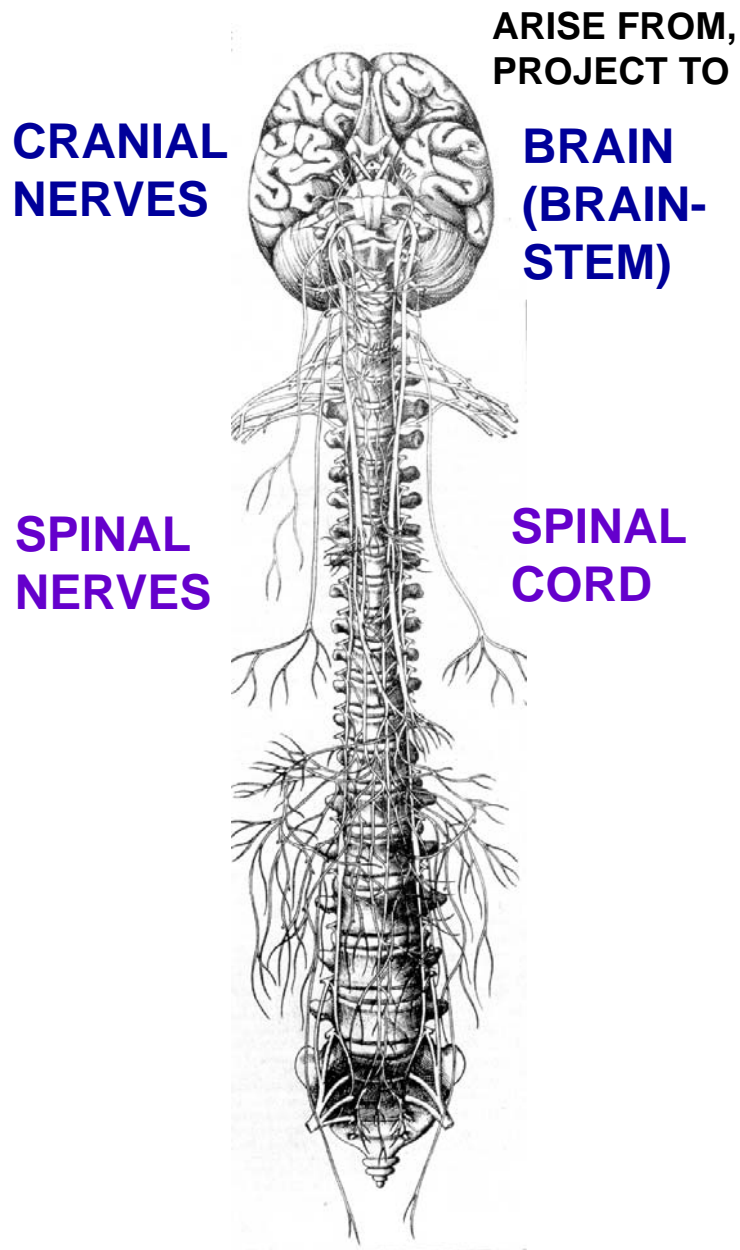


# CRANIAL NERVES



## OVERVIEW: CRANIAL NERVES

A. Contain inflow/outflow of brain; spinal nerves contain inflow/outflow of spinal cord.

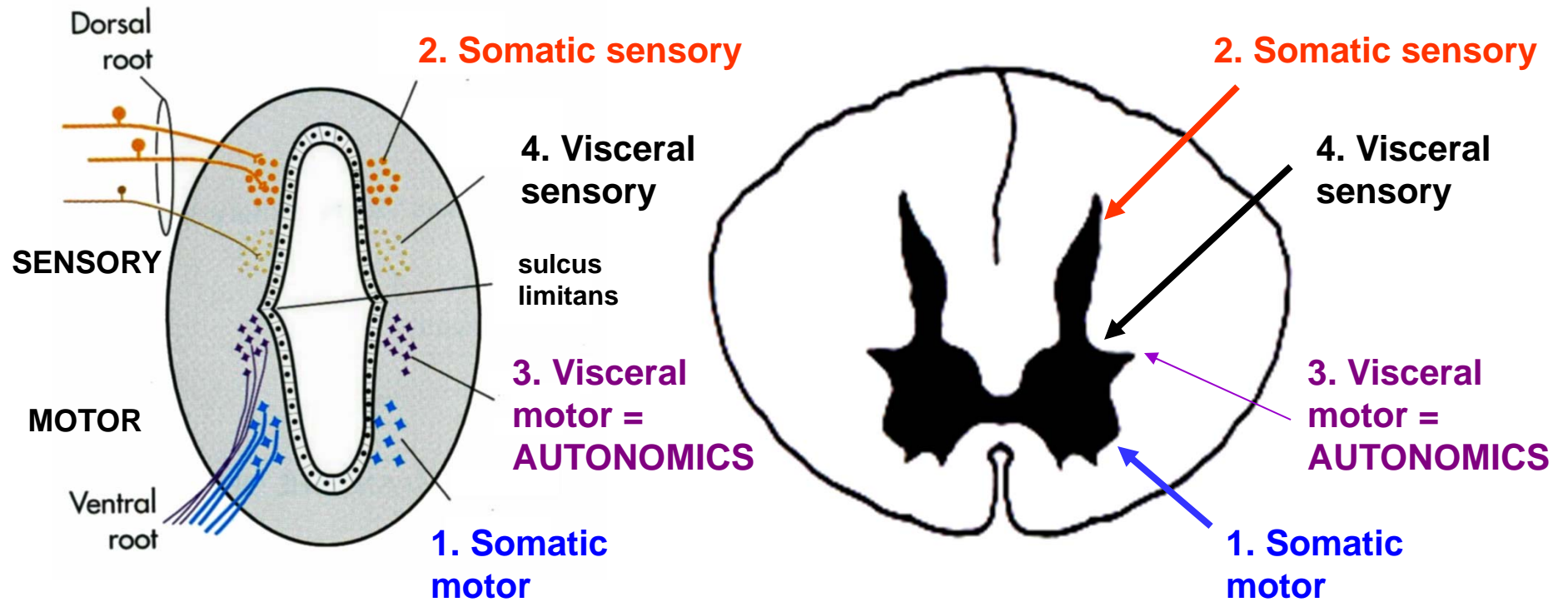
B. Contain types of similar to those found in spinal nerves; ex. sensory axons to skin.

C. Contain types of neurons not found in spinal nerves; ex. taste fibers.

D. Many cranial nerves contain more than one type of neuron.

E. To analyze types of neurons in different cranial nerves, system of classification of types of neurons.

# WHY DO YOU NEED TO KNOW THIS? CLASSIFICATION IS REFLECTED IN CENTRAL NERVOUS SYSTEM



Nervous system forms as a Neural Tube; cells form groups (columns); sensory dorsal, motor ventral; different types of neurons form columns that develop to adult locations

## 2) CLASSIFICATION OF INNERVATION

**Seven types of neurons - some are the same types of neurons as are found in spinal nerves; others are only found in cranial nerves**

A. Same types as spinal nerves

1. **Somatic motor** - Voluntary skeletal muscles (derived from somites)

2. **Somatic sensory** - Precise sensation to skin joints, muscle, tendon receptors (in head, also nasal and oral cavities)

3. **Visceral motor** (efferents) = AUTONOMICS - smooth muscles (including arrector pilae muscles of skin), blood vessels; secretomotor to glands.

4. **Visceral sensory** - Imprecise sensation from gut, blood vessels, glands, internal organs (in head, pharynx which is rostral end of gut)

## 2) CLASSIFICATION OF INNERVATION

B. Only in cranial nerves

5. **Special senses** - vision, hearing (auditory), balance (vestibular apparatus)

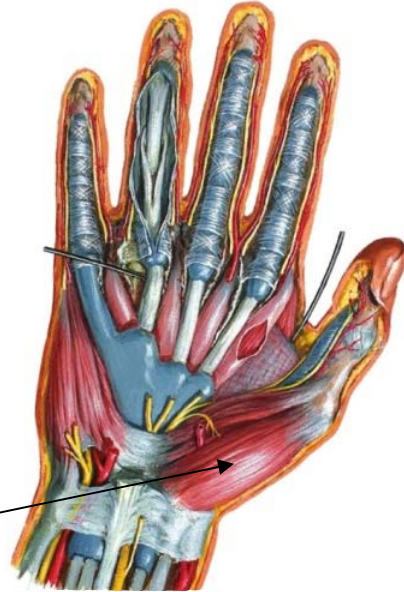
6. **Chemical senses** - taste and smell

7. **Branchiomotor** - Voluntary skeletal muscles from branchial arches

# SOME TYPES OF NEURONS ARE SIMILAR TO THOSE FOUND IN THE SPINAL CORD

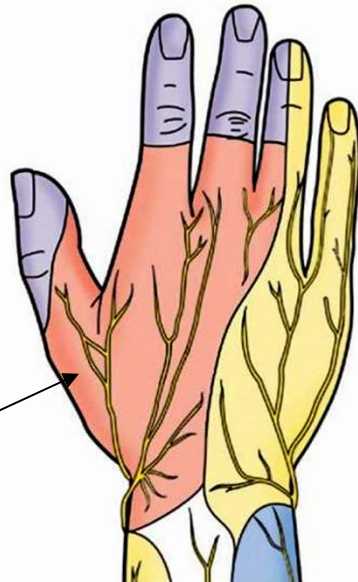
**SOMATIC MOTOR** - motor axons to skeletal muscles

ex. muscles of hand



**SOMATIC SENSORY** - sensory axons to skin ; also joints, body position

ex. skin of hand



## SOMATIC NERVOUS SYSTEM

E. Major divisions of nervous system - terminology based upon function but very confusing

1. Somatic Nervous system - considered voluntary, conscious part of nervous system

a. Somatic Motor (Efferents) - control skeletal muscle; voluntary activities (ex. limb or eye movements, walking); conscious actions.

b. Somatic Sensory (Afferents) - sensory neurons that innervate skin, joints; provide precise conscious sensation of touch, pressure, pain etc to skin; also provide sense of body position (proprioception).

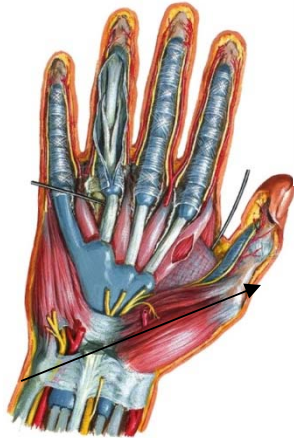


# THESE TYPES OF NEURONS ARE ALSO FOUND IN CRANIAL NERVES

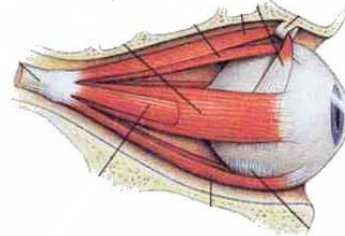
## IN HEAD

**SOMATIC MOTOR -**  
motor axons to skeletal muscles

ex. muscles of hand



eye muscles



move eyes

muscles of tongue



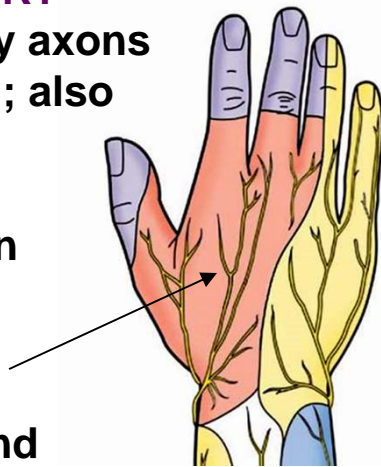
move tongue

**SOMATIC MOTOR IN HEAD - limited to two groups**

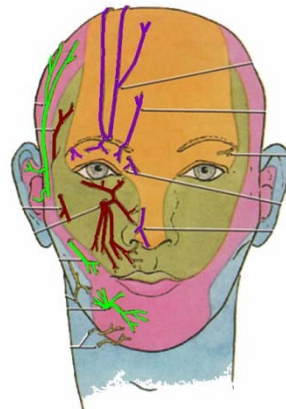
1. EYE MUSCLES - extraocular muscles that move eye (and lift upper eyelid)
2. MUSCLES OF TONGUE

**SOMATIC SENSORY-**  
sensory axons to skin ; also joints, body position

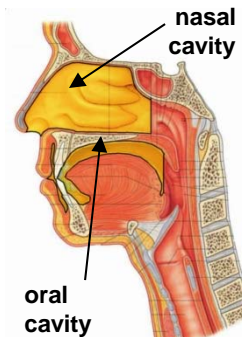
ex. skin of hand



skin of head

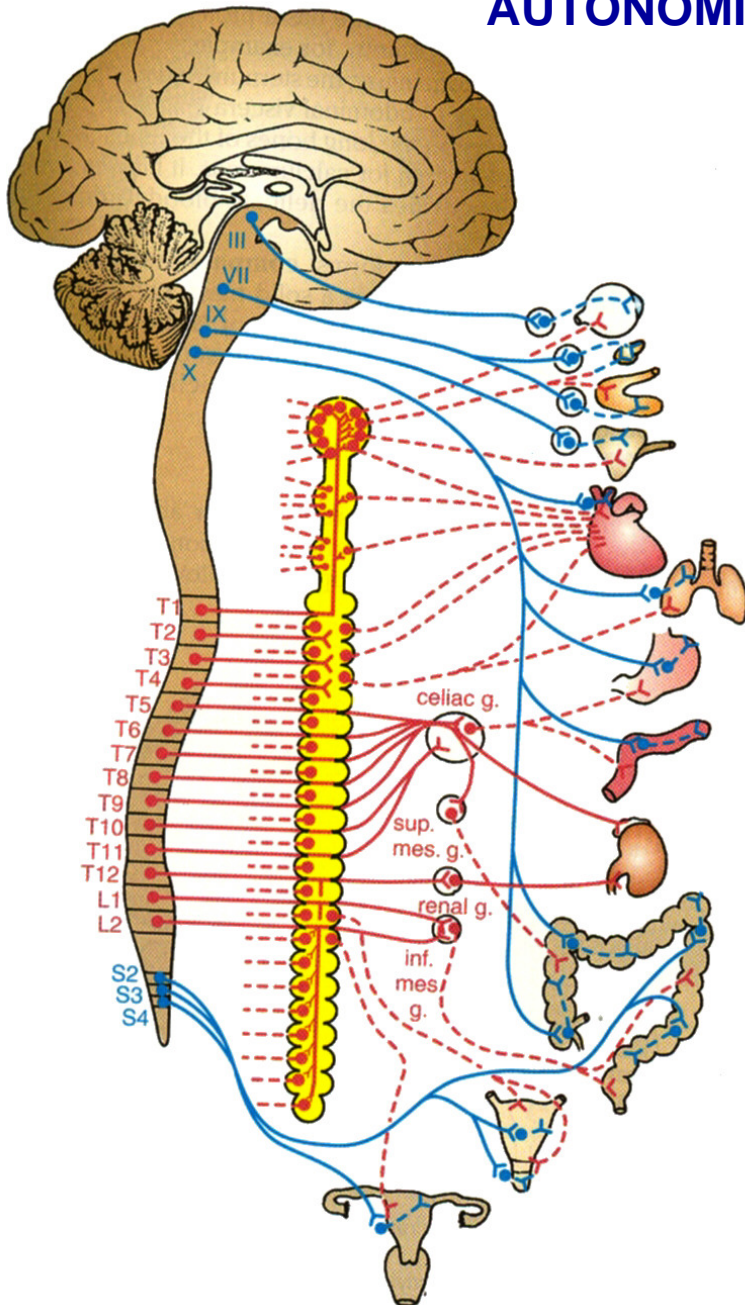


oral, nasal cavities



**SOMATIC SENSORY IN HEAD - mostly in CN V - precise sensation sensory to skin ; also oral cavity (inside mouth), nasal cavity (inside nose)**

## AUTONOMIC = VISCERAL NERVOUS SYSTEM

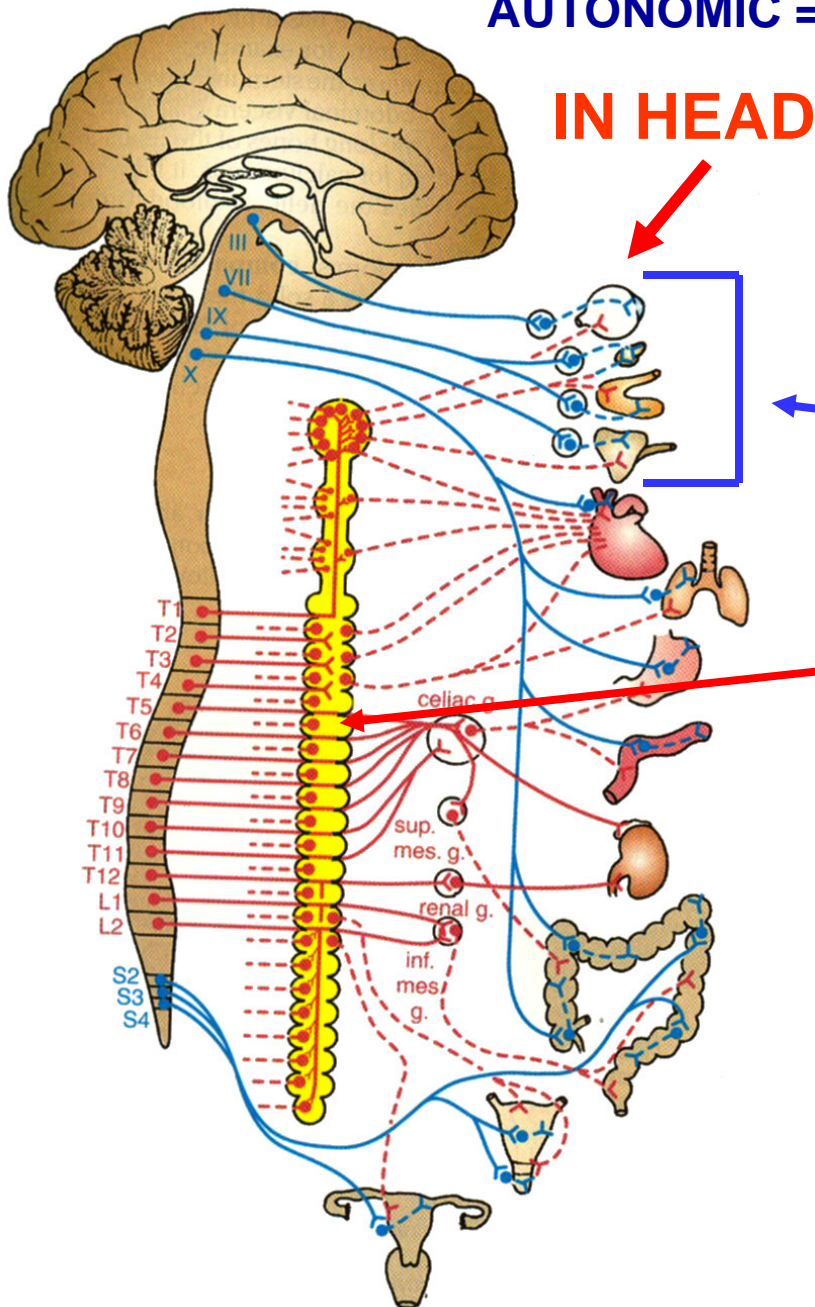


Autonomic Nervous system =  
Visceral nervous system -  
involuntary, unconscious part of  
nervous system

a. Visceral Motor (parasympathetic and sympathetic efferents) - control smooth and cardiac muscle, glands and internal organs; largely **unconscious actions (autonomic means self-regulating or automatic)**.

b. Visceral Sensory (afferents) - sensory neurons that innervate internal organs, blood vessels; only provide **imprecise localization of sensation** and dull sense of pressure, pain, etc.

## AUTONOMIC = VISCERAL NERVOUS SYSTEM IN HEAD



**IN HEAD**

### VISCERAL MOTOR Autonomic

**Nervous system** = Visceral nervous system - involuntary, unconscious part of nervous system

a. Parasympathetic (CRANIO-SACRAL outflow - IN CRANIAL NERVES) -

specific pathway in four cranial nerves

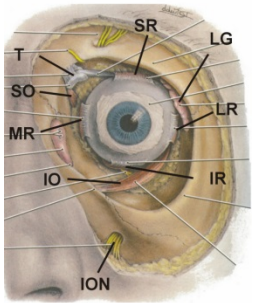
b. Sympathetics - not in cranial nerves  
- come from spinal cord - **THORACO-LUMBAR outflow**

c. Visceral Afferents - (not shown in diagram); sensory neurons that innervate internal organs, blood vessels; only provide **imprecise localization of sensation and dull sense of pressure, pain, etc.** - follow parasympathetic and sympathetic - in HEAD, some specific.



# SOME TYPES OF NEURONS ARE ONLY FOUND IN THE HEAD (IN CRANIAL NERVES)

Special Senses - vision, audition, vestibular

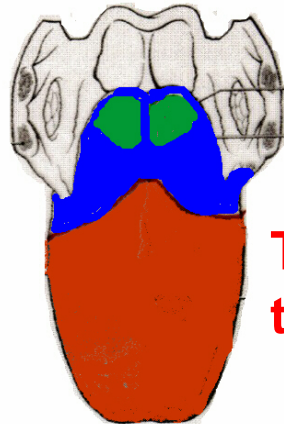


EYE

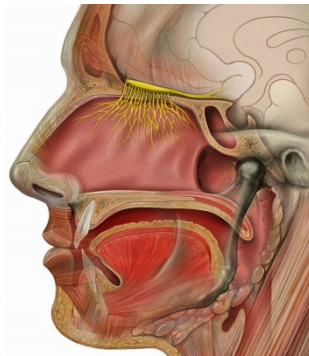


EAR

Chemical senses: taste and smell



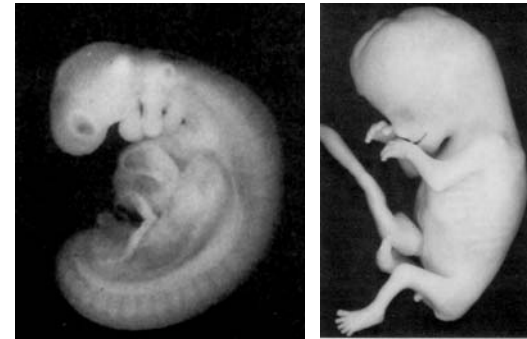
TONGUE - taste



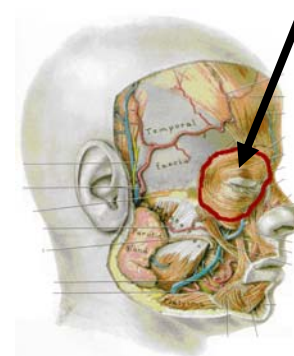
NOSE - smell

Branchiomotor - Skeletal muscles derived from branchial (gill) arches

FISH-LIKE → HUMAN



SKELETAL MUSCLES

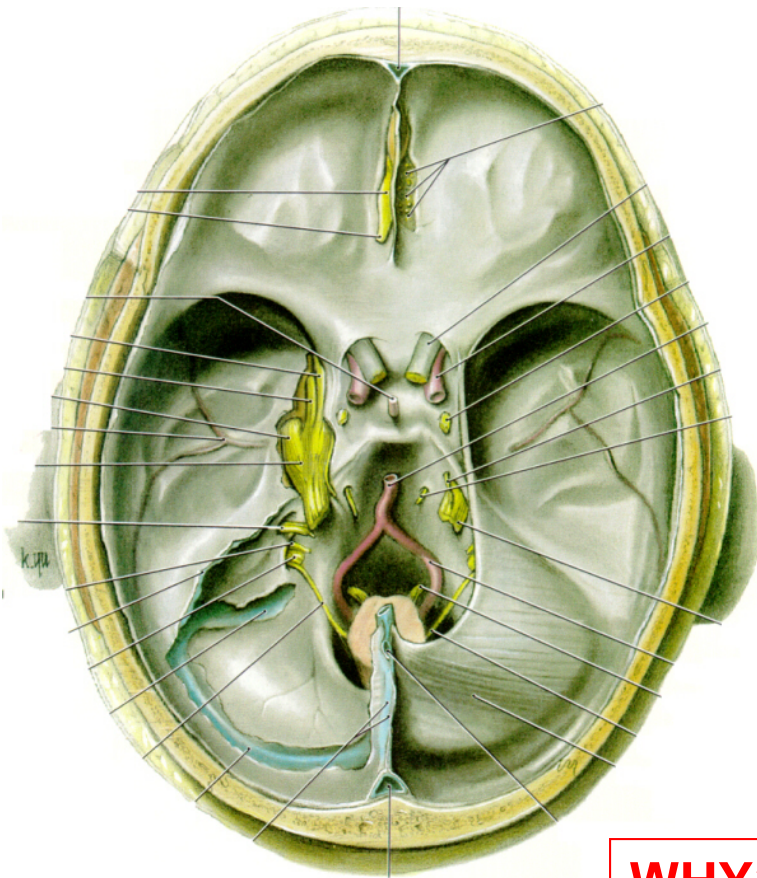


# HOW ARE THESE TYPES OF NEURONS DISTRIBUTED IN CRANIAL NERVES?

## TYPES OF NEURONS

1. Somatic motor
2. Somatic sensory
3. Visceral motor
4. Visceral sensory
5. Special senses
6. Chemical senses
7. Branchiomotor

CRANIAL NERVES IN CRANIAL CAVITY



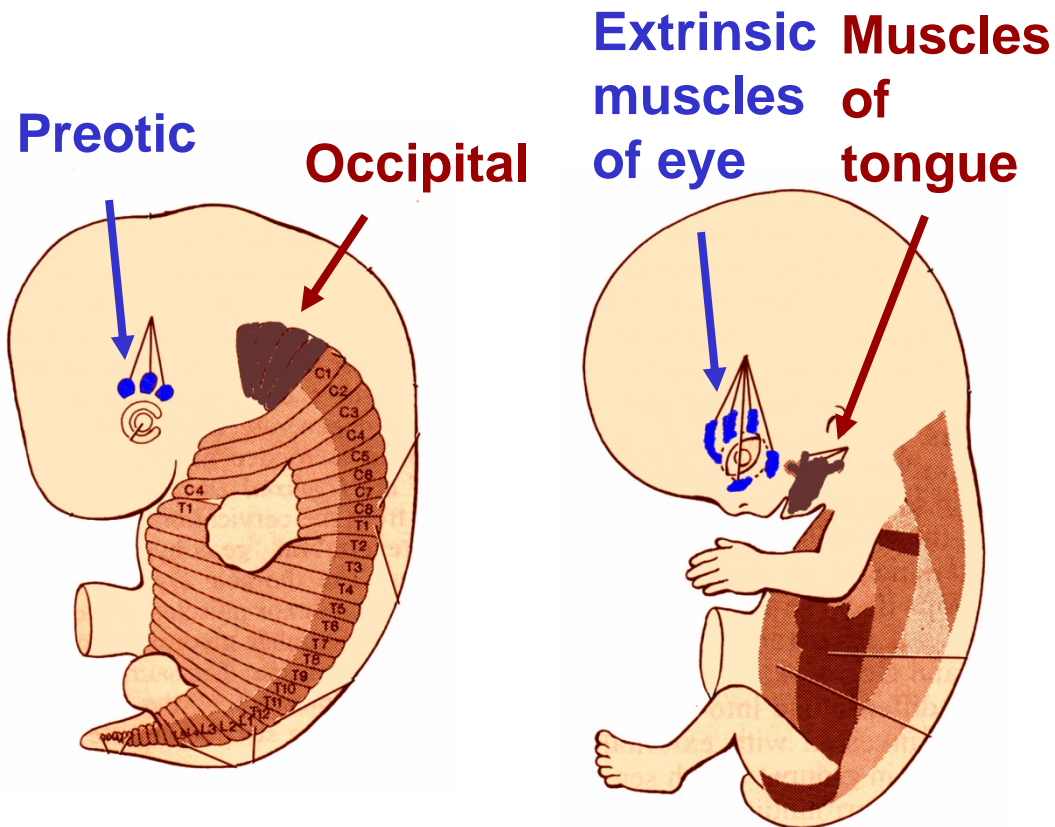
## CRANIAL NERVES

- |                 |                          |
|-----------------|--------------------------|
| I. Olfactory    | VII. Facial              |
| II. Optic       | VIII. Vestibulo-cochlear |
| III. Oculomotor | IX. Glossopharyngeal     |
| IV. Trochlear   | X. Vagus                 |
| V. Trigeminal   | XI. Accessory            |
| VI. Abducens    | XII. Hypoglossal         |

**WHY? TYPES OF NEURONS CORRESPOND TO COLUMNS OF NUCLEI IN THE BRAINSTEM**

# SOMATIC MOTOR

motor to skeletal muscle derived from somites (myotomes) ; only two groups in head



6 weeks

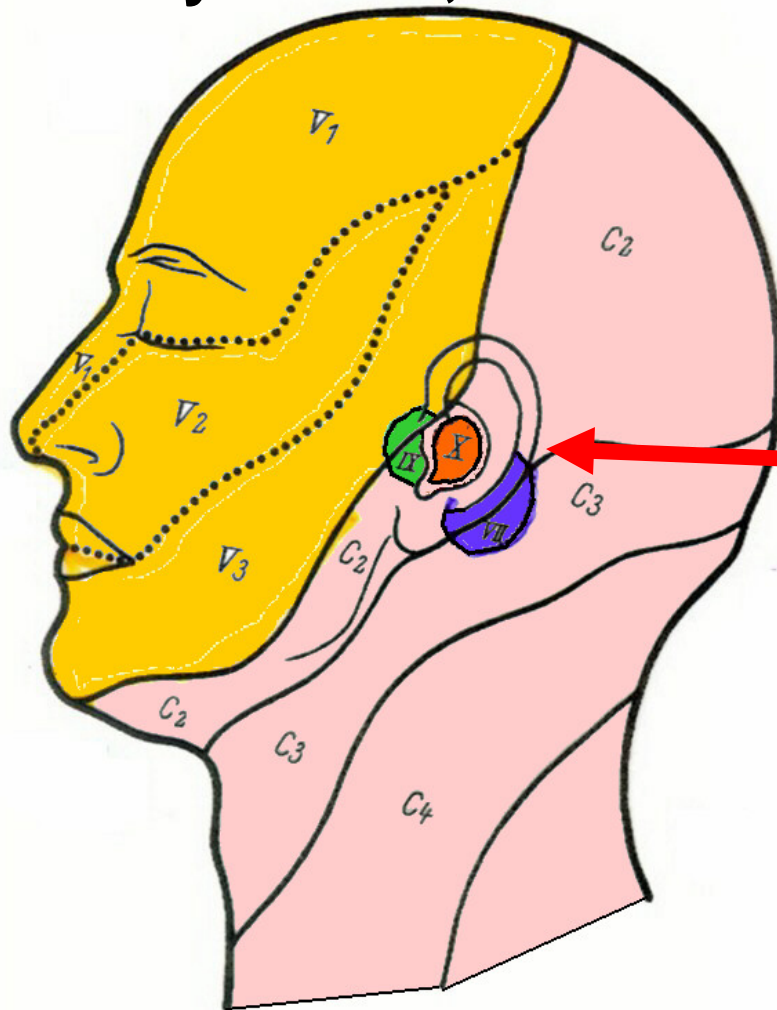
8 weeks

1) Preotic somites (somitomers) form extrinsic muscles of EYE: in CN III - Oculomotor, IV - Trochlear, VI - Abducens.

2) Occipital somites form muscles of TONGUE - in CN XII Hypoglossal N.

# SOMATIC SENSORY

sensory to skin, ORAL cavity, NASAL cavity, joints, muscles



**ALMOST ALL  
TRIGEMINAL V  
EXCEPTION:  
SKIN OF OUTER EAR –  
FOUR CRANIAL  
NERVES**

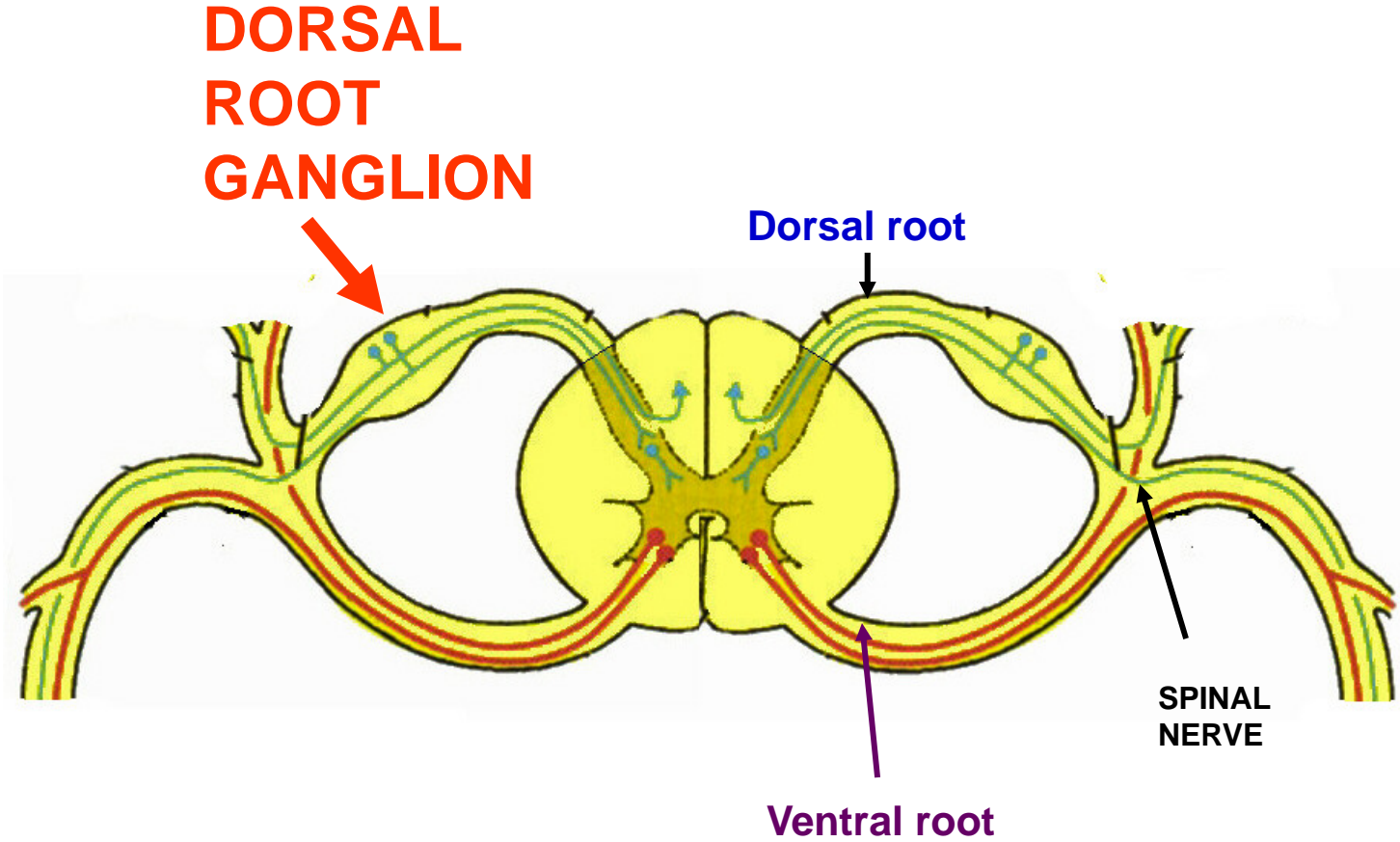
- 1) V - TRIGEMINAL
- 2) VII- FACIAL
- 3) IX - GLOSSO-  
PHARYNGEAL
- 4) X - VAGUS

**\*\***

**BELL'S PALSY (VII) - PARALYSIS OF FACIAL MUSCLES; IN RECOVERY, PATIENTS COMPLAIN OF EARACHES**



# SENSORY CELL BODIES IN DORSAL ROOT GANGLIA IN SPINAL CORD



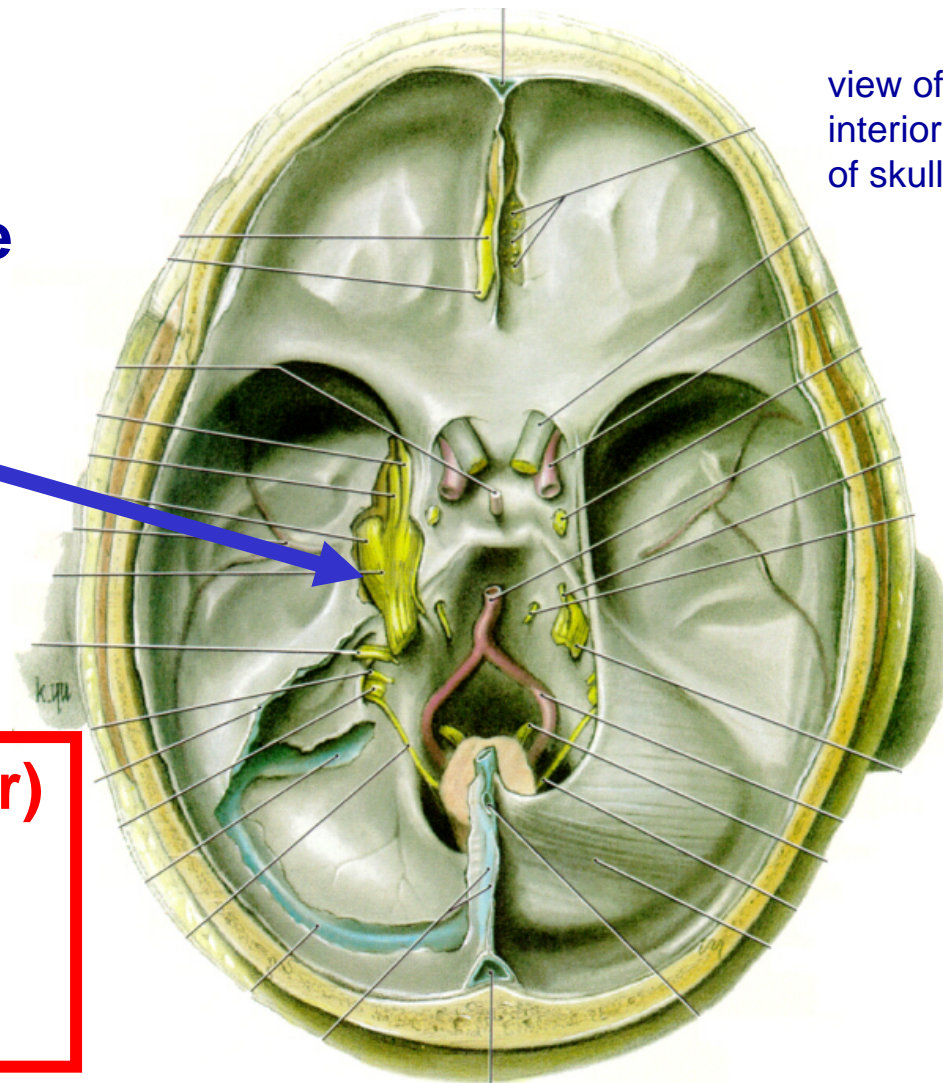
# SENSORY GANGLIA ARE ATTACHED TO CRANIAL NERVES

- cell bodies of sensory neurons in Trigeminal Nerve are in Trigeminal (Semilunar) Ganglion

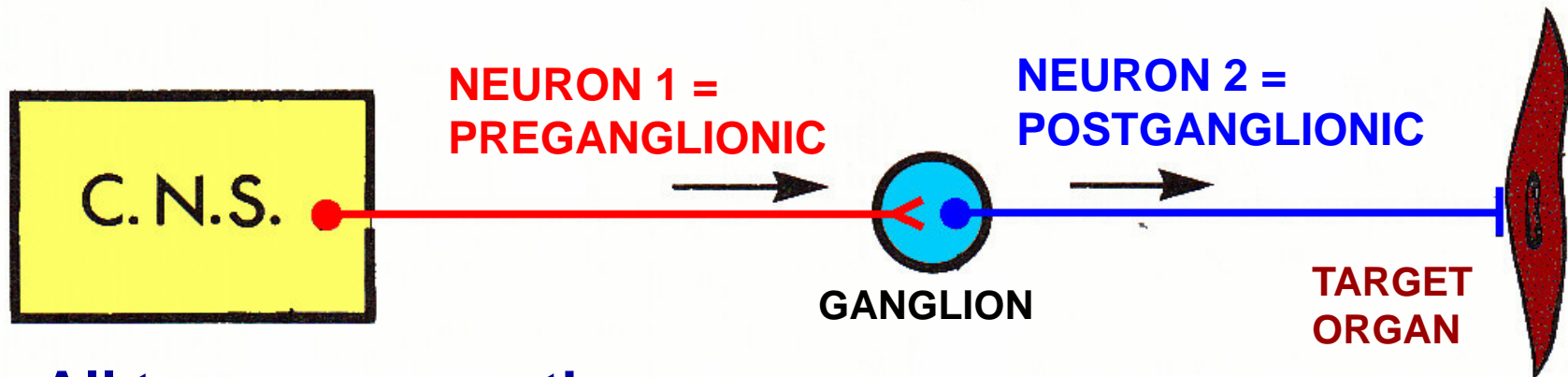
**Clinical - Mass (ex. tumor) pressing on Trigeminal Ganglion can produce numbness, intense pain**

**\*\***

Cell bodies of sensory neurons in VII (Facial Nerve) in Geniculate Ganglion



## VISCERAL MOTOR = AUTONOMIC NERVOUS SYSTEM

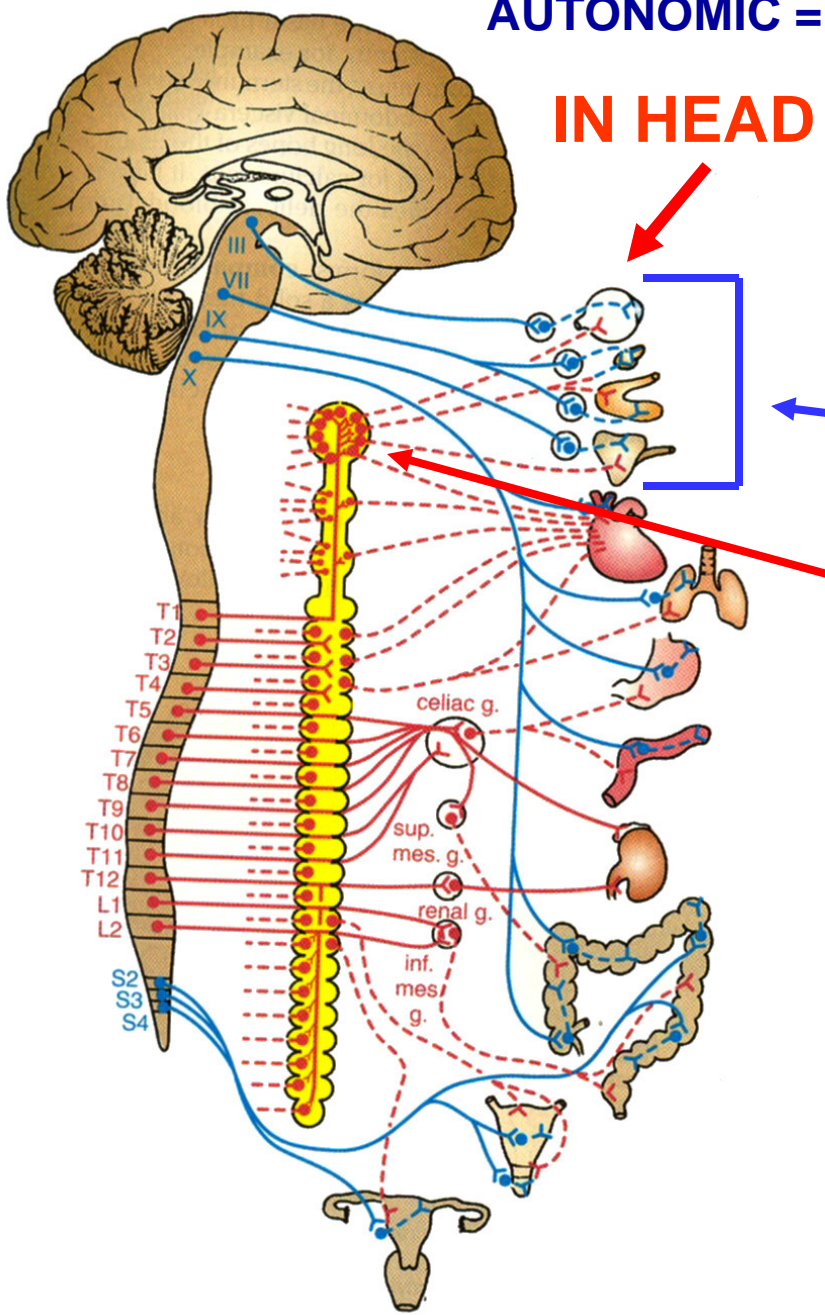


All two neuron pathways:

- 1) Neuron 1 = Preganglionic neuron - cell body in CNS; axon leaves CNS and synapses in autonomic ganglion
- 2) Neuron 2 = Post ganglionic neuron - cell body in autonomic ganglion; axon goes to target organ

note: Sympathetic - ganglia close to vertebrae  
Parasympathetic - ganglia close to target organ

# AUTONOMIC = VISCERAL NERVOUS SYSTEM IN HEAD



**VISCERAL MOTOR Autonomic Nervous system** = Visceral nervous system - involuntary, unconscious part of nervous system

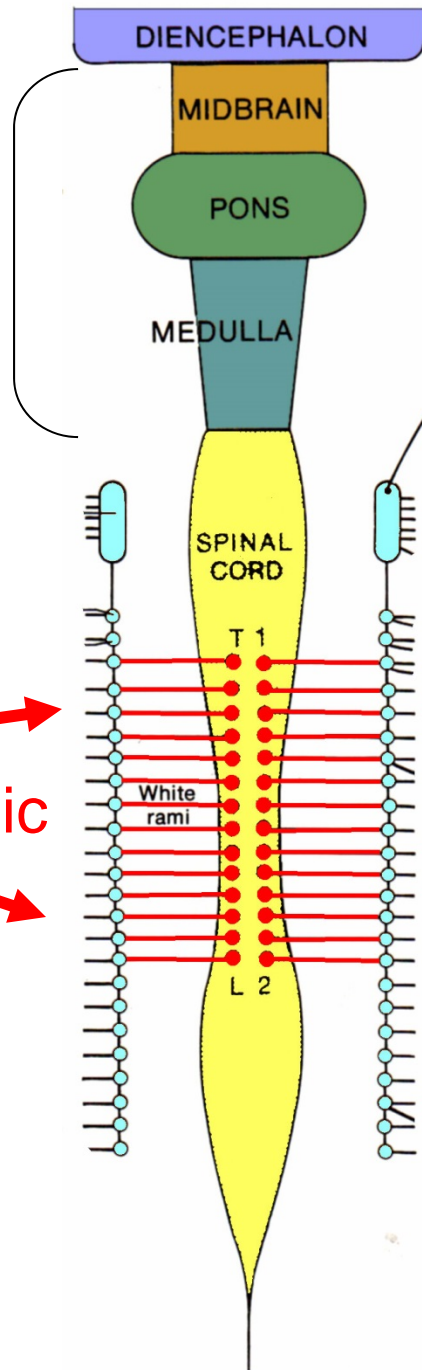
a. Parasympathetic (Cranio-sacral outflow) - in four cranial nerves

b. **Sympathetics - not in cranial nerves** - come from spinal cord - Thoraco-lumbar outflow

c. Visceral Afferents - (not shown in diagram); sensory neurons that innervate internal organs, blood vessels; only provide imprecise localization of sensation and dull sense of pressure, pain, etc. - **follow parasympathetic and sympathetic** - in HEAD, some specific (see below).



## BRAIN - parts of brainstem



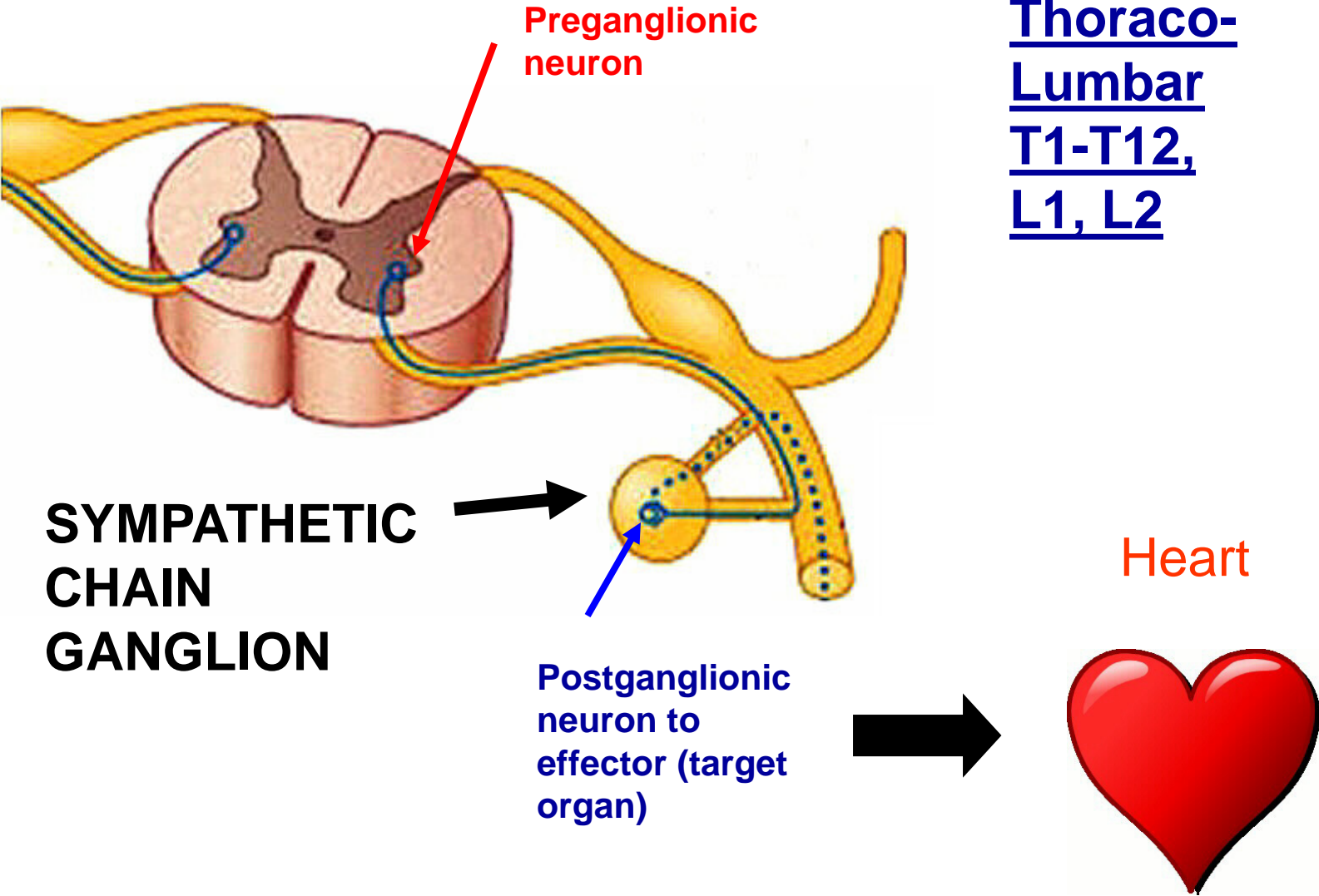
Sympathetic outflow (preganglionic neurons)

## SYMPATHETIC AUTONOMICS

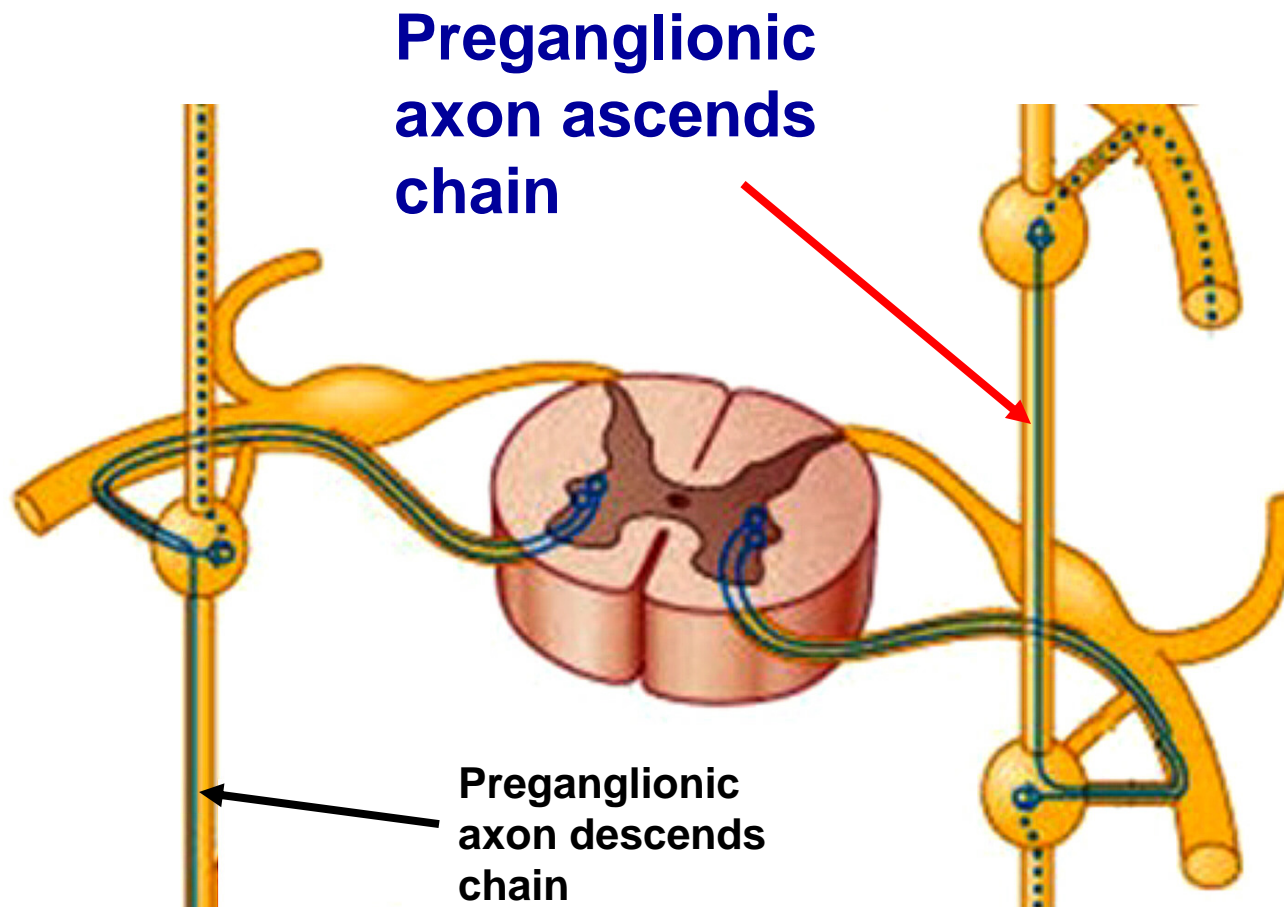
**Sympathetics - not in cranial nerves - come from spinal cord - All preganglionic sympathetics come out spinal cord at Thoracic and Lumbar levels**

**To supply rest of body - some preganglionic fibers ascend or descend in sympathetic chain**

# SYMPATHETICS IN THORAX, ABDOMEN



## SYMPATHETICS TO HEAD



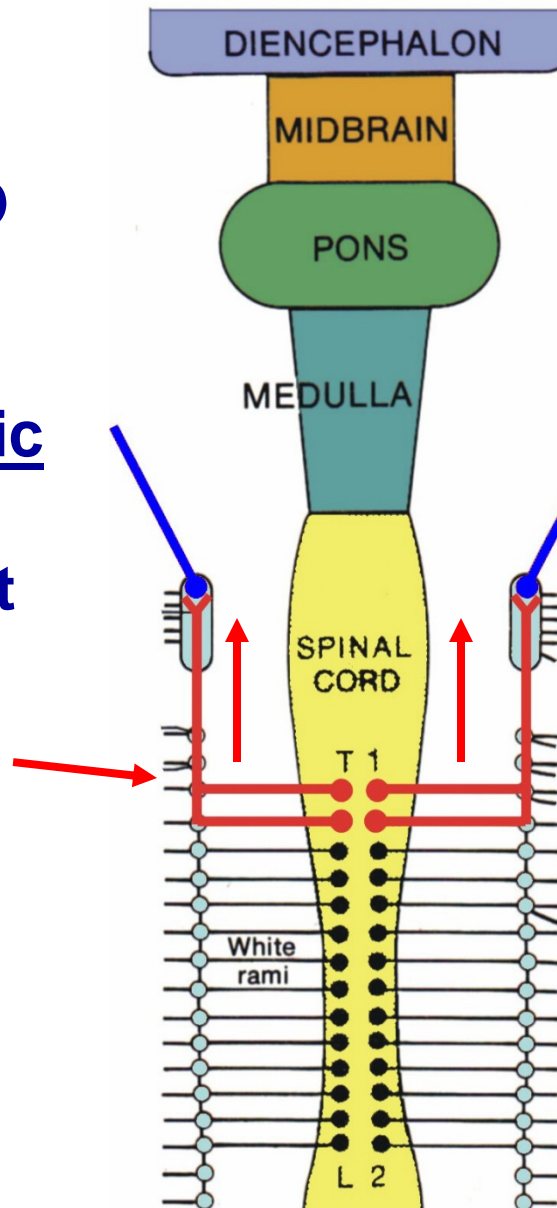
**PATHWAY TO HEAD -**  
**Preganglionic neuron in spinal cord at T1, T2**  
**- leaves and ascends sympathetic chain**

**SYMPATHETICS CAN ALSO COME OUT AND ASCEND OR DESCEND SYMPATHETIC CHAIN TO TERMINATE IN OTHER GANGLIA**

# SYMPATHETICS TO HEAD

## PATHWAY TO HEAD -

1) Neuron 1 (Preganglionic neuron) in spinal cord at T1, T2  
- leaves and ascends sympathetic chain



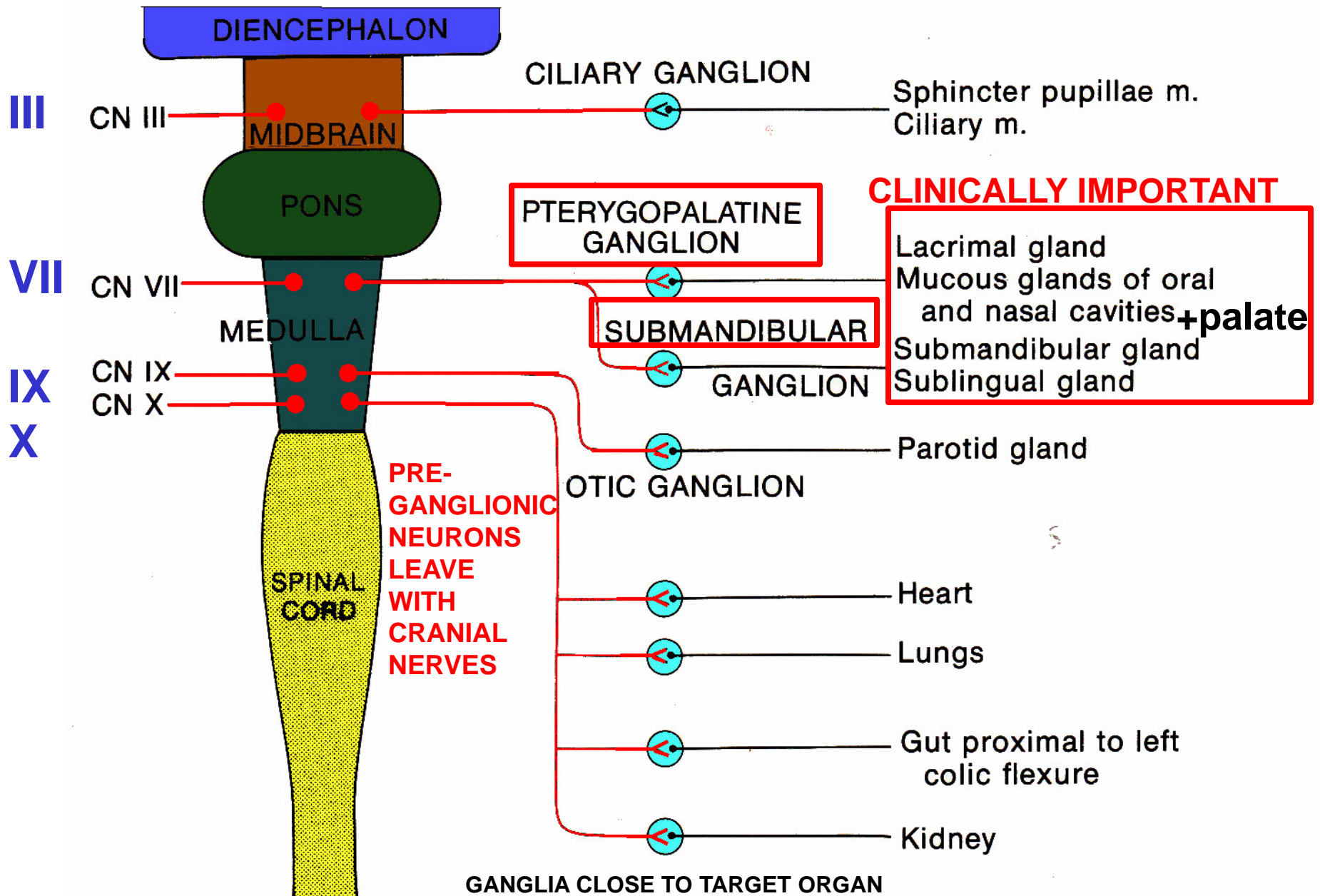
to Target Organ

Joins Plexus on Internal and External Carotid Arteries in mostly **Unnamed branches**

2) Neuron 2 (Postganglionic neuron) In Superior Cervical Ganglia

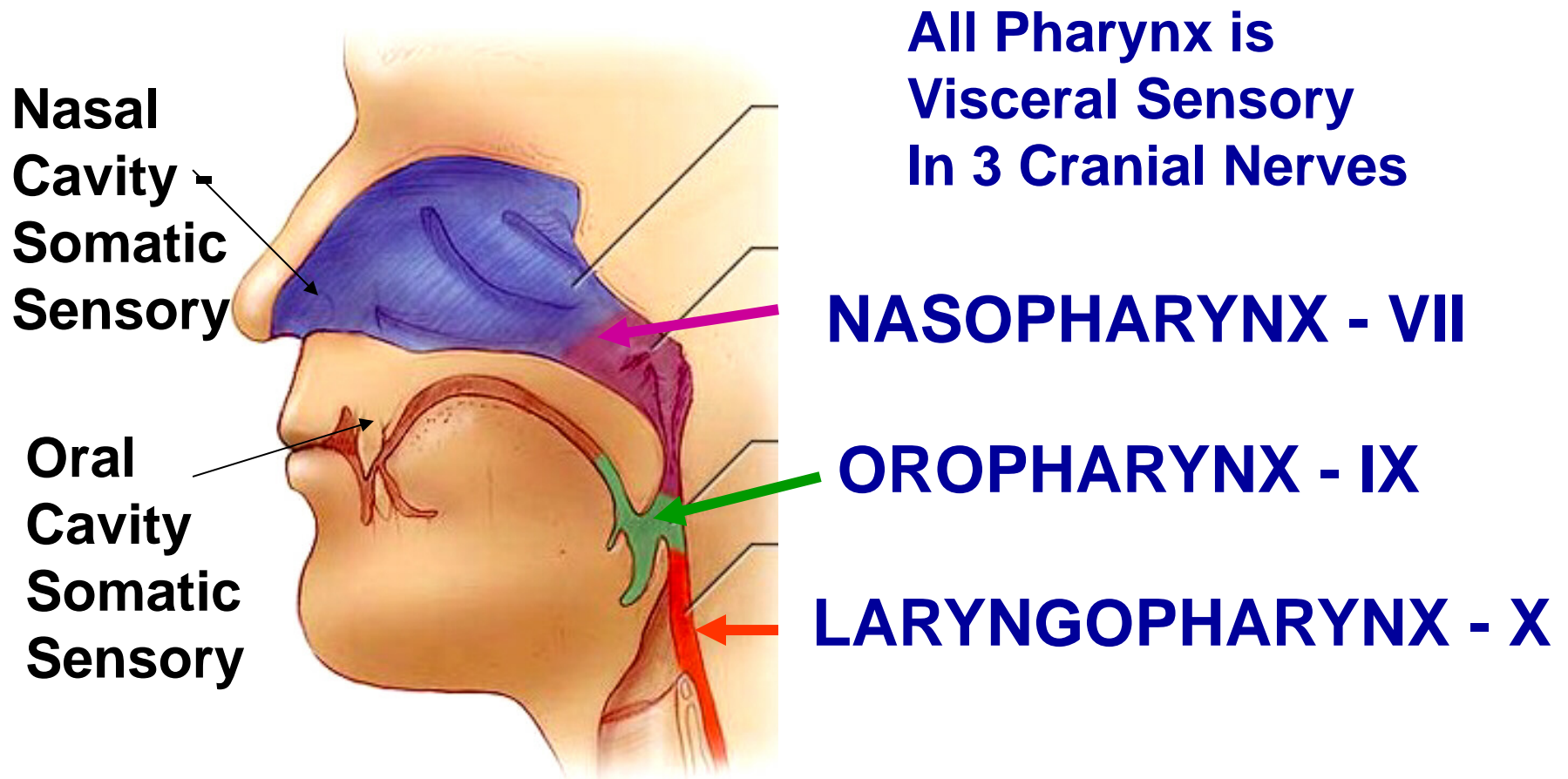


# PARASYMPATHETICS - IN CRANIAL NERVES



# VISCERAL SENSORY

Sensory to Pharynx and derivatives

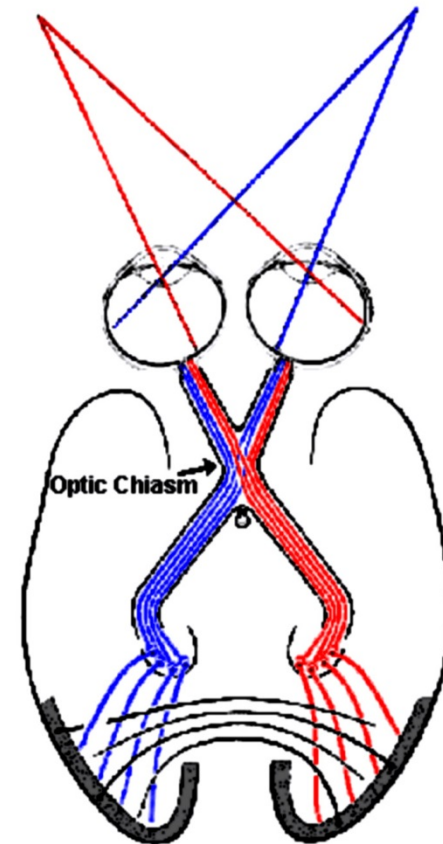
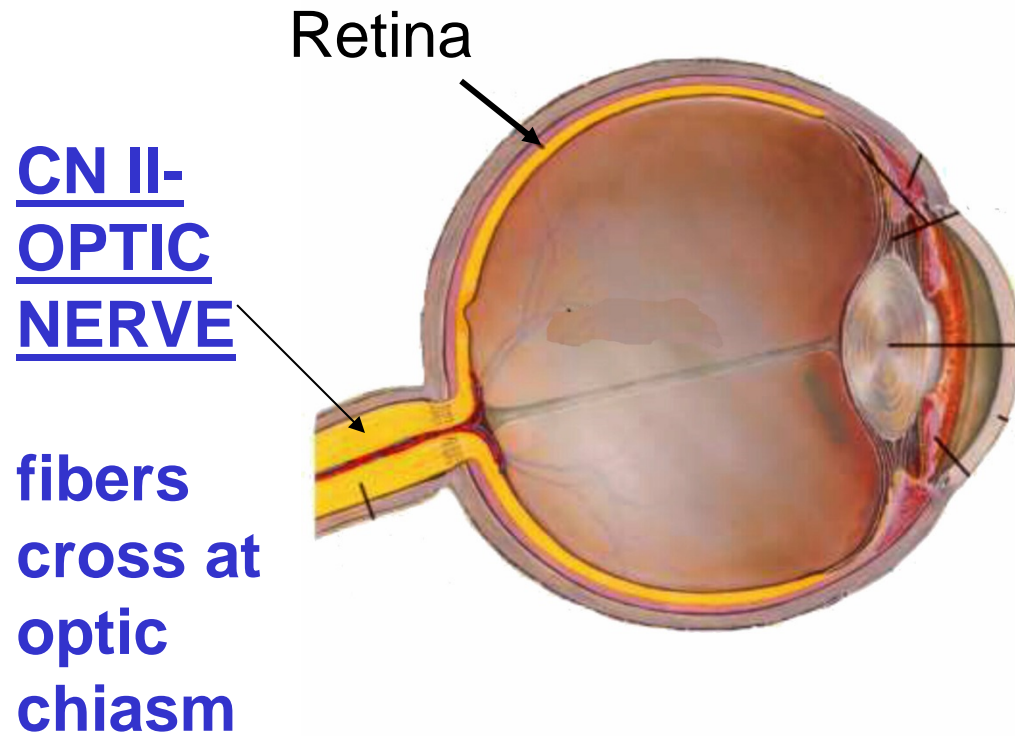


**PHARYNX IS UPPER PART OF GI TRACT = VISCERAL**

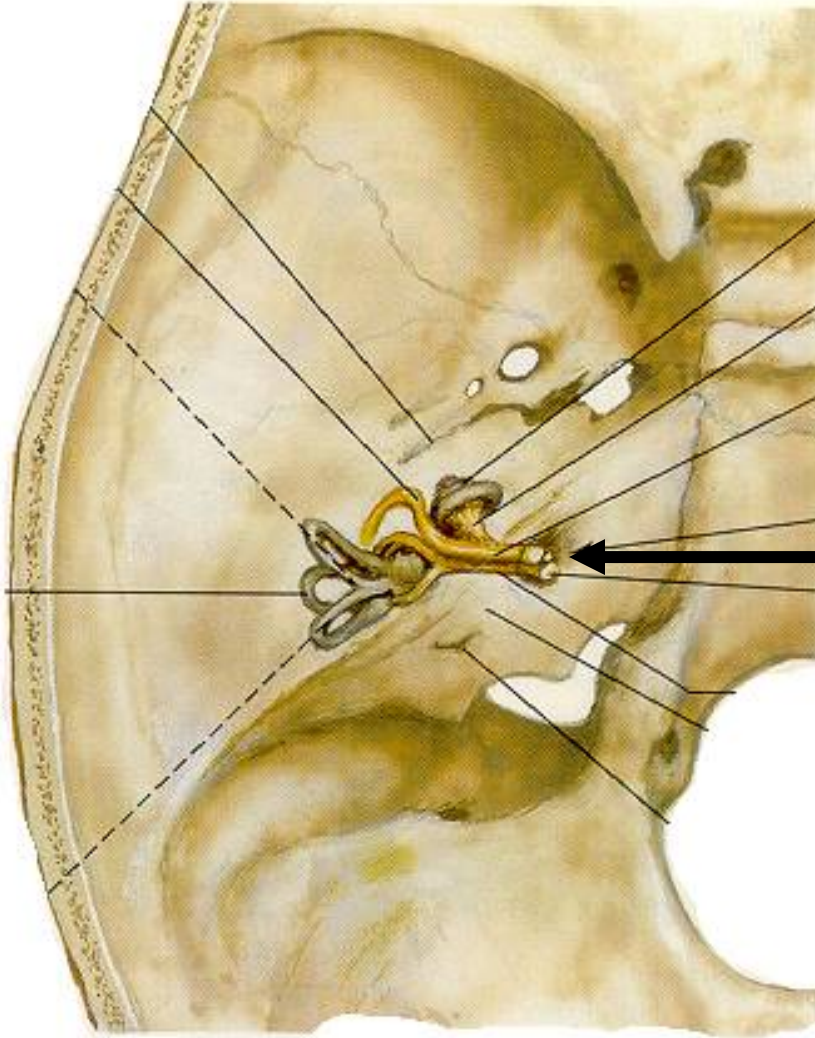
**Note: Authors disagree on innervation of nasopharynx**

# SPECIAL SENSES

Special senses only found in head - vision II,  
hearing and balance VIII



# SPECIAL SENSES



## VIII - VESTIBULO- COCHLEAR

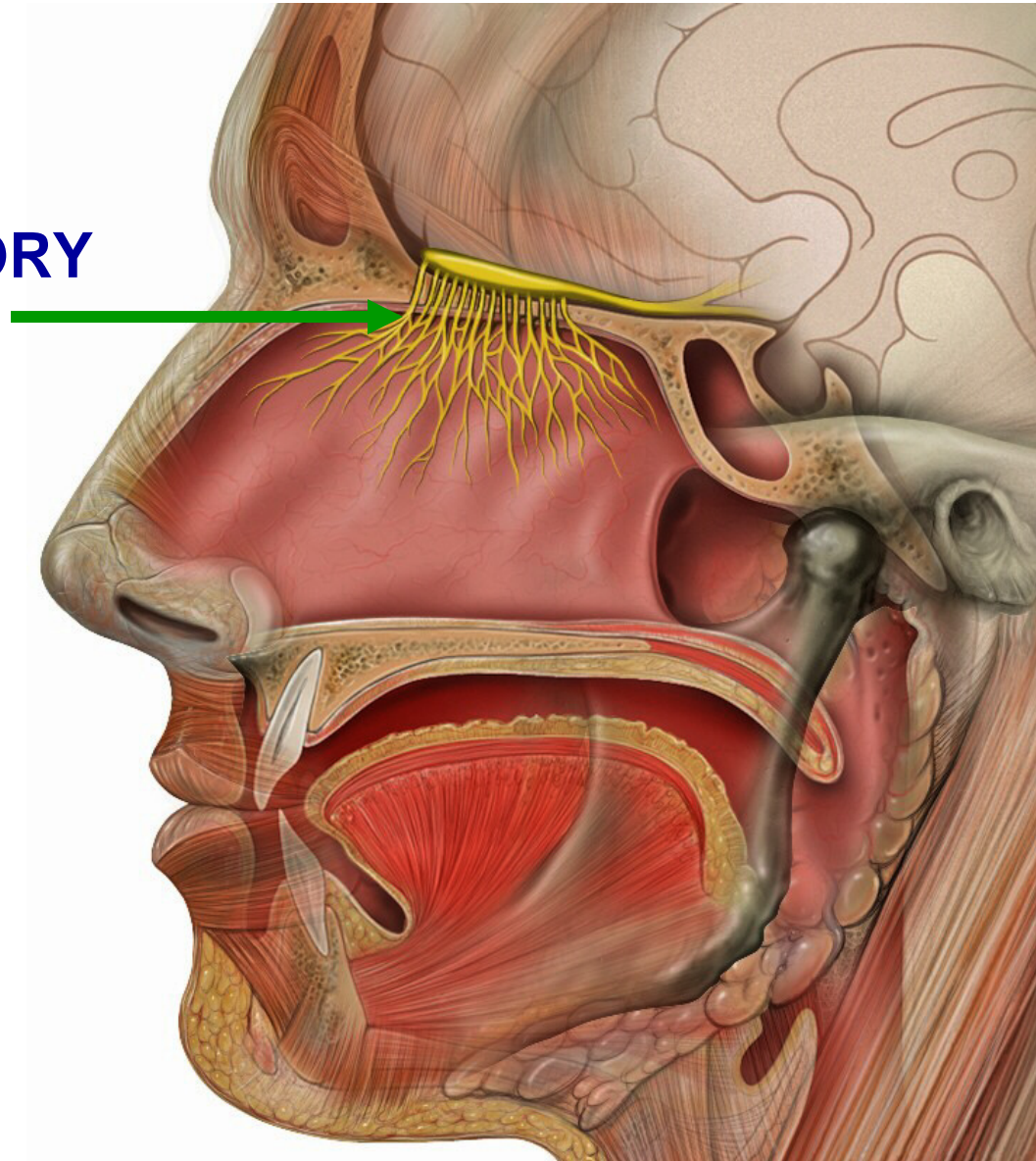
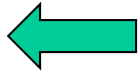
to 1) cochlea - hearing  
2) semicircular canals -  
(vestibular apparatus) -  
balance

in petrous part of  
temporal bone



# CHEMICAL SENSES - TASTE AND SMELL

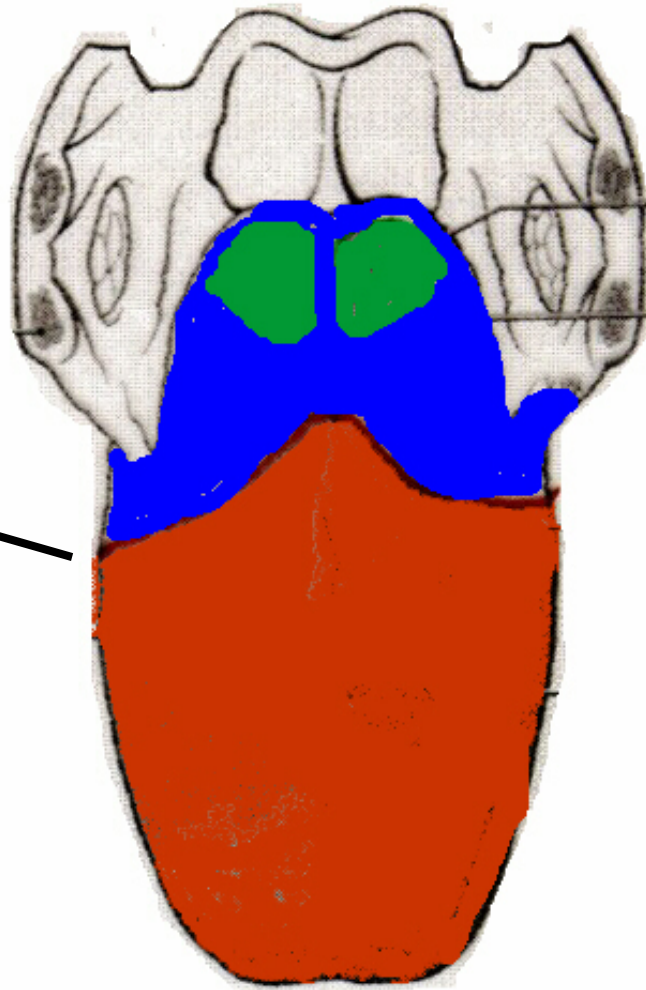
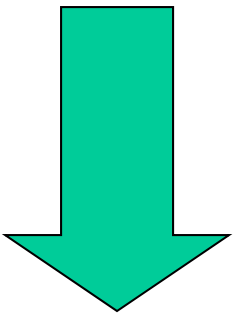
**I - OLFACTORY  
NERVE -  
SMELL**



# CHEMICAL SENSES - TASTE - in three cranial nerves



**TONGUE**



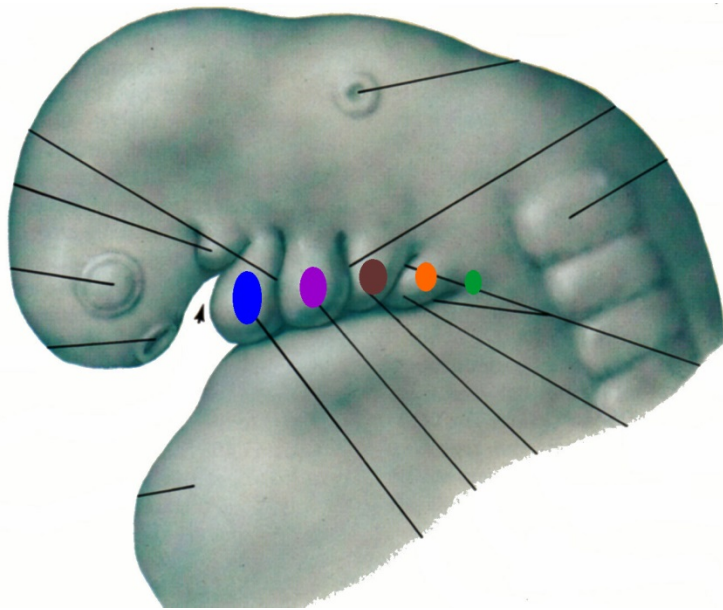
**X - VAGUS -  
ant. to epiglottis**

**IX - GLOSSO-  
PHARYNGEAL  
post. 1/3 of tongue**

**VII - FACIAL -  
ant. 2/3 of tongue**

# BRANCHIOMOTOR

- motor to voluntary skeletal muscles derived from branchial arches
- 'visceral' because develop in pharynx then migrate



**First -  
Trigeminal  
V**

**Second -  
Facial  
VII**

**Third  
Glosso-  
pharyngeal  
IX**

**Fourth  
Vagus  
X**

**Sixth  
Accessory  
XI**

**10) BRANCHIOMOTOR** - voluntary motor to skeletal muscles of face, ear, pharynx and neck that are derived from branchial arches.

Nerve

Innervates

V (Trigeminal)  
(all in V3)

muscles of mastication  
mylohyoid  
tensor tympani  
tensor palati  
anterior belly of digastric

VII (Facial)

muscles of facial expression  
stylohyoid  
posterior belly of digastric  
stapedius

IX (Glossopharyngeal)

stylopharyngeus

X (Vagus)

all muscles of pharynx (except stylopharyngeus)  
muscles of larynx  
all muscles of palate (except tensor palati)

XI (Accessory)

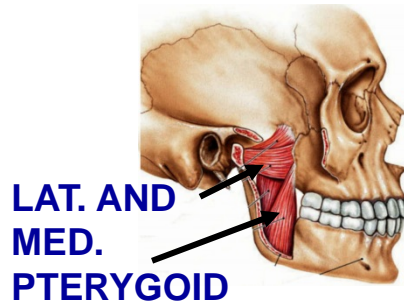
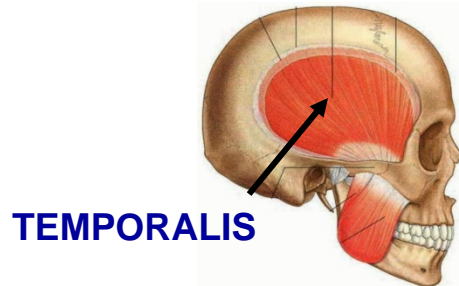
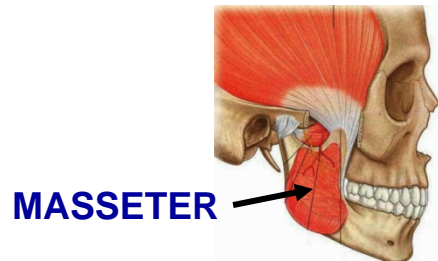
sternocleidomastoid  
trapezius

**KNOW THIS FOR EXAMS (ALSO STEP 1)**



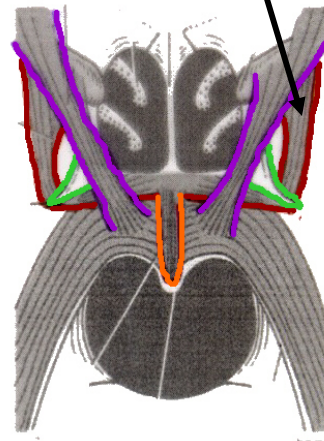
# V - TRIGEMINAL - BRANCHIOMOTOR

## MUSCLES OF MASTICATION

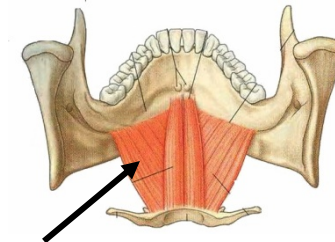
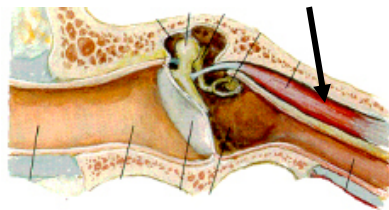


**ACTIONS - MOST CLOSE MOUTH -  
MASSETER, TEMPORALIS, MED. PTERYGOID  
OPEN MOUTH - LAT. PTERYGOID**

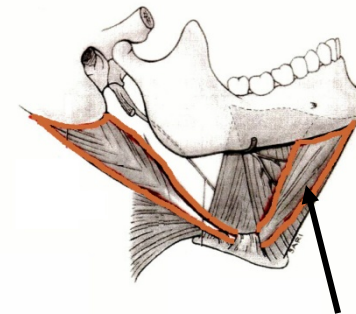
**TENSOR PALATI -  
tenses palate in  
swallowing**



**TENSOR TYMPANI -  
dampen sound**



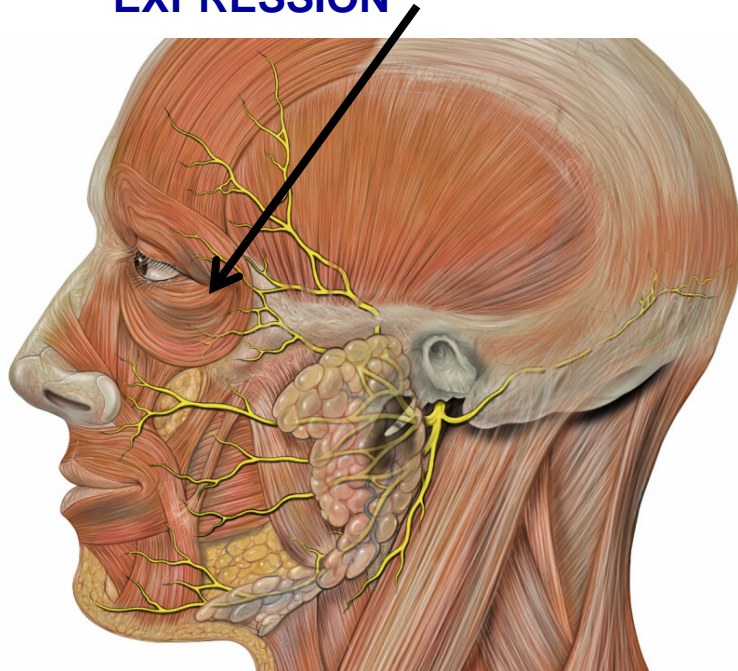
**MYLOHYOID -  
raise floor of  
mouth in  
swallowing**



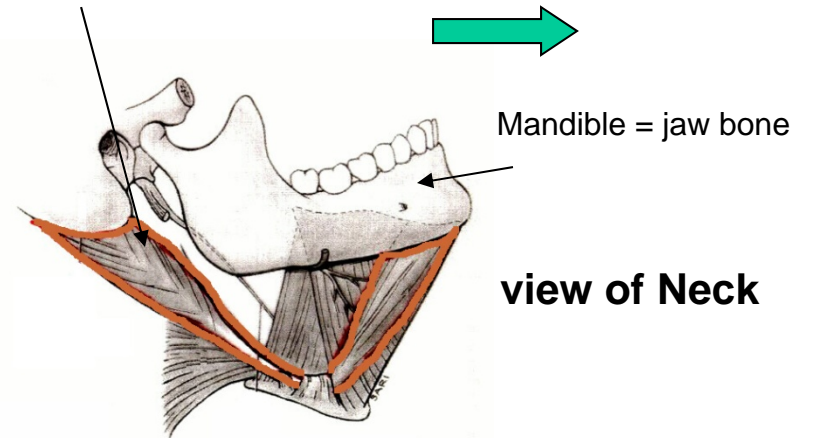
**ANT. BELLY OF  
DIGASTRIC -  
opens mouth**

# VII BRANCHIOMOTOR

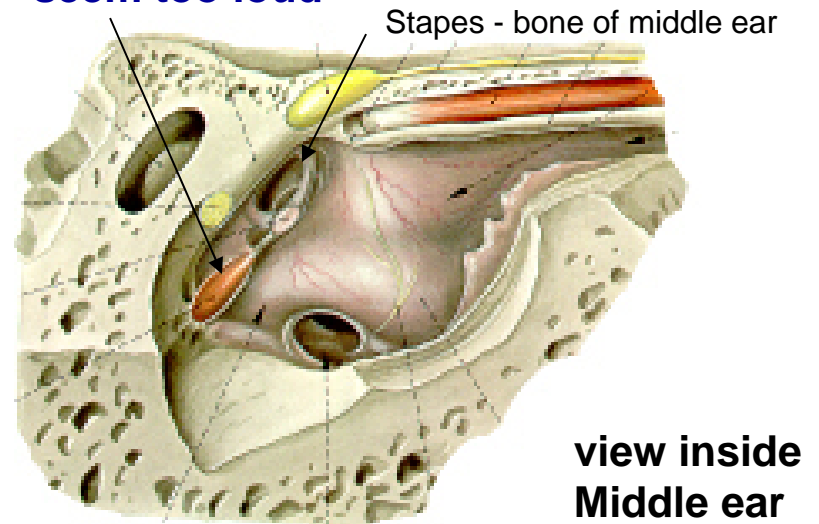
## MUSCLES OF FACIAL EXPRESSION



## STYLOHYOID, POST. BELLY DIGASTRIC



## STAPEDIUS - dampens sound - DAMAGE HYPERCOUSIA - sounds seem too loud

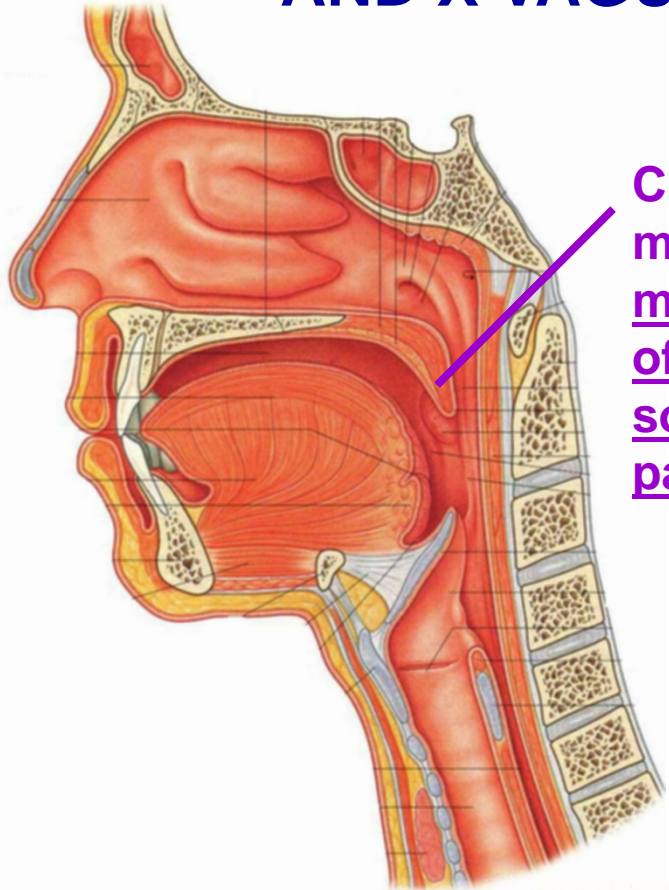


## FACIAL PARALYSIS

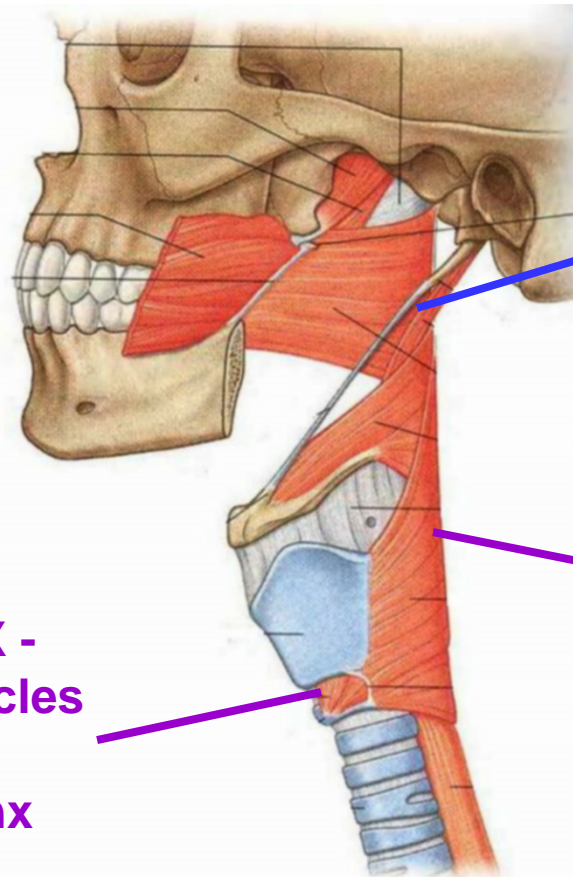
sagging face  
loss of naso-  
labial fold  
inability to close eye



# BRANCHIOMOTOR - IX GLOSSOPHARYNGEAL AND X VAGUS



CN X -  
most  
muscles  
of  
soft  
palate



CN IX -  
stylo-  
pharyngeus

CN X -  
muscles  
of  
pharynx

CN X -  
muscles  
of  
larynx



soft palate

**TEST BY HAVING PATIENT  
SAY AAHH!**

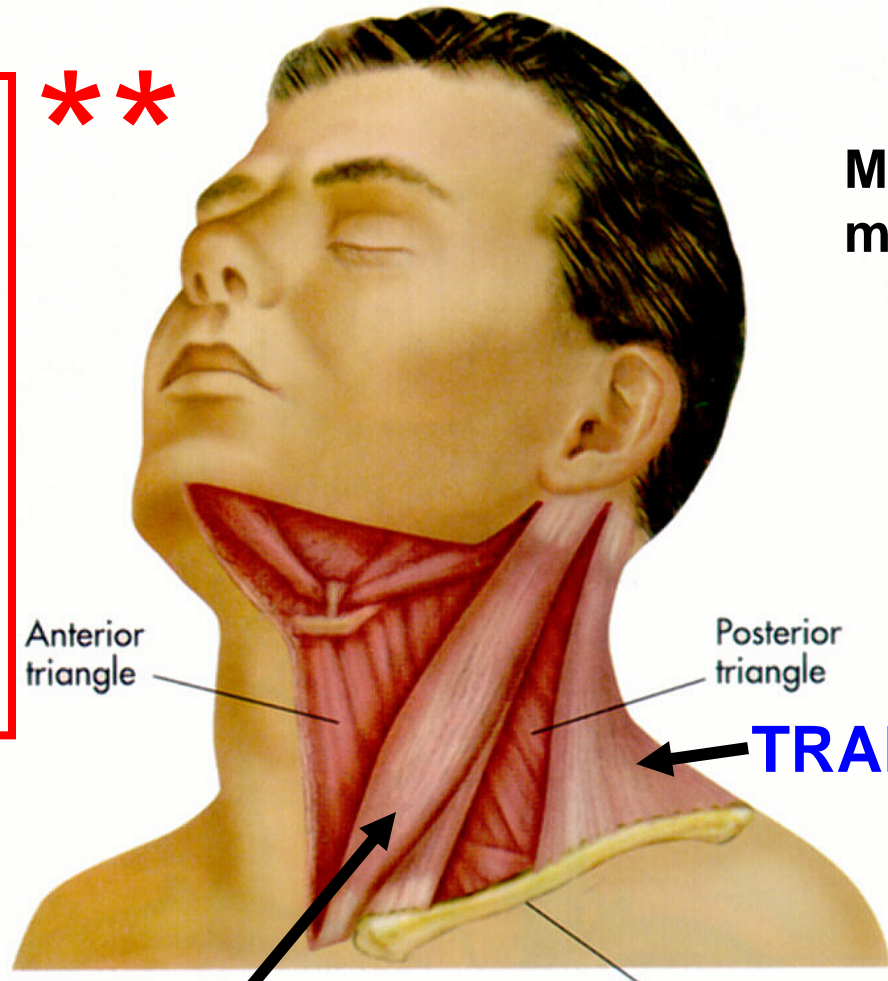


# XI - ACCESSORY NERVE - BRANCHIOMOTOR

**Clinical Test  
for  
XI (Accessory  
N.) -**  
1) Shrug  
shoulders  
2) Rotate head  
against  
resistance

**\*\***

Motor to two  
muscles



Anterior  
triangle

Posterior  
triangle

**\*\***

**TRAPEZIUS**

**Shrug  
shoulders**

**STERNOCLEIDO-  
MASTOID**

Turn head



# SUMMARY TYPES OF NEURONS IN CRANIAL NERVES

| TYPES OF NEURONS  | INNERVATE   | ASSOCIATED CRANIAL NERVES   | CLINICAL  |
|---|---|---|---|
| SOMATIC MOTOR (GSE)                                       | Motor to voluntary skeletal muscles (derived from somites)  | CN III, IV, VI - 1) Extraocular muscles (pre-otic somites)<br>CN XII - muscles of tongue (occipital somites)  | see ORBIT, TONGUE lectures  |
| SOMATIC SENSORY (GSA)                                     | <u>Precise sensation</u><br>Sensory to skin, joints (oral cavity, nasal cavity)   | CN V - mostly<br>V1 - Ophthalmic (above angle of eye)<br>V2 - Maxillary (angle of eye to angle of mouth)<br>V3 - Mandibular (below angle of mouth)<br><br>also Skin of External (Outer) Ear - V, VII, IX, X   | 1) Trigeminal Neuralgia - pain in region of affected division<br>2) Bell's palsy (VII)- pain in outer ear |
| VISCERAL MOTOR (GVE) (Parasympathetics in Cranial Nerves) | Smooth muscles, Glands, etc. (ganglia close to target organ)  | III - Ciliary ganglion - Pupillary constrictor, Ciliary muscle<br>VII - Pterygopalatine ganglion - Lacrimal gland, mucous glands of nose and palate<br>VII - Submandibular ganglion - Submandibular, Sublingual salivary glands<br>IX - Otic ganglion - Parotid | see Associated lectures (Orbit; Nasal, Oral Cavities; Ear)  |
| VISCERAL SENSORY (GVA)                                    | <u>Imprecise sensation:</u><br>Innervation of Gut, Blood Vessels, etc.<br>Specific for Innervation of Pharynx, Middle Ear | Pharynx<br>VII - Nasopharynx<br>IX - Oropharynx<br>X - Laryngopharynx<br>also Middle Ear - IX   | Imprecise localization in Choking on food; Middle ear infections  |
| SPECIAL SENSES (SSA)                                      | Vision, Audition, Balance   | II - Vision<br>VIII - Audition (hearing), Balance (vestibular apparatus)  | many; see associated lectures   |
| CHEMICAL SENSE (SVA)                                      | Taste, Smell  | Taste is distributed:<br>VII - anterior 2/3 of tongue<br>IX - posterior 1/3 of tongue<br>X - taste buds anterior to epiglottis<br>Smell - I - olfaction   | Damage produces loss of taste in region of innervation  |
| BRANCHIO-MOTOR (SVE)                                      | Voluntary skeletal muscles derived from Branchial Arches  | V - muscles of First Branchial Arch<br>VII - muscles of Second Branchial Arch<br>IX - muscles of Third Branchial Arch<br>X - muscles of Fourth and Sixth Branchial Arches<br>XI - muscles of caudal Sixth Branchial arch (disagreement among authors)           | see Branchial arch chart (above); also Branchial Arch Lecture, etc.<br><b>INCANTATION)</b>                |

**VII. SUMMARY OF TYPES OF NEURONS IN CRANIAL NERVES (parenthesis - OLD 3 Letter system)**

| Nerve | SOMATIC MOTOR (GSE) | BRANCHIO-MOTOR (SVE) | VISCERAL MOTOR (GVE) | SOMATIC SENSORY (GSA) | VISCERAL SENSORY (GVA) | CHEMICAL SENSE (SVA) | SPECIAL SENSES (SSA) |
|-------|---------------------|----------------------|----------------------|-----------------------|------------------------|----------------------|----------------------|
| III.  | +                   |                      | +                    |                       |                        |                      |                      |
| IV.   | +                   |                      |                      |                       |                        |                      |                      |
| VI.   | +                   |                      |                      |                       |                        |                      |                      |
| XII.  | +                   |                      |                      |                       |                        |                      |                      |
| V.    |                     | +                    |                      | +                     |                        |                      |                      |
| VII.  |                     | +                    | +                    | +                     | +                      | +                    |                      |
| IX.   |                     | +                    | +                    | +                     | +                      | +                    |                      |
| X.    |                     | +                    | +                    | +                     | +                      | +                    |                      |
| XI.   |                     | +                    |                      |                       |                        |                      |                      |
| I.    |                     |                      |                      |                       |                        | +                    |                      |
| II.   |                     |                      |                      |                       |                        |                      | +                    |
| VIII. |                     |                      |                      |                       |                        |                      | +                    |

## 2) CLASSIFICATION OF INNERVATION - 7 types of neurons - some are the same as found in spinal nerves; others are only found in cranial nerves

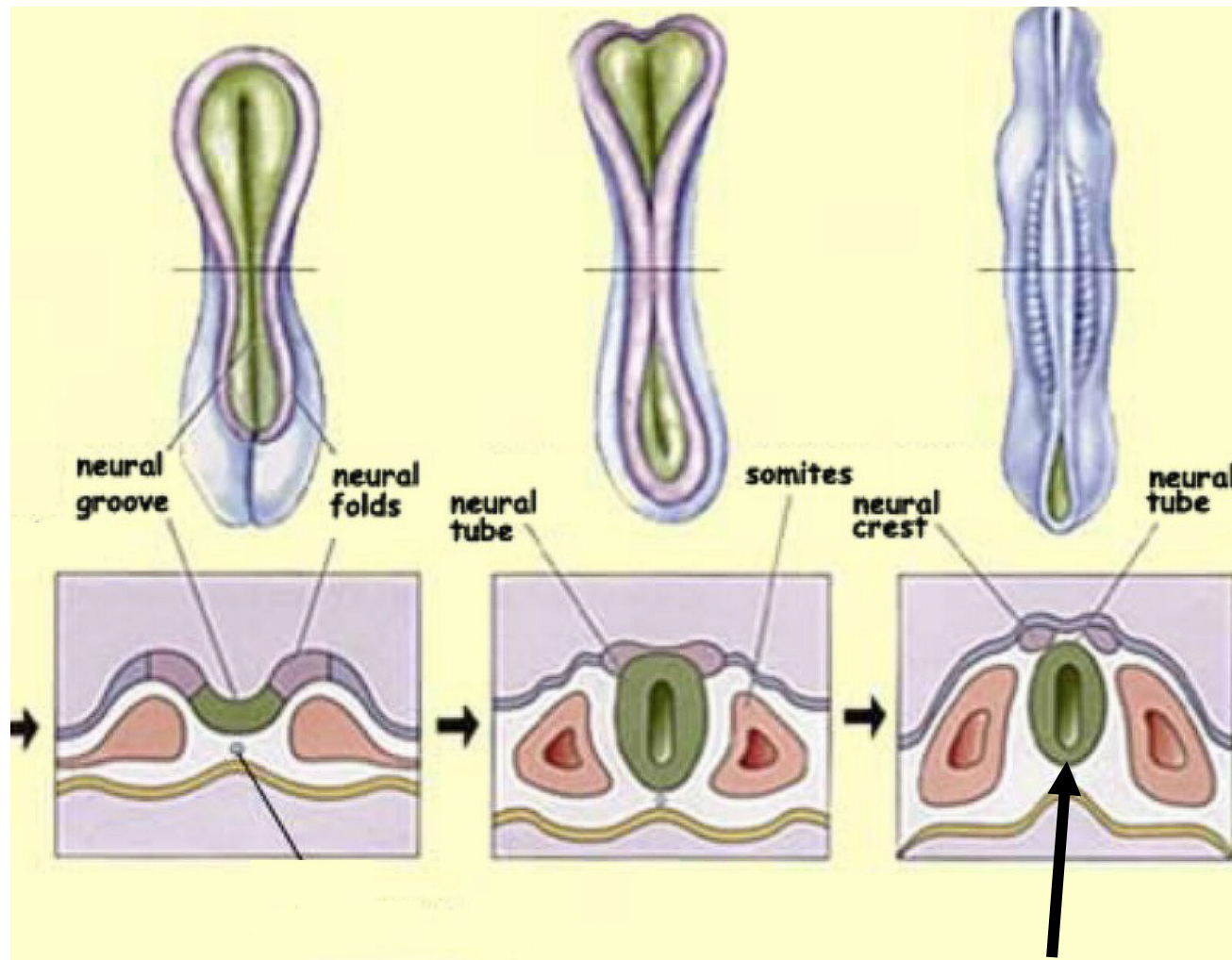
### A. Same as spinal nerves

1. **Somatic motor** - Voluntary skeletal muscles (from somites)
2. **Somatic sensory** - Precise sensation - sensory to skin, joints, muscle and tendon receptor endings, nasal and oral cavity
3. **Visceral motor** (efferents) - smooth, muscle glands; smooth muscles of skin (arrector pilae muscles) and blood vessels, secretomotor to glands
4. **Visceral sensory** - Imprecise sensation sensory to gut, blood vessels, glands and internal; in head: pharynx (rostral end of gut)

### B. Only in cranial nerves

5. **Special senses** - vision, hearing (auditory) and balance (vestibular apparatus)
6. **Chemical senses** - taste and smell
7. **Branchiomotor** - Voluntary skeletal muscles from branchial arches.

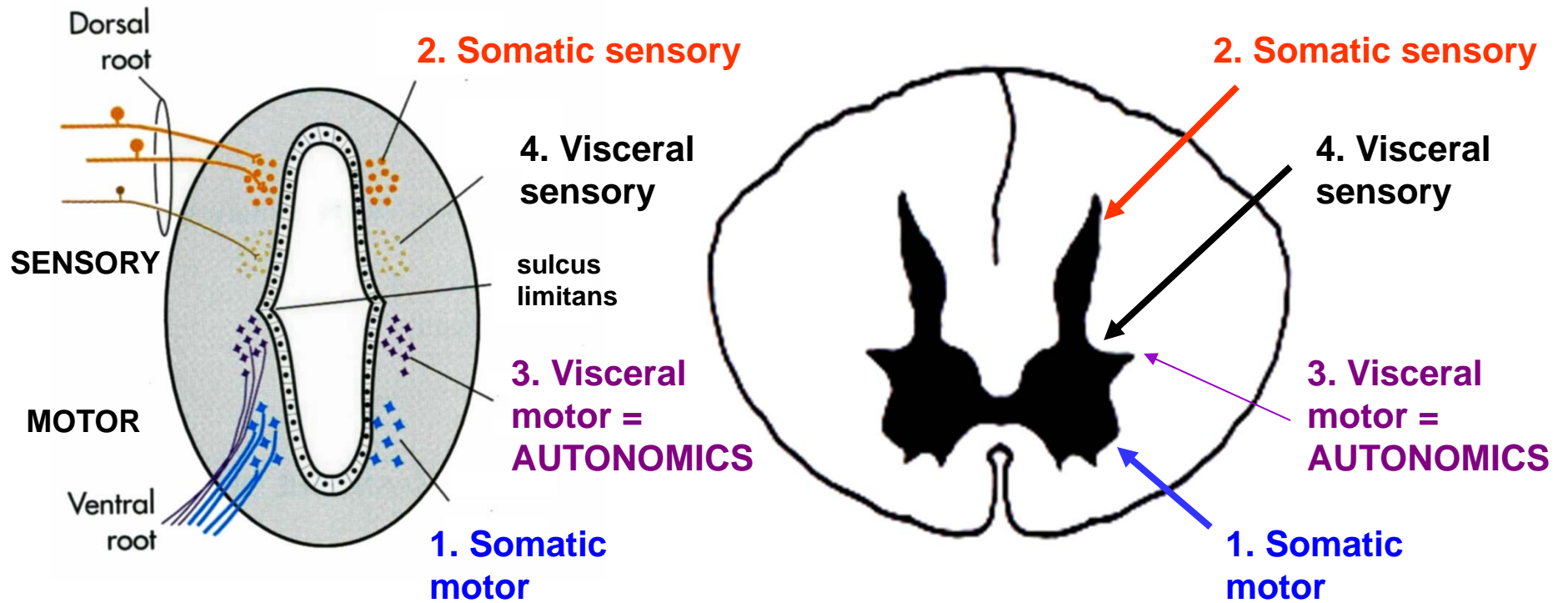
# WHY DO YOU NEED TO KNOW THIS? CLASSIFICATION IS REFLECTED IN CENTRAL NERVOUS SYSTEM



Nervous system forms as a Neural Tube



# WHY DO YOU NEED TO KNOW THIS? CLASSIFICATION IS REFLECTED IN CENTRAL NERVOUS SYSTEM



Nervous system forms as a Neural Tube; cells form groups (columns); sensory dorsal, motor ventral; different types of neurons form columns that develop to adult locations



# CRANIAL NERVE: CAPSULE SUMMARY

- I. Olfactory - smell
- II. Optic - vision
- III. Oculomotor - eye movements; also parasympathetics to eye smooth muscles
- IV. Trochlear - eye movements
- V. Trigeminal - sensory nerve to skin, also pain, temperature touch to oral and nasal cavities, (outer ear)
- VI. Abducens - eye movements
- VII. Facial - muscles of facial expression; also taste, parasympathetics
- VIII. Vestibulo-cochlear (Stato-acoustic) - hearing and balance
- IX. Glossopharyngeal - sensory to pharynx, back of tongue (Gag reflex)
- X. Vagus - motor to pharynx (most), larynx (voice box); soft palate; parasympathetics to thorax, abdomen
- XI. Accessory (Spinal Accessory) - motor to sternocleidomastoid, trapezius
- XII. Hypoglossal - motor to muscles of tongue

# APPENDIX: OLDER SYSTEM: CLASSIFICATION OF INNERVATION AS FUNCTIONAL COMPONENTS

## A. First letter

**G = General = types of neurons found both in spinal nerves and cranial nerves.**

**S = Special = types of neurons only found in cranial nerves not spinal nerves.**

## B. Second letter

**S = Somatic = types of neurons innervating structures derived from somites.**

**V = Visceral = types of neurons innervating gut, structures derived from or associated with gut and branchial arches; also vascular system, smooth muscle, internal organs and glands.**

## C. Third letter

**A = Afferent = sensory neurons.**

**E = Efferent = motor neurons to skeletal and smooth muscle; also secretomotor neurons to glands.**



# **CLASSIFICATION OF INNERVATION AS FUNCTIONAL COMPONENTS**

## **II. TRANSLATING TYPES OF NEURONS TO FUNCTIONAL COMPONENTS (ALPHABET SOUP)**

**Like spinal nerves -**

- 1. SOMATIC MOTOR = GSE - General Somatic Efferent**
- 2. SOMATIC SENSORY = GSA - General Somatic Afferent**
- 3. VISCERAL MOTOR = GVE - General Visceral Efferent**
- 4. VISCERAL SENSORY = GVA - General Visceral Afferent**

**Only in cranial nerves -**

- 5. SPECIAL SENSES = SSA - Special Somatic Afferent**
- 6. CHEMICAL SENSES = SVA - Special Visceral Afferent**
- 7. BRANCHIOMOTOR = SVE - Special Visceral Efferent**

**Table 9.1. Functional Components of the Cranial Nerves**

| No.  | Name              | SSA | GSA | GVA | SVA | GSE | SVE | GVE |
|------|-------------------|-----|-----|-----|-----|-----|-----|-----|
| I    | Olfactory         |     |     |     | •   |     |     |     |
| II   | Optic             | •   |     |     |     |     |     |     |
| III  | Oculomotor        |     |     |     |     | •   |     | •   |
| IV   | Trochlear         |     |     |     |     | •   |     |     |
| V    | Trigeminal        |     | •   |     |     |     | •   |     |
| VI   | Abducent          |     |     |     |     | •   |     |     |
| VII  | Facial            |     | •   | •   | •   |     | •   | •   |
| VIII | Vestibulocochlear | •   |     |     |     |     |     |     |
| IX   | Glossopharyngeal  |     | •   | •   | •   |     | •   | •   |
| X    | Vagus             |     | •   | •   | •   |     | •   | •   |
| XI   | Accessory         |     |     |     |     |     | •   |     |
| XII  | Hypoglossal       |     |     |     |     | •   |     |     |

# CAPSULE SUMMARY OF CRANIAL NERVES: **TYPES** **OF NEURONS**

**GSE = SOMATIC MOTOR** - voluntary skeletal muscle from somites; two groups: eye (III, IV and VI) and tongue (XII)

**GSA = SOMATIC SENSORY** precise sensory – touch, pain etc. – skin, also nasal cavity and oral cavity; also joint position, muscles; almost all V; also Bell's palsy ear ache – VII, IX, and X to skin of outer ear

**GVE = VISCERAL MOTOR** autonomics - parasympathetics – see chart – III, VII, IX, X

(note: sympathetics to head – out T1, T2; up chain; synapse Sup. Cerv. Ganglion; post-ganglionics with arteries, unnamed branches)

**GVA = VISCERAL SENSORY** - imprecise sensory (blood vessels, etc); also pharynx is VII, IX, X (popcorn); also middle ear (IX)

**SSA = SPECIAL SENSES** - means special senses vision (II) and hearing and balance (VIII)

**SVA = CHEMICAL SENSES** - means smell (I) and taste (VII, IX, X)

**SVE = BRANCHIOMOTOR** - voluntary skeletal muscle from branchial arches – V, VII, IX, X, XI – memorize incantation