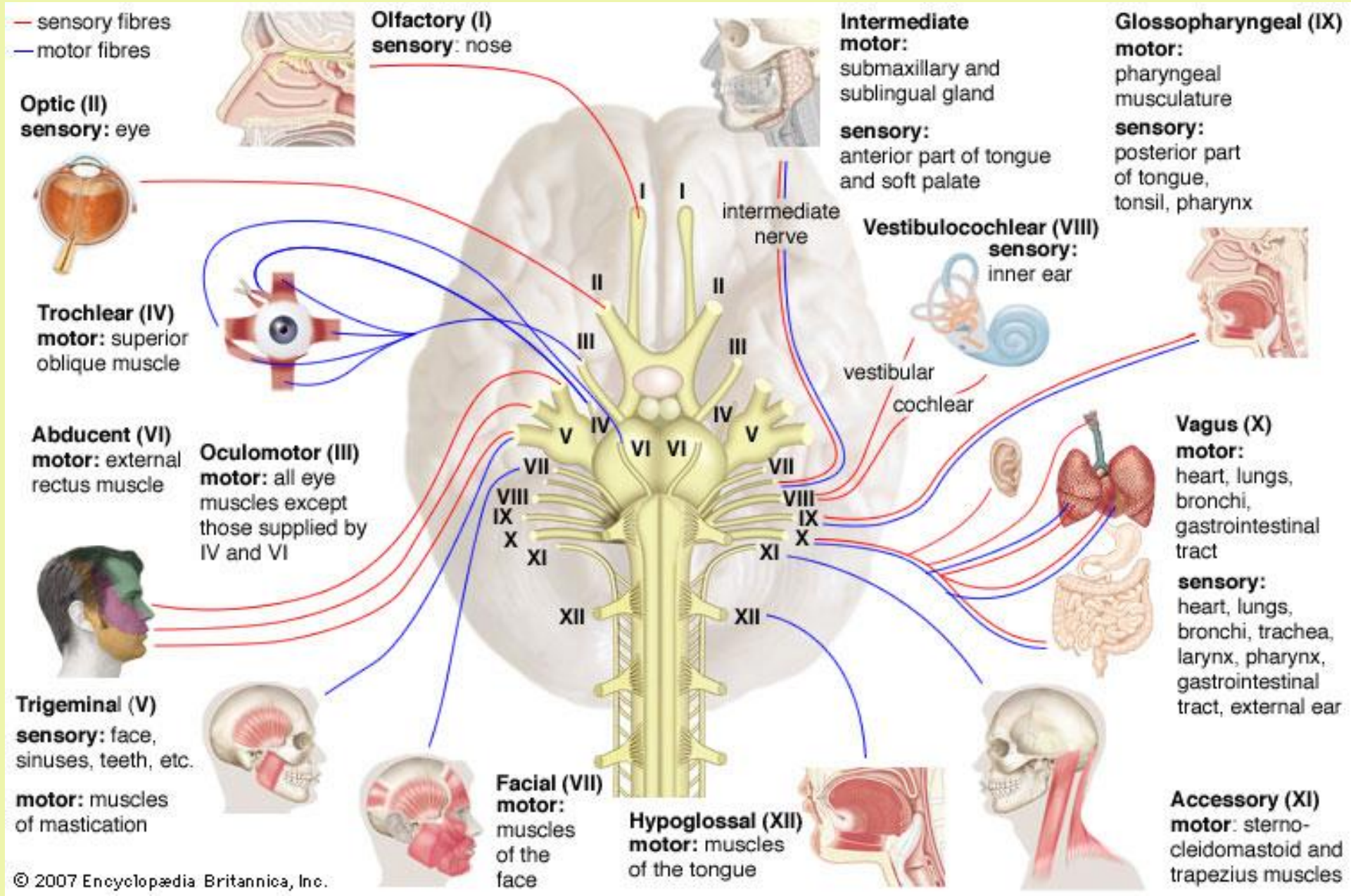
# Mnemonics

- **O**h, **O**h, **O**h **T**o **T**ake **A** **F**amily **V**acation! **G**o **V**egas **A**fter **H**ours!
- **O**n **O**ld **O**lympus' **T**owering **T**ops, **A**merican, **F**inn, **S**cott and **G**erman **V**iewed **A**nd **H**opped"
- **O**h **O**h **O**h **T**o **T**ouch **A**nd **F**eel a **V**irgin **G**irl's **V**agina **A**nd **H**ymen.
- **OL**d **OP**ie **OC**casionally **TR**ies **TRIG**onometry **A**nd **F**eels **VE**ry **GLO**omy, **VAGU**e, **A**nd **HYPO**active.

# CRANIAL NERVES

## 1st part

David Kachlík



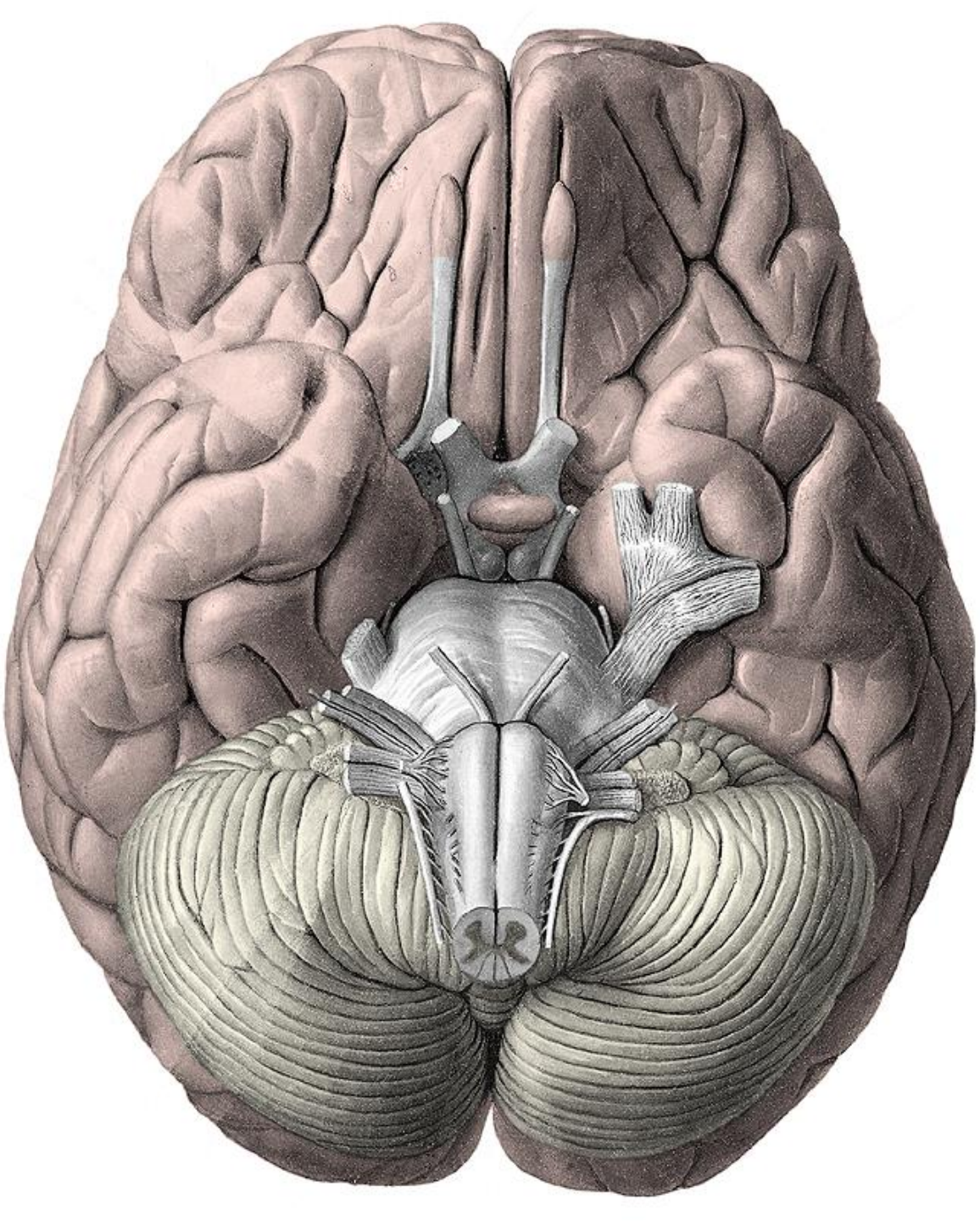
# Numeral clasification

- *Claudius Galenus* (2nd century)

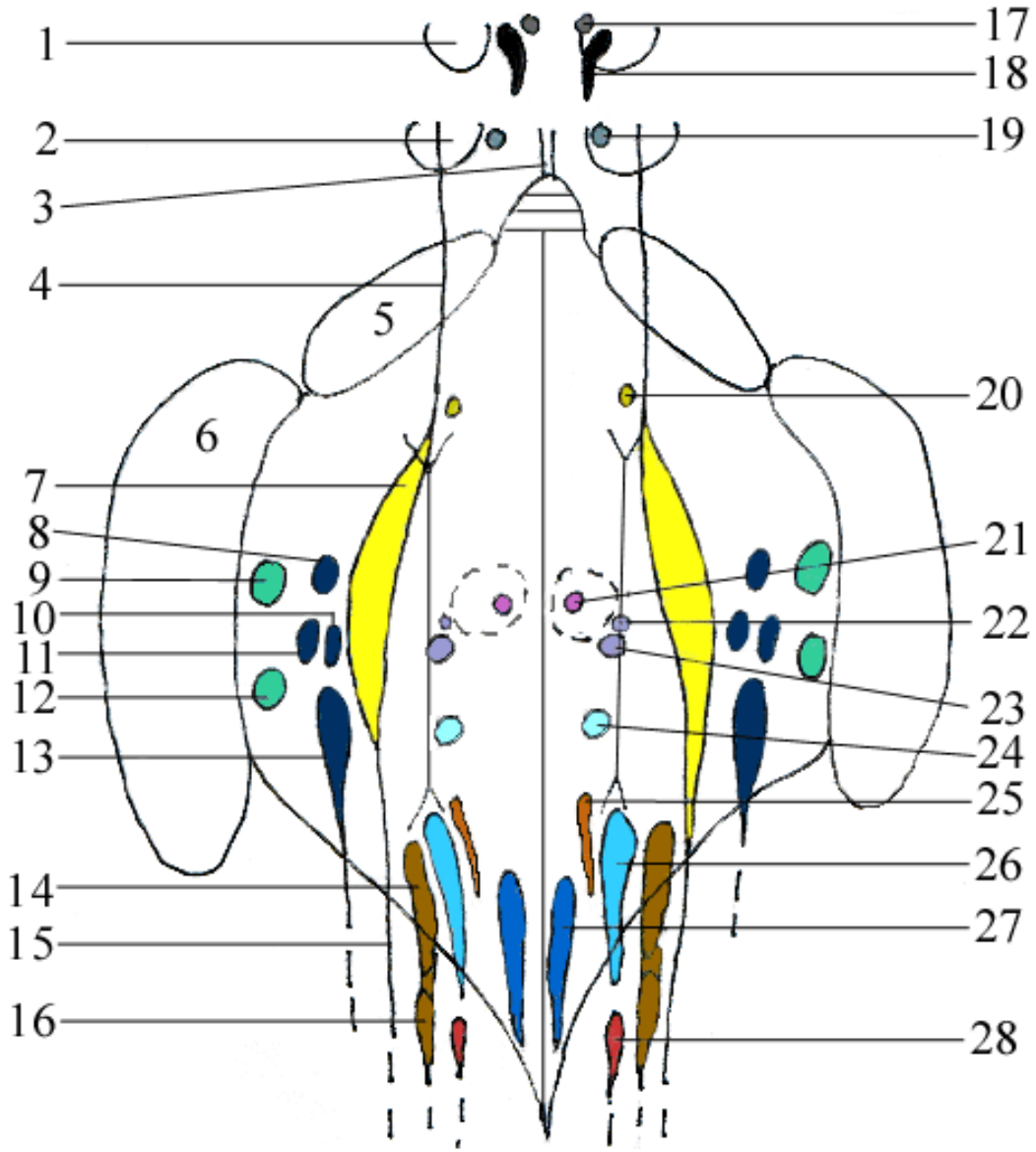
  7 pairs
- *Thomas Willis* (1664)

  9 pairs
- ***Samuel Thomas von Sömmerring* (1778)**

  **12 pairs**

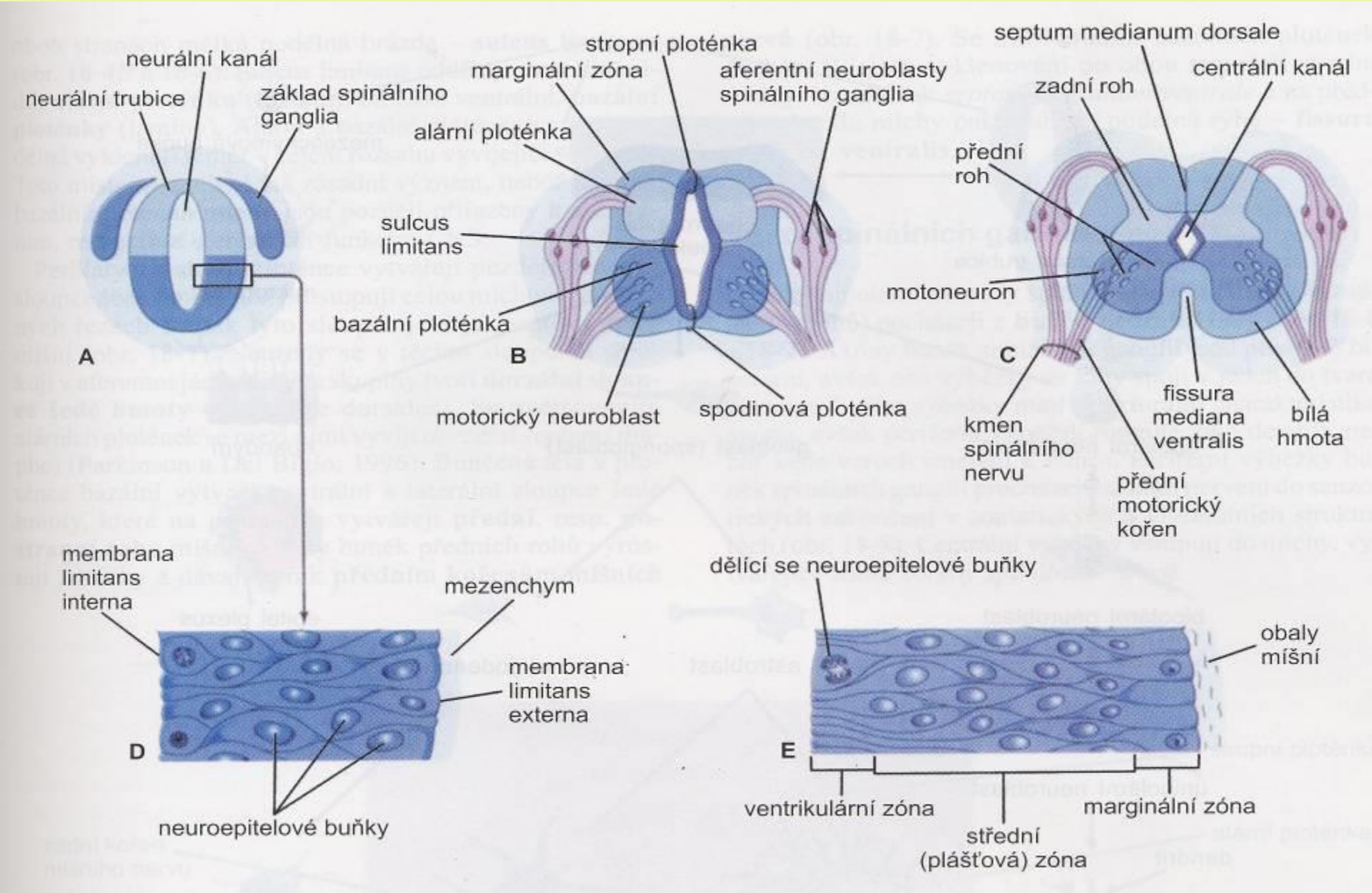


# FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANILA NERVES NUCLEI



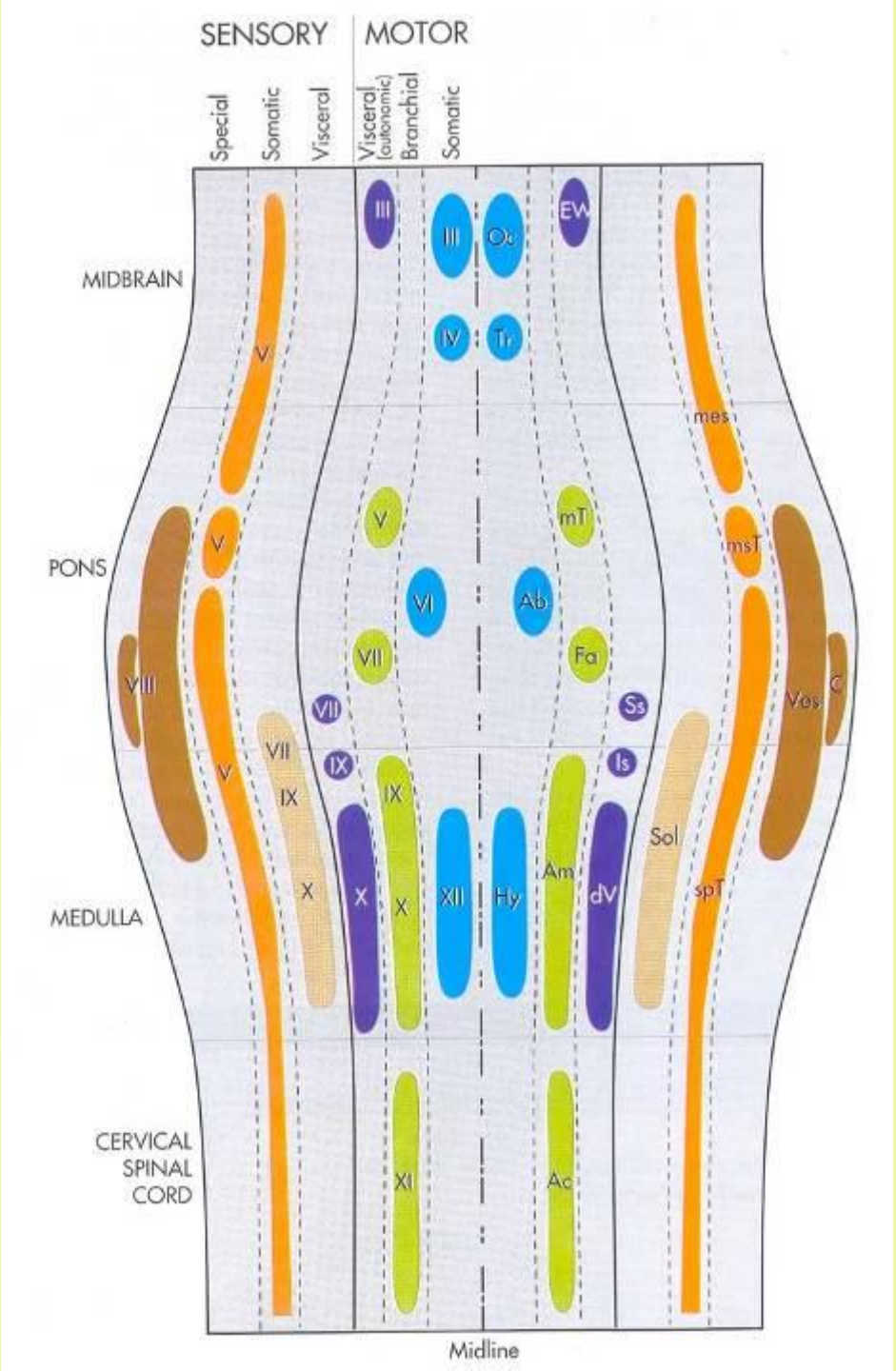

1 - superior colliculus
2 - inferior colliculus
3 - frenulum of superior medullary velum
4 - mesencephalic tract of n. V.
5 - superior cerebellar peduncle
6 - middle cerebellar peduncle
7 - principal nucleus of n. V.
8 - superior vestibular nucleus */Bechtětrev/*
9 - posterior cochlear nucleus
10 - medial 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 nulceus
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)

# Basal *versus* Alar plate

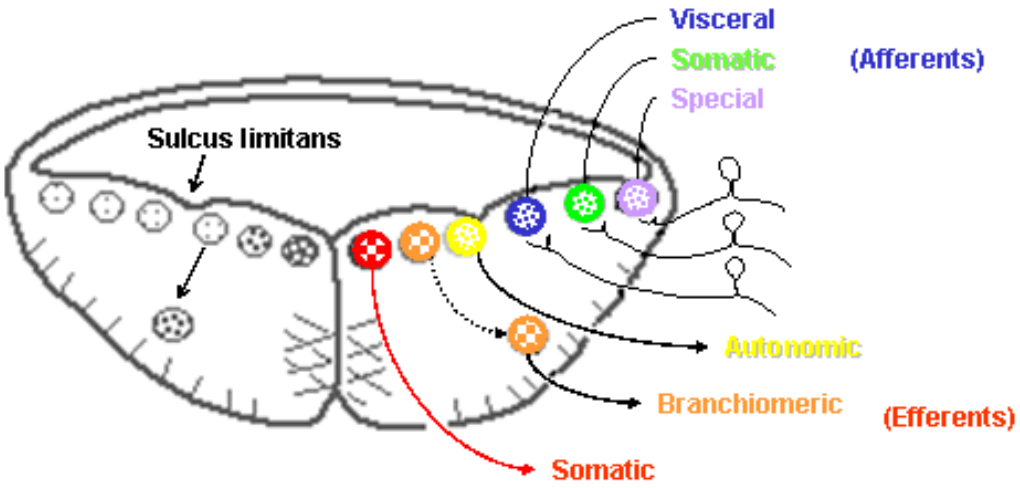


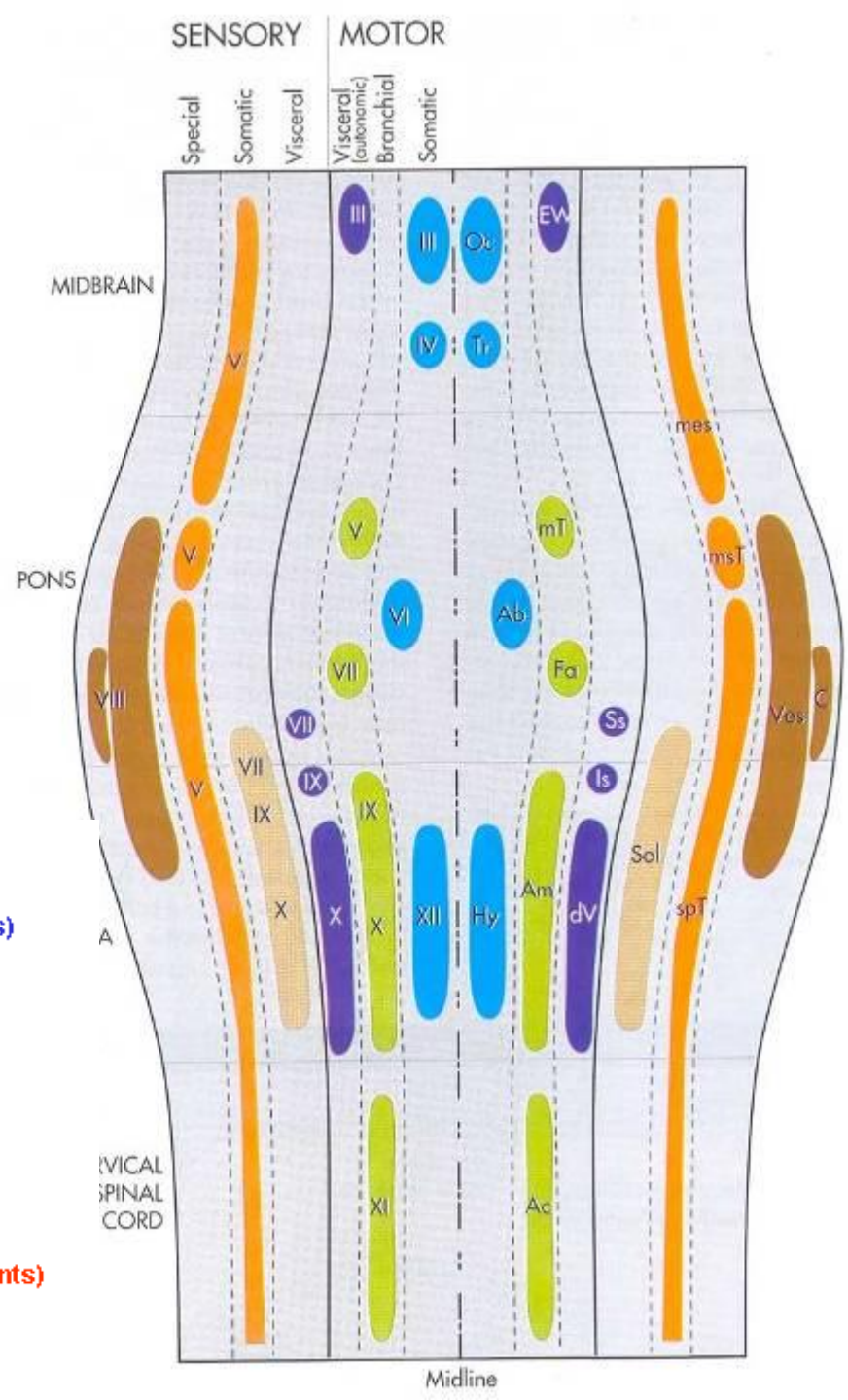
# Developmental classification *mediolaterally*

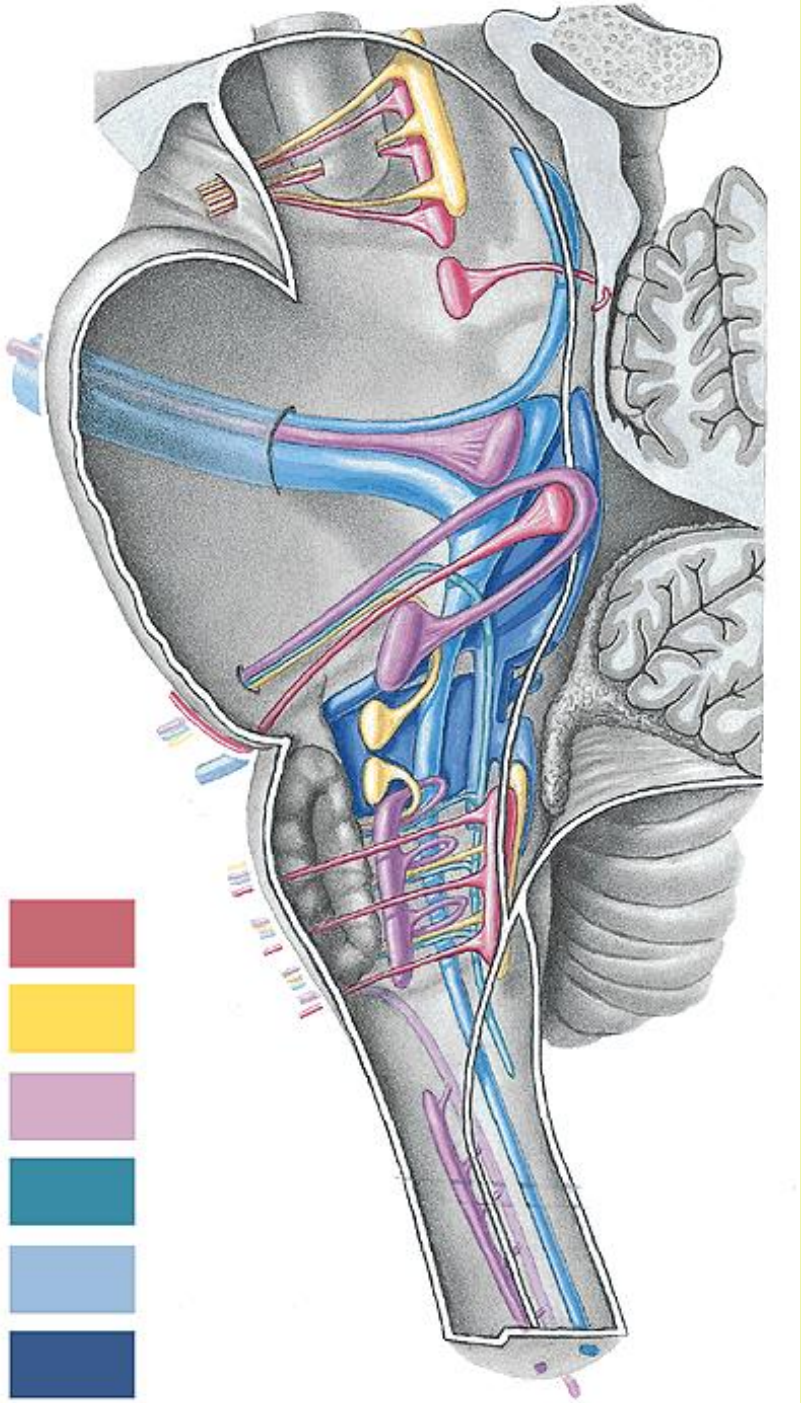
- **somatomotor somatic**
- **somatomotor branchial**
- **visceromotor**
- **viscerosensory**
- **somatosensory**
- **special sensory**

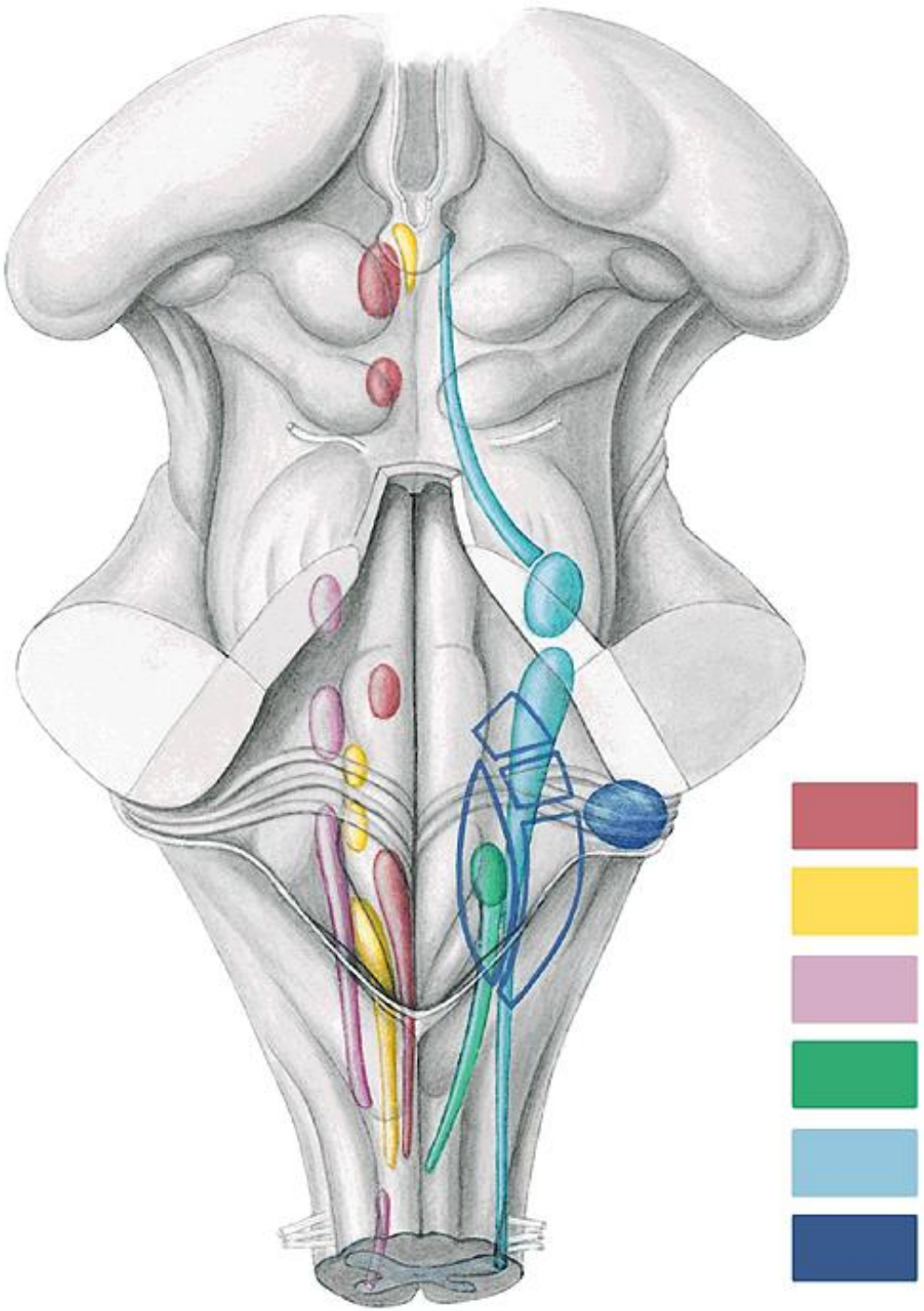


# Developmental classification *mediolaterally*

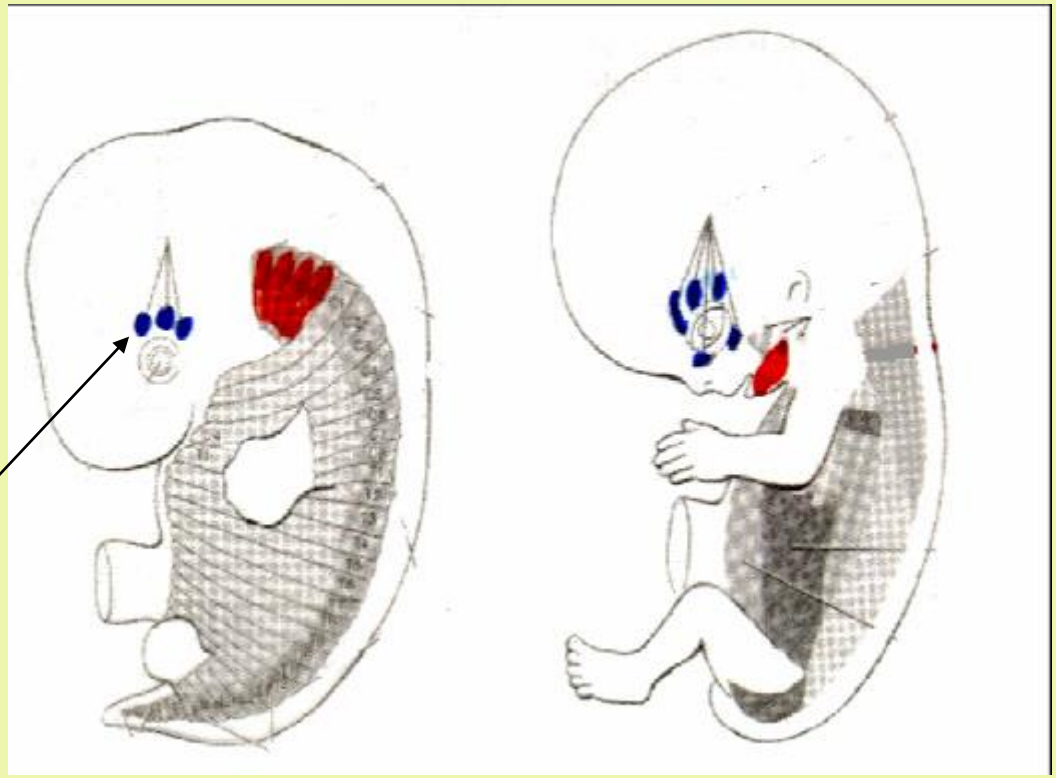






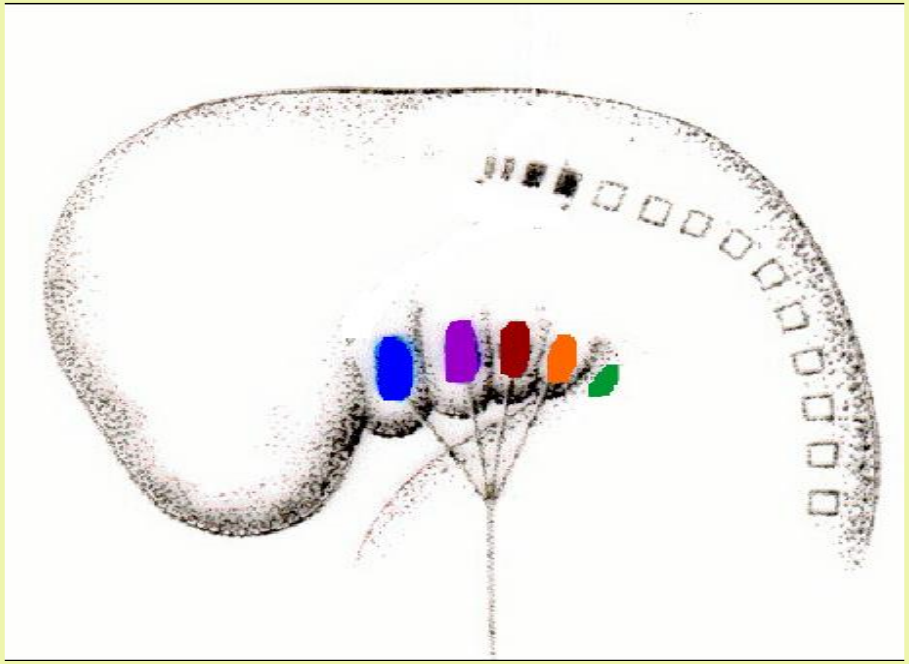
# SomatoMotor somatic CN

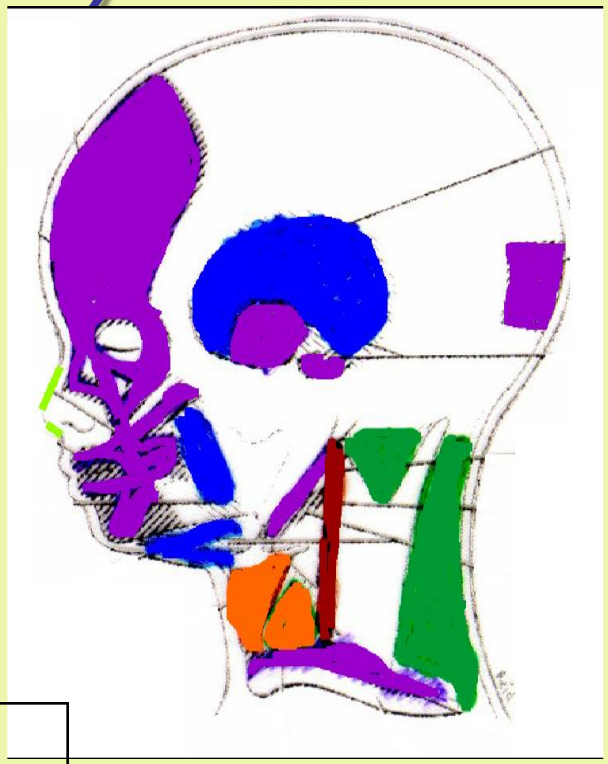


- preotic myotoms (somitomers) form external muscles of eyeball – n. III, IV, VI

- occipital somites form muscles of tongue – n. XII

# SomatoMotor Branchial CN (BranchioMotor)

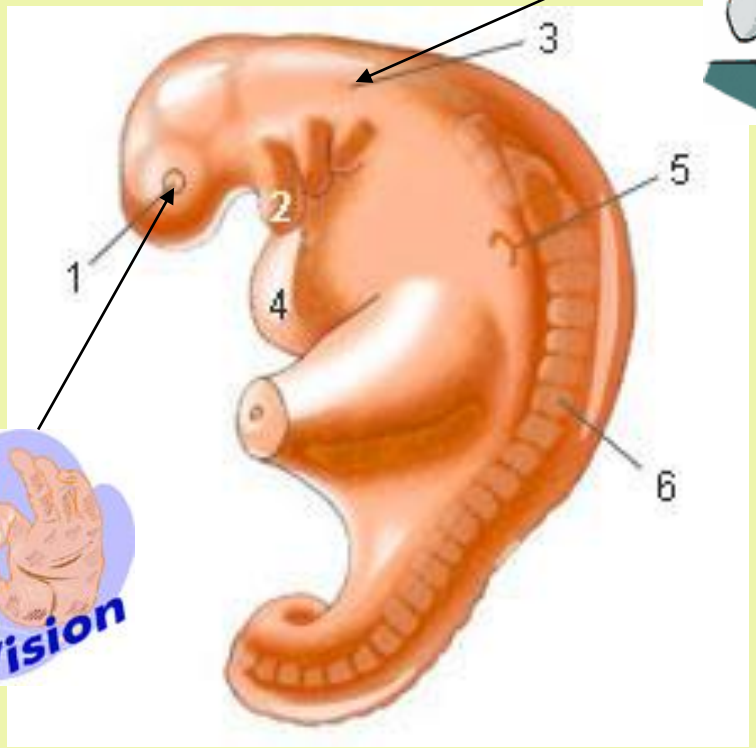




| | |
|---|---|
| 1st arch | V. |
| 2nd arch | VII. |
| 3rd arch | IX. |
| 4th arch | X. – n. laryngeus superior |
| 6th arch | r. int. XI. - n. lar. recurrens |

# Special sensory CN

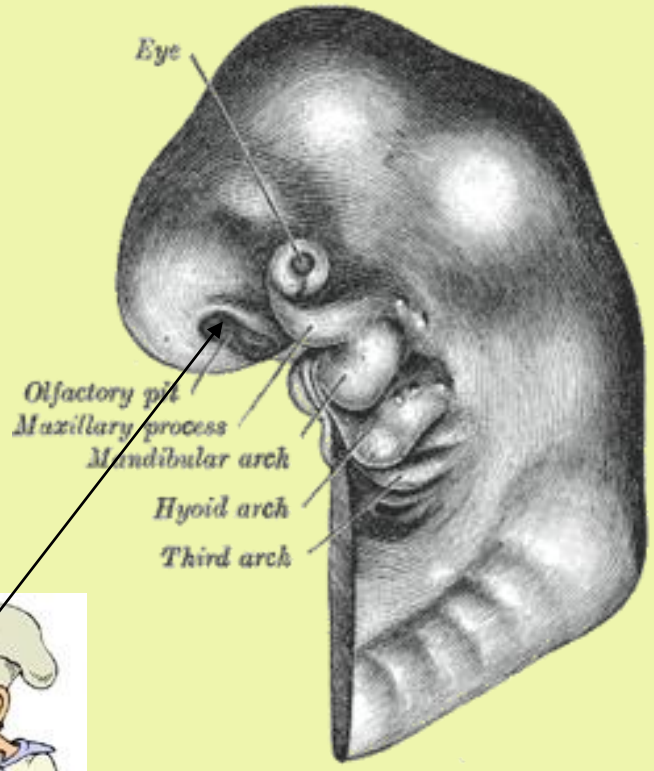
VIII.







II.




I.

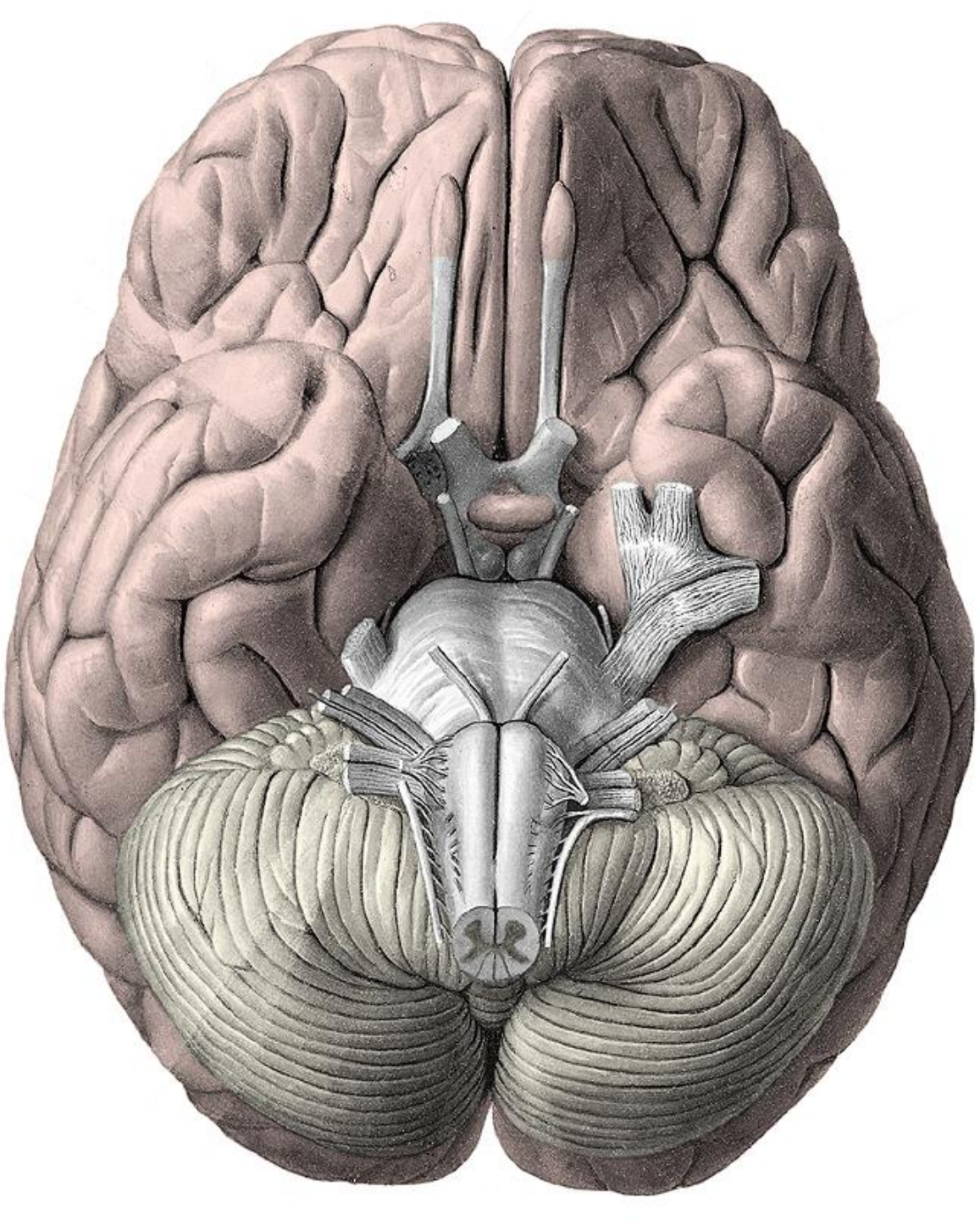
# Where CN emerge from brain?

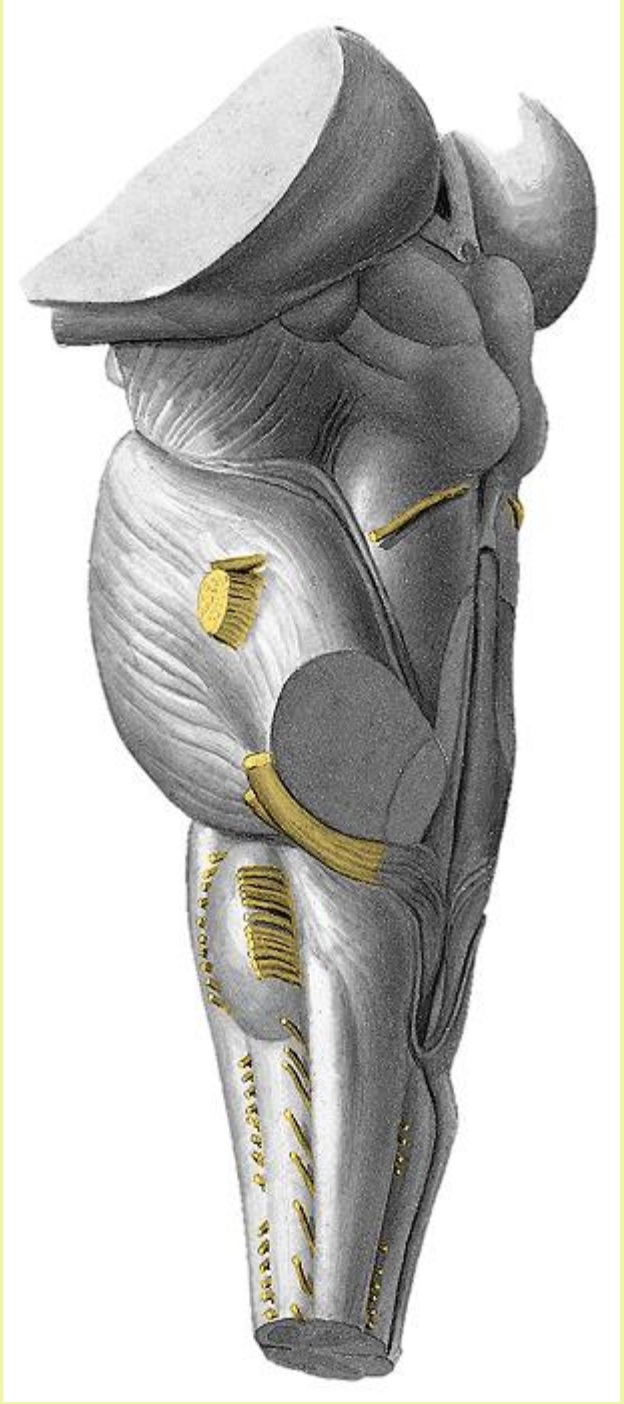
I. – telencephalon

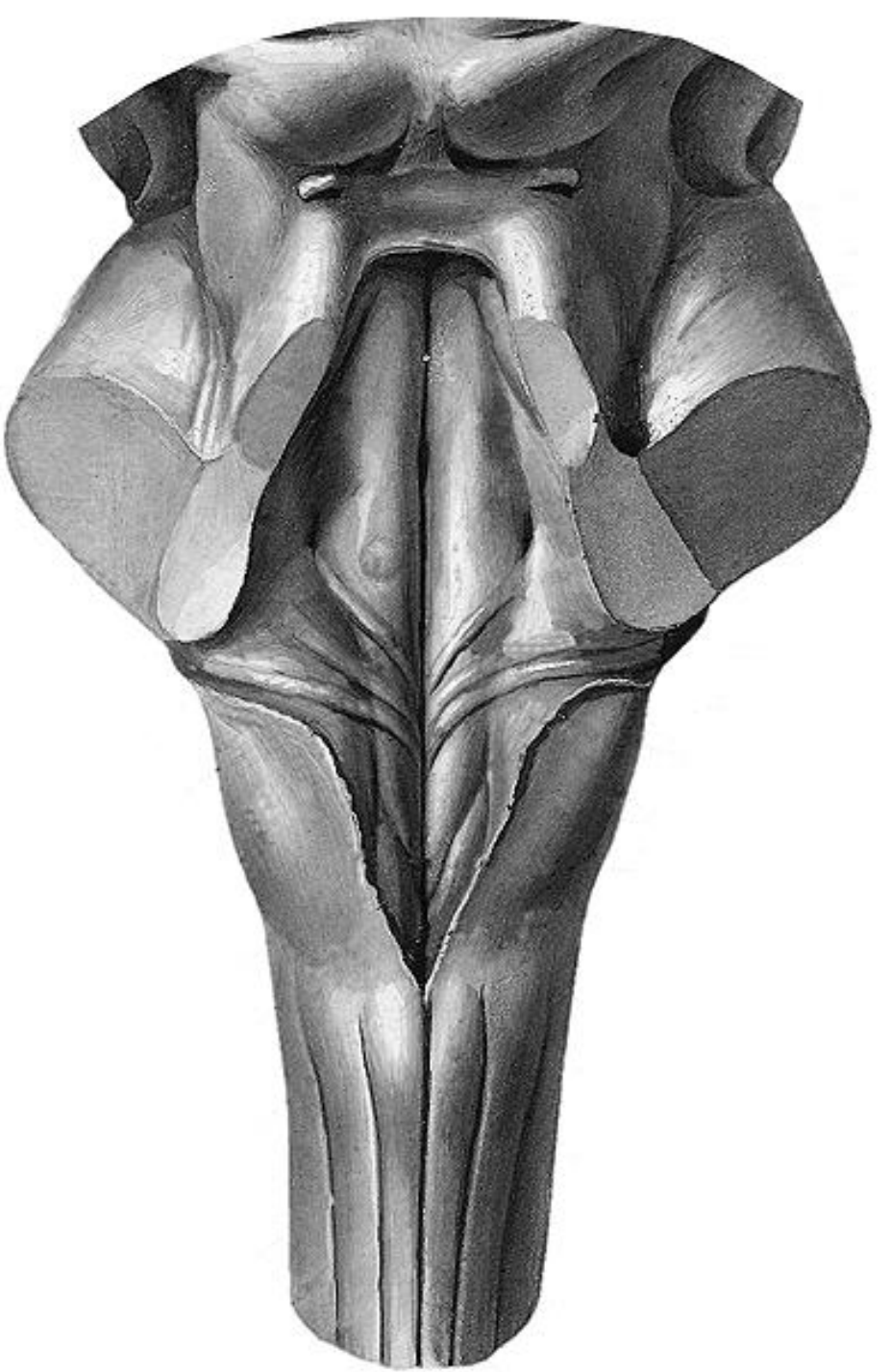
II. – diencephalon

**III.-XII. – brain stem**

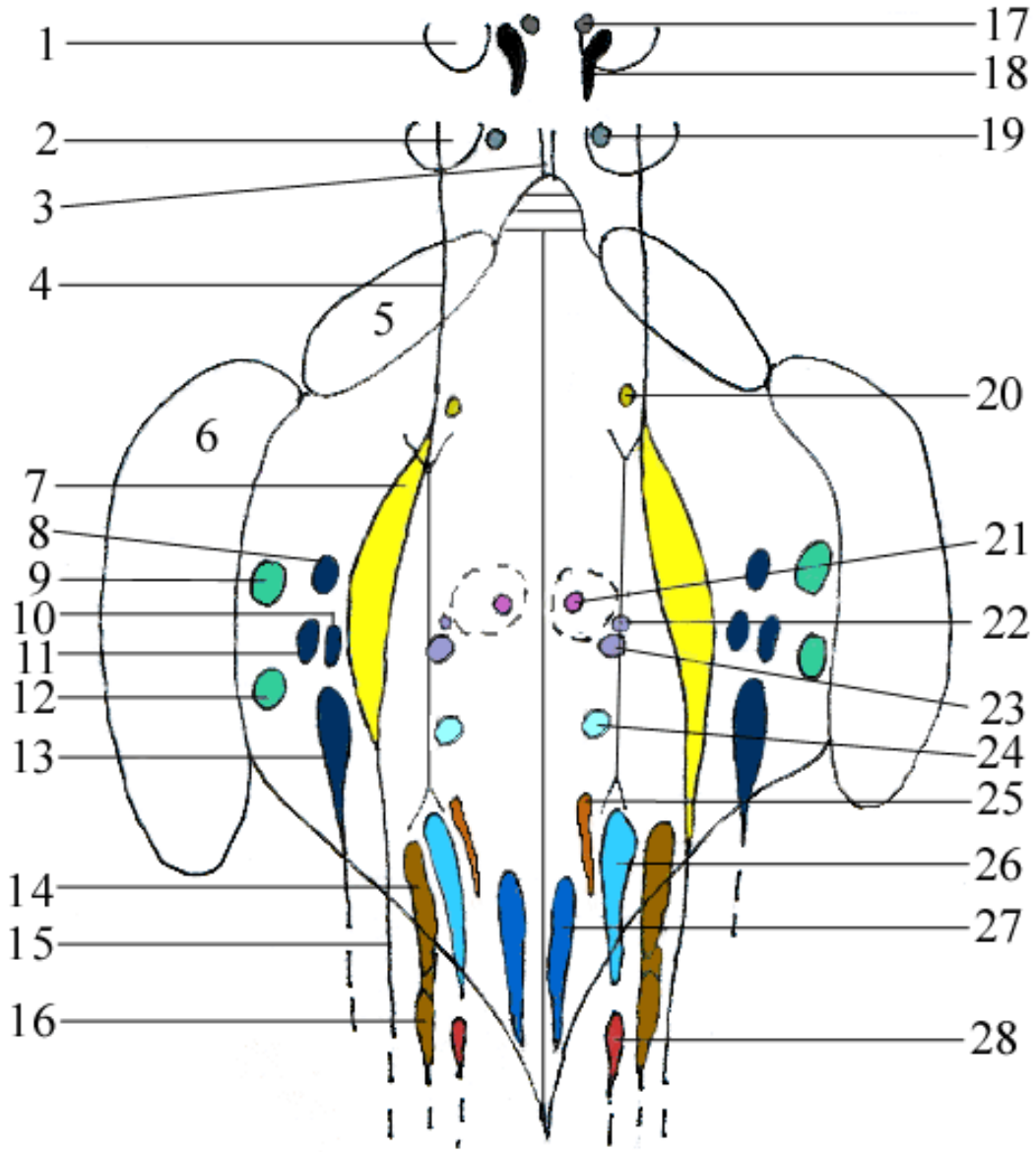
*IV. – dorsally !!!*





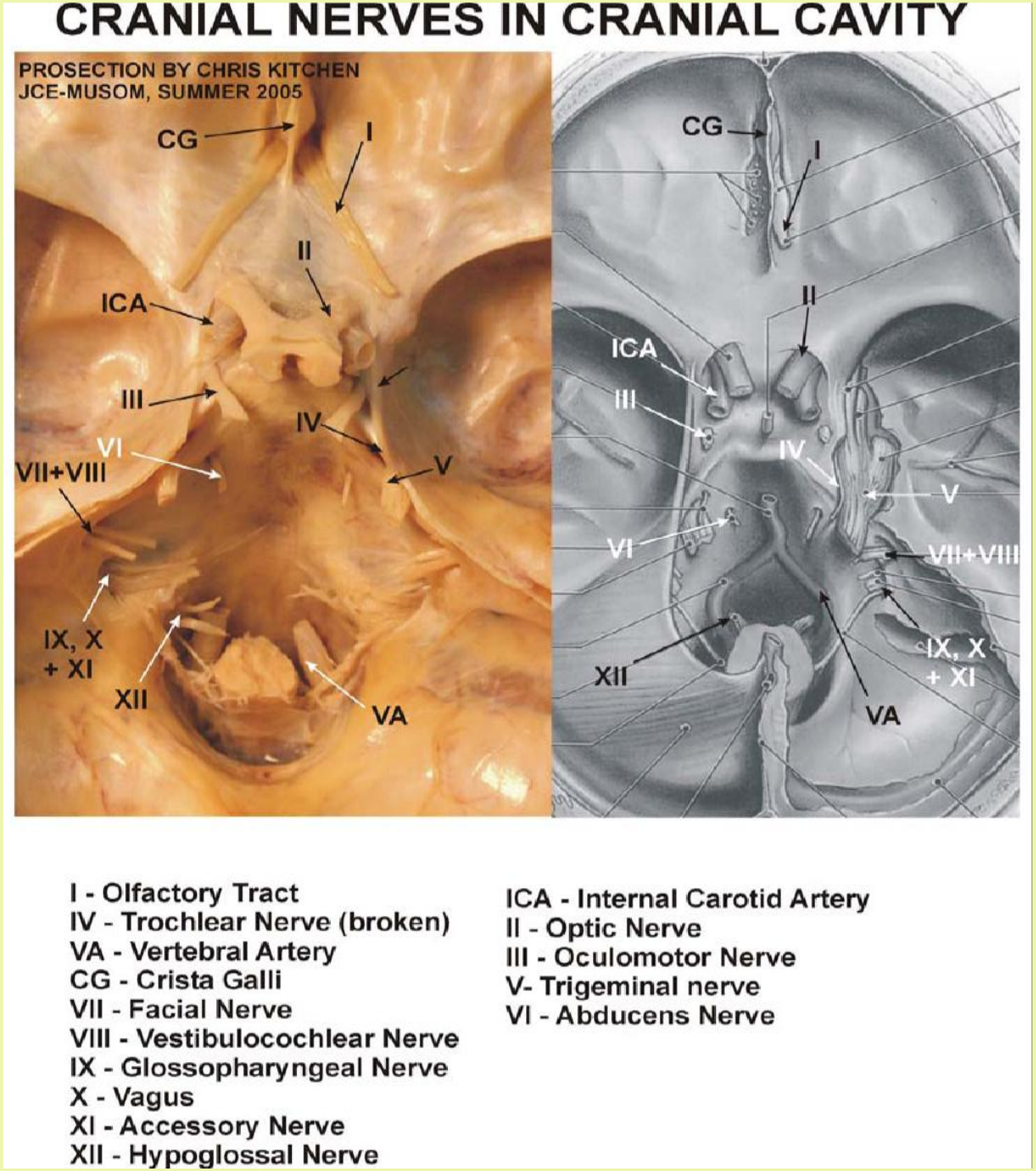


# FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANILA NERVES NUCLEI




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 */Bechtětrev/*
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 nulceus
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)

# Where CN submerge into skull?

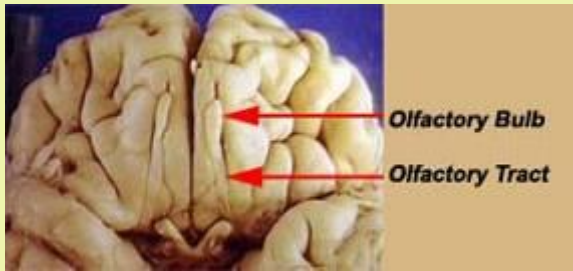


# General scheme for CN studying

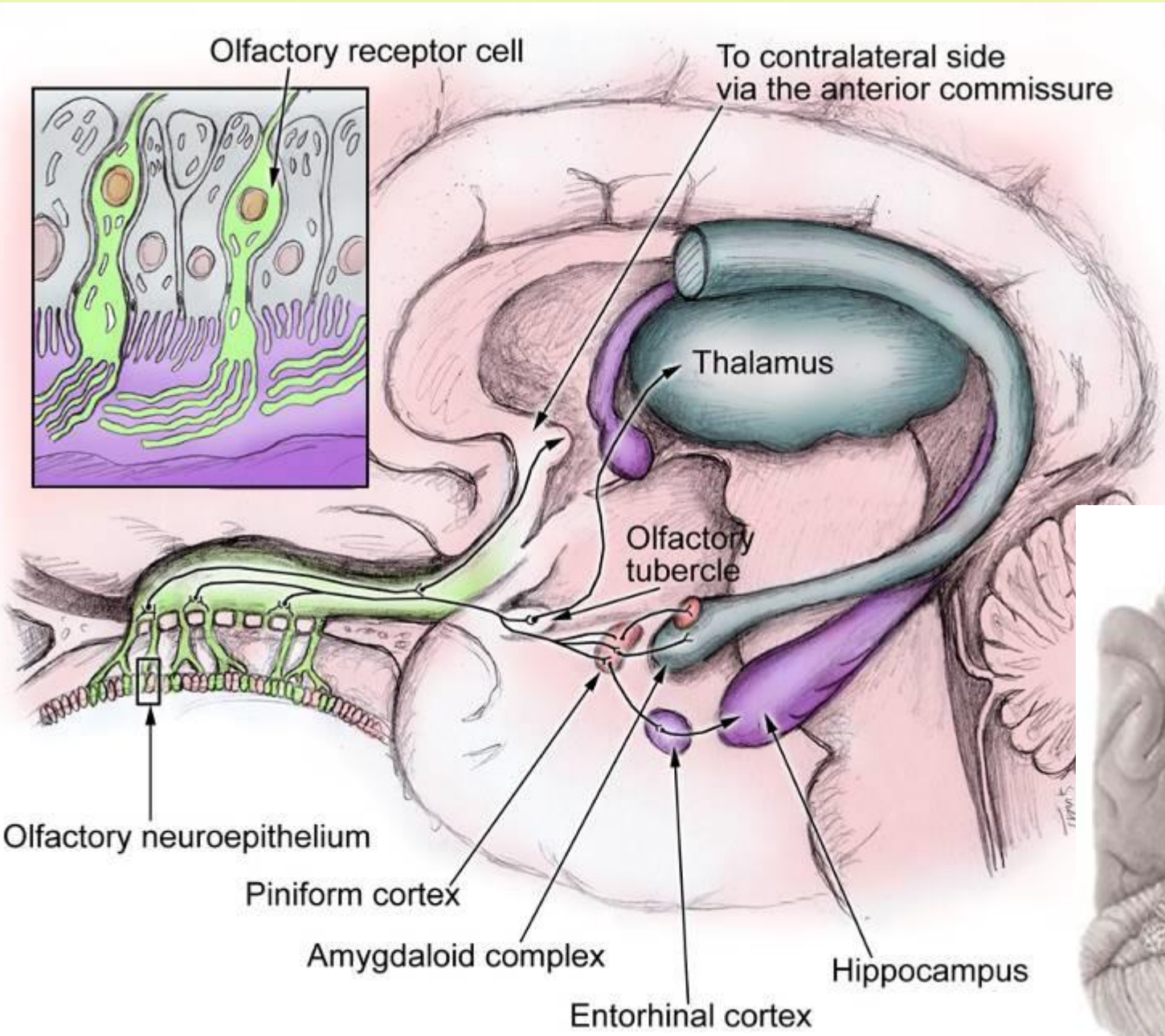
1. number, Latin and English term
2. developmental type of CN
3. nuclei + their location
4. transmitted modalities
5. where CN submerge into skull
6. course of CN + topography
7. branches
8. overview of supplied area
9. clinical examination, reflexes
10. palsy = paralysis (plegia) or iritation

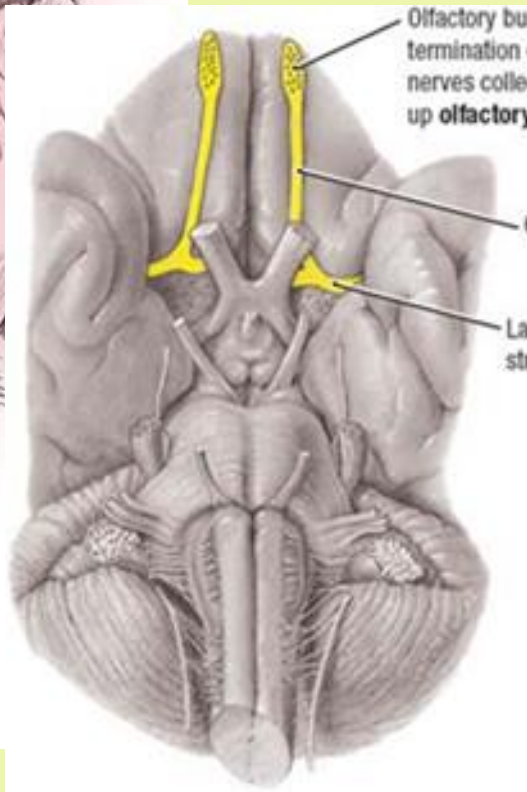
# I. = N. olfactorius

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. I


Olfactory receptor cell
To contralateral side
via the anterior commissure
Thalamus
Olfactory
tubercle
Olfactory neuroepithelium
Piniform cortex
Amygdaloid complex
Entorhinal cortex
Hippocampus


Olfactory bu
termination
nerves colle
up olfactory

# Nerves of Nasal Cavity

## Distribution of Olfactory Mucosa

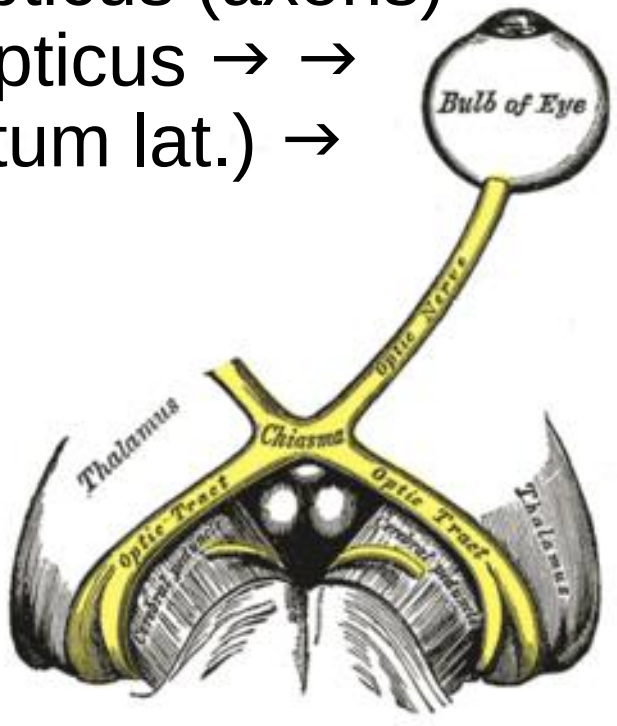
# Symptoms of olfaction disroders

- hyposmia
- anosmia
- hyperosmia
- parsomia
- kakosmia

cranial injury →

# II. = N. opticus

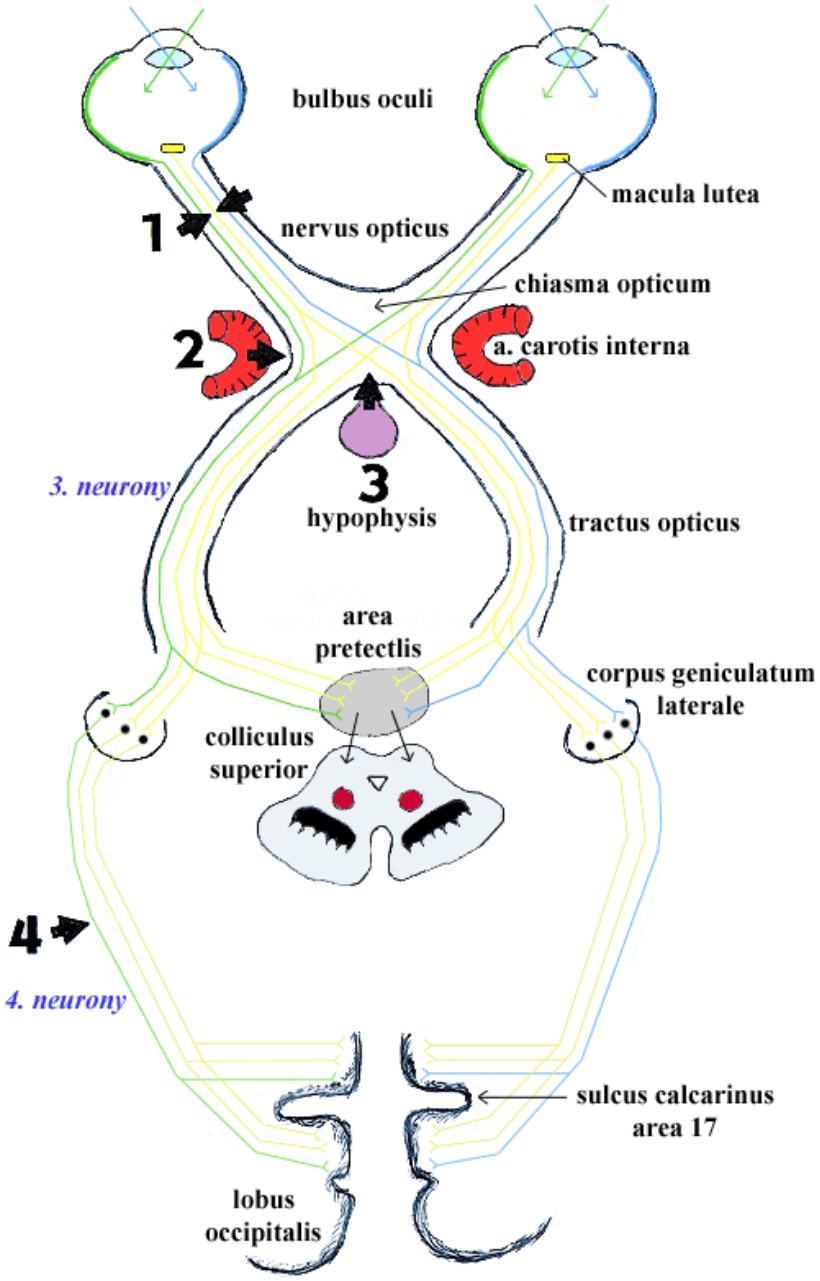
1. pouch from diencephalon
2. no nuclues ! – centres in cortex (area 17)
3. special sensory: vision
4. orbita → canalis opticus → cavitas cranii media
5. ganglionic cells of retina → n. opticus (axons) → chiasma opticum → tractus opticus → → metathalamus (corpus geniculatum lat.) → area 17
6. no branches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



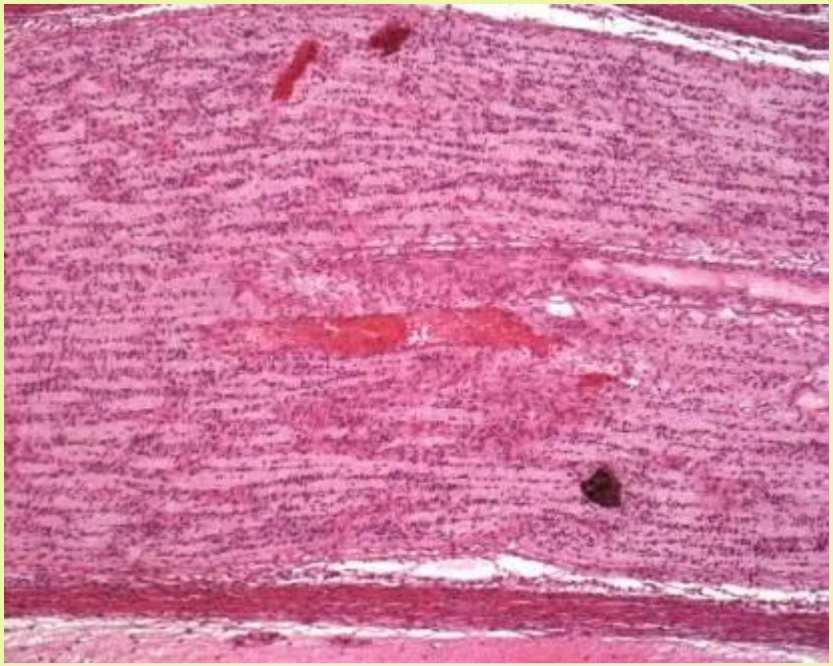
# II. = N. opticus

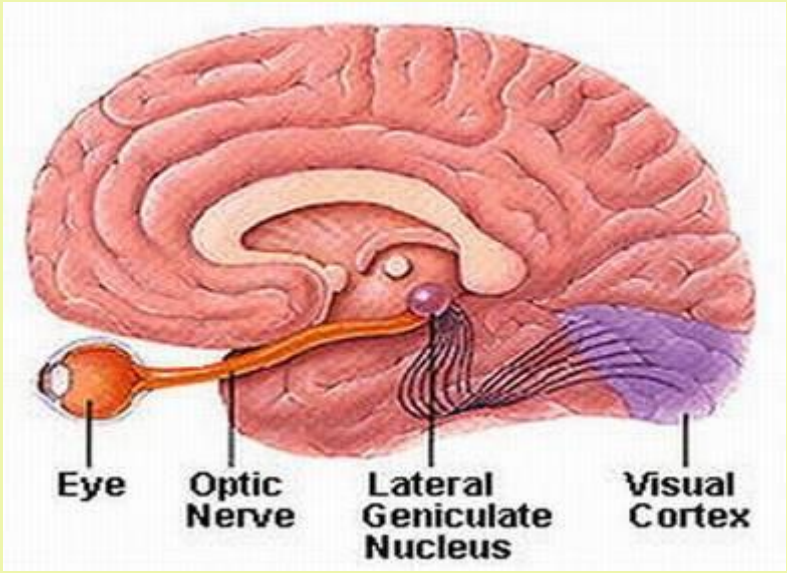
- pouch from diencephalon = *thalamus opticus*
- axons divided by endoneurium (1 mil. of axons)
- nerve covered with meninges
- nerve contains a. et v. centralis retinae in its centre
- *partially decussated* in chiasma

- 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





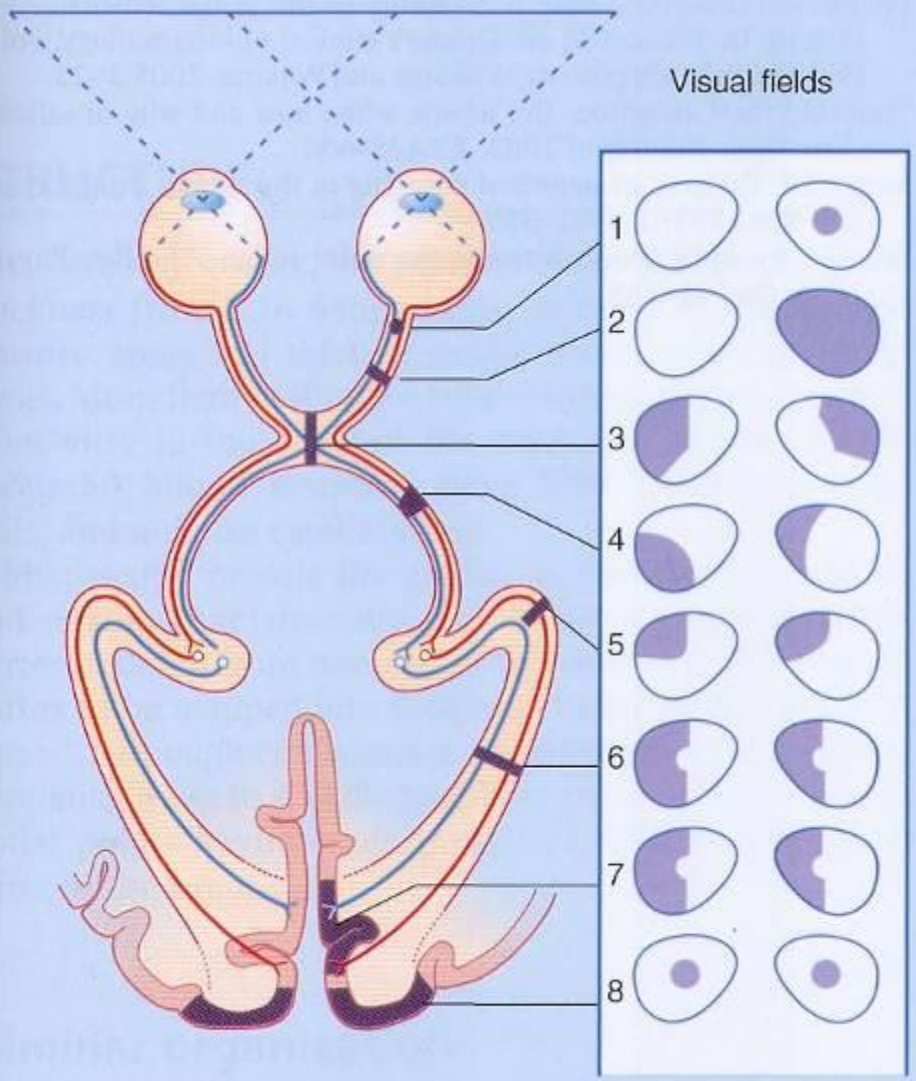



**Table CP 28.1.1** Classification of dyphasia.

| 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 |

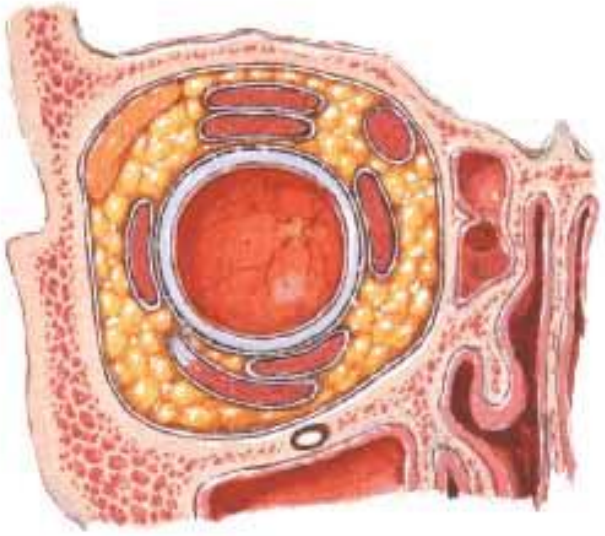
# External muscles of the eye-ball

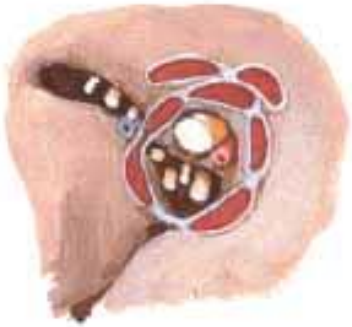
- mm. **recti** (bulbi)
  - sup., inf., med., lat.
- mm. **obliqui** (bulbi)
  - inf., sup.
- m. levator palpebrae superioris
- *innervation*: n. III., IV., VI.
- *smooth muscles:* m. orbitalis *Mülleri*, m. tarsalis sup. *Mülleri* + inf.

# External muscles of the eye-ball

**Fascia of Orbit and Eyeball**

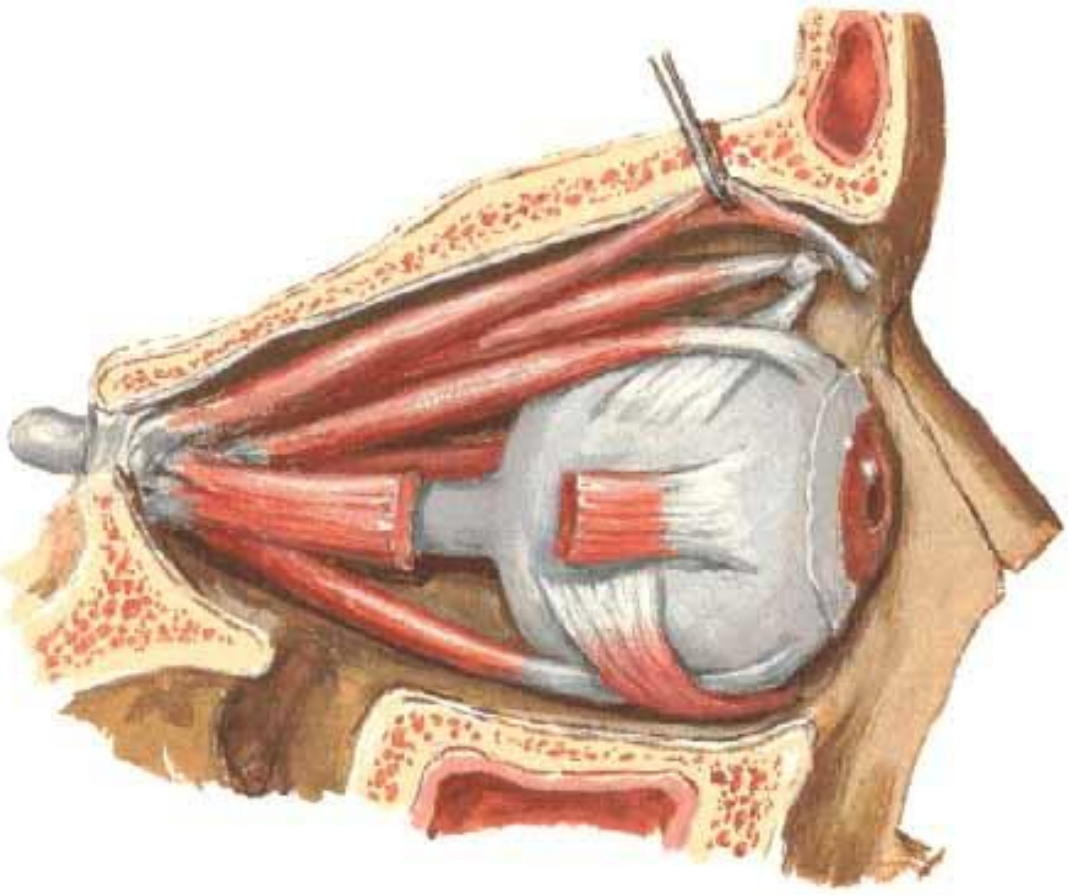
Frontal Section and Entering Structures





**Extrinsic Eye Muscles**

Right Lateral View



# Movements of the eye-ball 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 the eye-ball II.

paired movements (both eyes working together)

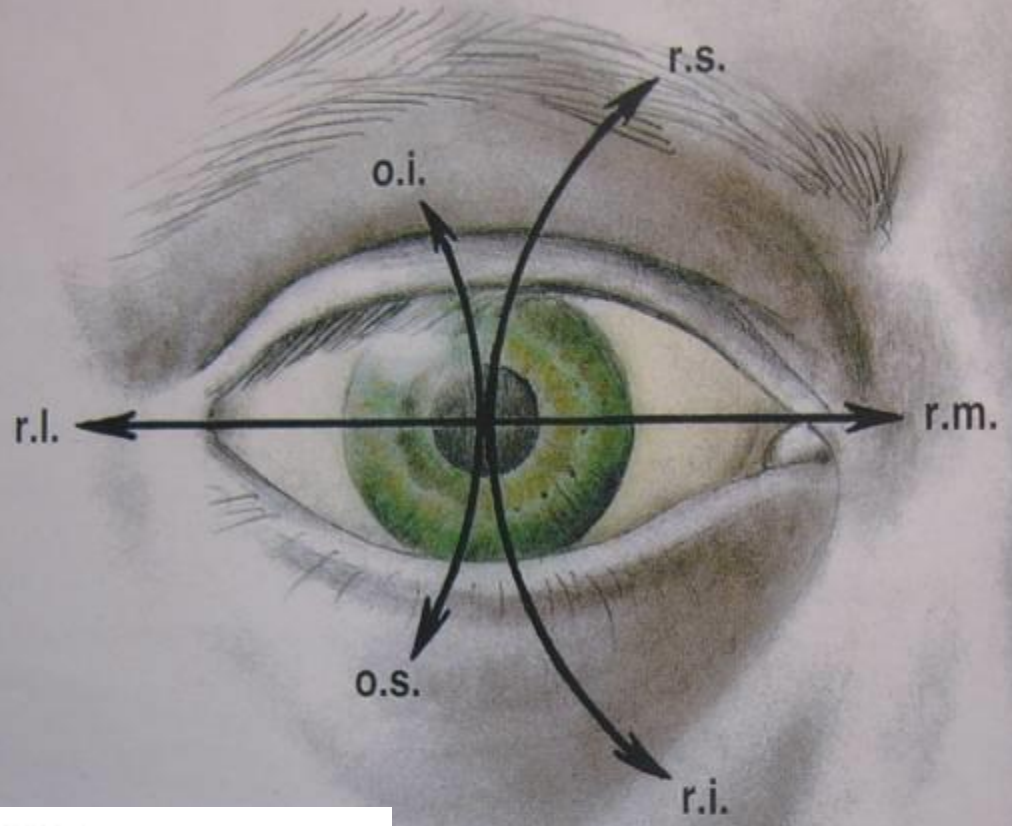
- simultaneous movement of both eyes in the same direction = **version (conjugate movements)**
  - **dextro**version (to the right) + **levo**version (to the left)
  - supraversion (sursumversion) + infra/deorsumversion (up + down)
  - dextro/levoelevation + dextro/levodepression (up/down and to side)
  - dextro/levocykloversion (rotation to the right/left)

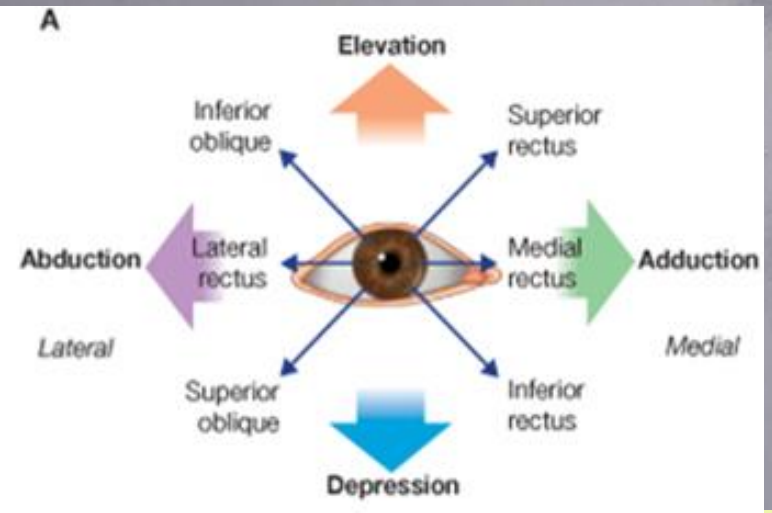
- simultaneous movement of both eyes in opposite directions = **vergence (disconjugate movements)**, convergence = both eyes moving nasally or inward , divergence = both eyes moving temporally or outward

- *strabismus; heterotropia; squint* = one eye constantly is turned inward ("crossed-eye"), outward ("wall-eye"), upward, or downward.

http://www.tedmontgomery.com/the_eye/eom.html

# Movements of the eye-ball



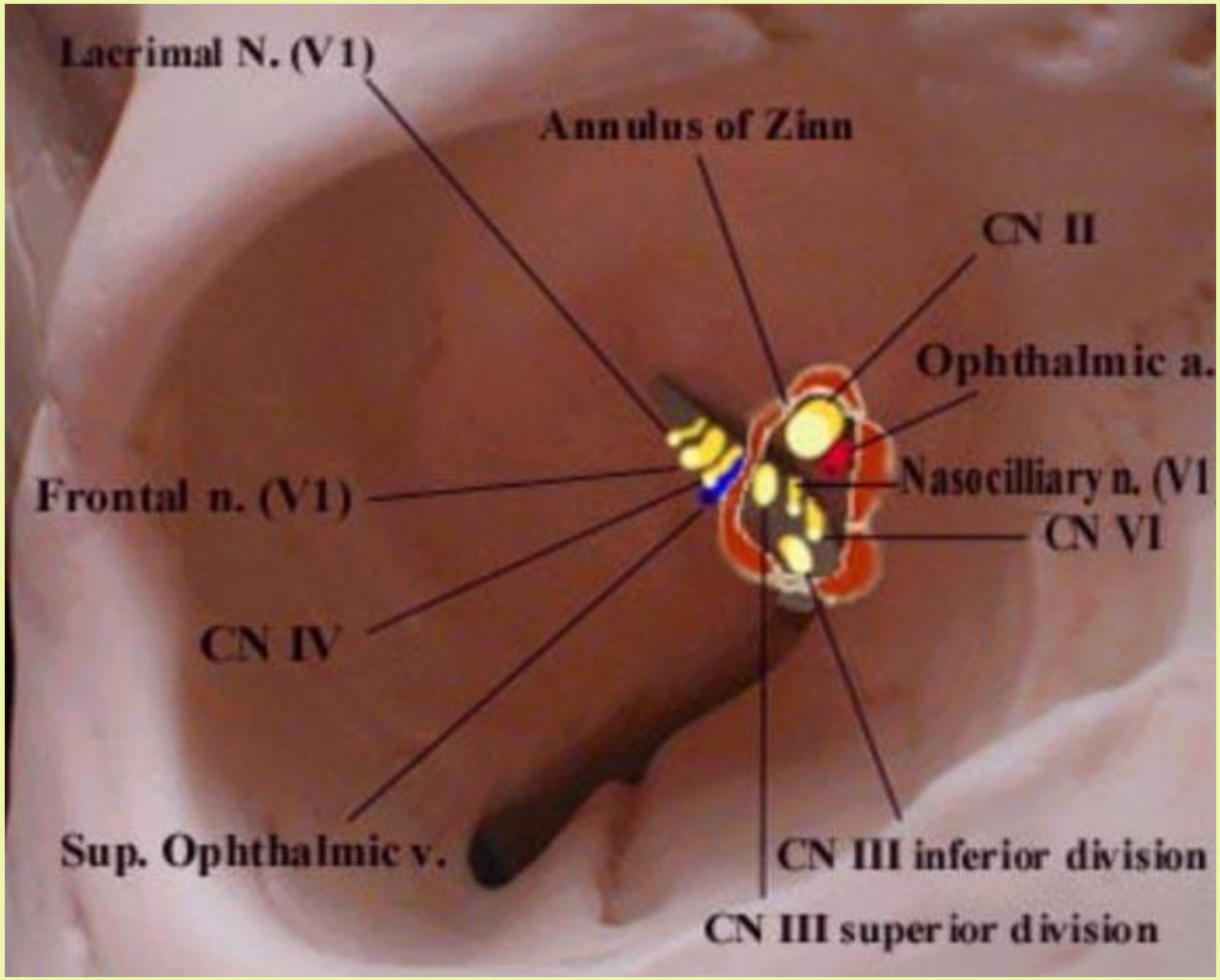
# Anulus tendineus communis *Zinni*

passing through:

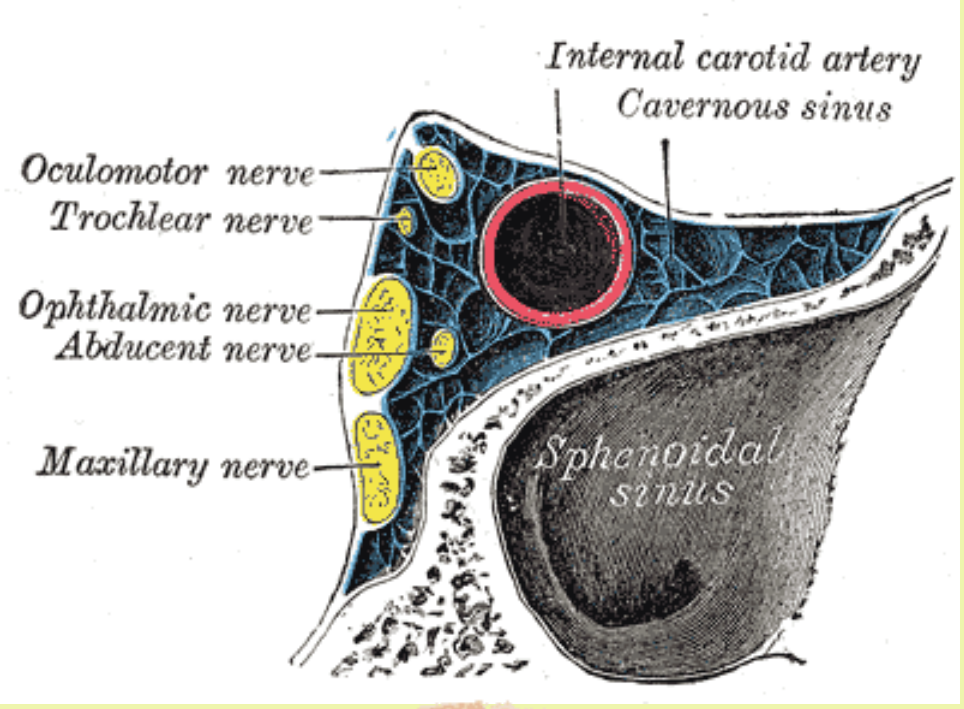
- n. III
- n. VI
- n. nasociliaris
- n. II + AO

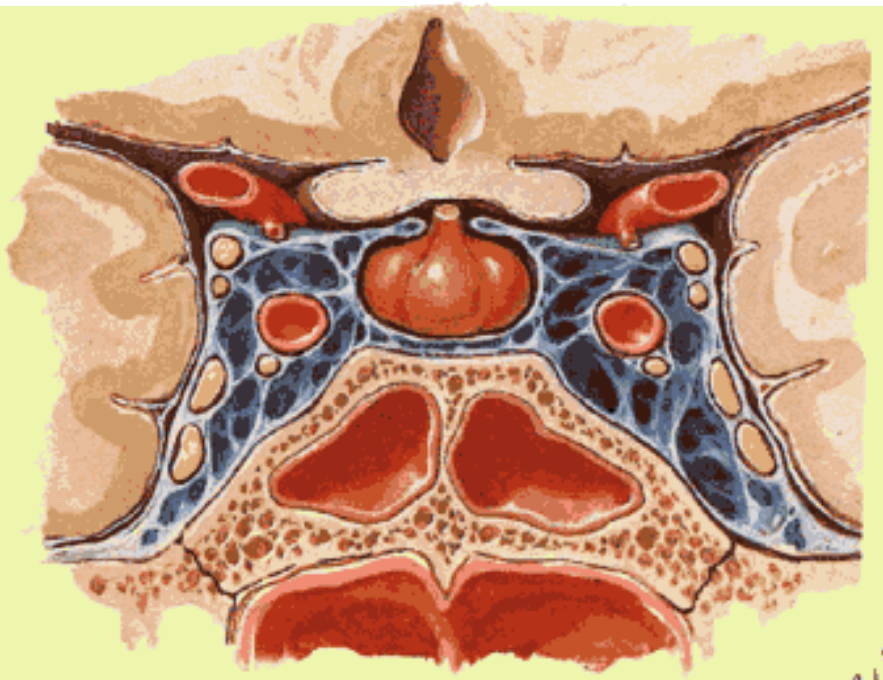
passing by:

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



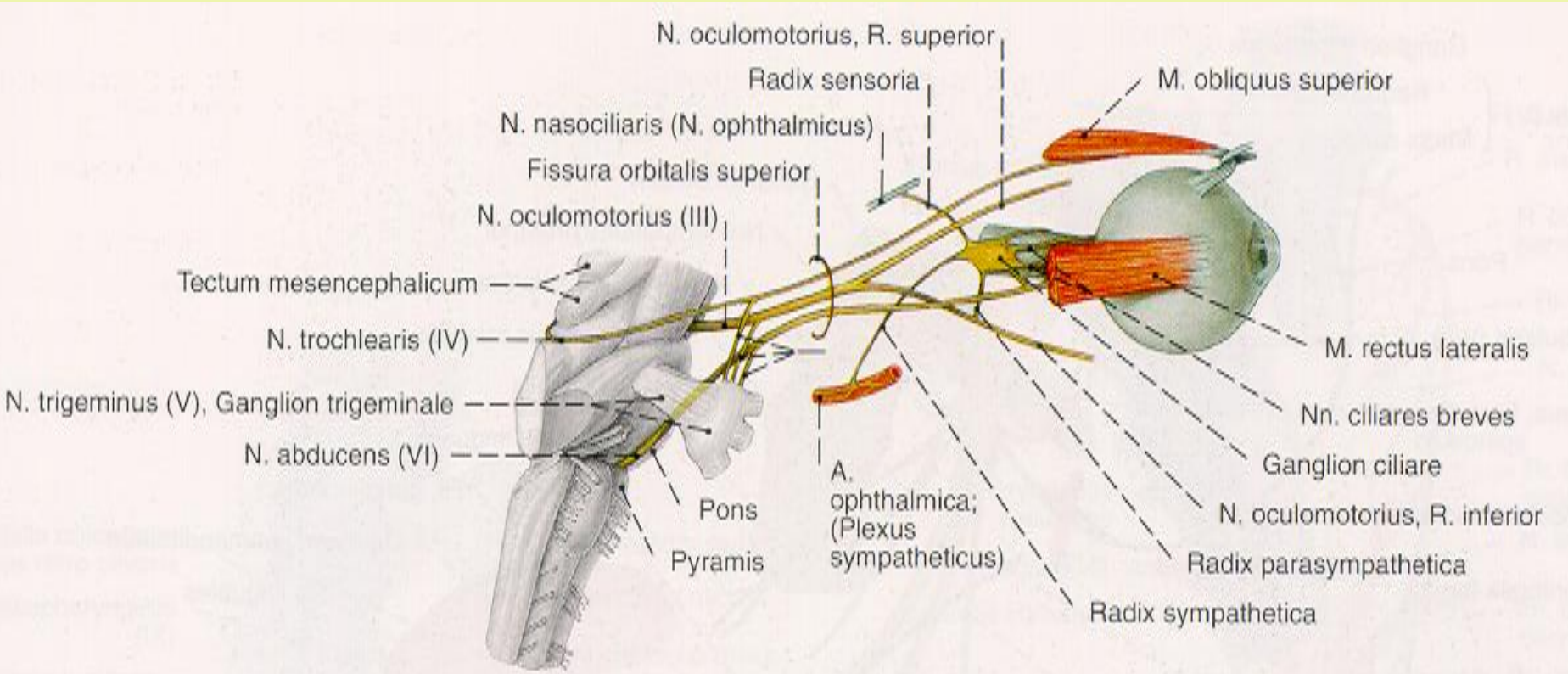
# Sinus cavernosus



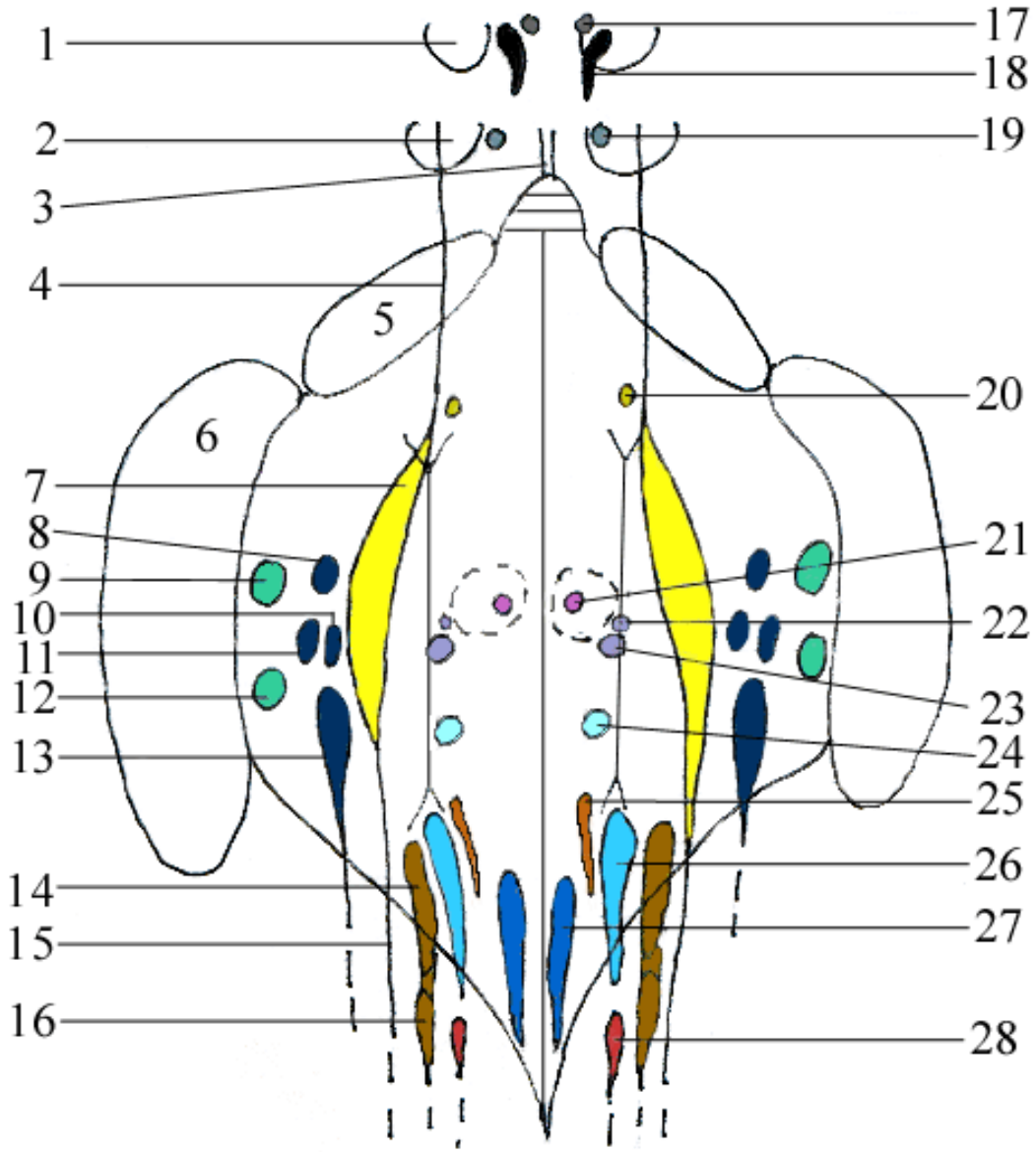



# IV. = N. trochlearis

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



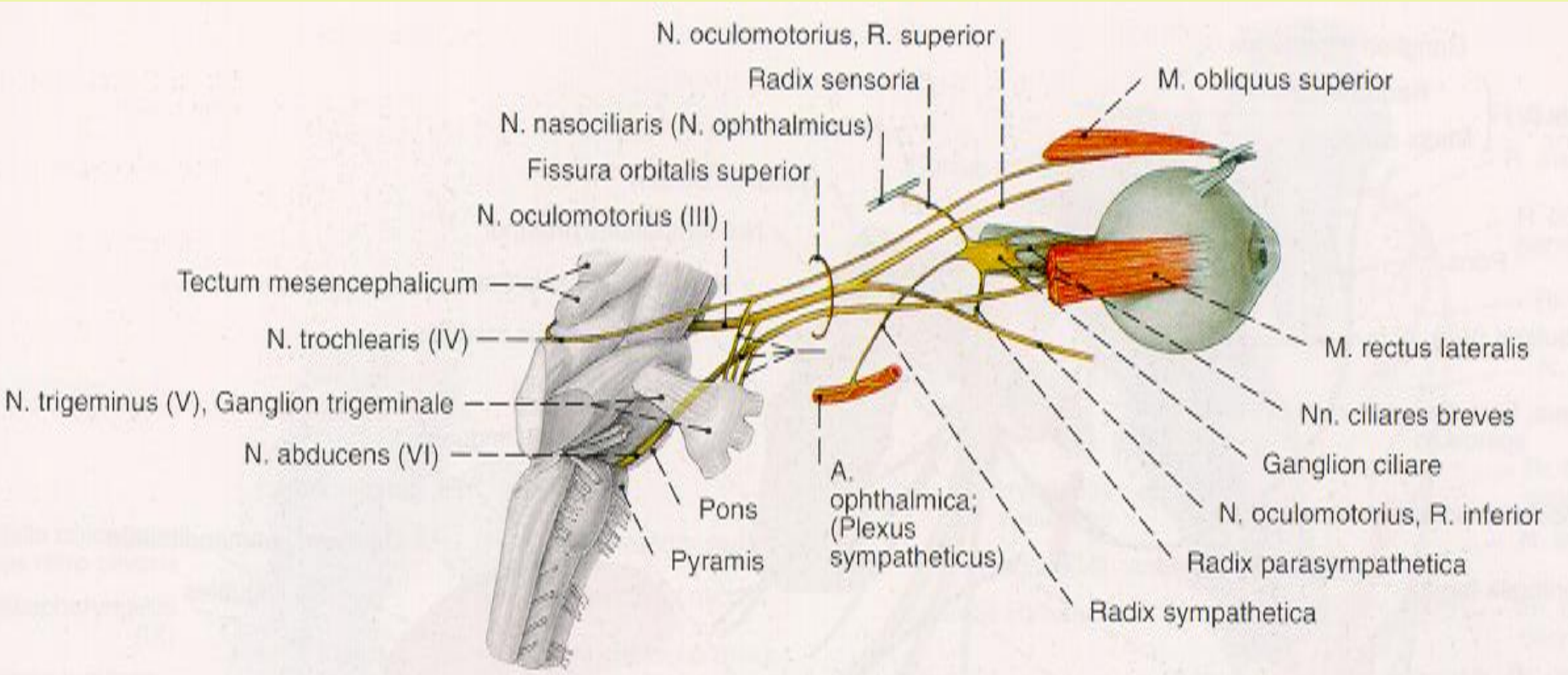
# FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANILA NERVES NUCLEI




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 */Bechtětrev/*
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 nulceus
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)

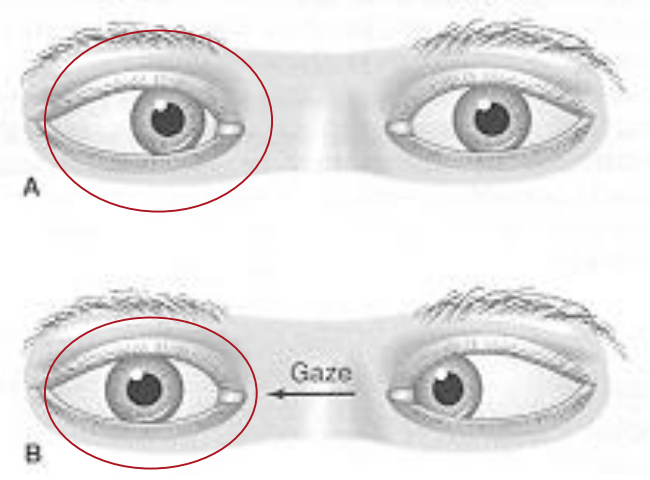
# VI. = N. abducens

- 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

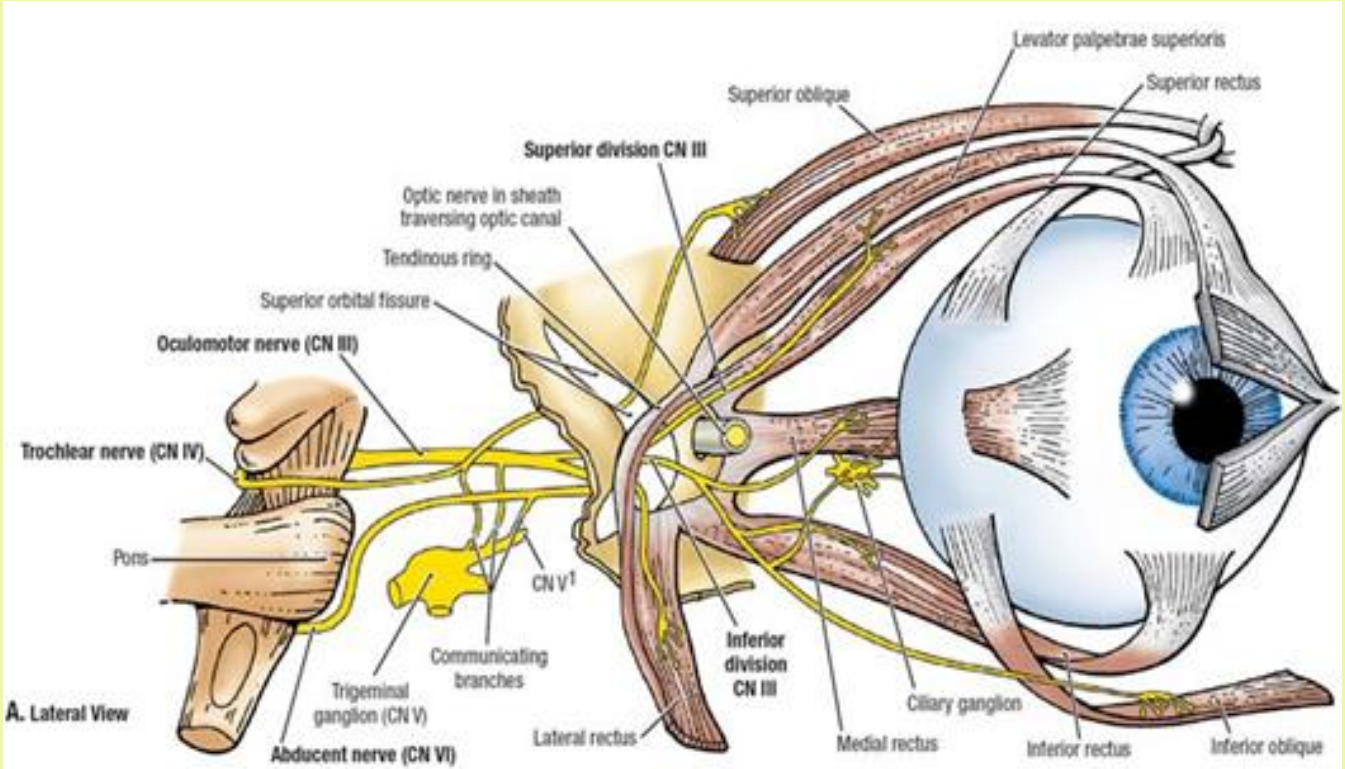
- strabismus convergens = convergent squint



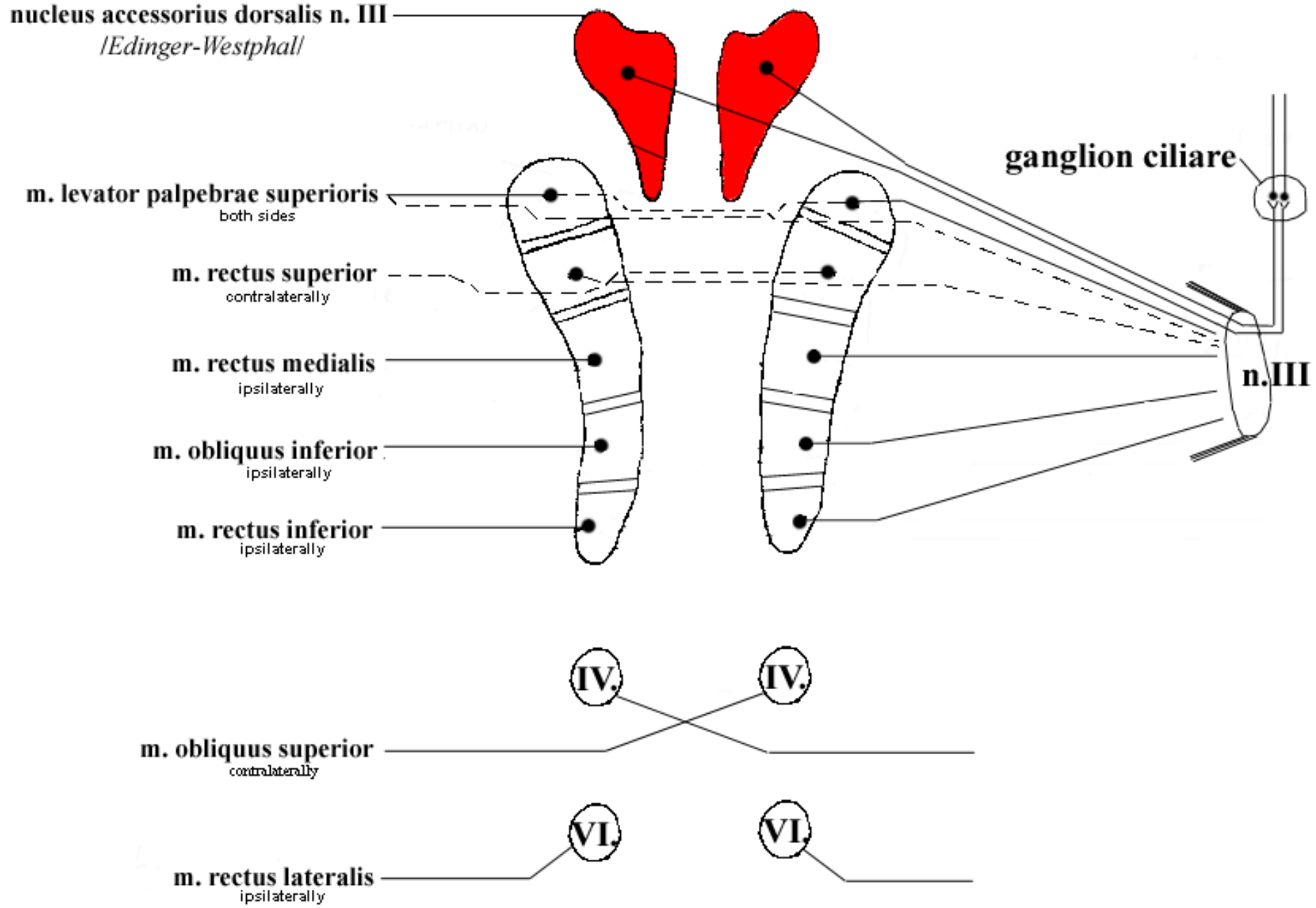


# III. = N. oculomotorius

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

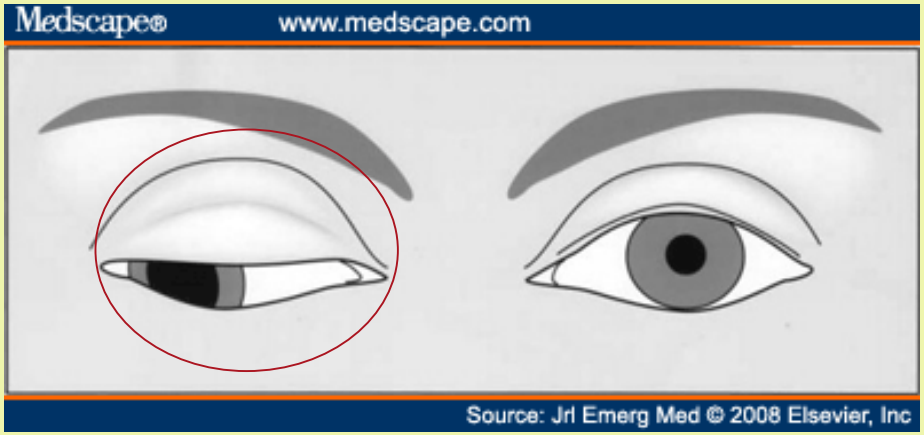


# STRUCTURE OF N. III NUCLEUS



# Palsy of n. III

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



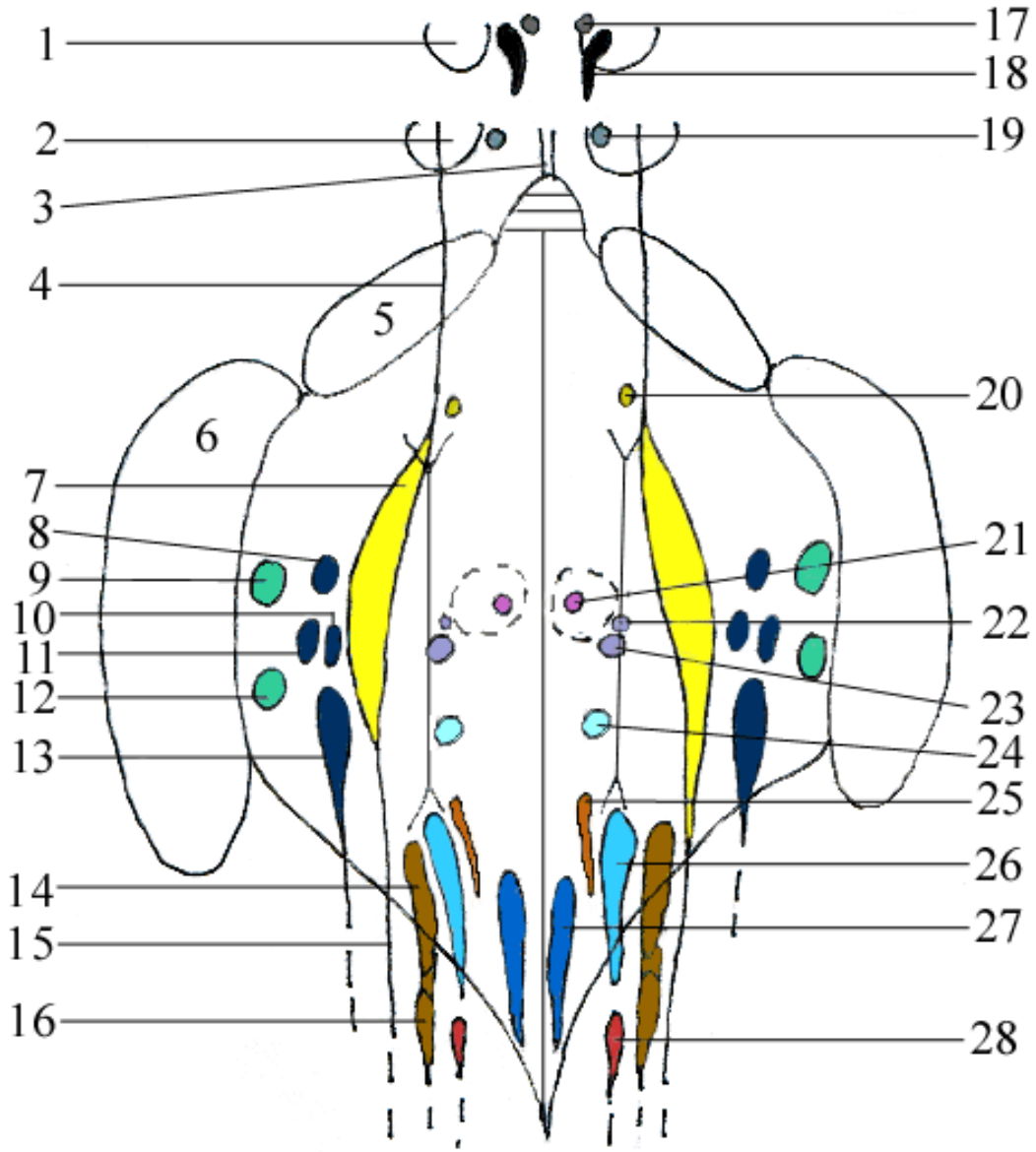


# V. = N. trigeminus

**4** nuclei

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

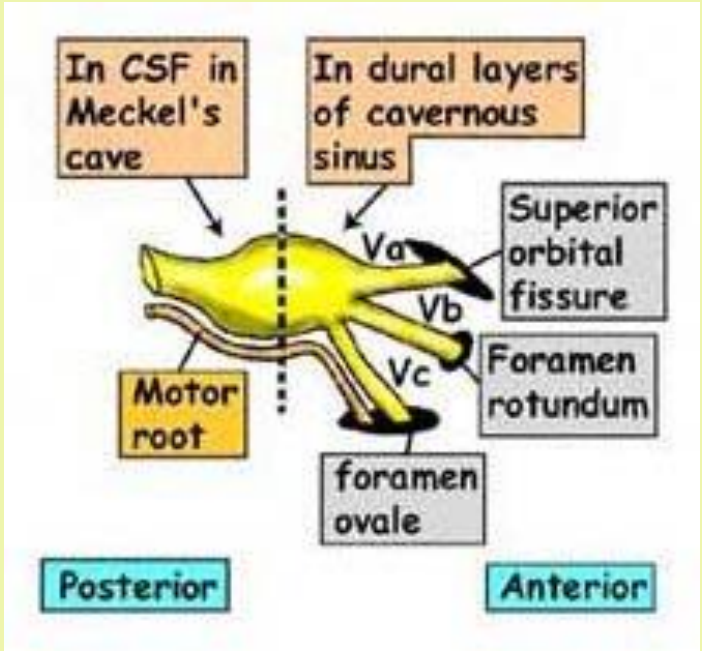
# FLOOR OF FOURTH VENTRICLE (RHOMBOID FOSSA) WITH SURFACE PROJECTION OF CRANILA NERVES NUCLEI




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 */Bechtětrev/*
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 nulceus
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 *-sensory*
- in periphery joined with *somatovisceral* fibres from other cranial nerves
- *ganglion trigeminale Gasseri* (located within cavum trigeminale *Meckeli*) – sensory
- 3 main branches



# 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

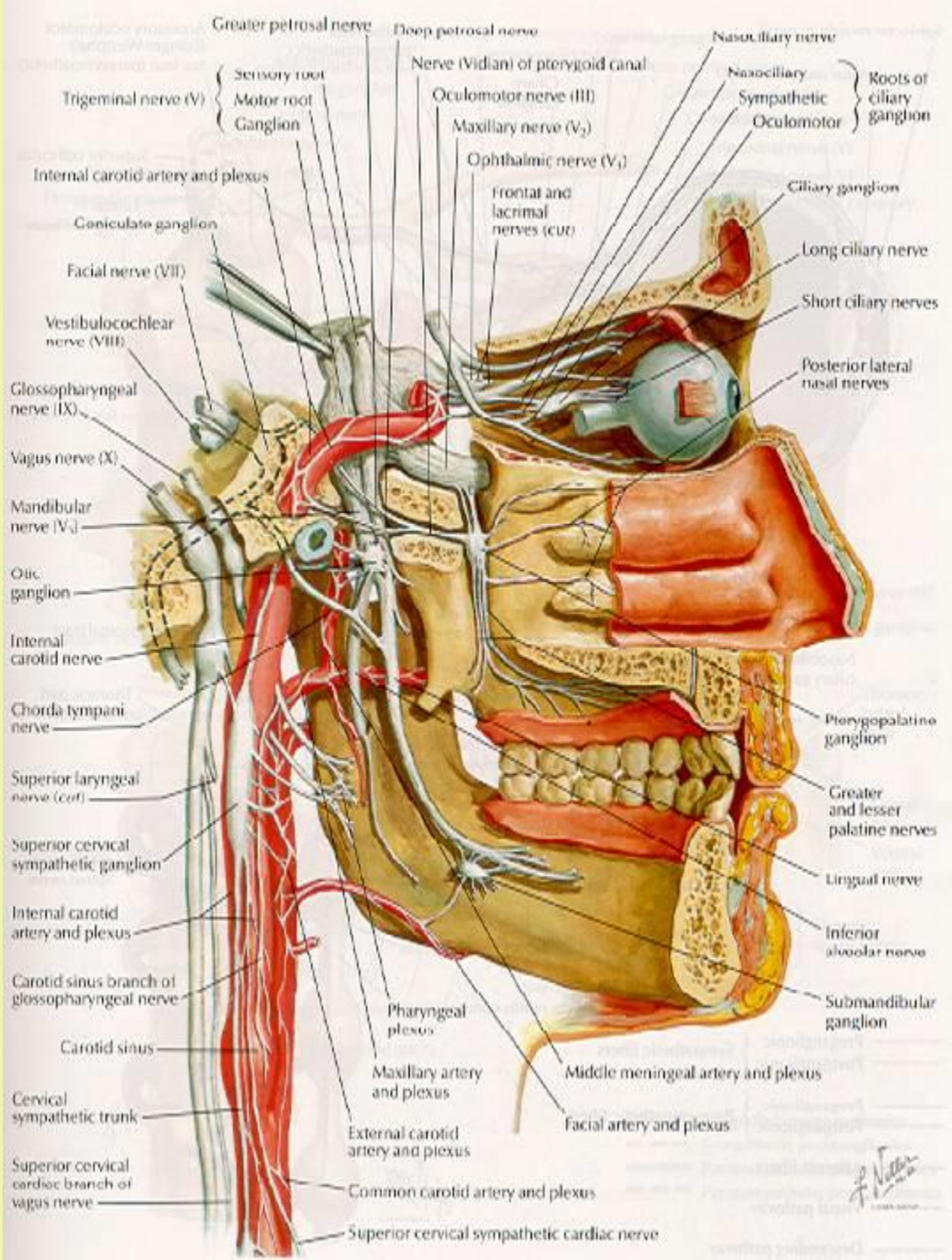
  fibres within V3 only !!!

# N. V

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

all send off *ramus meningeus*

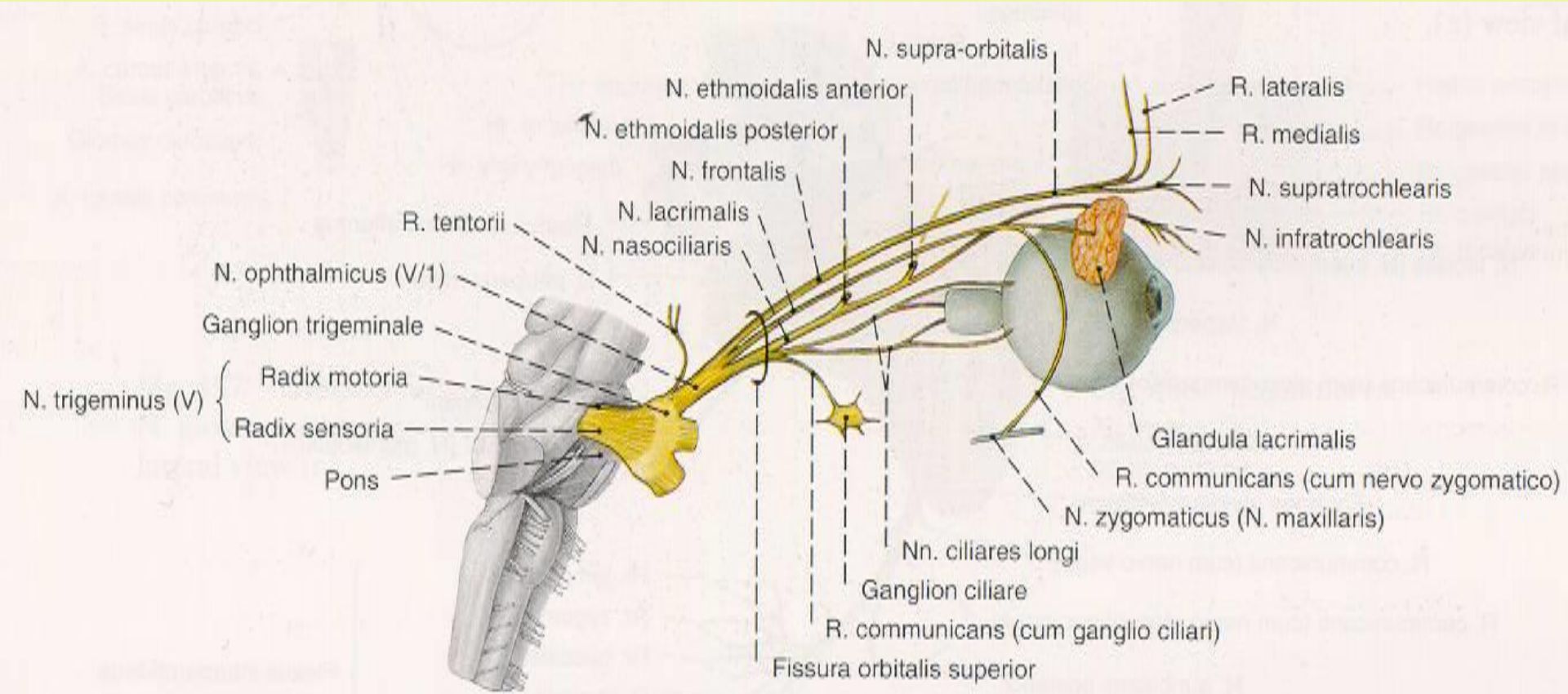
*V1 – r. tentorii*

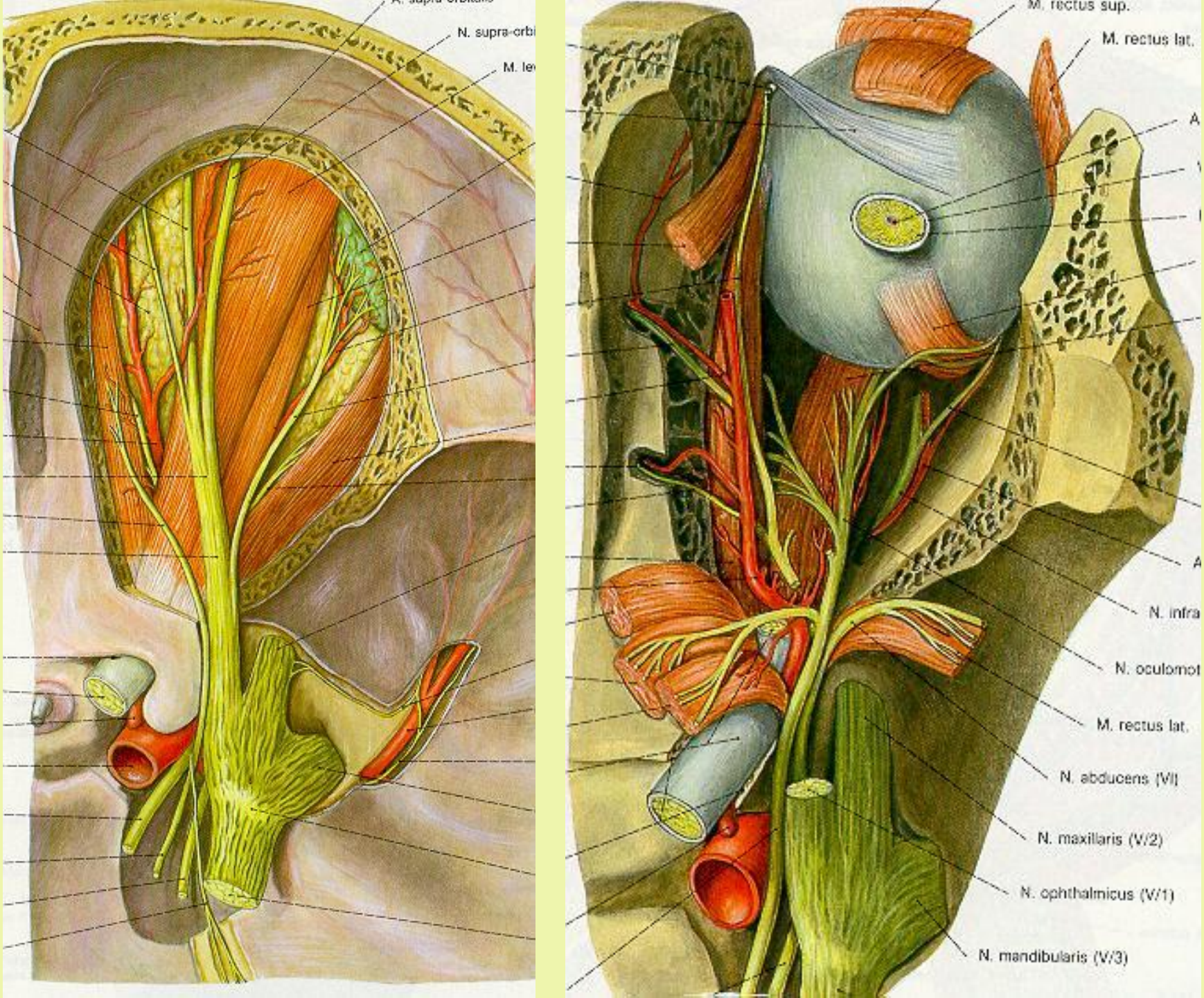


# V1 = N. ophthalmicus

- n. frontalis
- n. nasociliaris
- n. lacrimalis

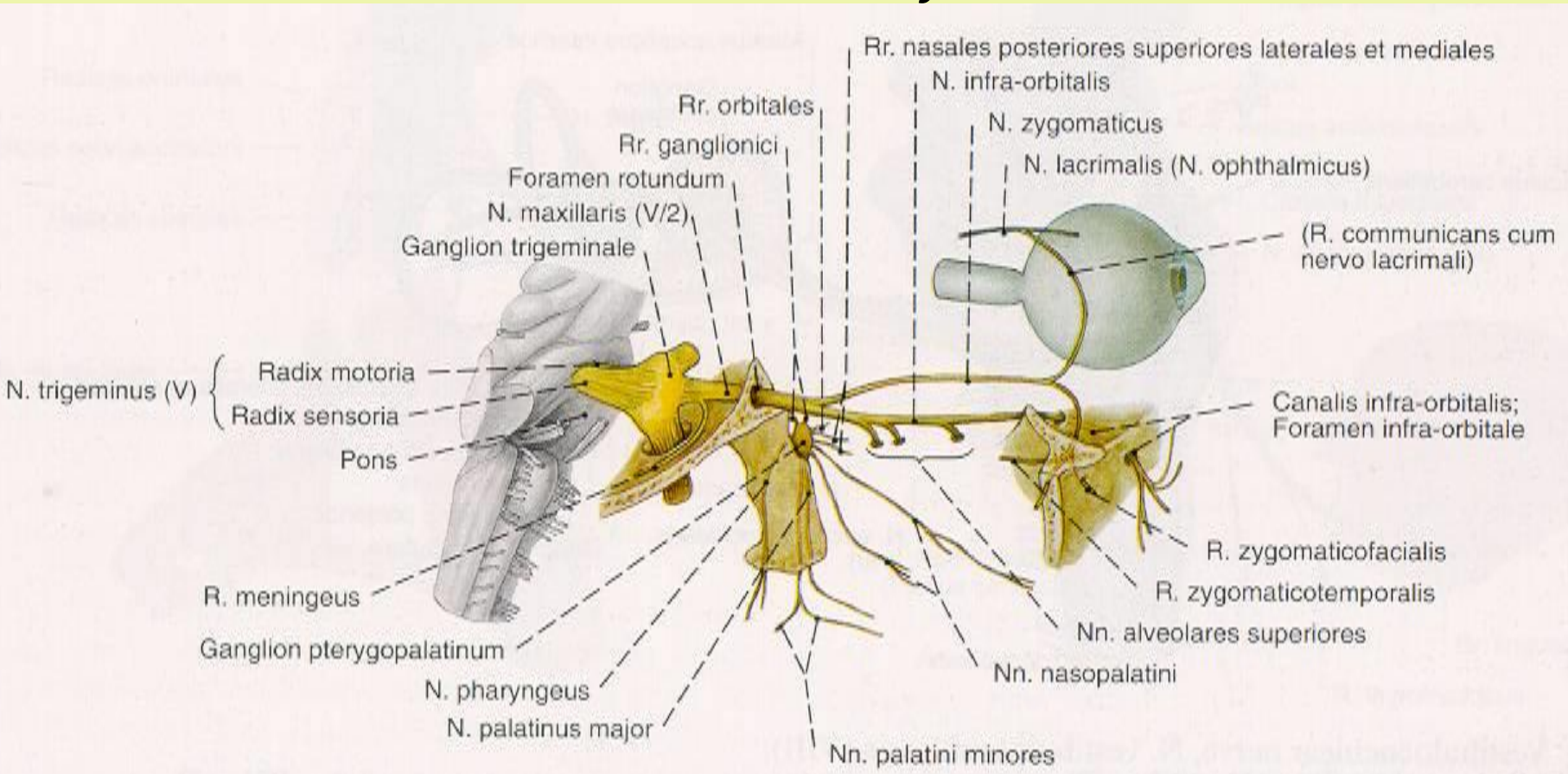
- *ganglion ciliare parasympathetic*
- n. supraorbitalis – *palpation sensitivity*




N. supra-orbi
M. le
M. rectus sup.
M. rectus lat.
N. infra
N. oculomot
M. rectus lat.
N. abducens (VI)
N. maxillaris (V/2)
N. ophthalmicus (V/1)
N. mandibularis (V/3)

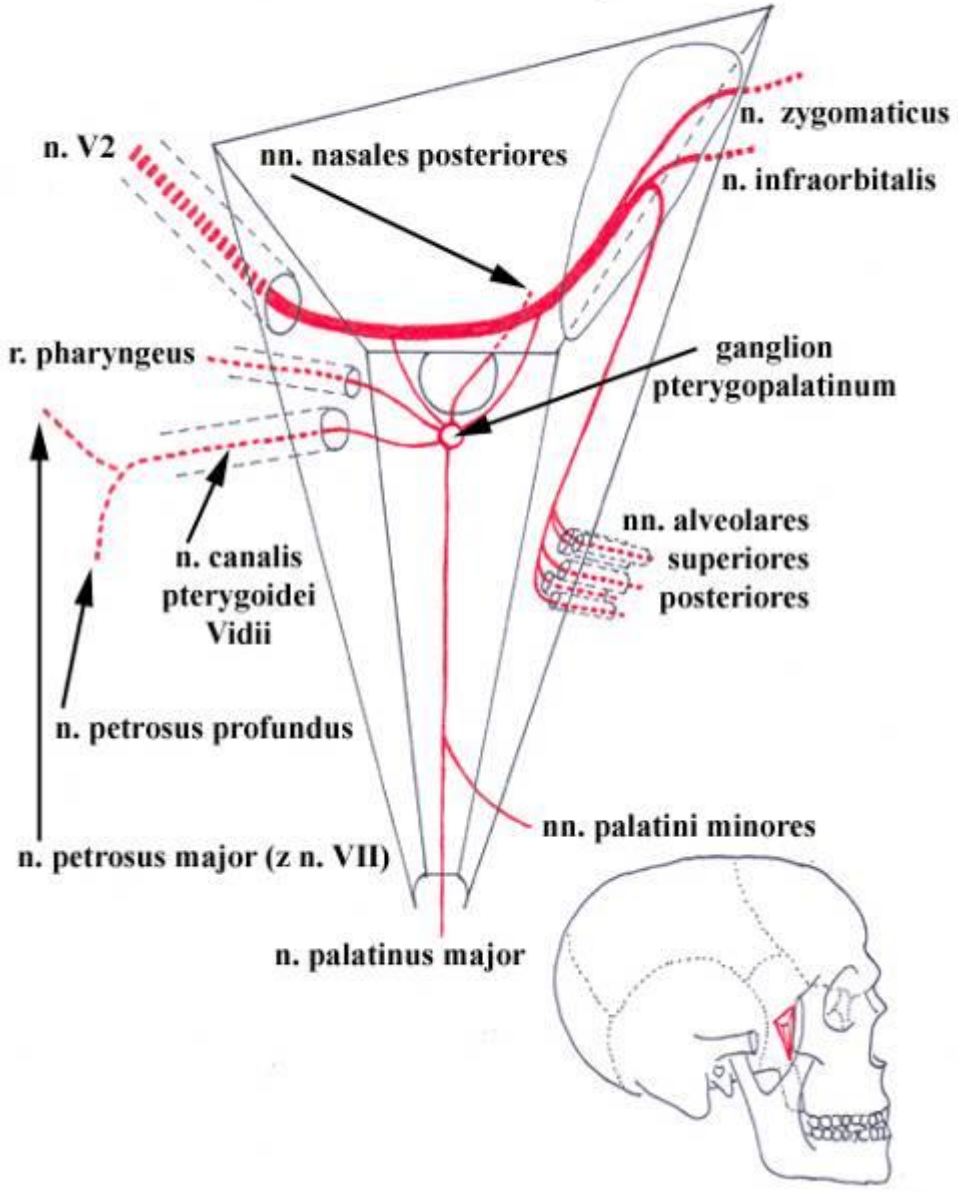
# V2 = N. maxillaris

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



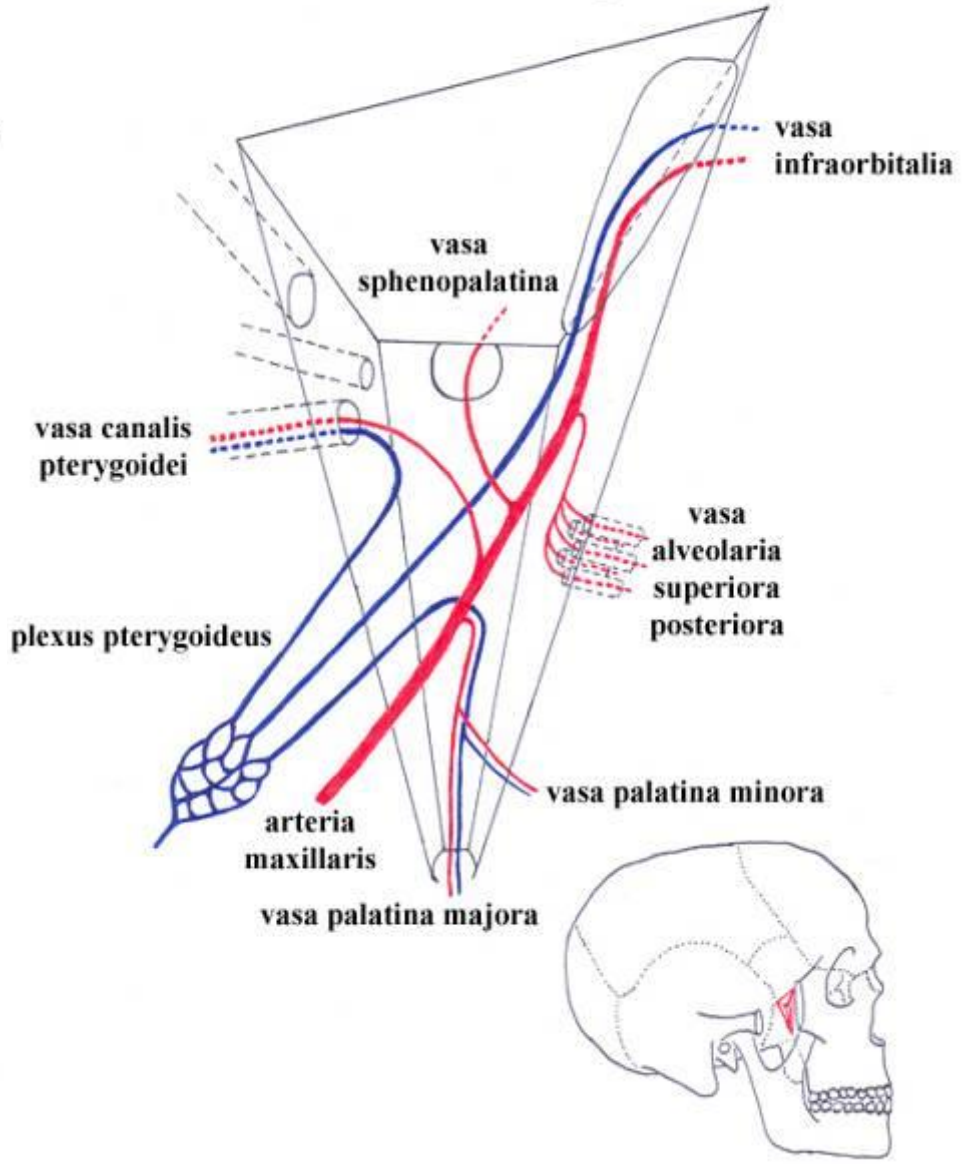
# FOSSA PTERYGOPALATINA

## l.dx. - *nervy*




# FOSSA PTERYGOPALATINA

## l.dx. - *cévy*



# V3 = N. mandibularis

<u>somatomotor branches</u>

for muscles of 1st pharyngeal arch

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

<u>somatosensory branches</u> (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

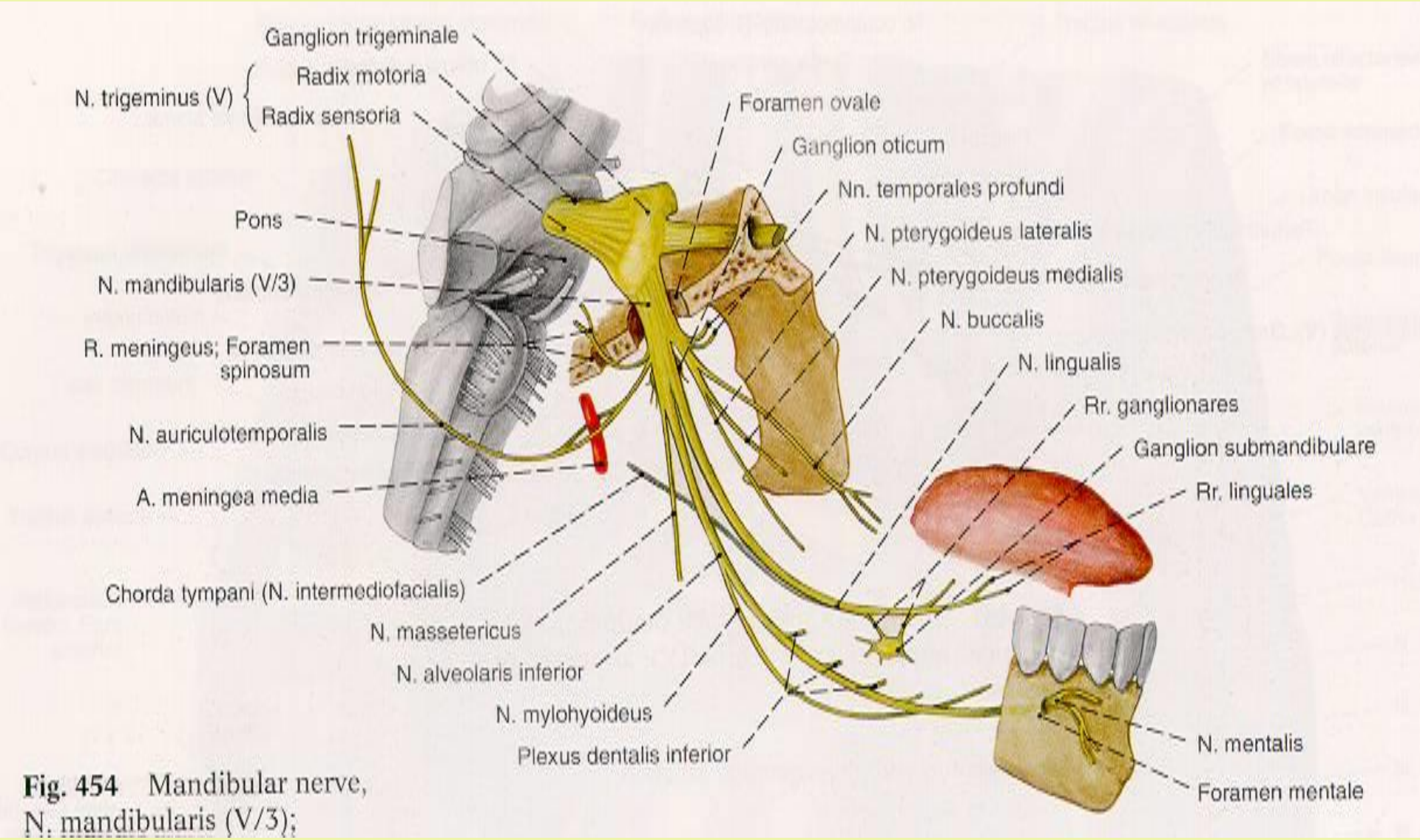
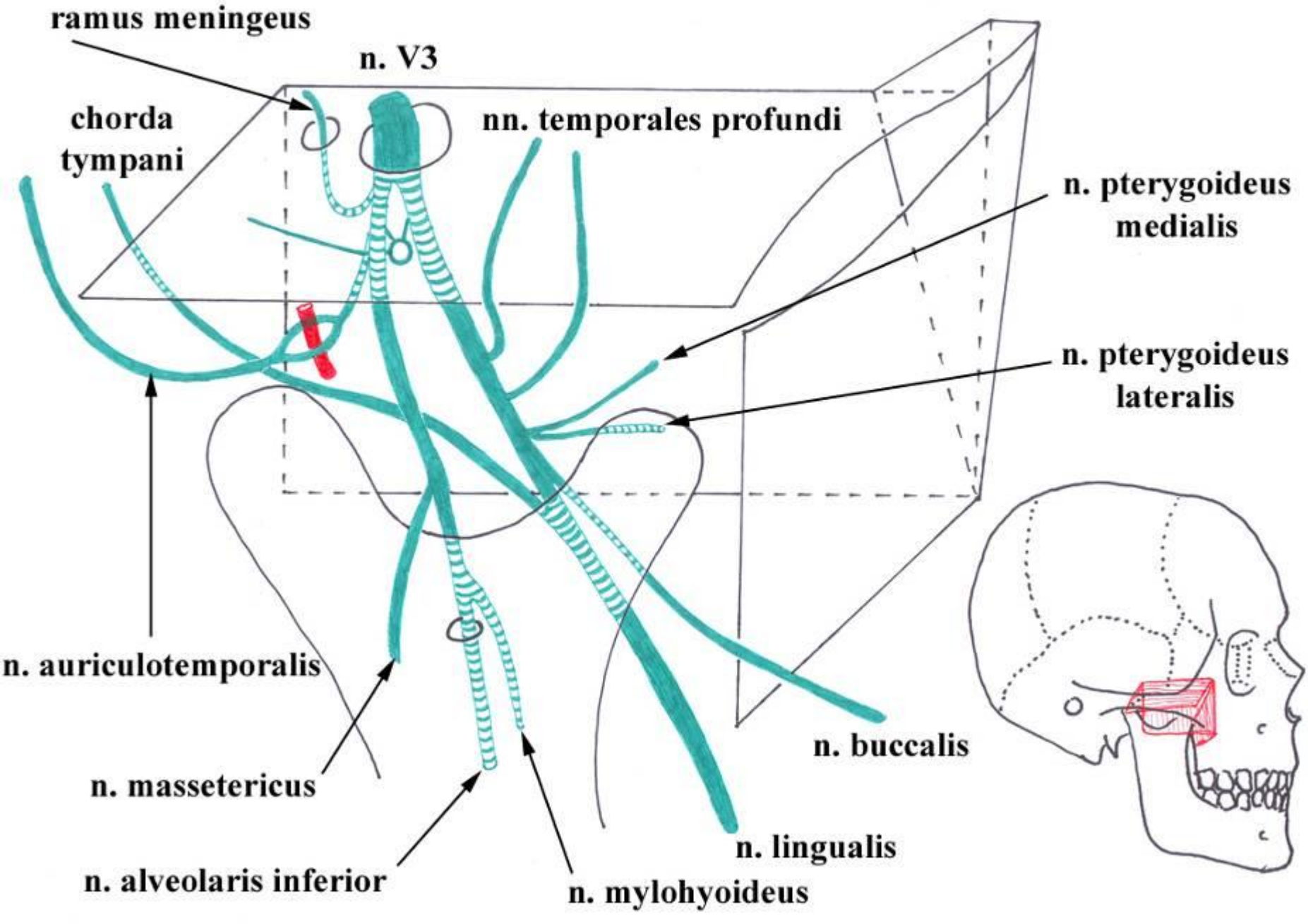
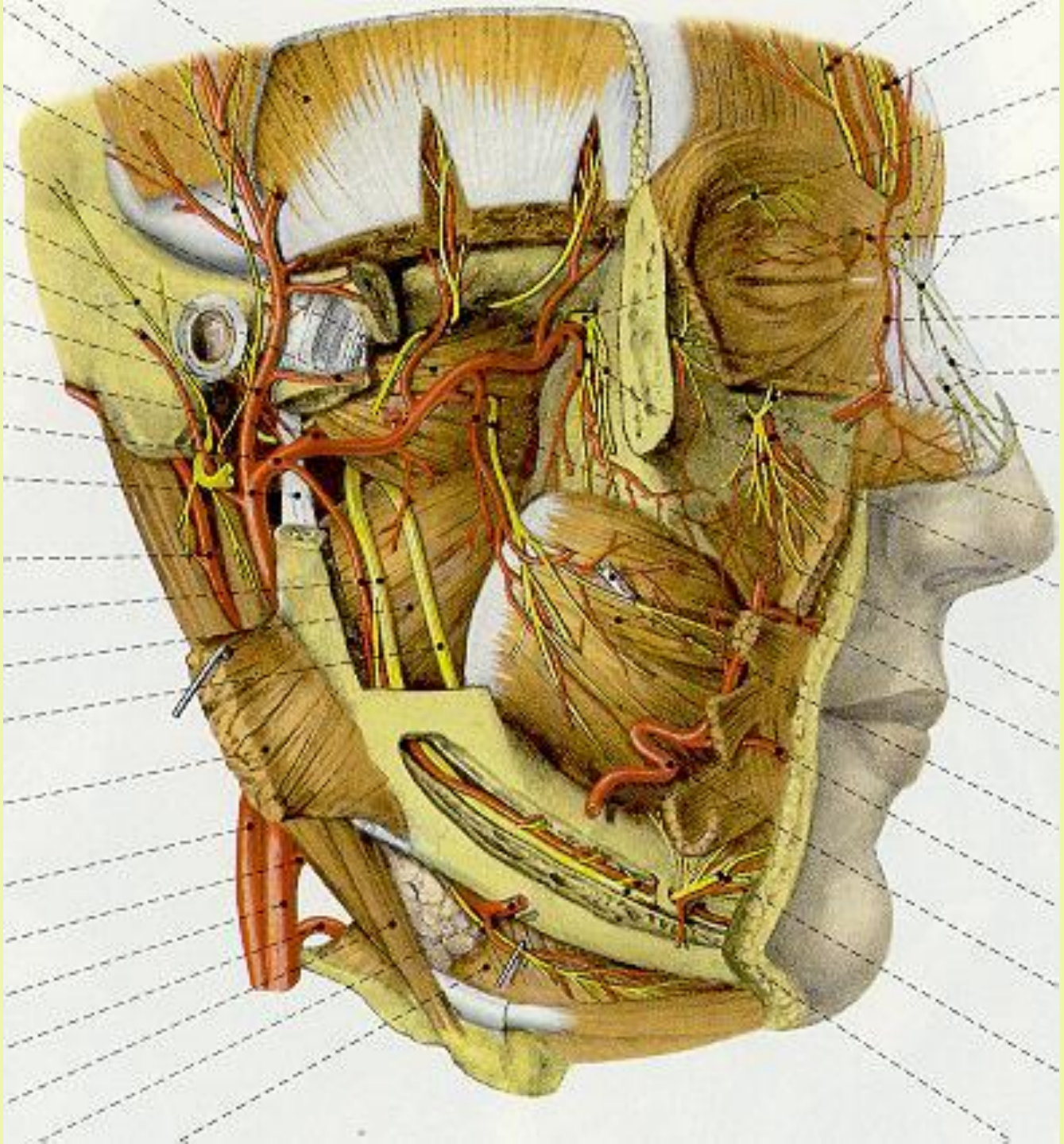
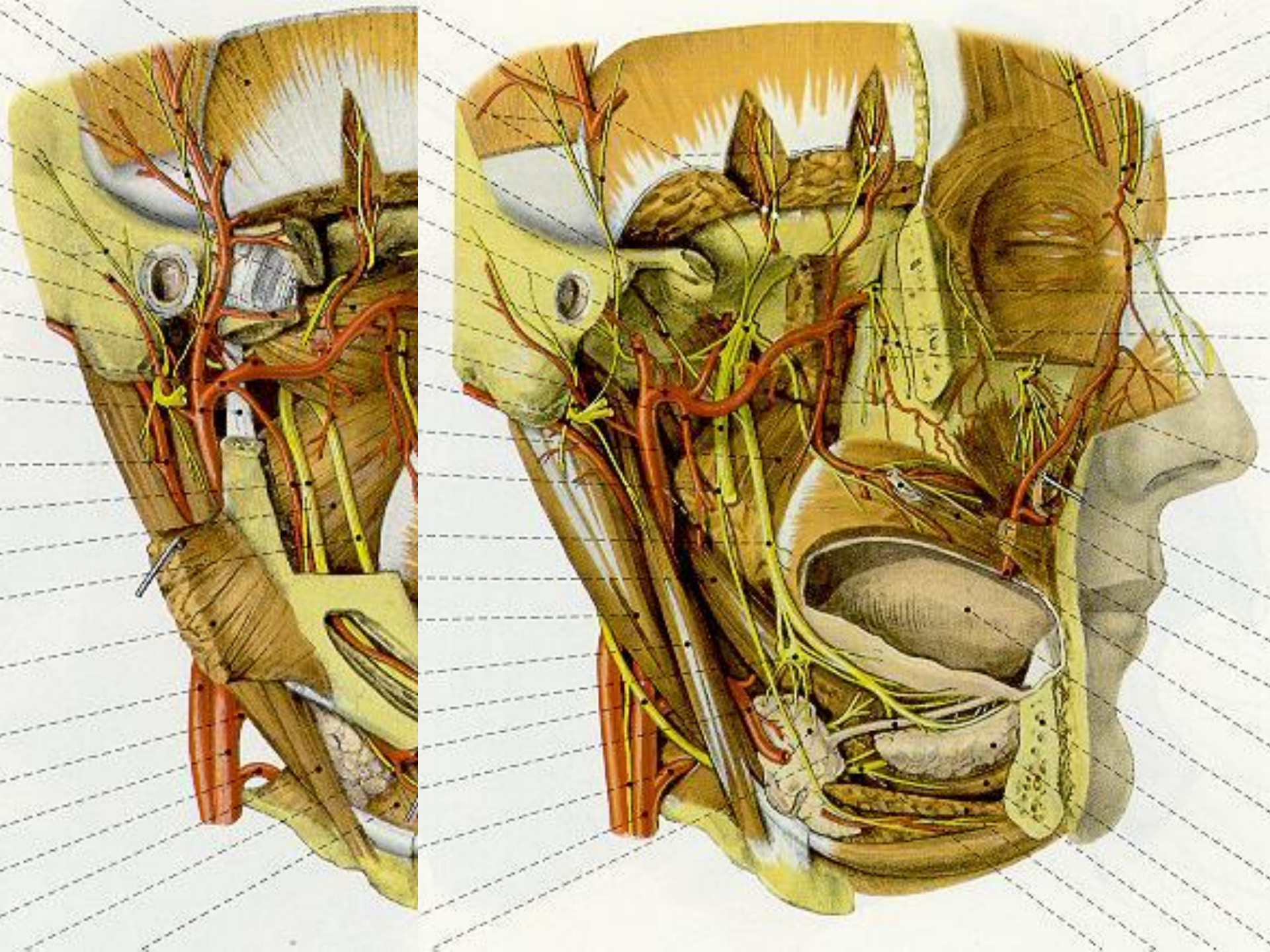



**Fig. 454** Mandibular nerve, N. mandibularis (V/3);

# FOSSA INFRATEMPORALIS - l.dx.

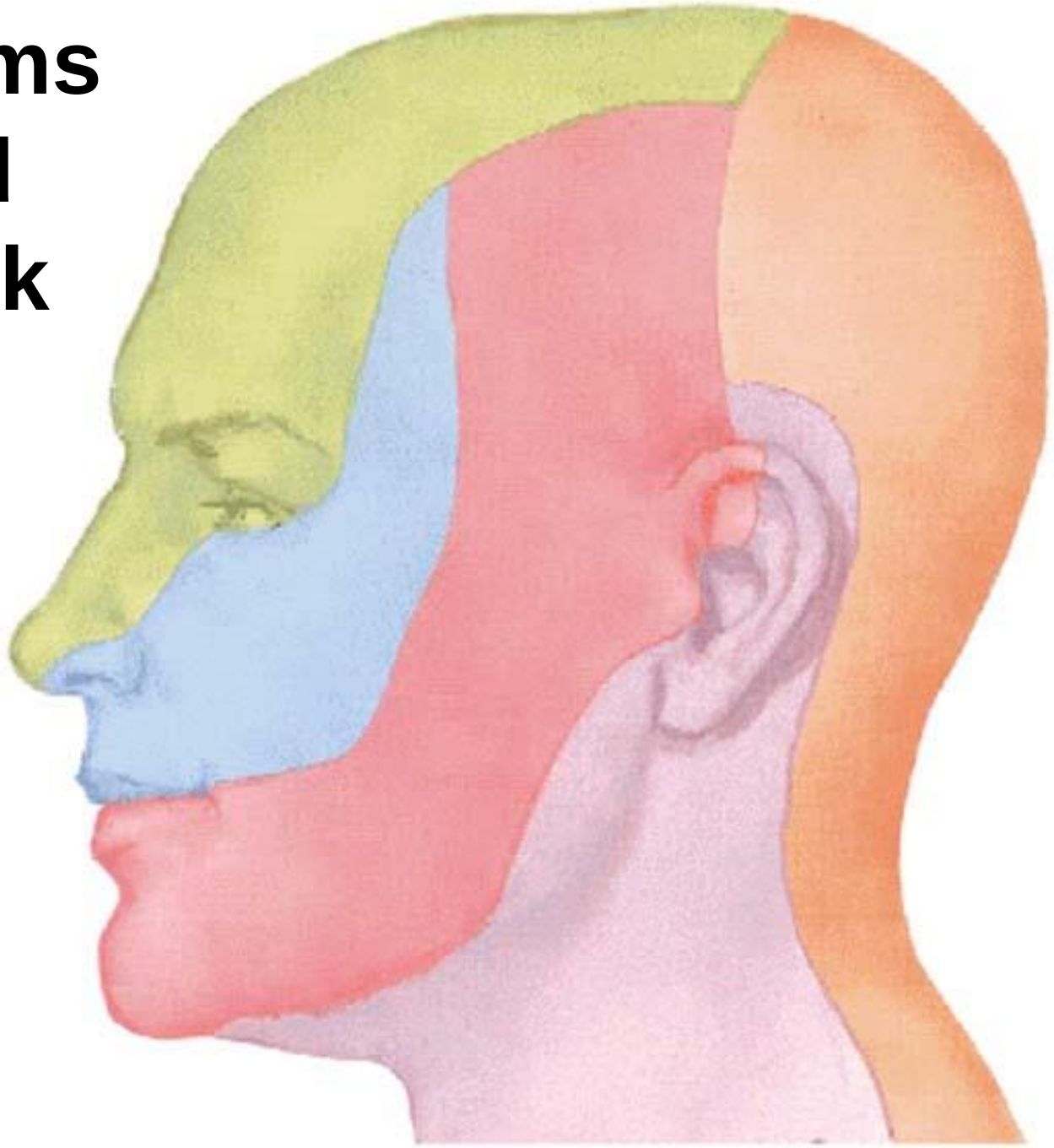






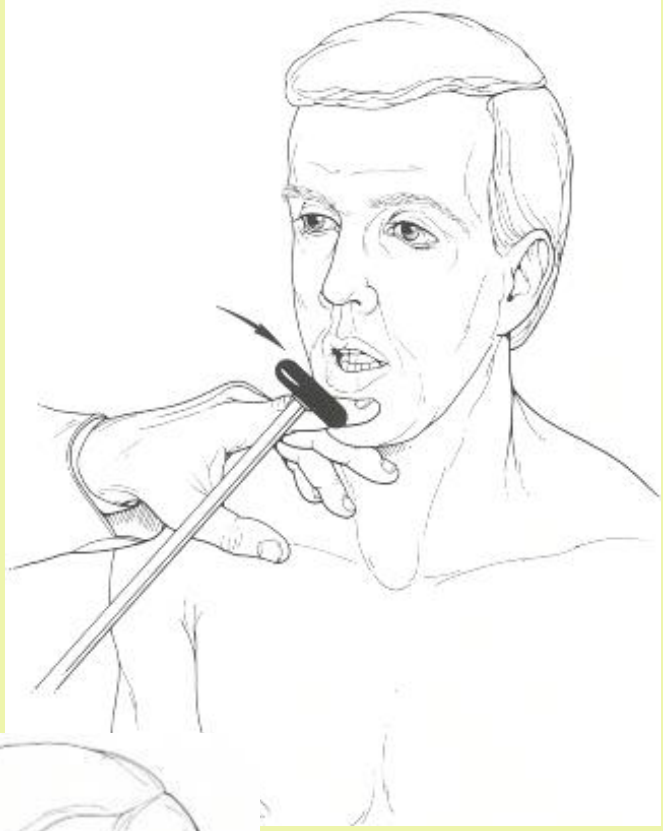
# Dermatoms of head and neck

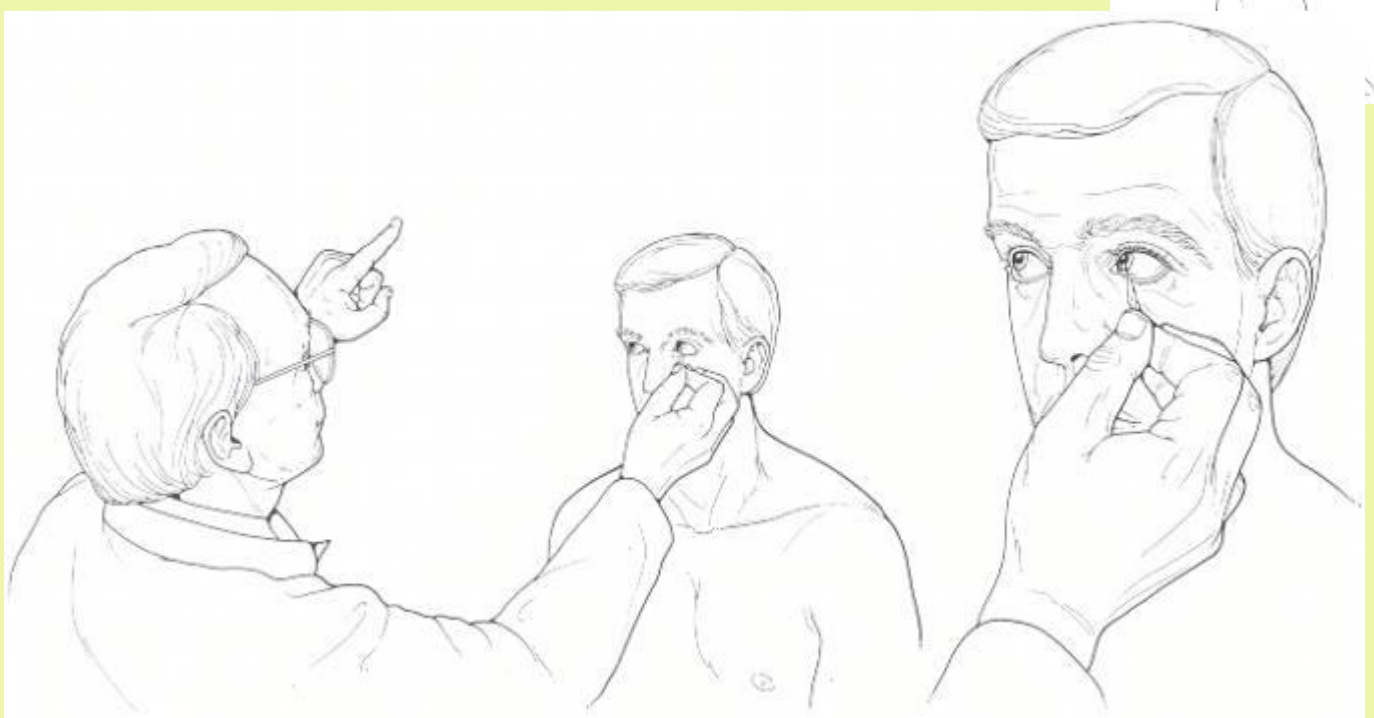
- V1
- V2
- V3
- C2
- C3



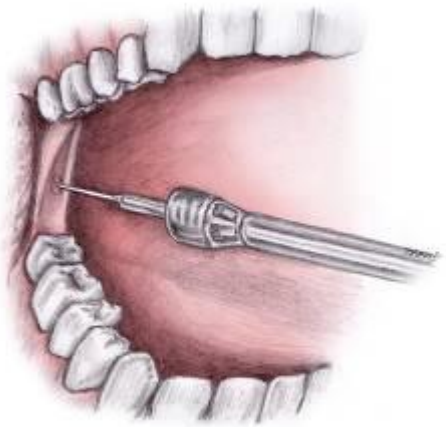
# Reflex examination

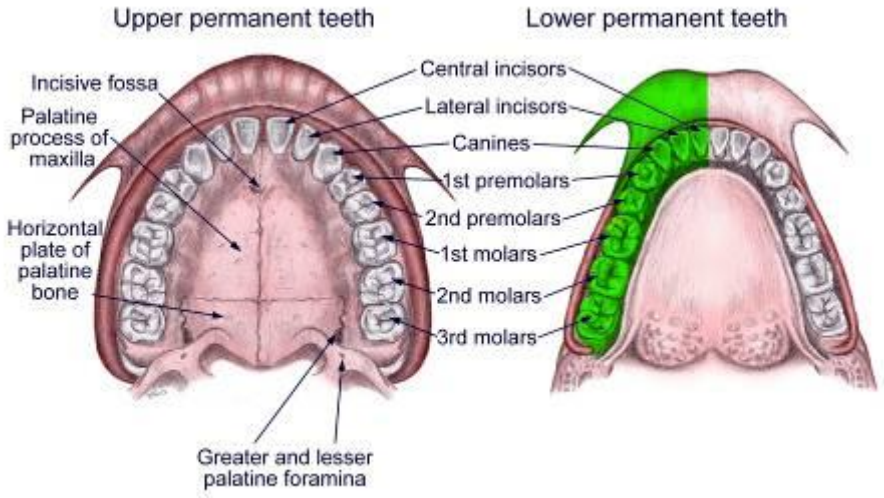
- masseter reflex
- corneal reflex

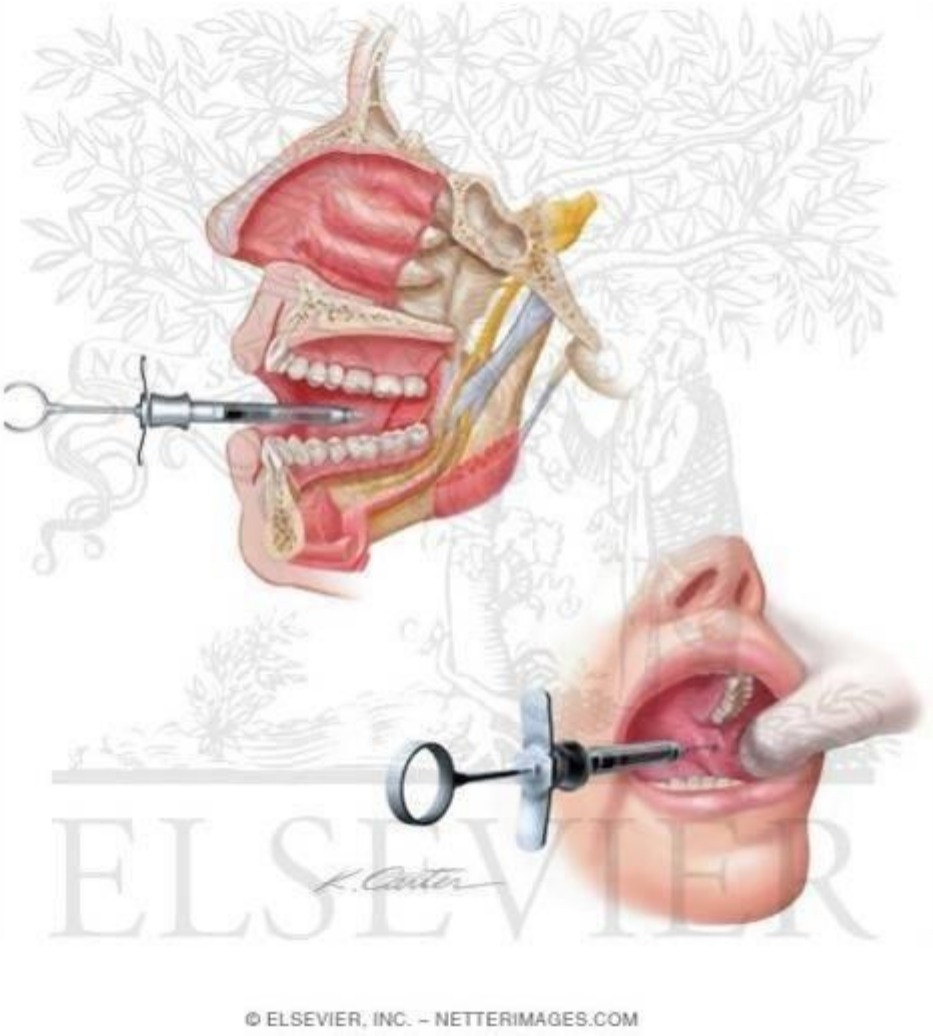




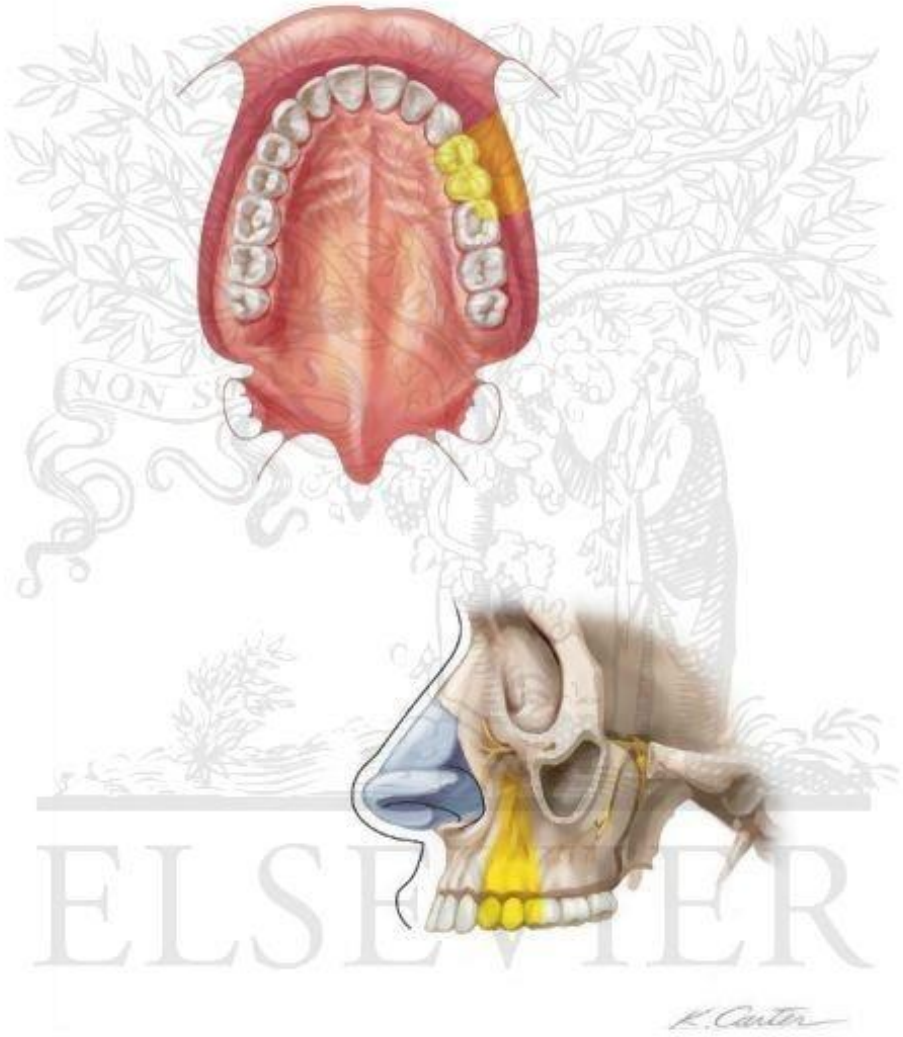
# Field block = conduction anaesthesia – lower dental arch

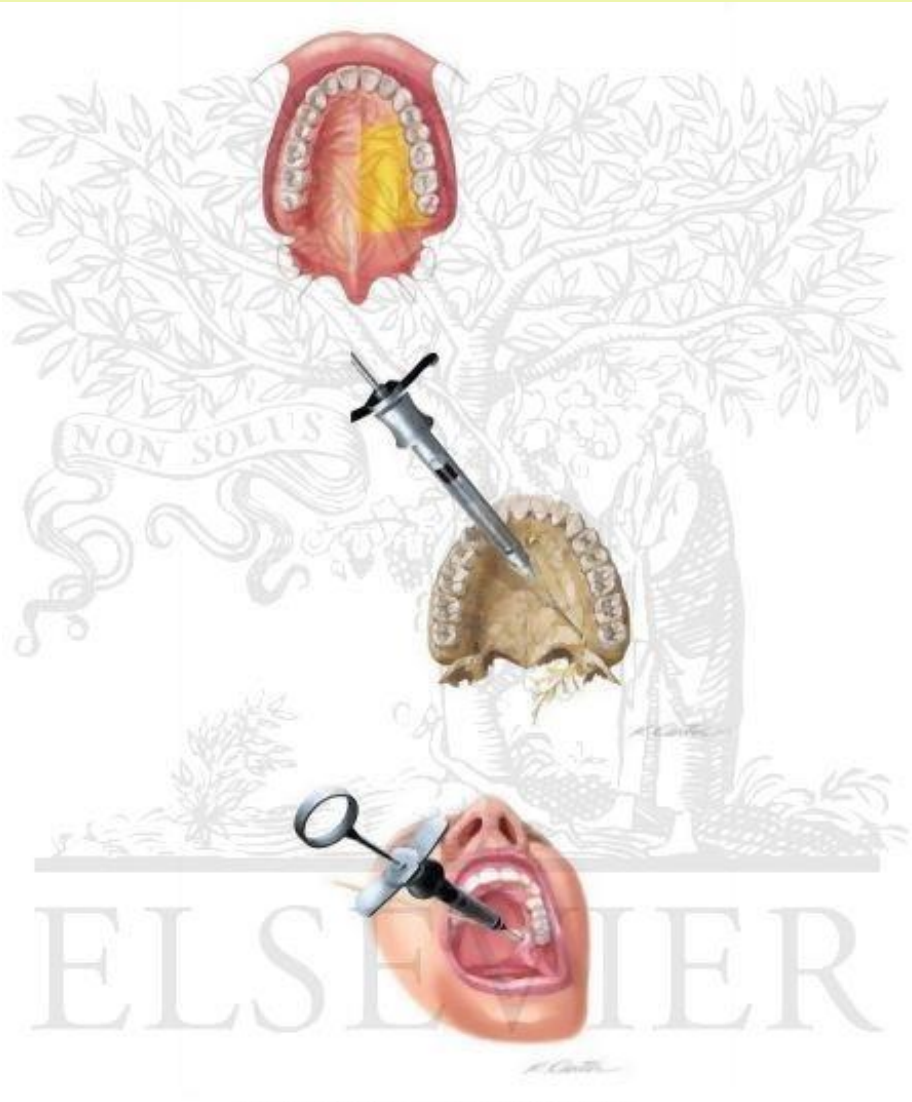




# Field block = conduction anaesthesia – upper dental arch



# Clinical anatomy

- Herpes zoster ophthalmicus (V1) →

- Herpes simplex (V2,V3) ↓

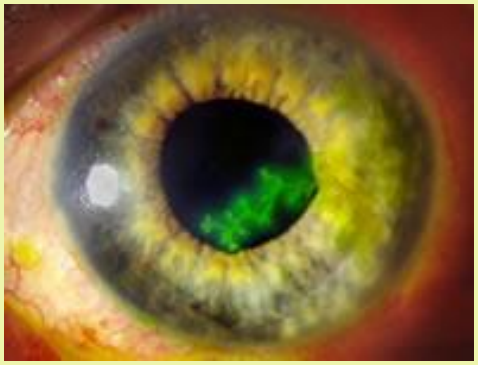


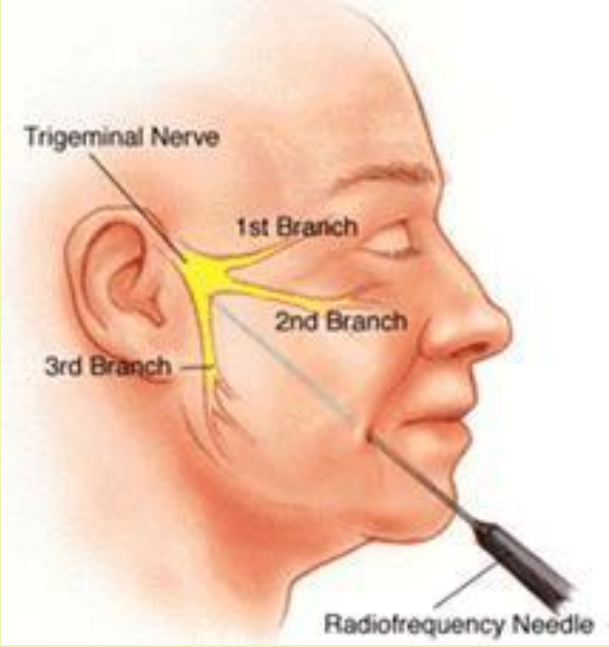
FIGURE 2. Case of herpes zoster ophthalmicus

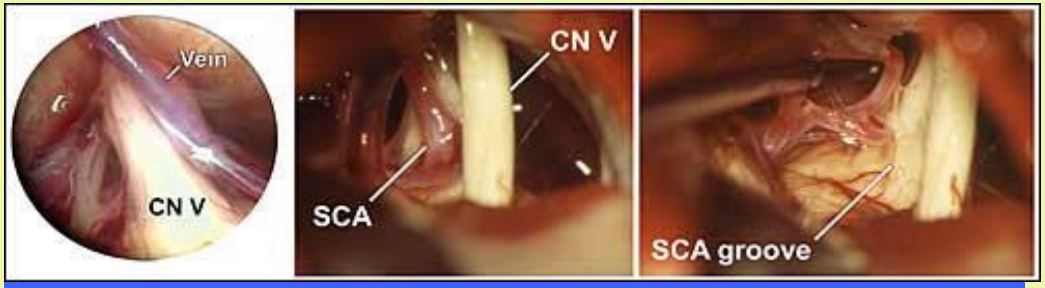
Photo/MN Oxman, University of California, San Diego

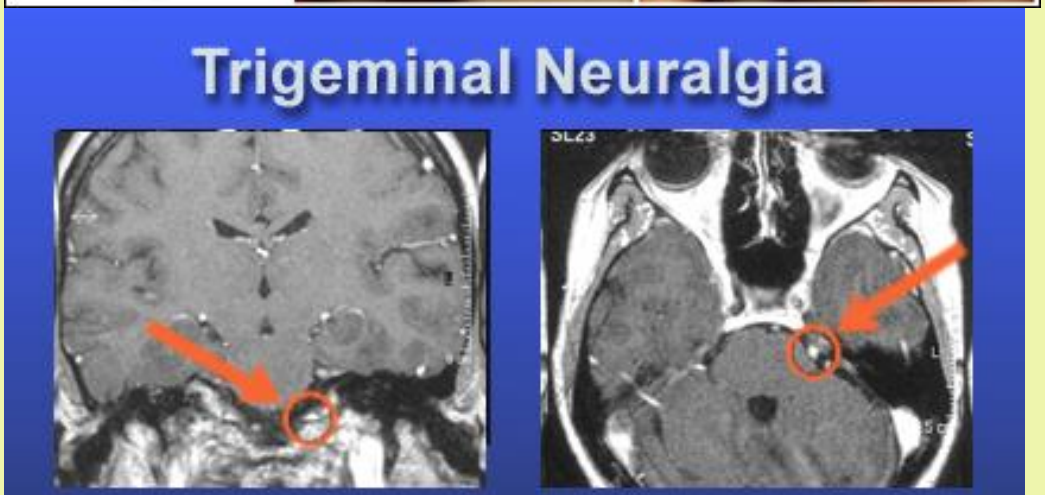
# Neuralgia trigeminalis

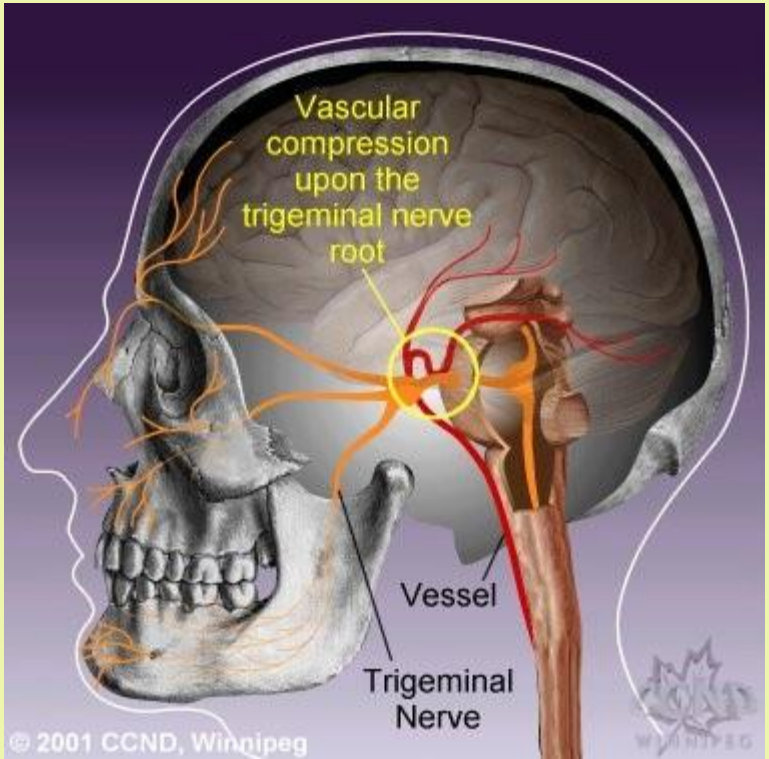
(*Tic douloureux; Prosopalgia*)

- microvascular decompression (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



# www

- http://www.youtube.com/watch?v=4xzQ5vnvL-o