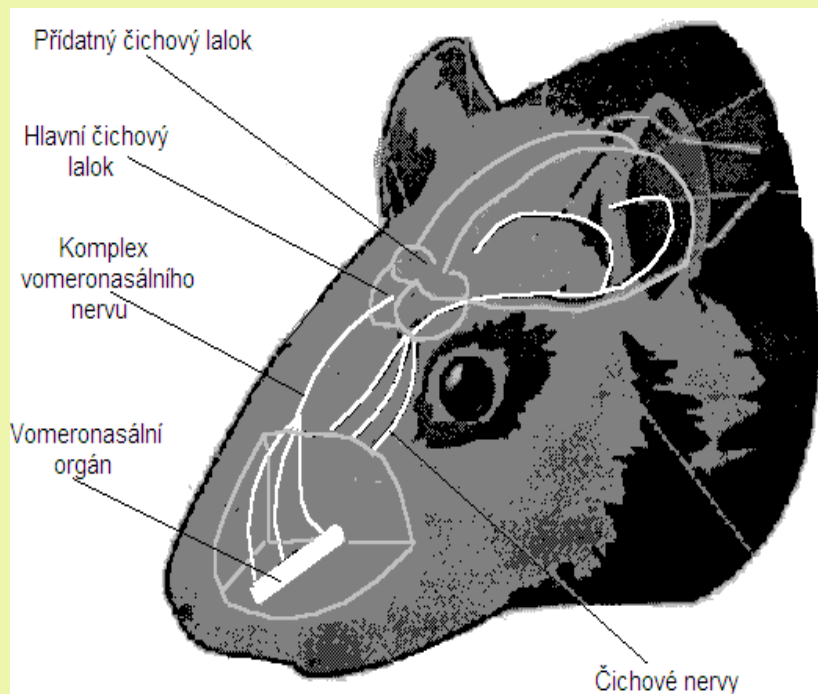


Organum vomeronasale *Jacobsoni*

- rudimentary organ – pheromones
- reptiles (main organ of smell), rodents
- horses and cats (related to reproduction)
- stimuli from the oral cavity through the canalis incisivus to the nasal cavity
- chemoreceptors
- inside the cartilago vomeronasalis on the septum nasi
- n. vomeronasalis → bulbus olfactorius (n.I) → hypothalamus + corpus amygdaloideum

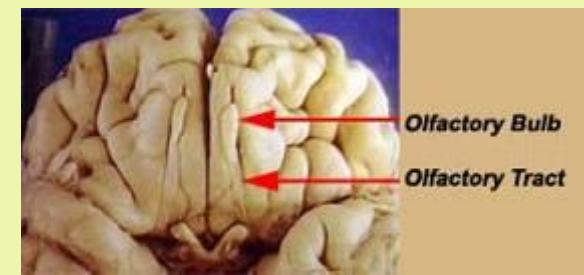


Organum vomeronasale *Jacobsoni*

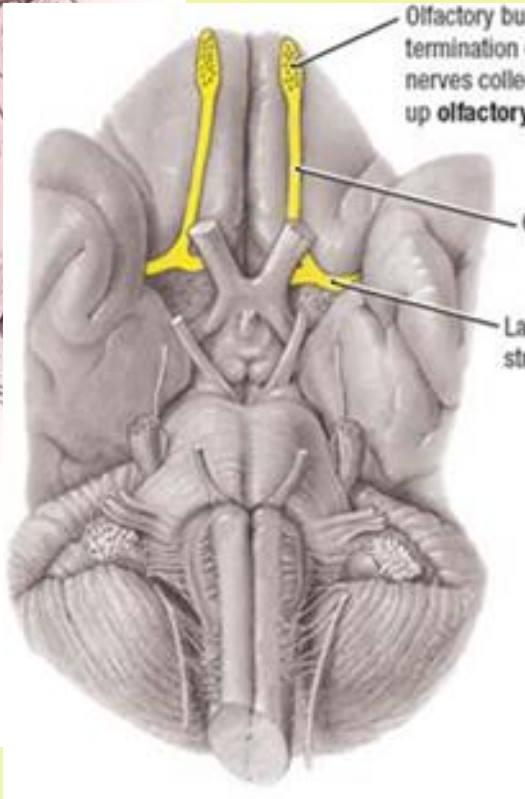


I. = N. olfactorius

1. pouch from telencephalon
2. no nuclues ! – centres in cortex (e.g. area 28)
3. special sensory: olfaction (= smell)
4. cavitas nasi → lamina cribrosa → cavitas cranii anterior
5. olfactory cells in nasal mucosa → fila olfactoria (axons) → bulbus olfactorius (perikarya) → tractus olfactorius → trigonum olfactorium → stria olfactoria med+lat. → area 28
6. no branches
7. cranial part of cavitas nasi in the extent of concha nasalis superior on the lateral wall, roof and septum
8. objective olfactometry
9. irritation/palsy

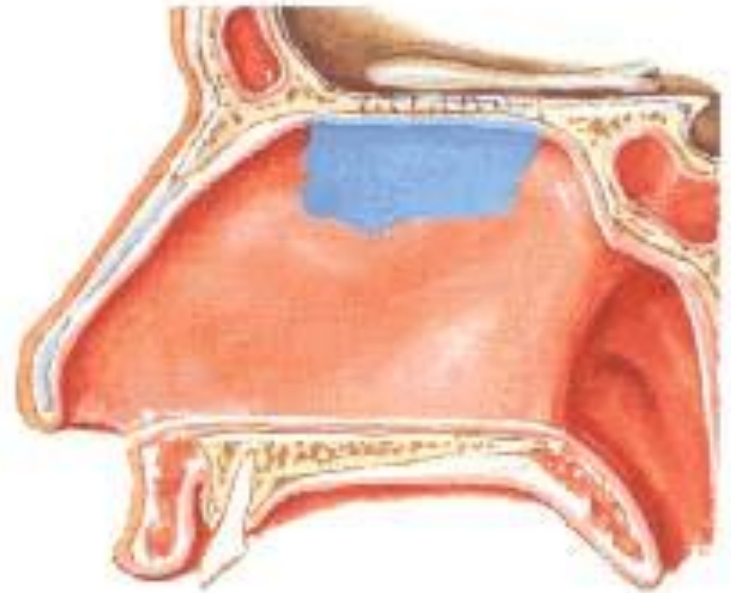
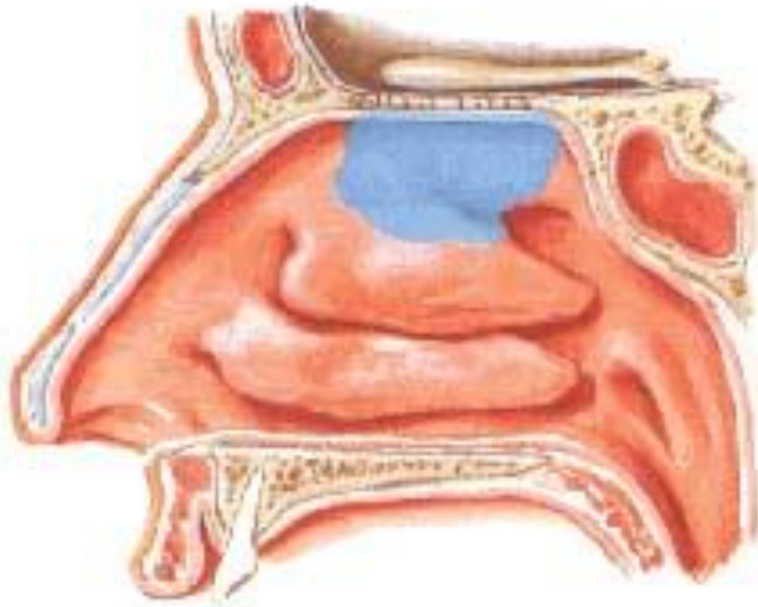


n. l



Nerves of Nasal Cavity

Distribution of Olfactory Mucosa



Symptoms of olfaction disorders

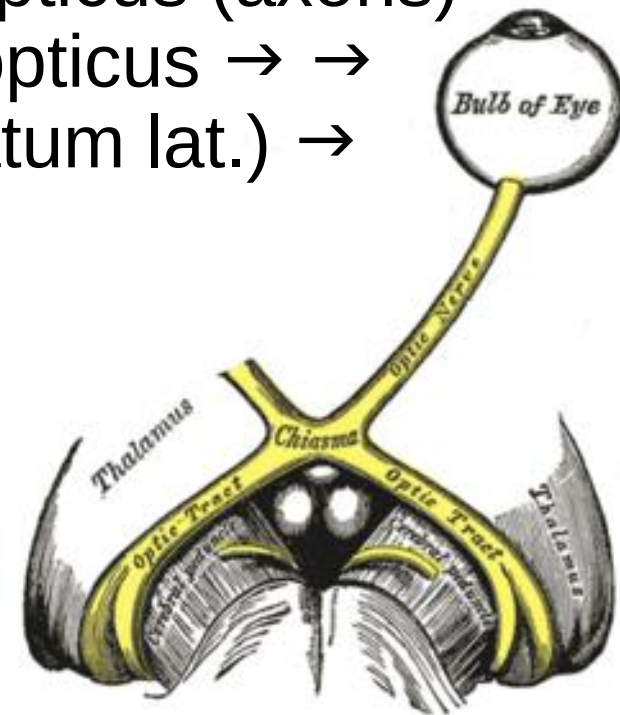
- hyposmia
- anosmia
- hyperosmia
- parosmia
- kakosmia

cranial injury →



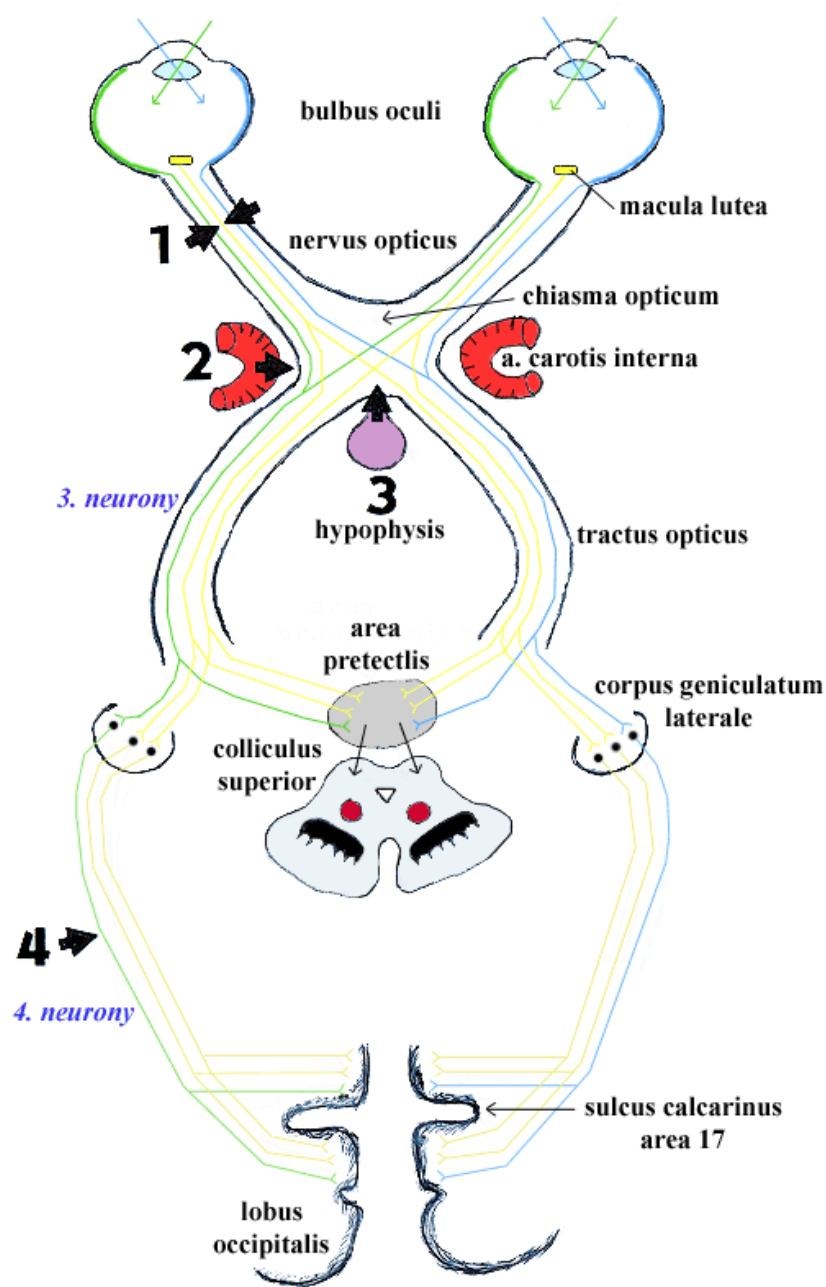
II. = N. opticus

1. pouch from diencephalon
2. no nuclues ! – centres in cortex (area 17)
3. special sensory: vision
4. orbita → canalis opticus → cavitas cranii media
5. ganglionic cells of retina → n. opticus (axons)
→ chiasma opticum → tractus opticus → →
metathalamus (corpus geniculatum lat.) →
area 17
6. no branches
7. retina
8. examination of perimetre
9. palsy / irritation („*phospenes*“)

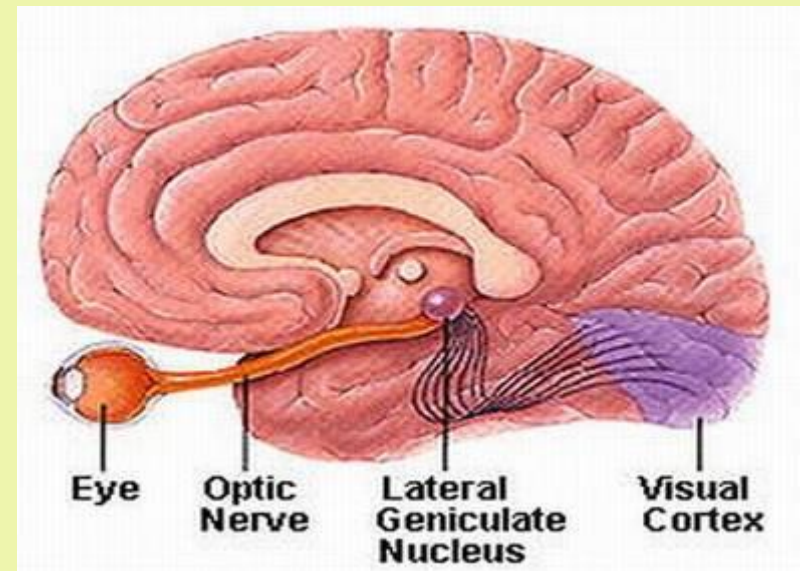
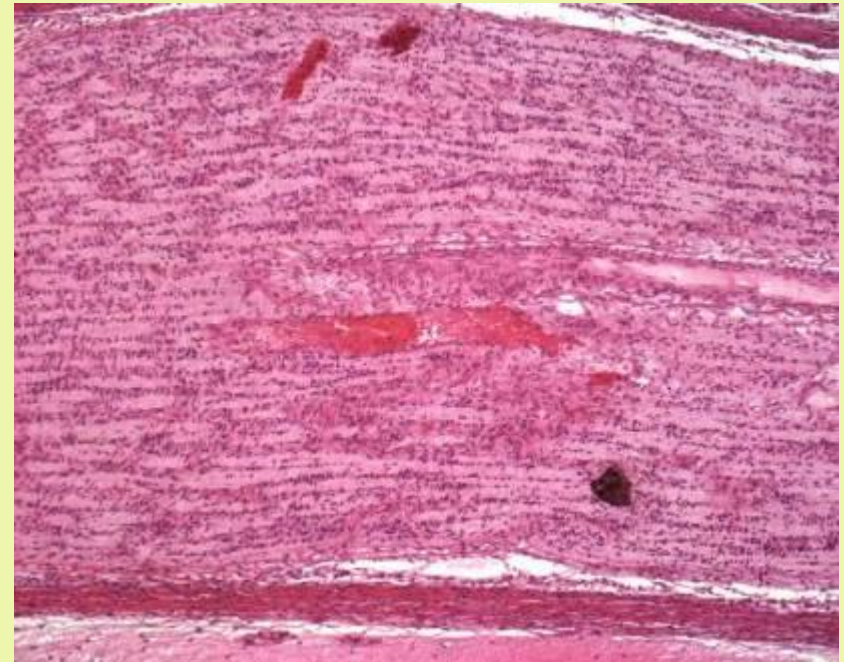


II. = N. opticus

- pouch from diencephalon = *thalamus opticus*
- axons divided by endoneurium (1 mil. of axons)
- nerve covered with meninges
- nerve contains a. et v. centralis retinae in its centre
- *partially decussated* in chiasma
- axons of 3rd neuron (=ganglionic cells of retina)
(1st neuron = 130 mil.of rods + 7 mil. of cones, 2nd neuron = bipolar cells)
- ganglionic cells of retina → nervus opticus → chiasma opticum → tractus opticus → metathalamus (corpus geniculatum lat.) → area 17



- 1 - amaurosis (= slepota) levého oka
- 2 - hemianopsia nasalis (porucha jen na levém oku)
- 3 - hemianopsia heteronyma bitemporalis
- 4 - hemianopsia homonyma dextra



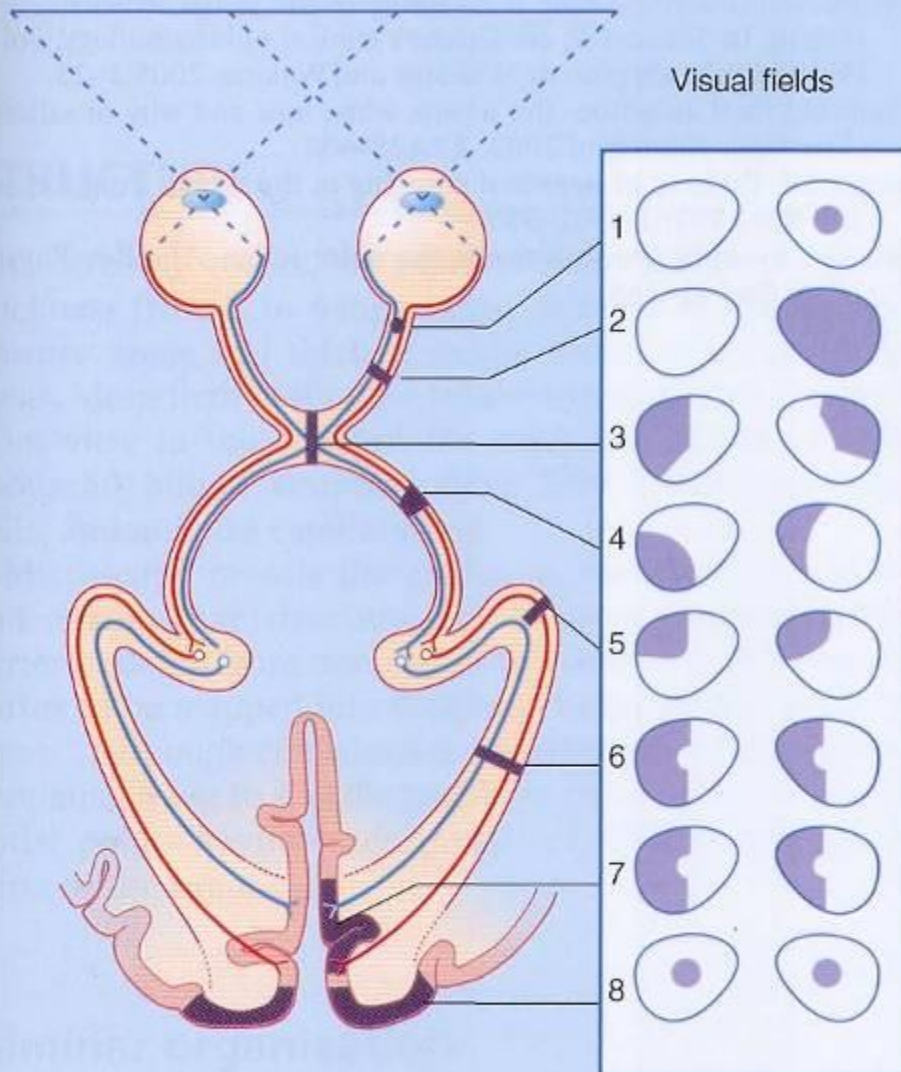


Table CP 28.1.1 Classification of dyphasia.

Number	Lesion	Field defect
1	Partial optic nerve	Ipsilateral*scotoma ^a
2	Complete optic nerve	Blindness in that eye
3	Optic chiasm	Bitemporal hemianopia
4	Optic tract	Homonymous ^b hemianopia
5	Meyer's loop	Homonymous upper quadrantanopia
6	Optic radiation	Homonymous hemianopia
7	Visual cortex	Homonymous hemianopia
8	Bilateral macular cortex	Bilateral central scotomas

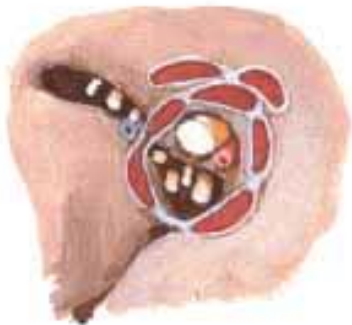
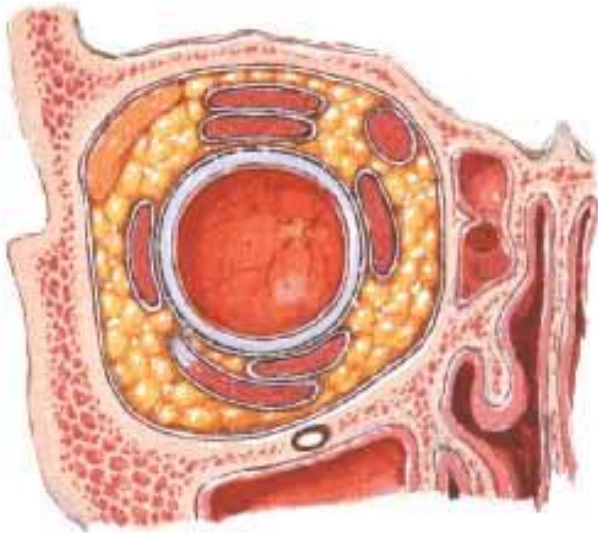
External muscles of the eyeball

- mm. **recti** (bulbi)
 - sup., inf., med., lat.
- mm. **obliqui** (bulbi)
 - inf., sup.
- m. levator palpebrae superioris
- innervation: n. III., IV., VI.
- smooth muscles: m. orbitalis *Mülleri*, m. tarsalis sup. *Mülleri* + inf.
- internal smooth muscles: m. sphincter pupillae + m. dilatator pupillae, m. ciliaris

External muscles of eyeball

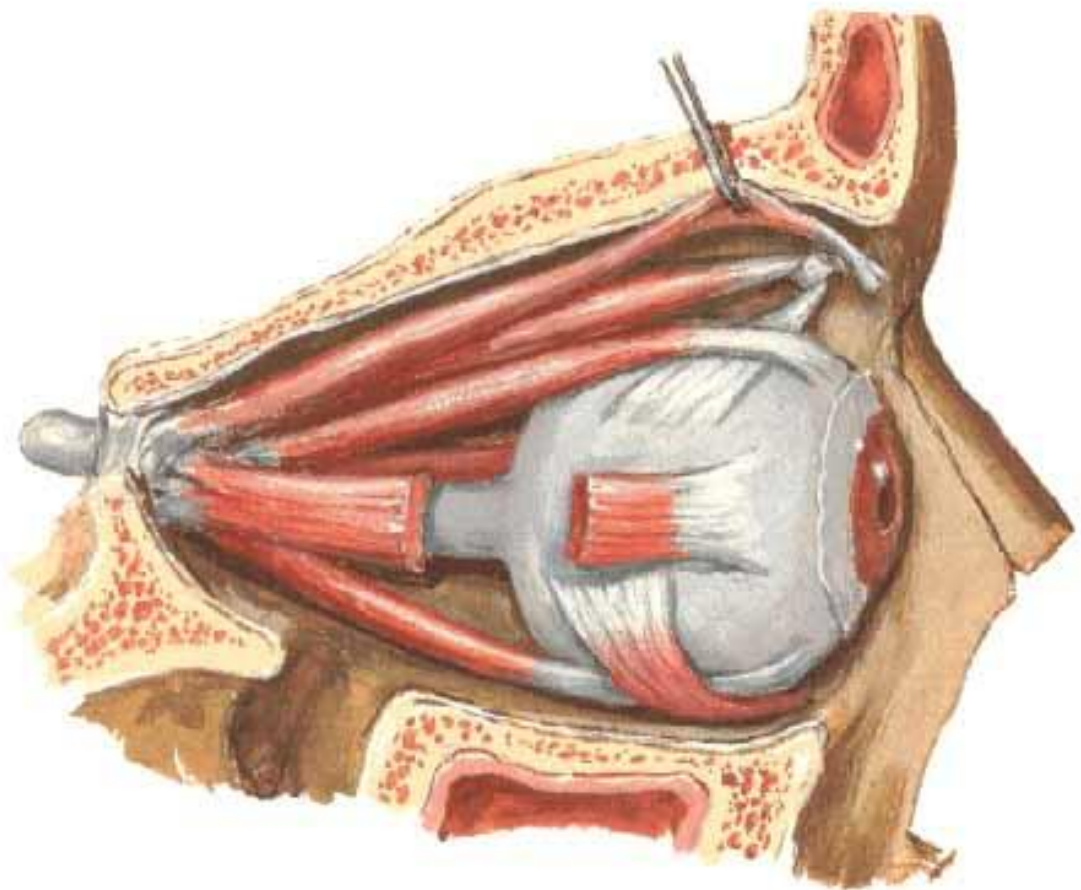
Fascia of Orbit and Eyeball

Frontal Section and Entering Structures



Extrinsic Eye Muscles

Right Lateral View



Movements of eyeball I.

movements around axis = *ductions*

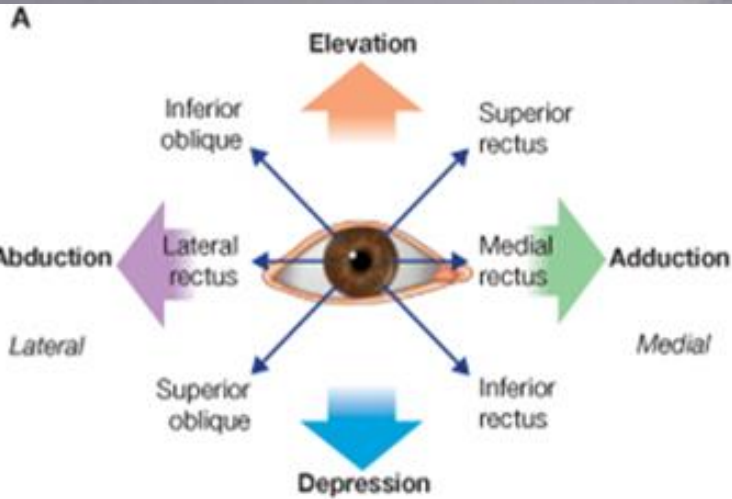
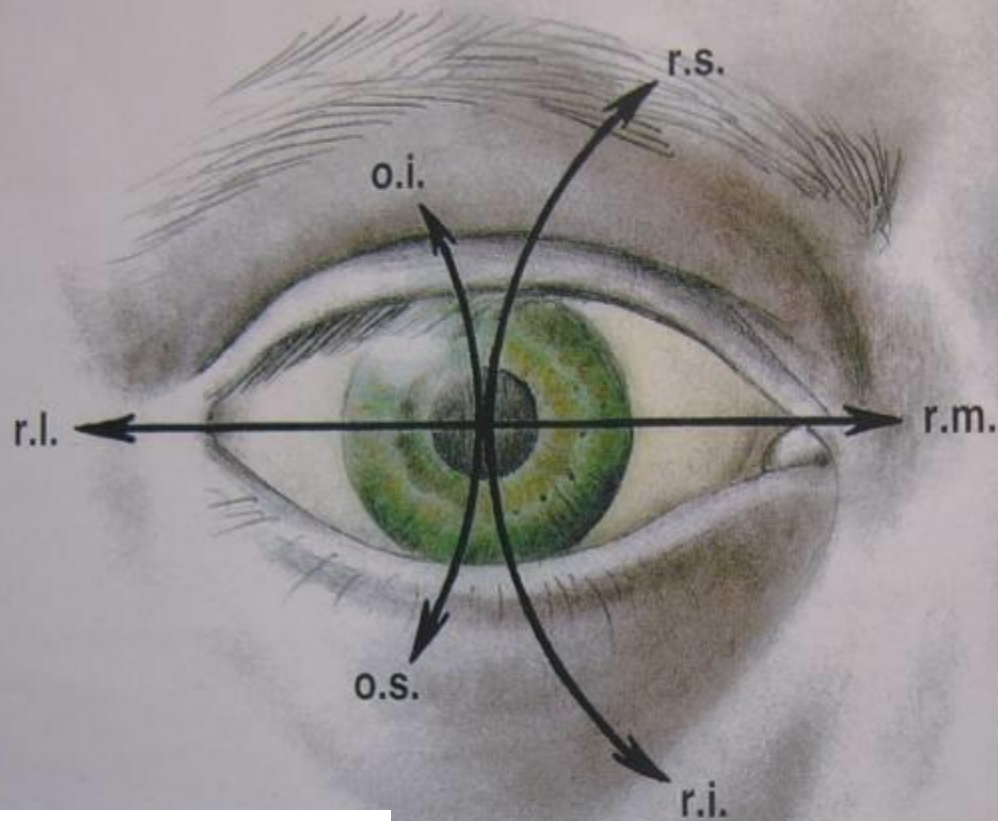
- around vertical axis:
 - **adduction** (internal)
 - **abduction** (external)
- around horizontal axis:
 - **elevation** (sursumduction; supraduction): up
 - **depression** (deorsumduction; infraduction): down
- around sagittal (antero-posterior) axis:
 - **intorsion** (incykloduction): tilted internally
 - **extorsion** (excykloduction): tilted externally

Movements of eyeball II.

paired movements (both eyes working together)

- simultaneous movement of both eyes in the same direction = **version (conjugate movements)**
 - **dextro**version (to the right) + **sinistro**version (to the left)
 - supraversion (sursumversion) + infra/deorsumversion (up + down)
 - dextro/levoelevation + dextro/sinistrodepression (up/down and to side)
 - dextro/sinistrocykloverversion (rotation to the right/left)
- simultaneous movement of both eyes in opposite directions = **vergence (disconjugate movements)**,
 - **convergence** = both eyes moving nasally or inward
 - **divergence** = both eyes moving temporally or outward
- *strabismus; heterotropia; strabism; squint* = one eye constantly is turned inward (“crossed-eye”), outward (“wall-eye”), upward, or downward.

Movements of the eye-ball



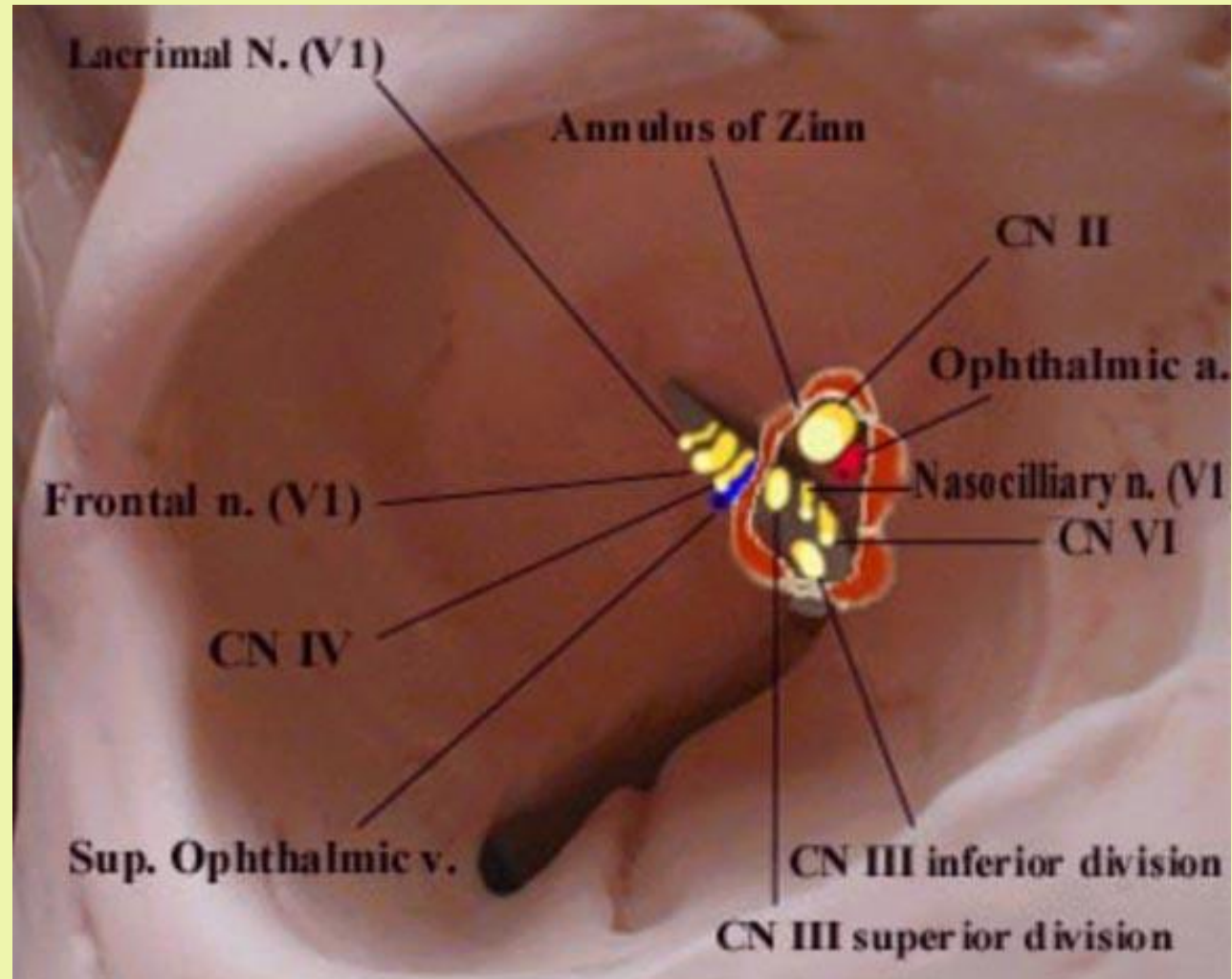
Anulus tendineus communis *Zinni*

passing through:

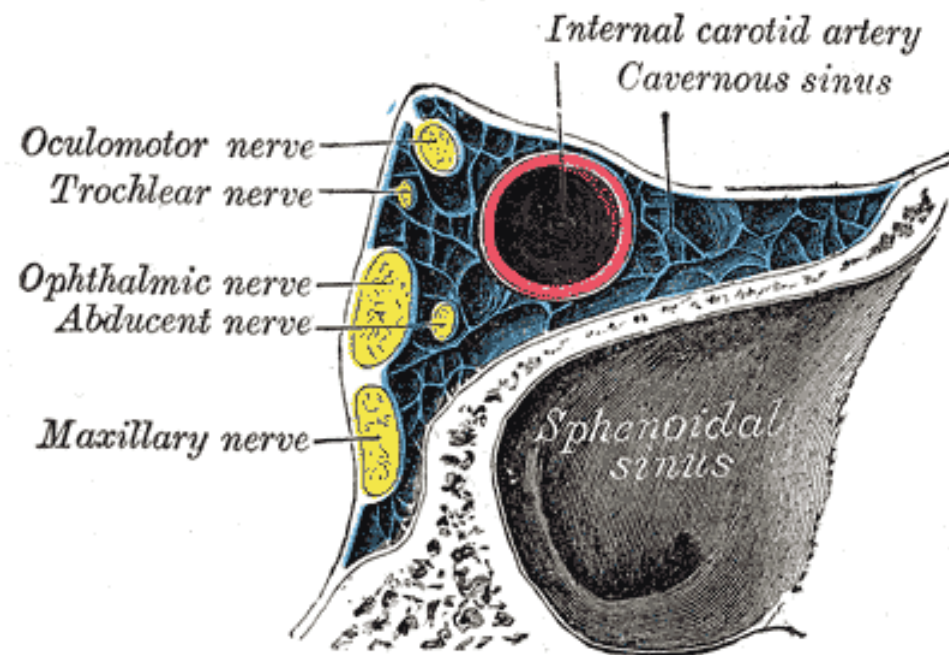
- n. III
- n. VI
- n. nasociliaris
- n. II + AO

passing by:

- n. IV
- n. frontalis
- n. lacrimalis
- VOS

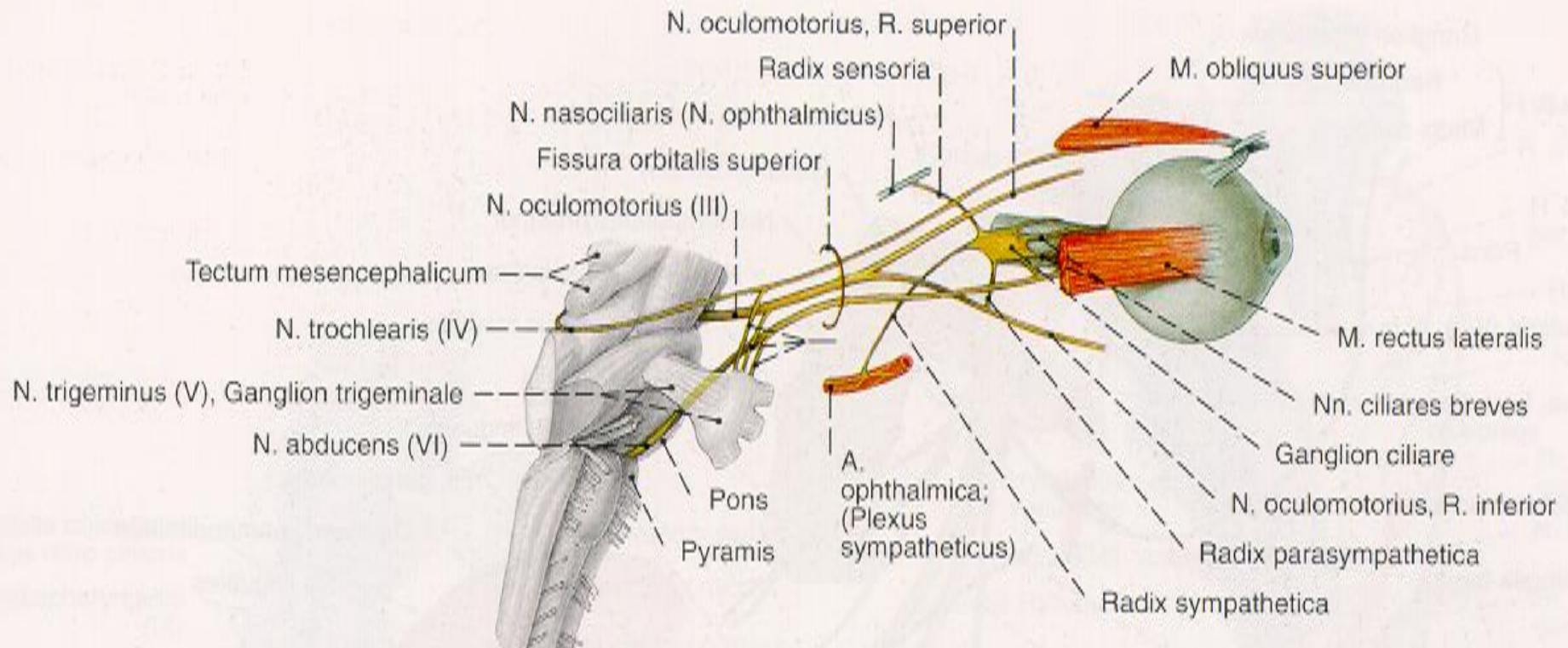


Sinus cavernosus

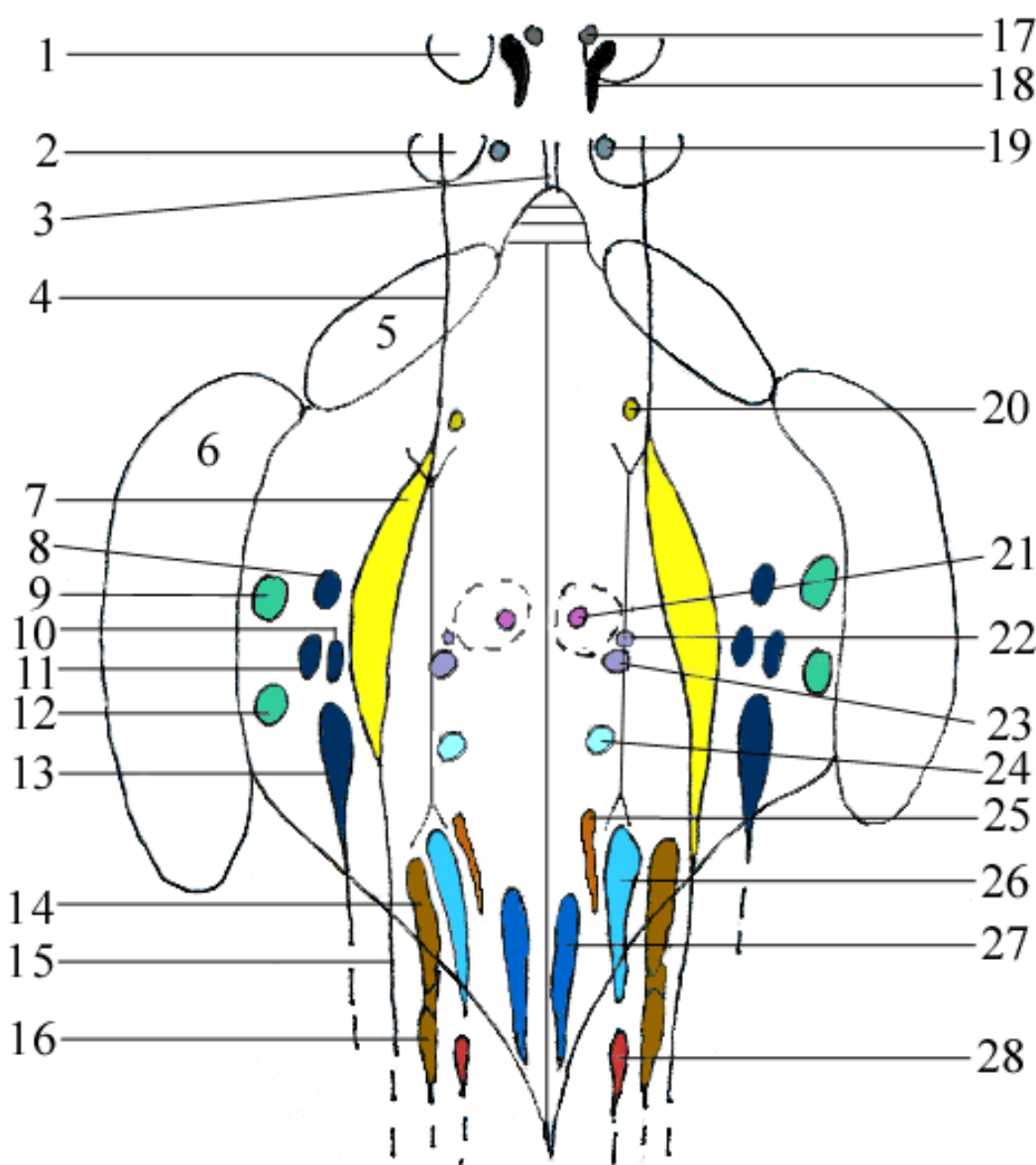


IV. = N. trochlearis

- ncl. n. IV. – mesencephalon; 3.400 axons
- decussated within brain stem (*decussatio fibrarum nervorum trochlearium*)
- *pure somatomotor* → 1 muscle = **m. obliquus superior**
- emerges dorsally from brain stem
- topography: sinus cavernosus, fissura orbitalis superior, passing outside ATC Zinni



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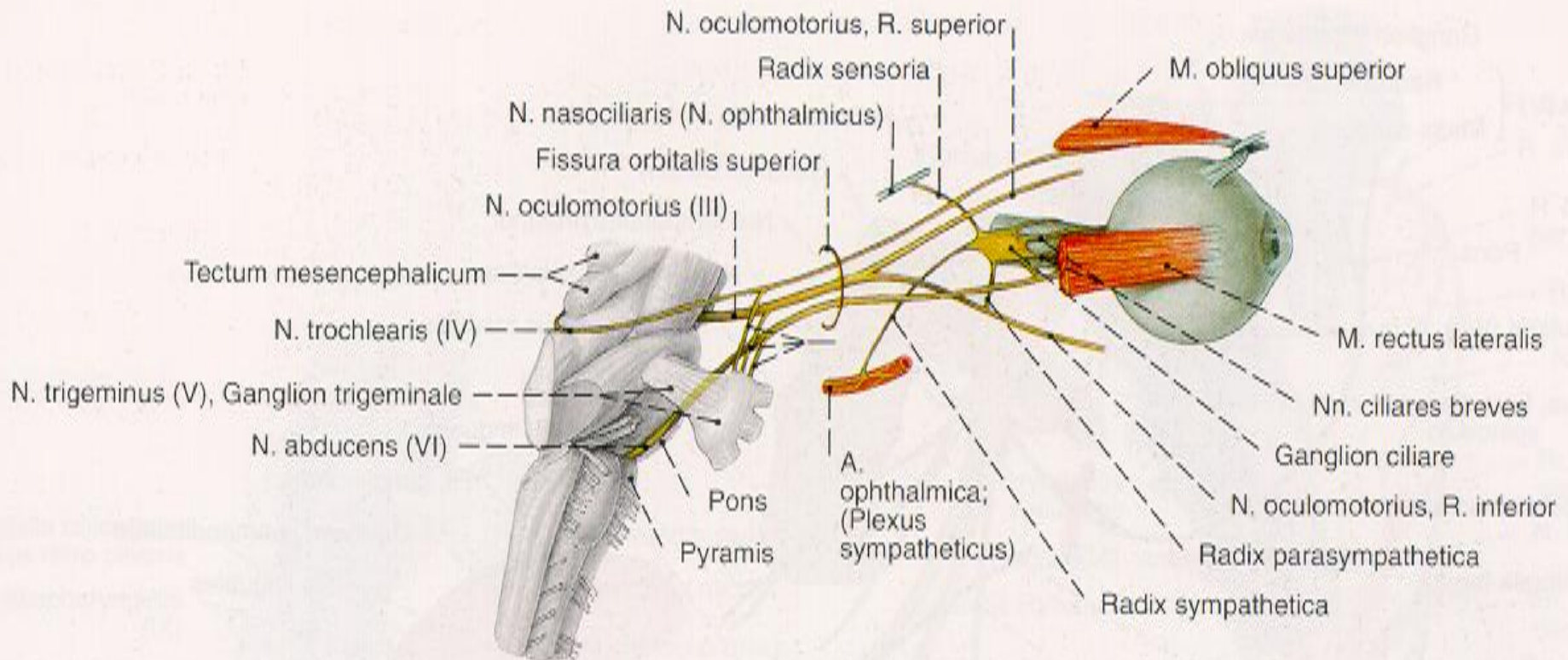


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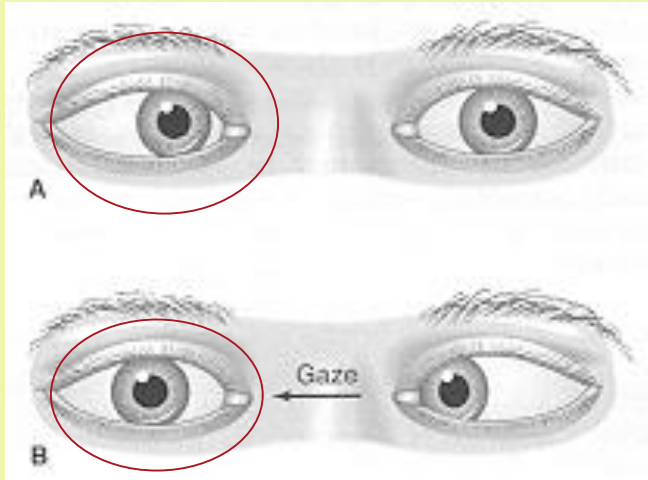
VI. = N. abducens

- ncl. n. VI. – pons, under floor of fossa rhomboidea
- 6-7.000 axons
- non-decussated
- *pure somatomotor* → 1 muscle = **m. rectus lateralis**
- topography: Dorello's canal, sinus cavernosus, fissura orbitalis superior, passing through ATC Zinni



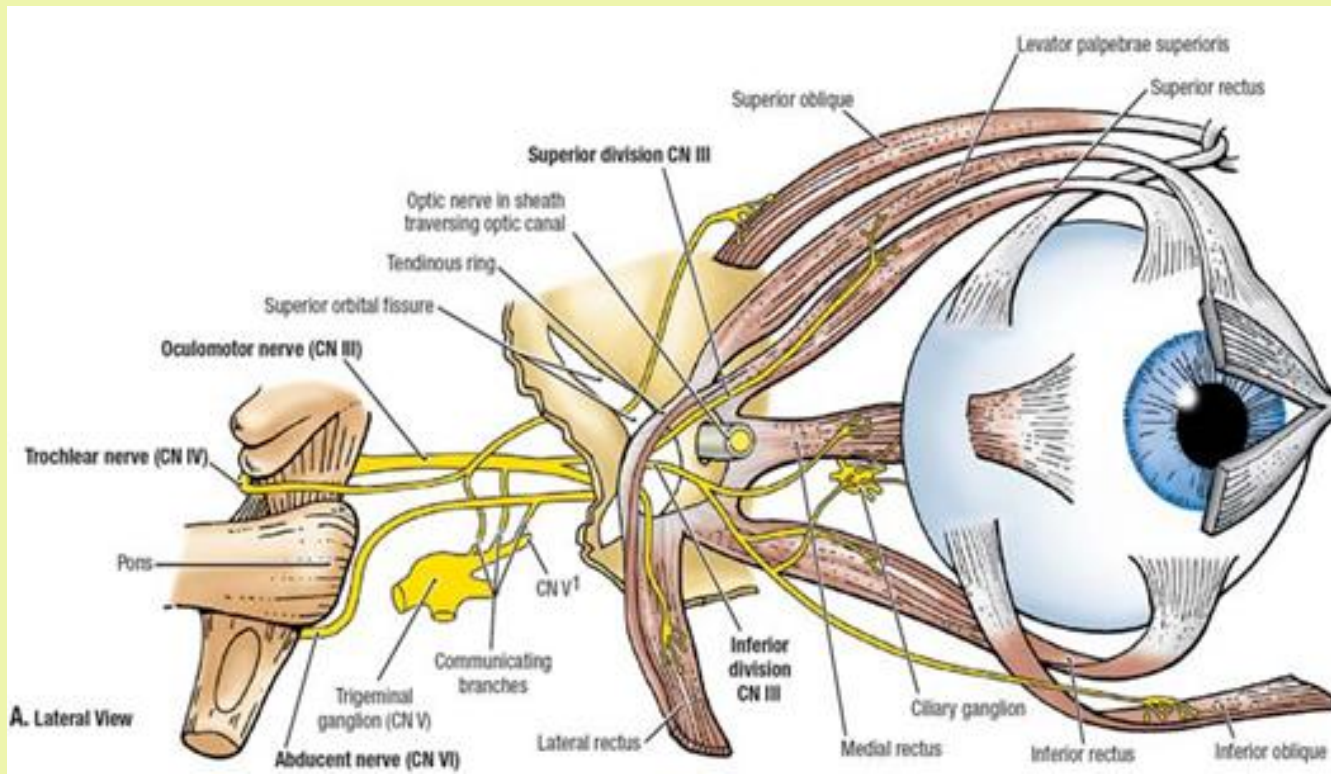
Palsy of n. VI

- strabismus convergens = convergent squint

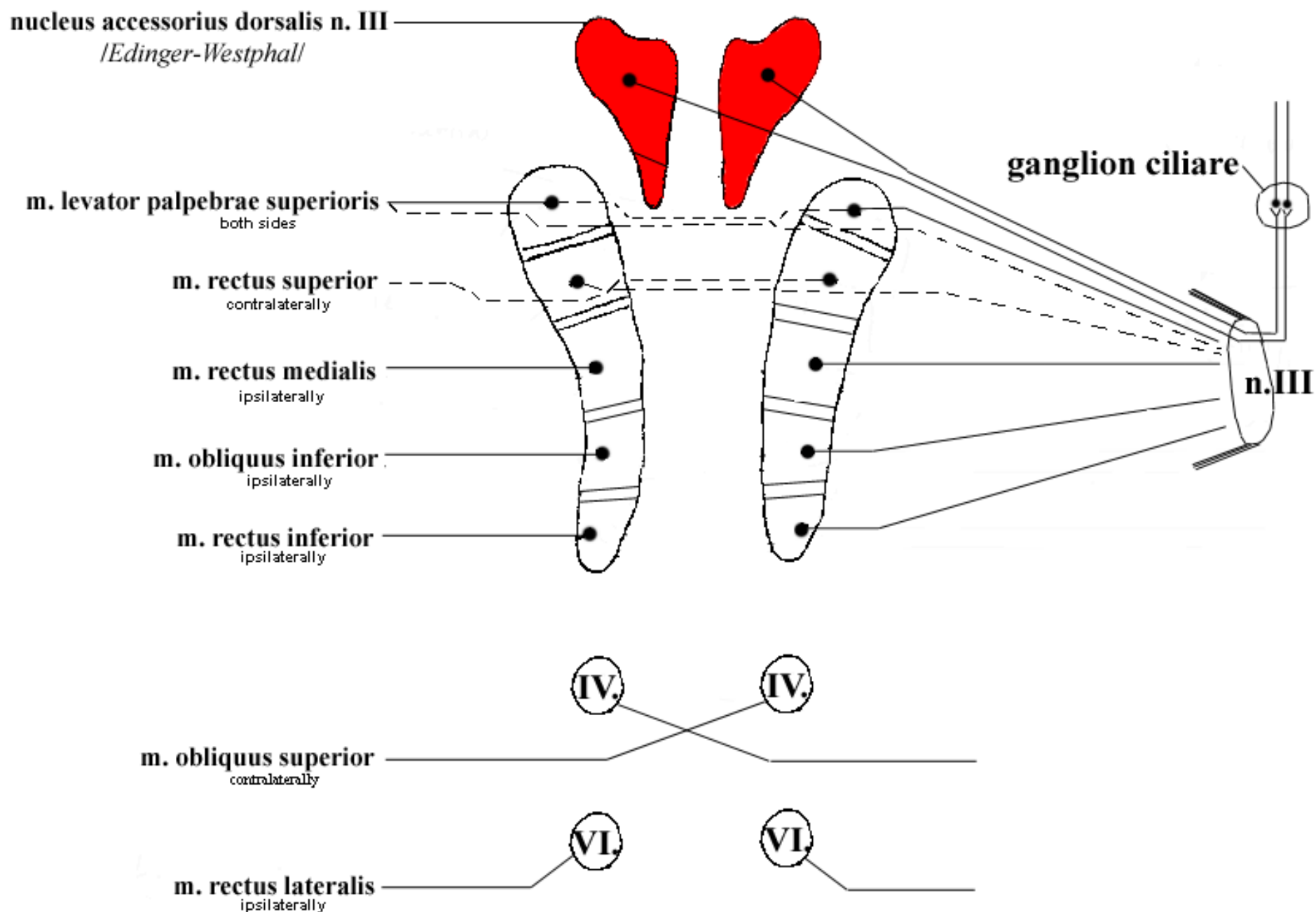


III. = N. oculomotorius

- ncl. n. III. – mesencephalon (24.000 axons)
- ncl. n. III. accessorius (pars preganglionica) *Edinger-Westphal*
- partially decussated within brain stem
- *somato-* and *visceromotor* (= *parasympathetic*)
- topography: sinus cavernosus, fissura orbitalis superior, passing through ATC *Zinni*

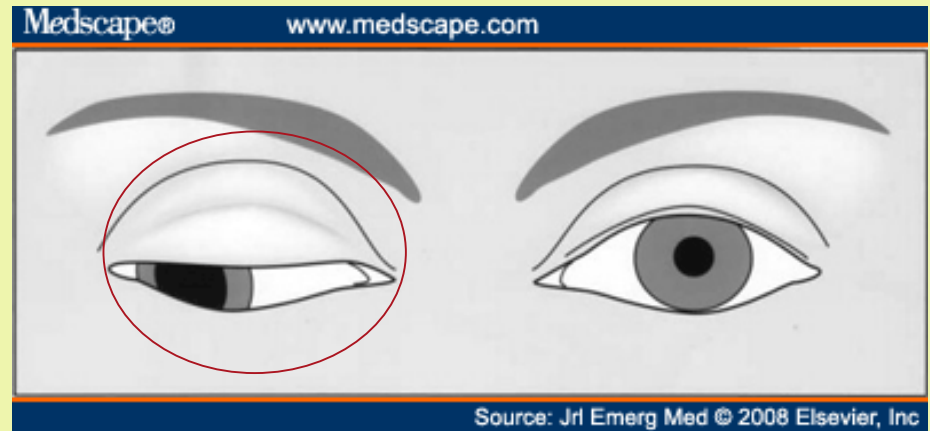


STRUCTURE OF N. III NUCLEUS



- strabismus divergens
- widened pupil
(= mydriasis)
- accommodation
disturbance (no focus
at proximal)
- depressed upper lid
(= ptosis)
- doubled vision
(= diplopia)

Palsy of n. III

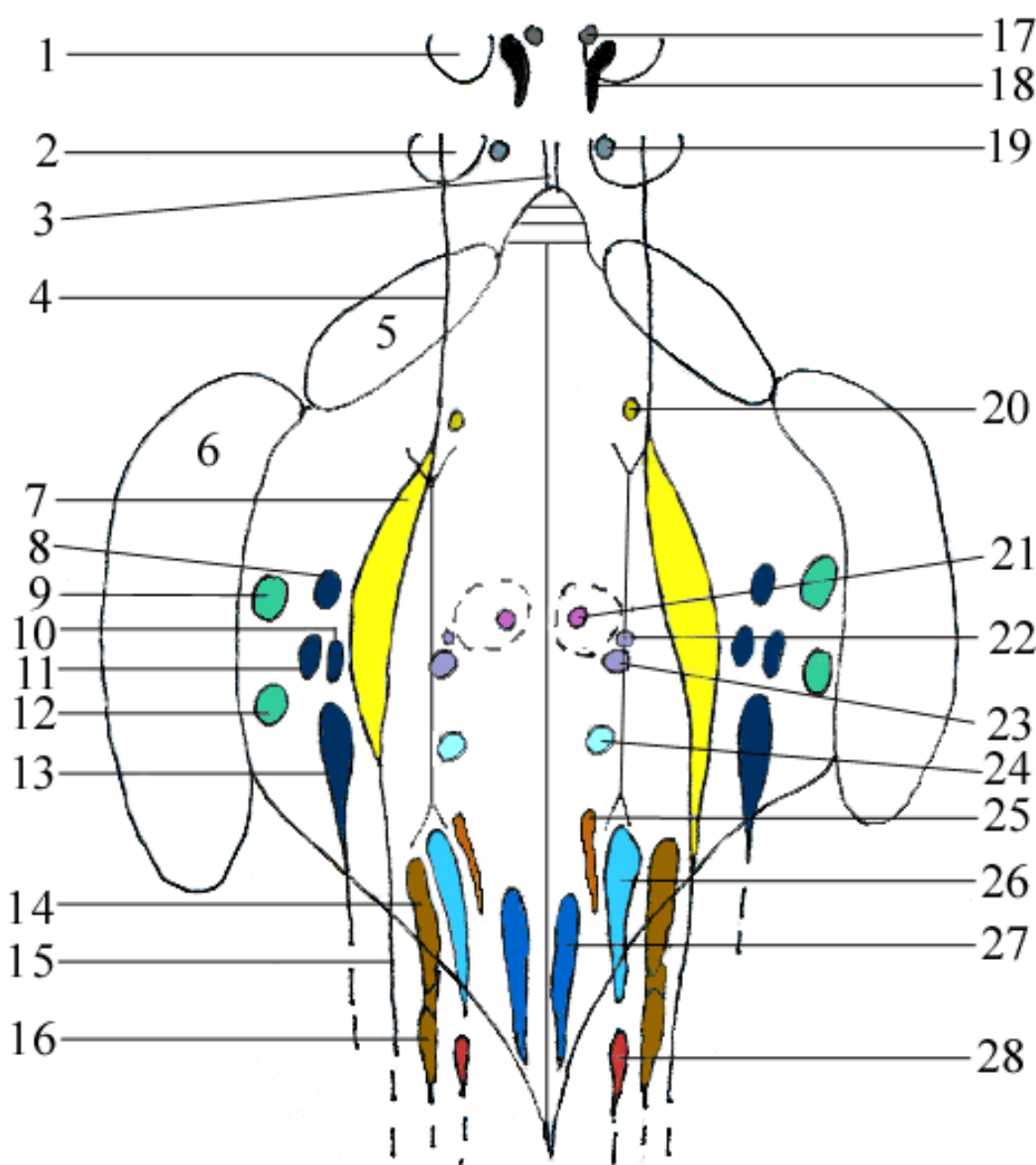


V. = N. trigeminus

4 nuclei

- ncl. **mesencephalicus** n. V. – mesencephalon
 - proprioception from oculomotor, masticatory, facial, tongue muscles and temporomandibular joint
 - *not-migrated ganglion*
- ncl. **principalis** n. V. – pons
 - touch
- ncl. **spinalis** n. V. – medulla
 - pain and temperature + information from n. IX, X, XI
- ncl. **motorius** n. V. – pons
 - 8 muscles

FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANIAL NERVE NUCLEI

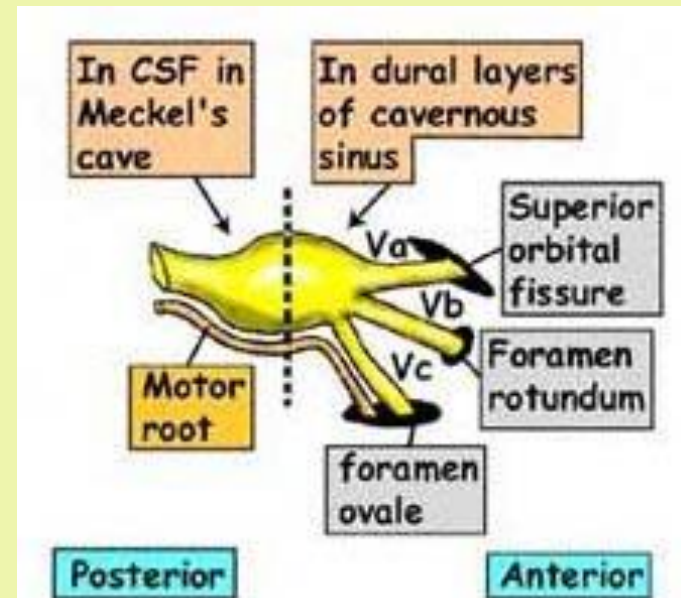


- 1 - superior colliculus
- 2 - inferior colliculus
- 3 - frenulum of superior medullary velum
- 4 - mesencephalic tract of n. V.
- 5 - superior cerebellar peduncle
- 6 - middle cerebellar peduncle
- 7 - principal nucleus of n. V.
- 8 - superior vestibular nucleus /*Bechtëtrev*/
- 9 - posterior cochlear nucleus
- 10 - medial vestibular nucleus /*Schwalbe*/
- 11 - lateral vestibular nucleus /*Deiters*/
- 12 - anterior cochlear nucleus
- 13 - inferior vestibular nucleus /*Roller*/
- 14 + 16 - nuclei tractus solitarii
- 15 - spinal tract of n. V.
- 17 - accessory nucleus of n. III. /*Edinger-Wesphal*/
- 18 - nucleus of n. III.
- 19 - nucleus of n. IV.
- 20 - motor nucleus of n. V.
- 21 - nucleus of n. VI.
- 22 - superior salivatory nucleus
- 23 - nucleus of n. VII.
- 24 - superior salivatory nucleus
- 25 - posterior nucleus of n. X.
- 26 - nucleus ambiguus
- 27 - nucleus of n. XII.
- 28 - nucleus of n. XI.

(= part of nucleus ambiguus and retroambiguus)

V. = N. trigeminus

- non-decussated
- ***somatomotor*** and ***somatosensory***
- in periphery joined with *visceromotor (both)* fibres from other cranial nerves
- *ganglion trigeminale Gasseri* (located within *cavum trigeminale Meckeli*)
 - sensory
- 3 main branches
 - V1
 - V2
 - V3



V. = N. trigeminus

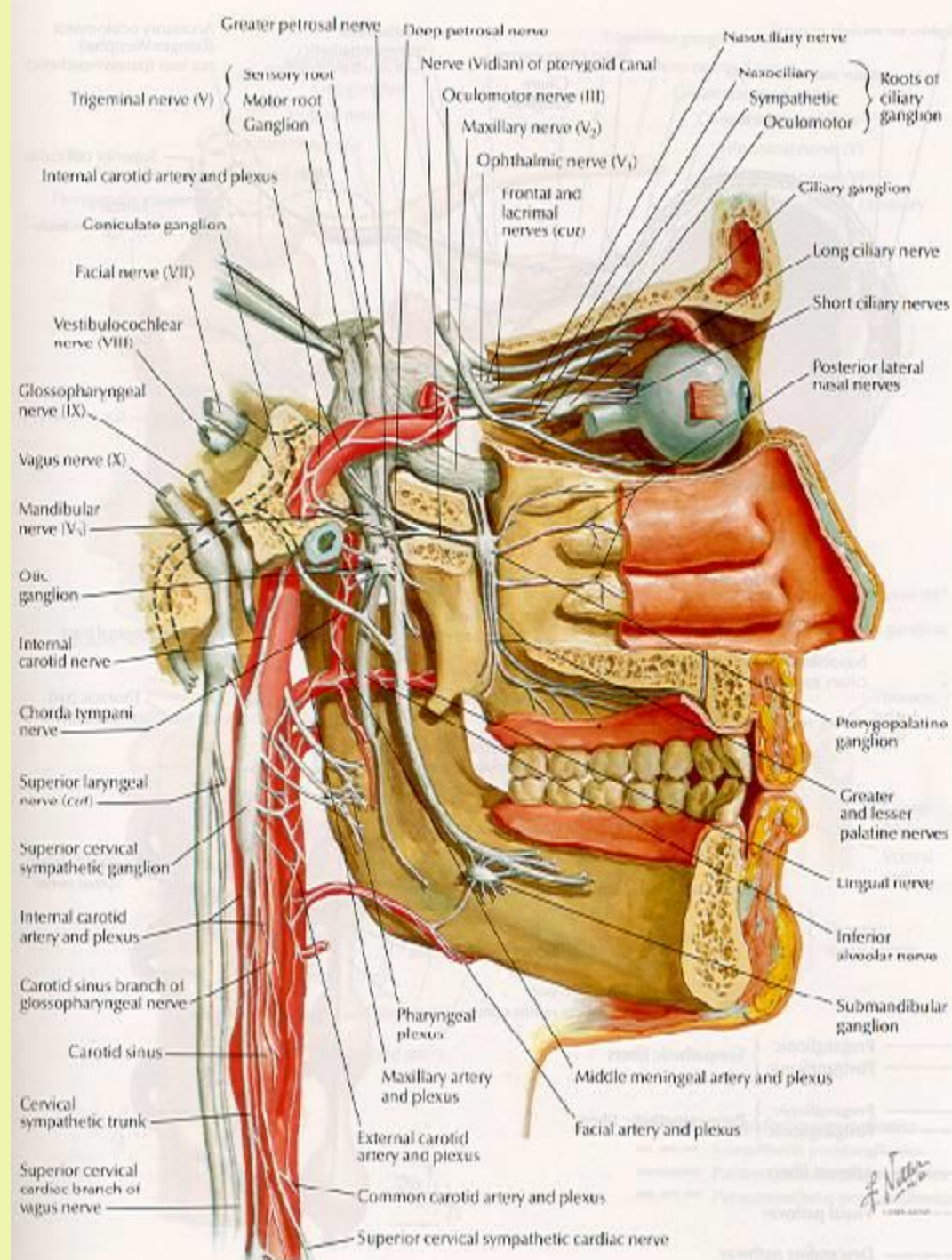
- V1 = N. ophthalmicus
- V2 = N. maxillaris
- V3 = N. mandibularis
- Radix motoria = „Portio minor“
 - somatomotor branch for masticatory muscles
 - and another 4 muscles derived from 1st pharyngeal arch
 - fibres within V3 only !!!

N. V

- V1 = N. ophthalmicus
- V2 = N. maxillaris
- V3 = N. mandibularis

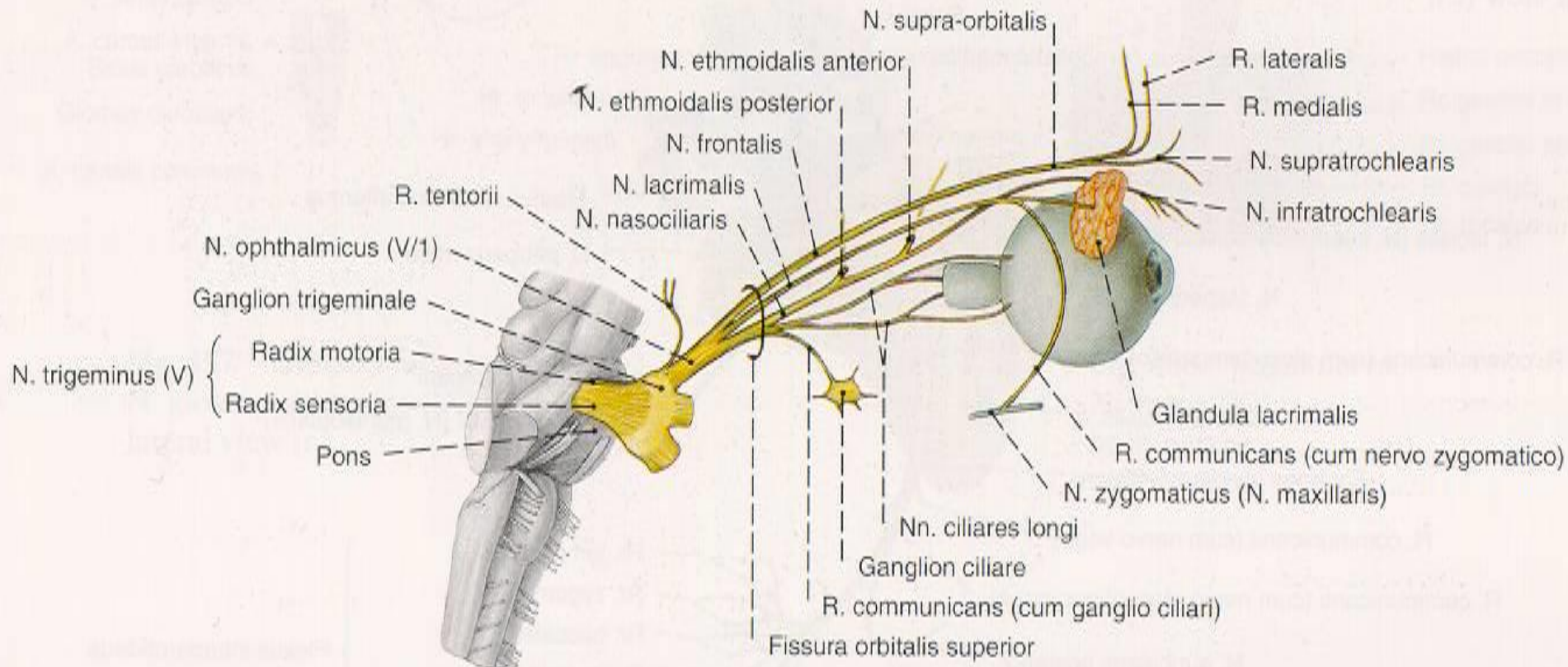
all send off *ramus meningeus*

V1 – *r. tentorii*



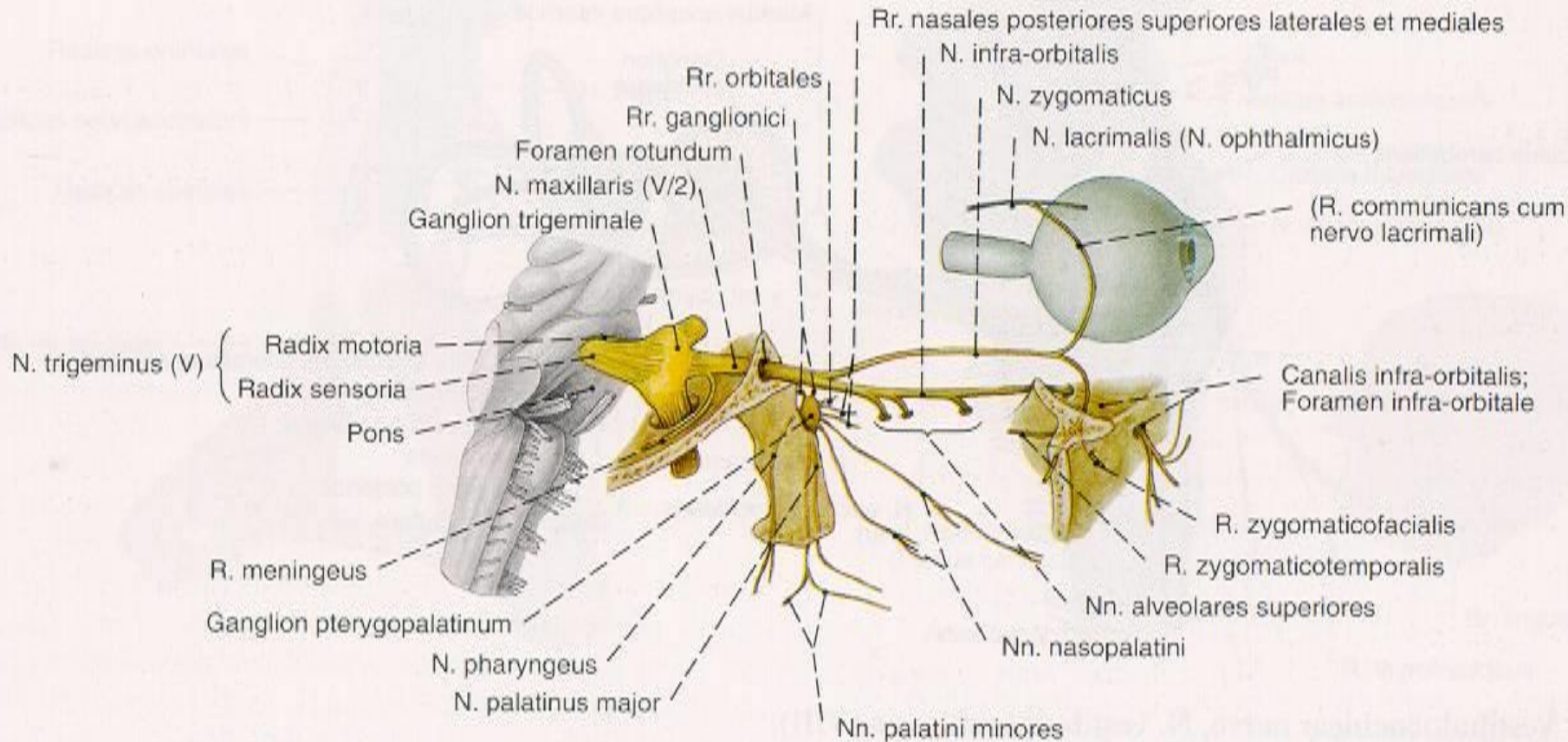
V1 = N. ophthalmicus

- n. frontalis
- n. nasociliaris
- n. lacrimalis
- *ganglion ciliare*
parasympathetic
- n. supraorbitalis – *palpation*
sensitivity



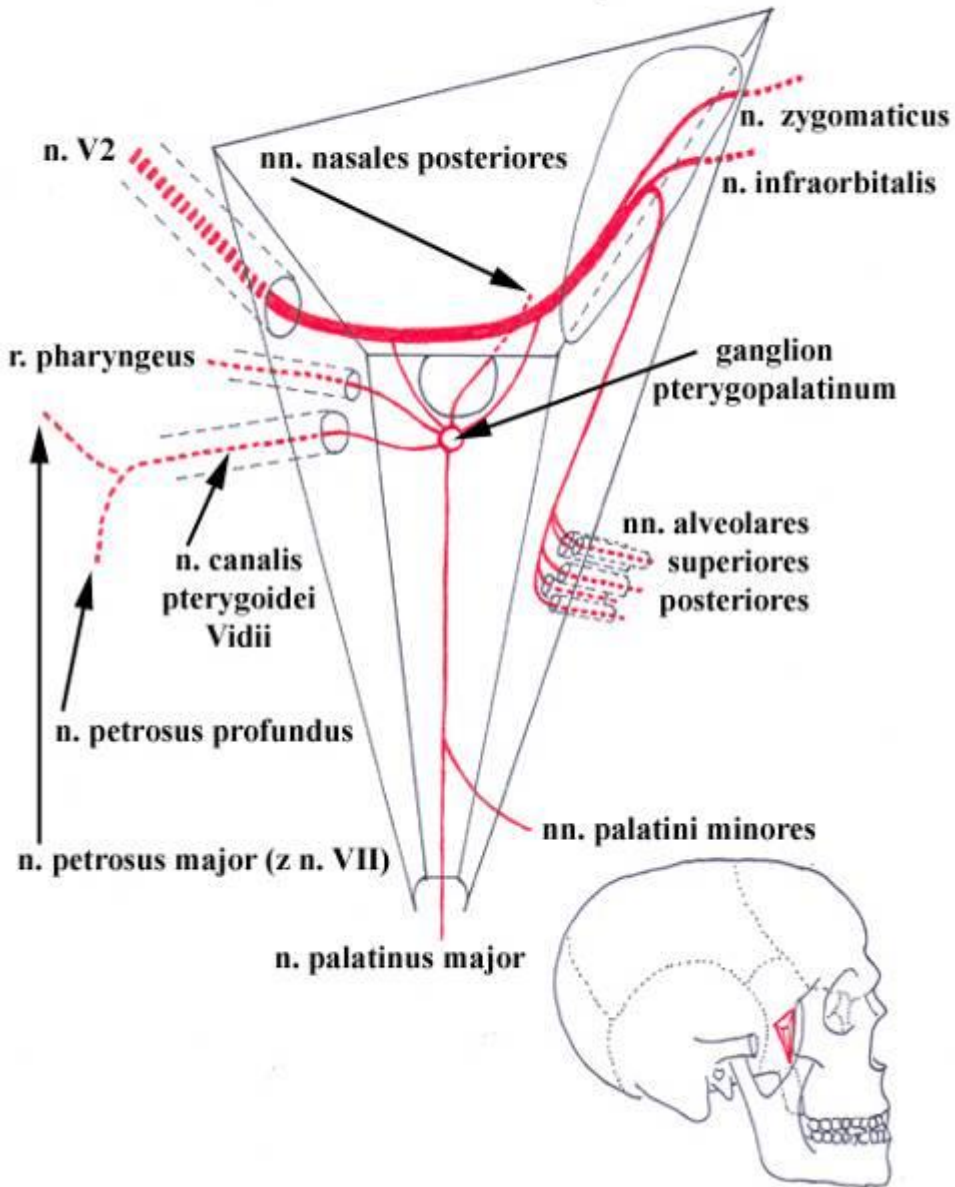
V2 = N. maxillaris

- 6 branches in fossa pterygopalatina
 - *ganglion pterygopalatinum*
 - *parasympathetic*
- n. infraorbitalis – *palpation sensitivity*



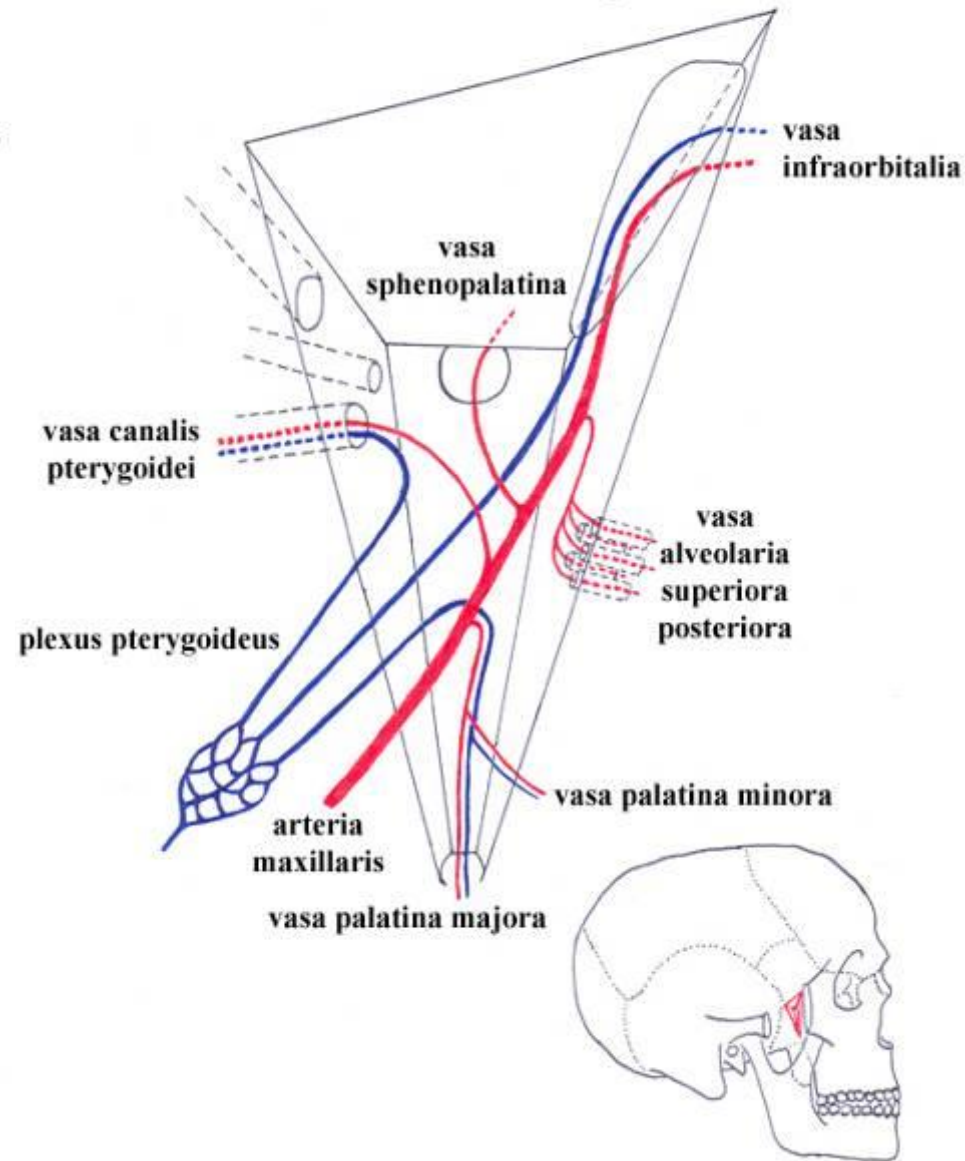
FOSSA PTERYGOPALATINA

l.dx. - nervy



FOSSA PTERYGOPALATINA

l.dx. - cévy



V3 = N. mandibularis

somatomotor branches

for muscles of 1st
pharyngeal arch

- 4 masticatory muscles
- 2 suprahyoid muscles
- m. tensor veli palatini
- m. tensor tympani

somatosensory branches (5 branches)

- n. alveolaris inferior
- n. lingualis
 - chorda tympani from n. VII
- n. buccalis
- n. auriculotemporalis
- *parasympathetic ganglion submandibulare + ganglion oticum*
- n. mentalis – palpation sensitivity

V3 = N. mandibularis

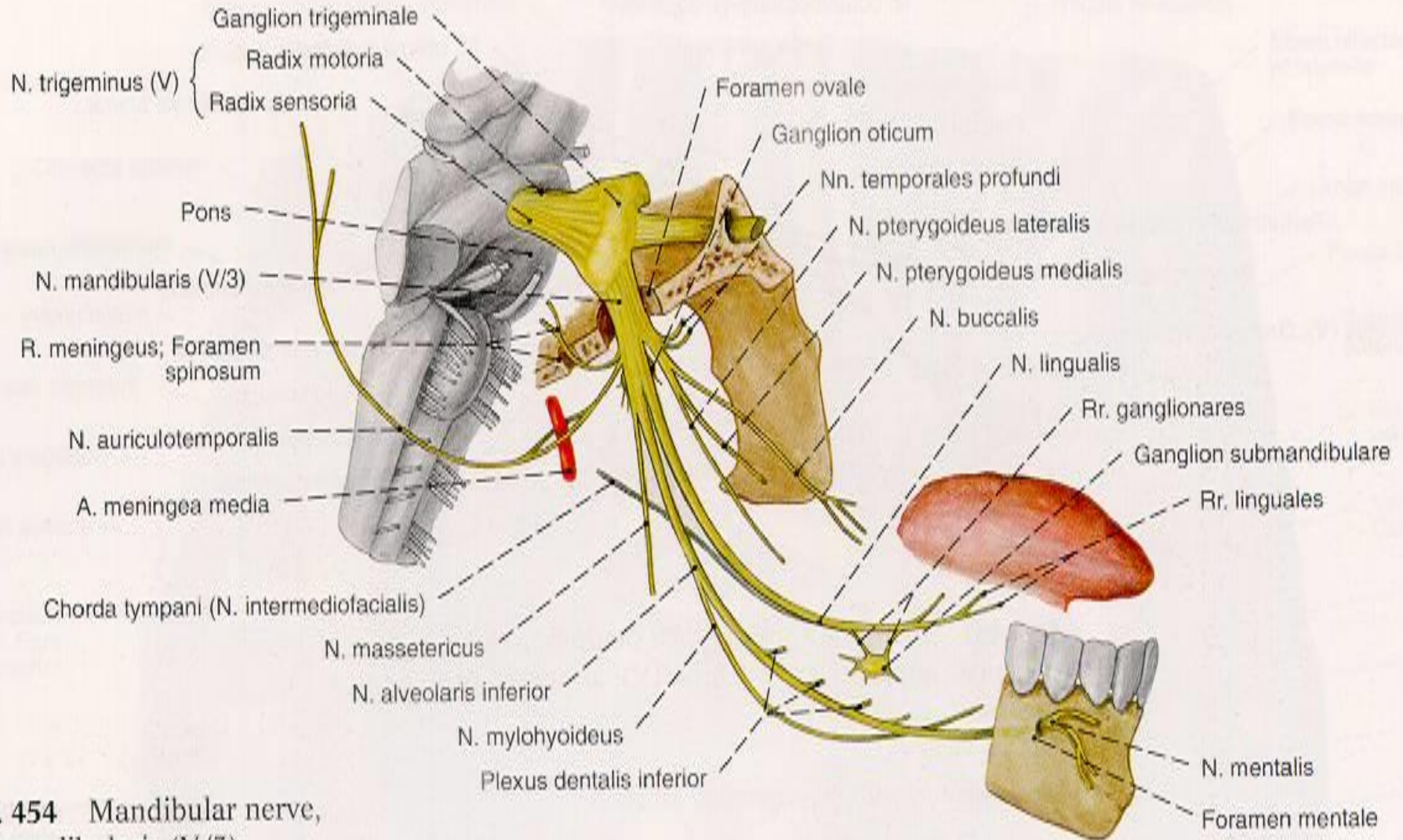
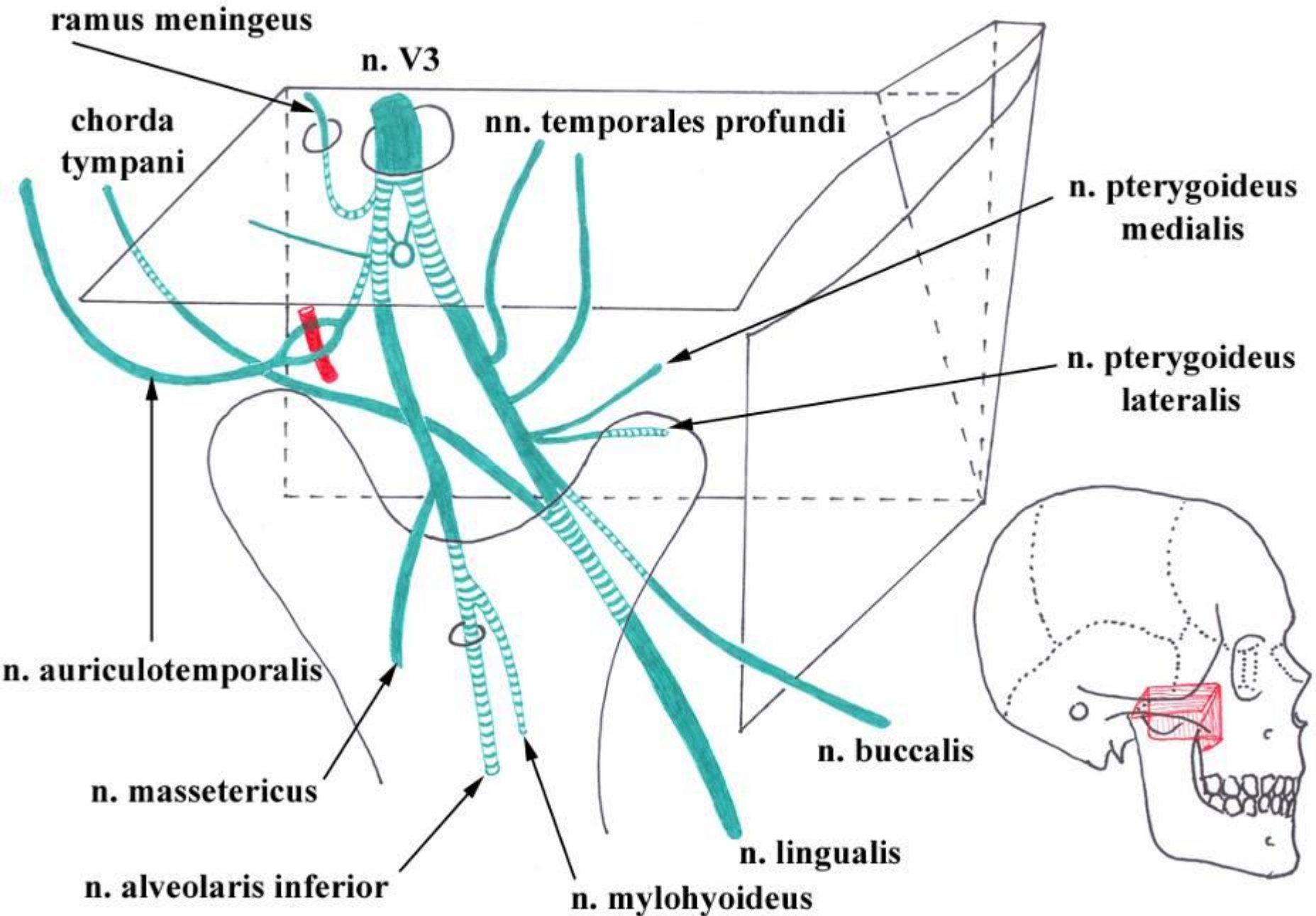
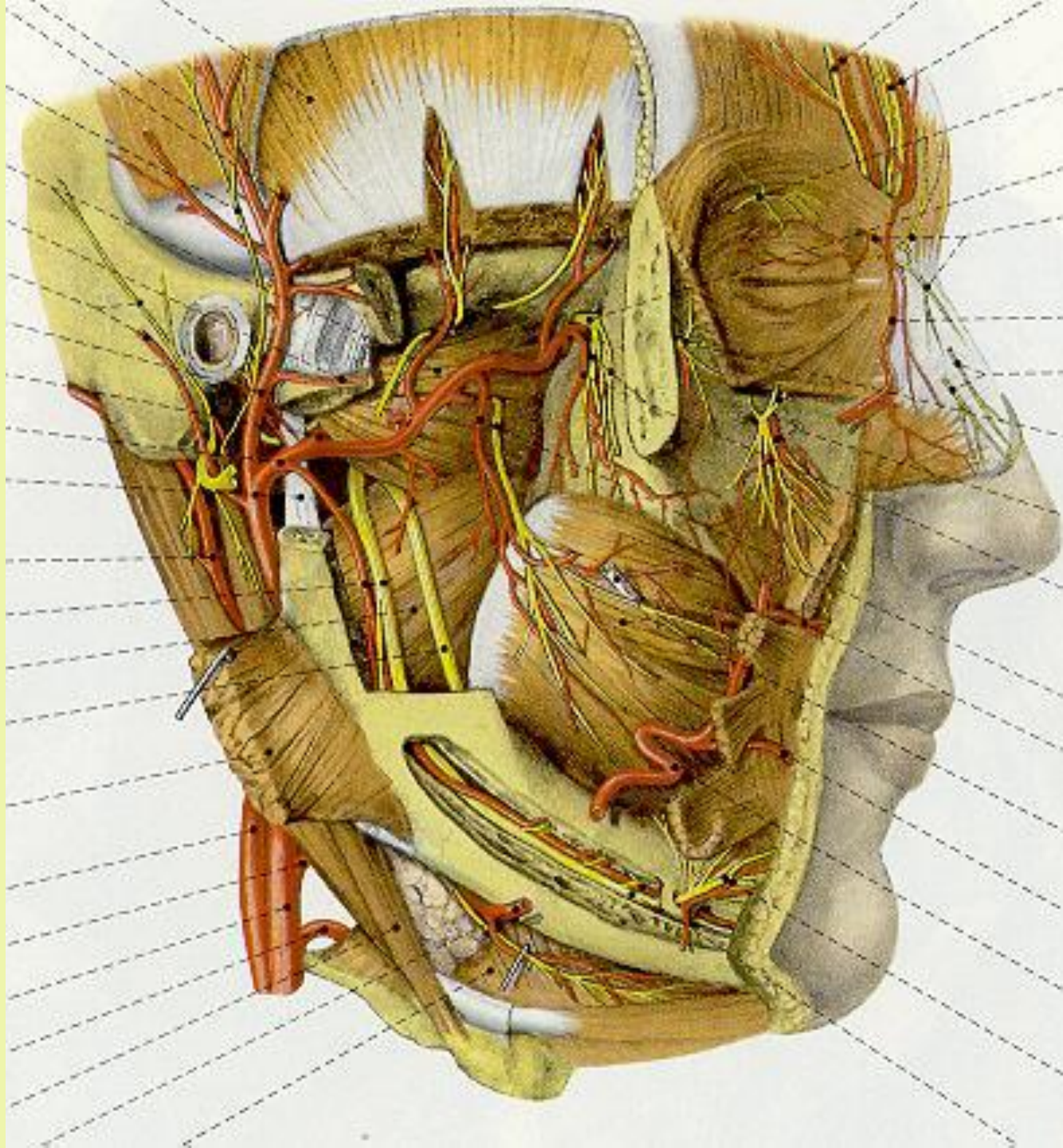
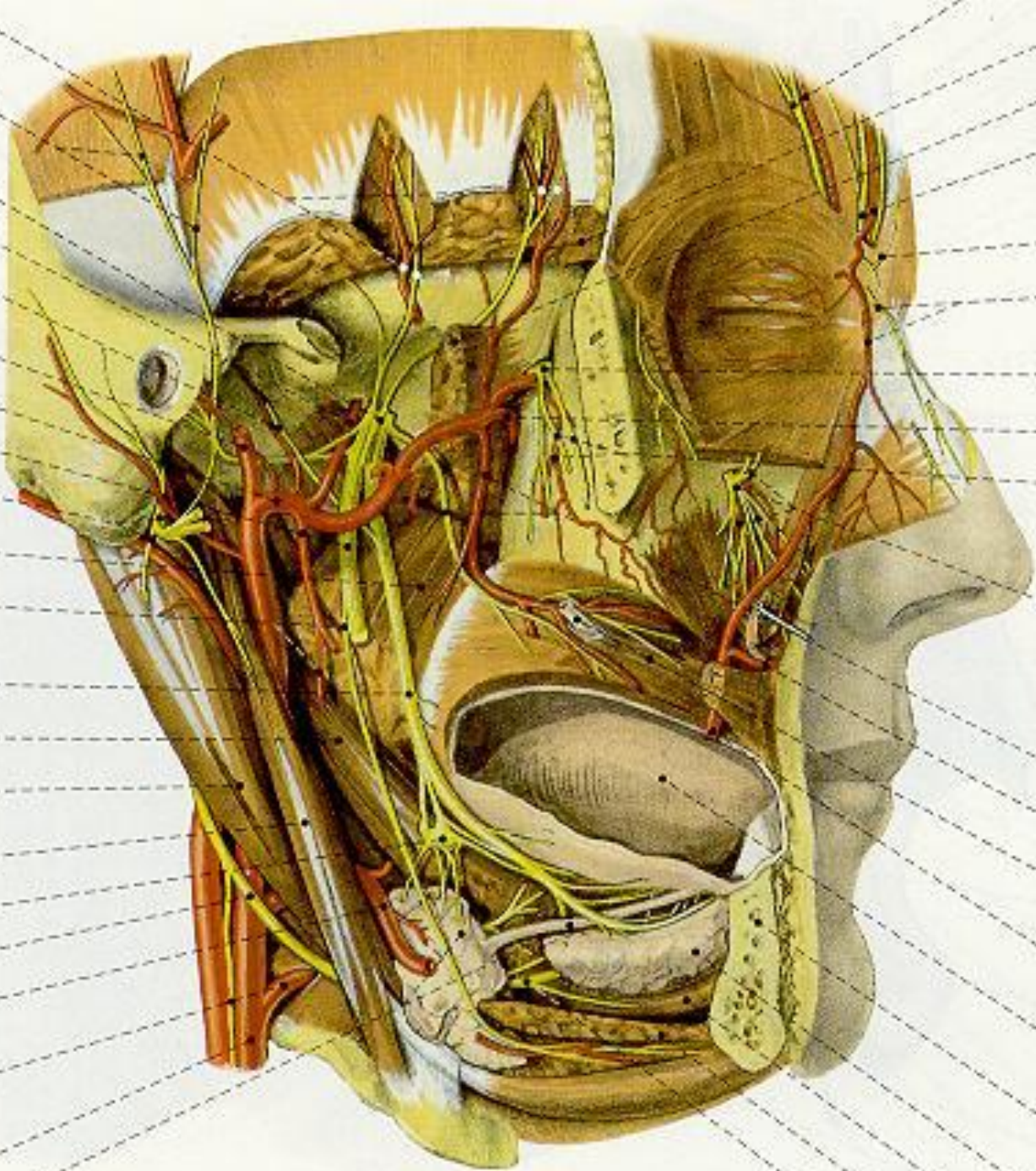
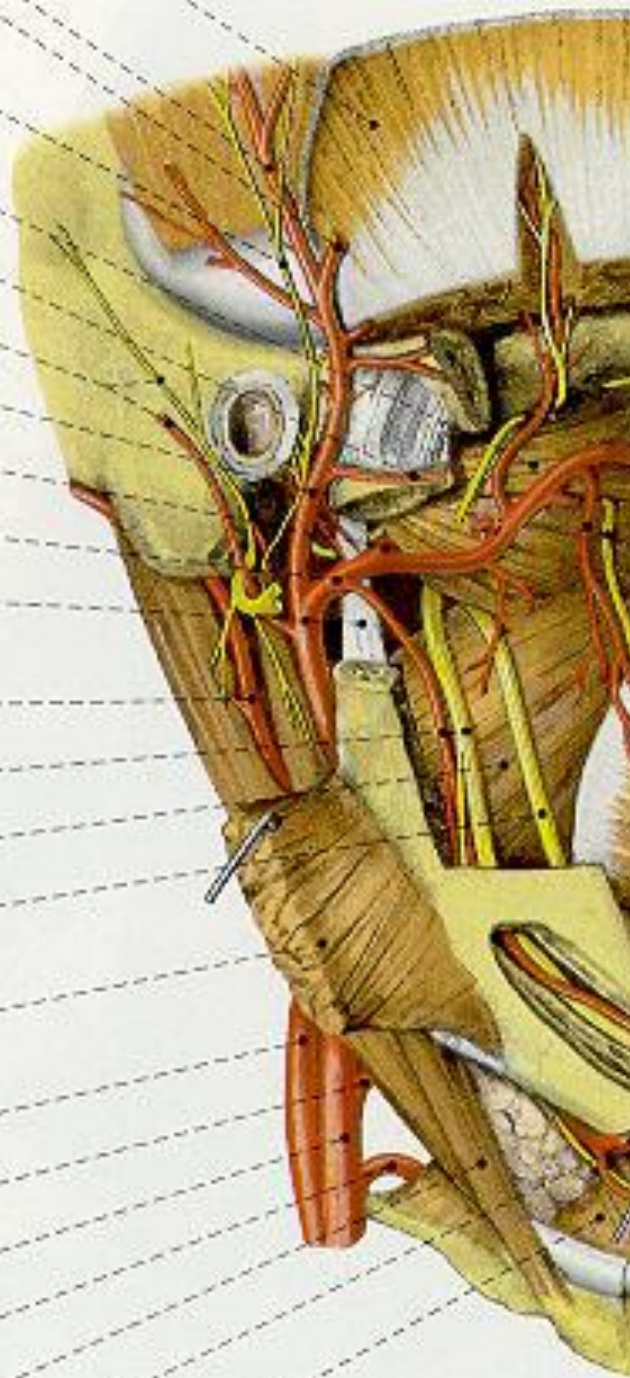


Fig. 454 Mandibular nerve,
N. mandibularis (V/3);

FOSSA INFRATEMPORALIS - l.dx.

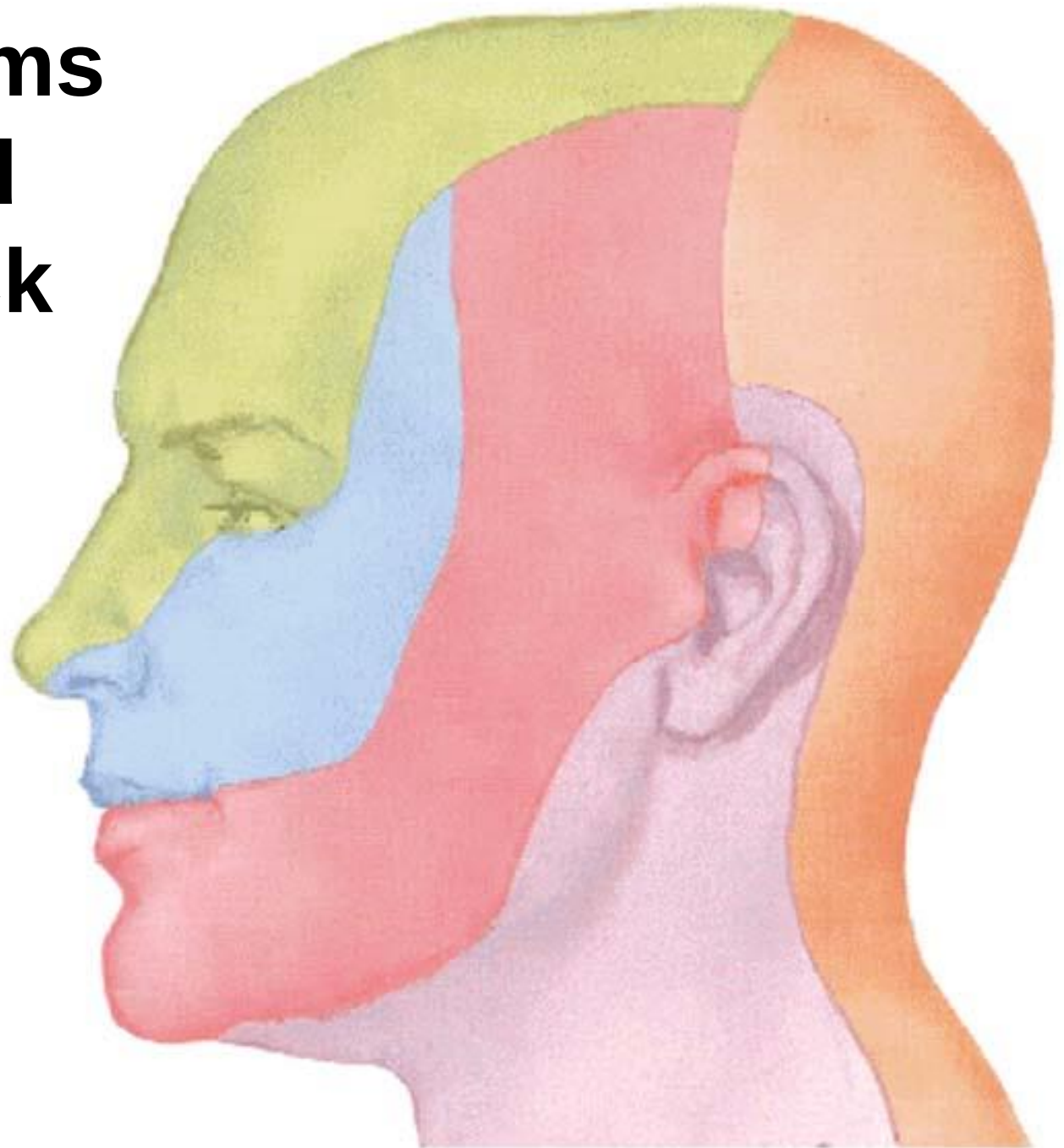






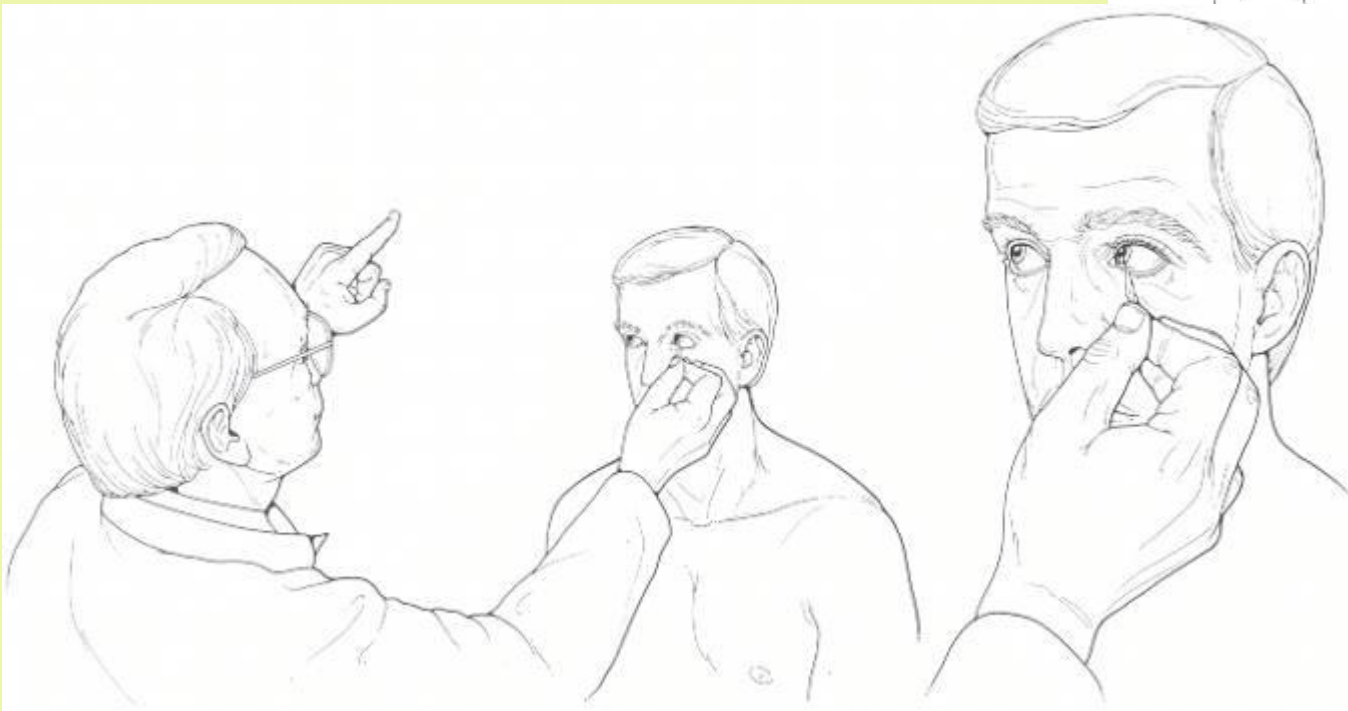
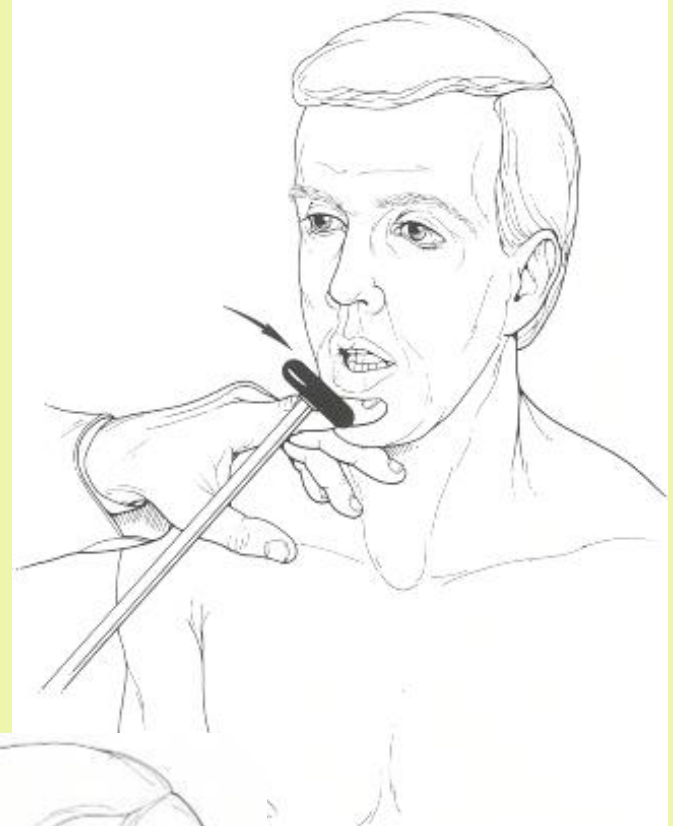
Dermatomes of head and neck

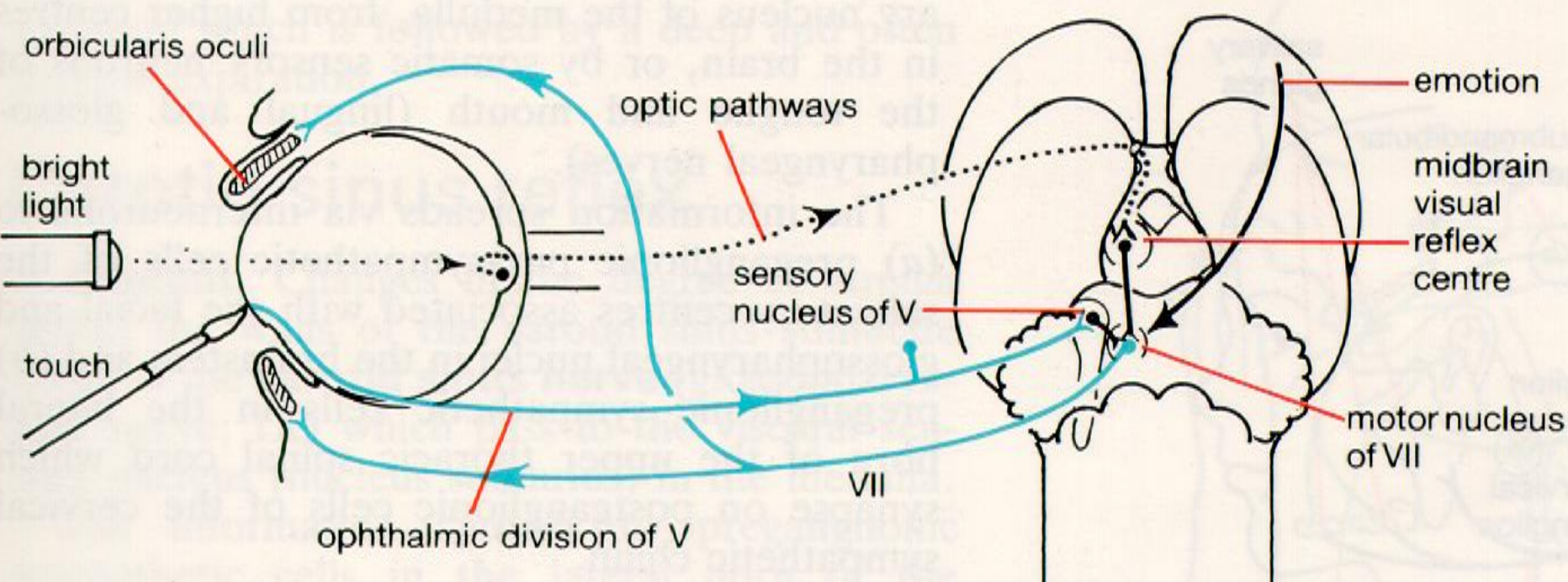
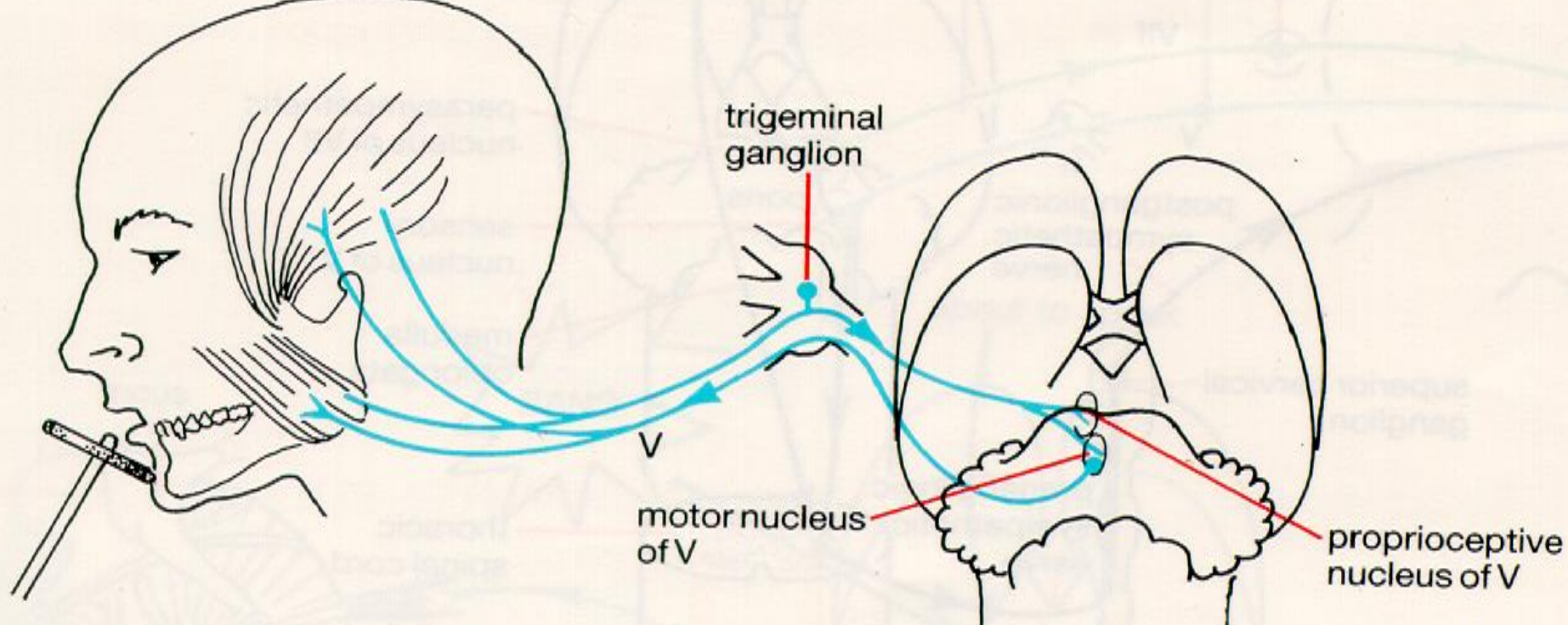
- V1
- V2
- V3
- C2
- C3



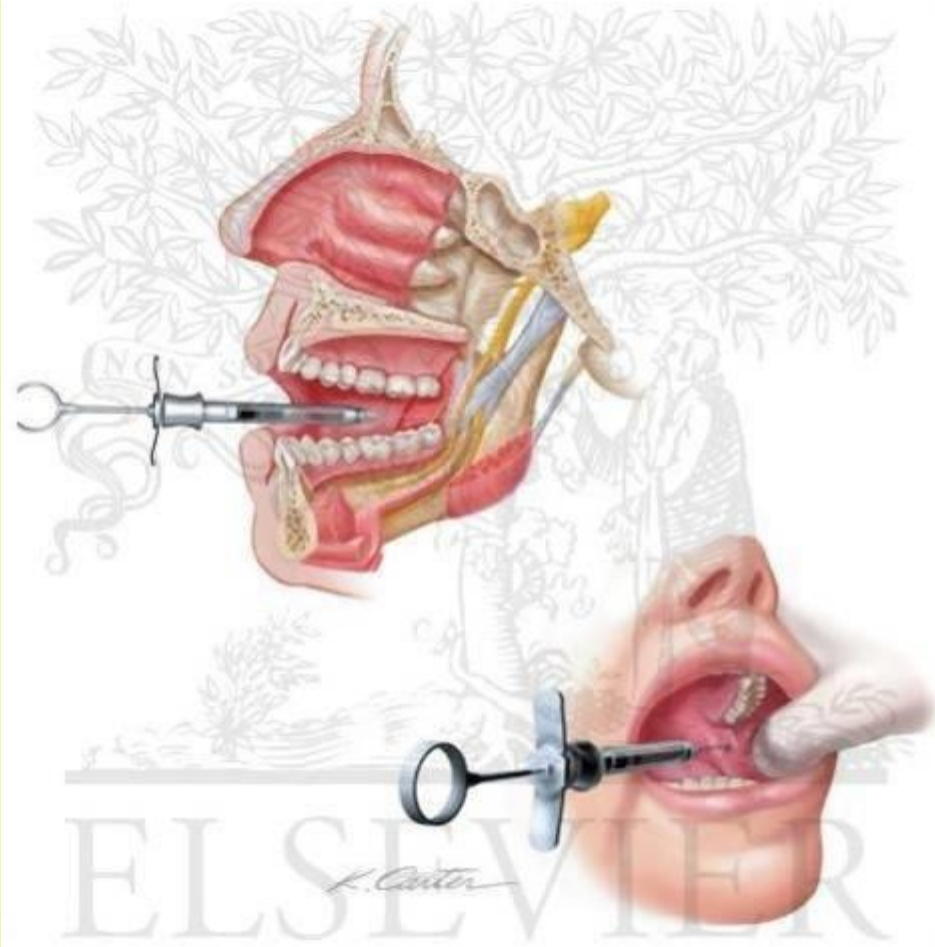
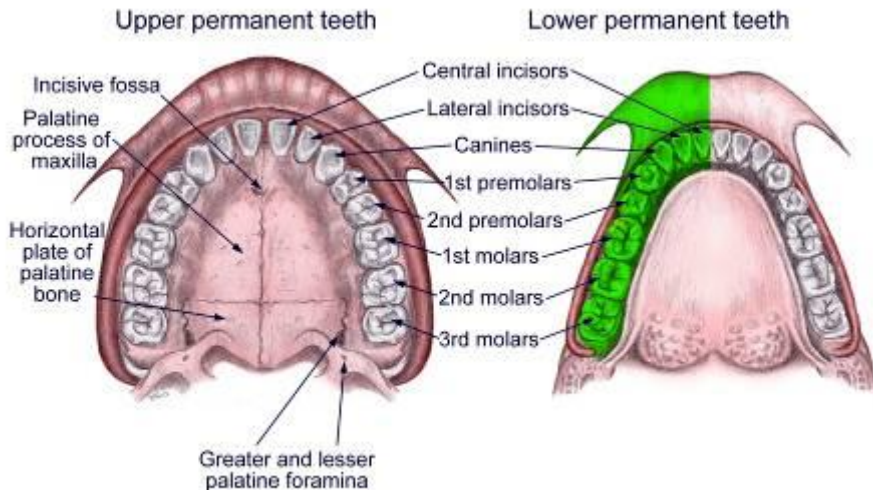
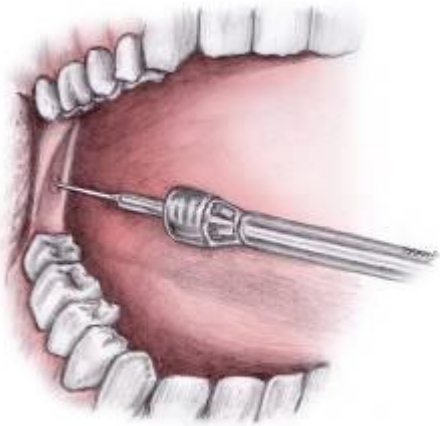
Reflex examination

- masseter reflex
- corneal reflex

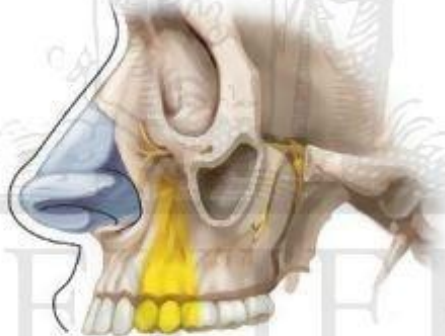
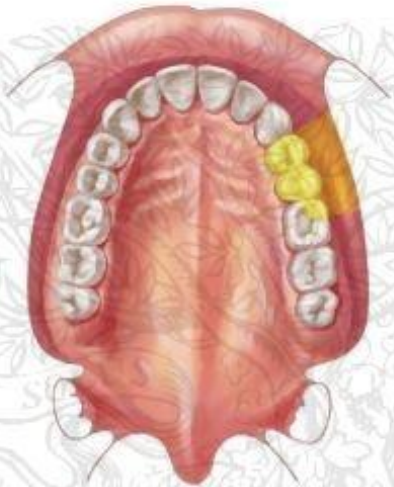




Field block = conduction anaesthesia – lower dental arch



Field block = conduction anaesthesia – upper dental arch



K. Carter



K. Carter

Viral infections

- Herpes zoster ophthalmicus (V1) →
- Herpes simplex (V2,V3) ↓

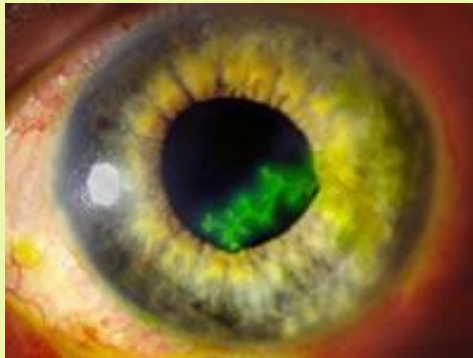


FIGURE 2. Case of herpes zoster ophthalmicus

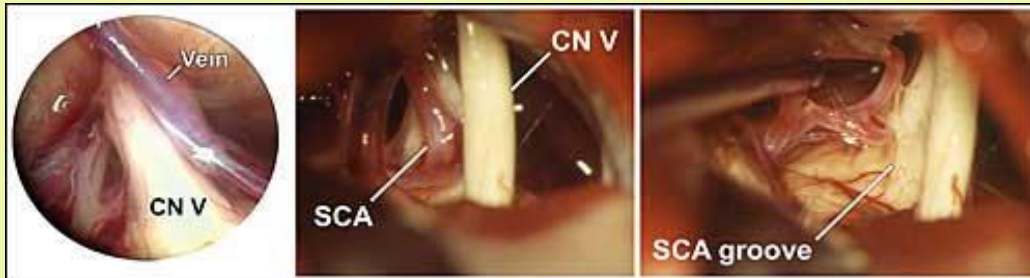
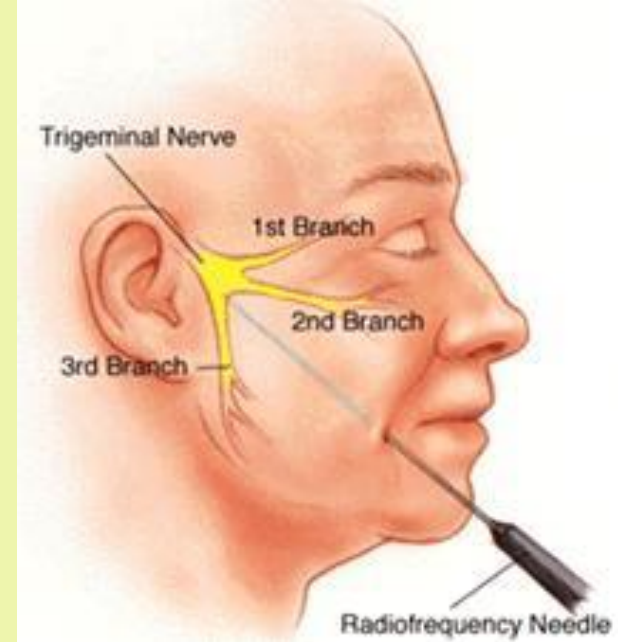


Photo/MN Oxman, University of California, San Diego

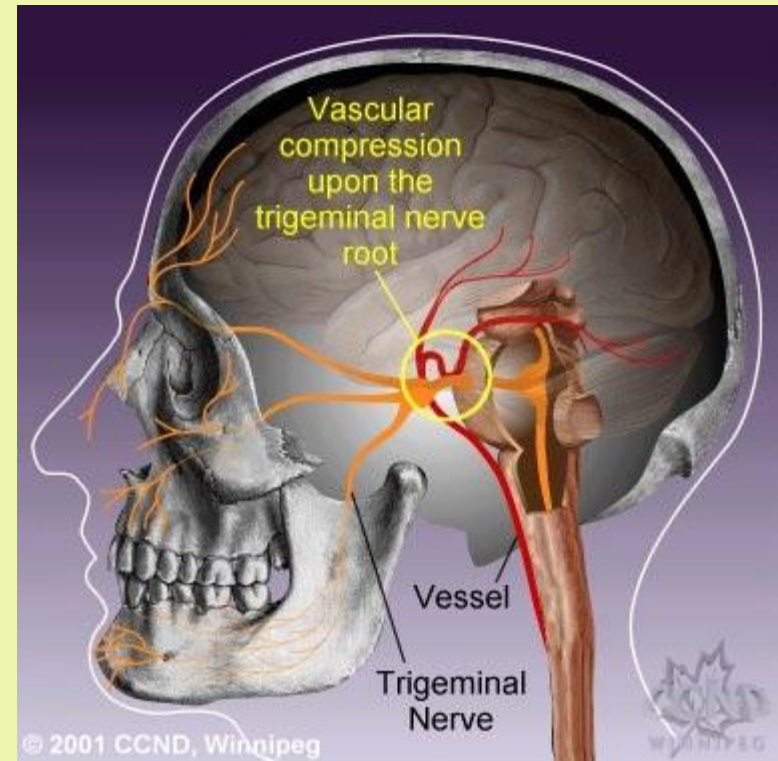
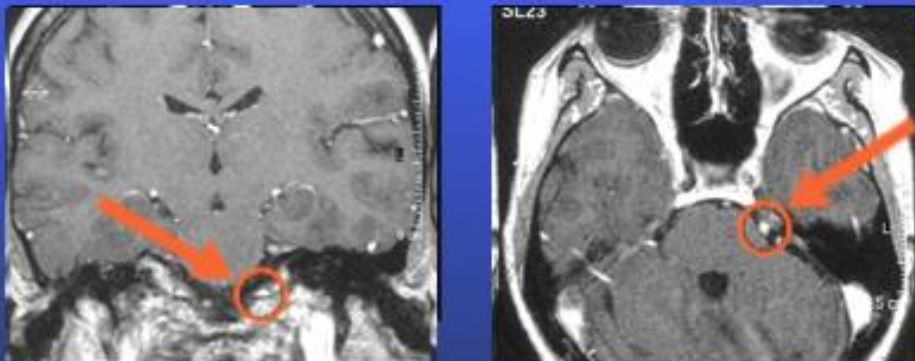
Neuralgia trigeminalis

= *Tic douloureux; Prosopalgia*

- microvascular decompression (80% - loop of a. cerebelli superior)
 - compression in transition between CNS and PNS
 - contact of sheath of oligodendrocytes and Schwann 's cells = „Obersteiner-Redlich zone)
- rhizolysis
- gamma knife – termocoagulation



Trigeminal Neuralgia



WWW

- [http://www.youtube.com/watch?v=4xzQ5v
nvL-o](http://www.youtube.com/watch?v=4xzQ5v
nvL-o)