

PSYC301: Neurological examination

Jay Hosking, PhD



Overview

- A. Introduction to examination and cranial nerves
- B. Neurological examination
- C. The mental status exam



Learning Objectives

1. To appreciate the goals of the neurological examination.
2. To learn the twelve cranial nerves, whether they are sensory / motor / both, and their basic functions. What would dysfunction of any of these cranial nerves look like?
3. To learn the components of the neurological exam: What is each test? What is each test assessing? And what could dysfunction look like and mean? Note: you do not need to remember each test, so much as come up with a reasonable way to test each component of each cranial nerve.
4. To appreciate the goals of the mental status exam. What does each test assess? What brain dysfunction can be inferred for each test?



What is a Neurological Examination?

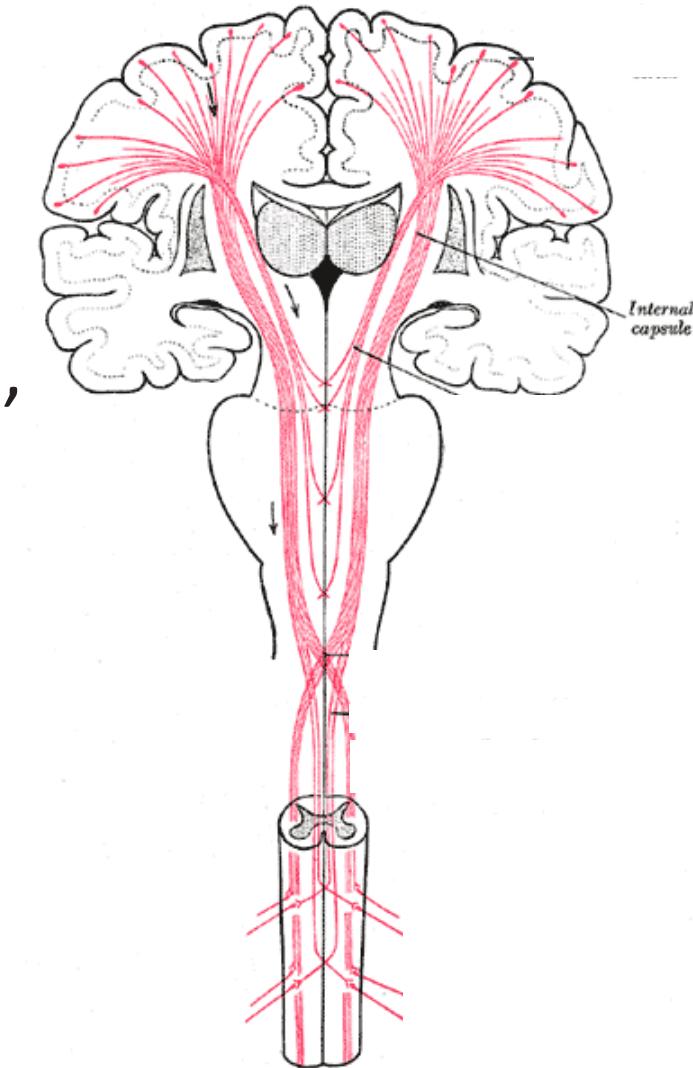
A neurological examination is a series of tests conducted by a neurologist to evaluate the integrity of the nervous system for many reasons, including (but not limited to):

- Following trauma or stroke
- When there are suspected neurodegenerative changes
- Following exposure to a neurotoxic agent



Localization?

- Cerebral Hemisphere (Telencephalon)
- Internal Capsule
- Brainstem (Diencephalon, Mesencephalon, Metencephalon, or Myelencephalon?)
- Spinal Cord
- Cranial Nerves
- Neuromuscular Junction
- Muscle



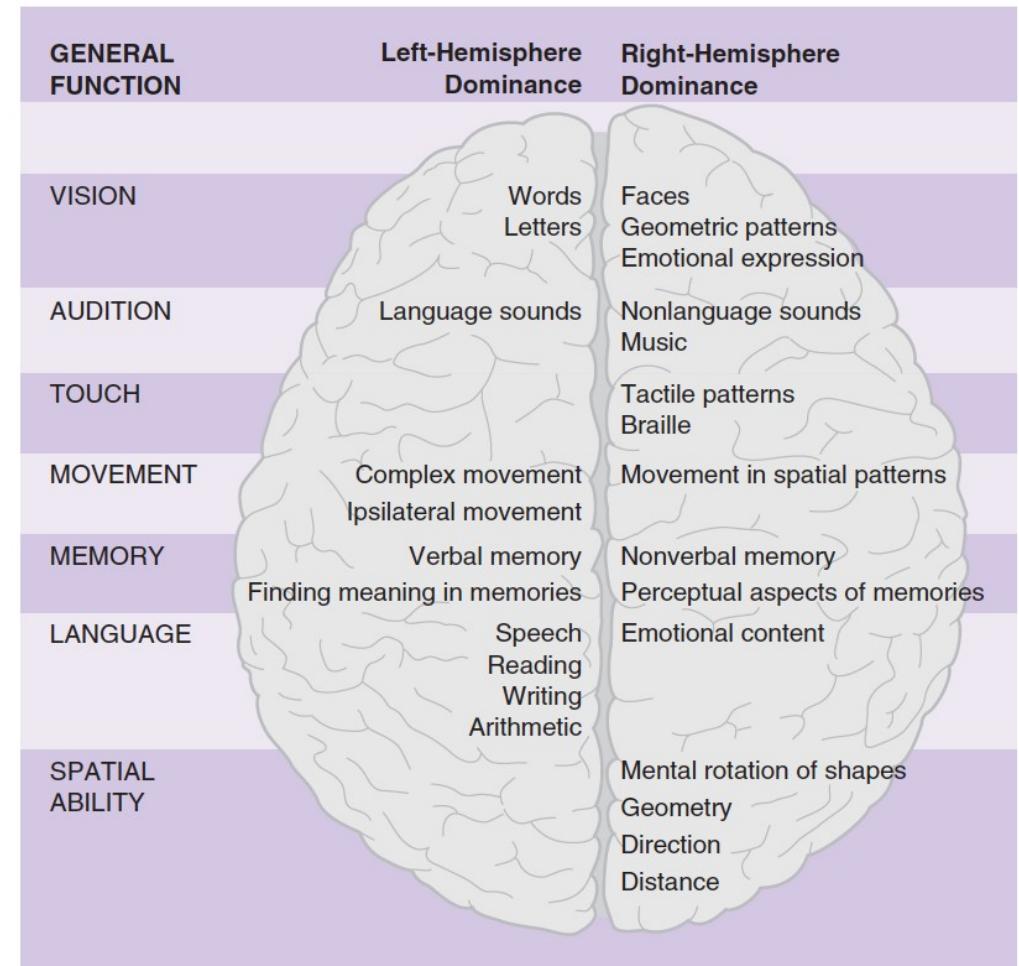
Overview of common components of exam

- Patient history
- Cranial nerve function
- Motor function (e.g., reflexes)
- Somatosensory function
- Coordination
- Mental status



Patient History

- Age, education and **handedness**



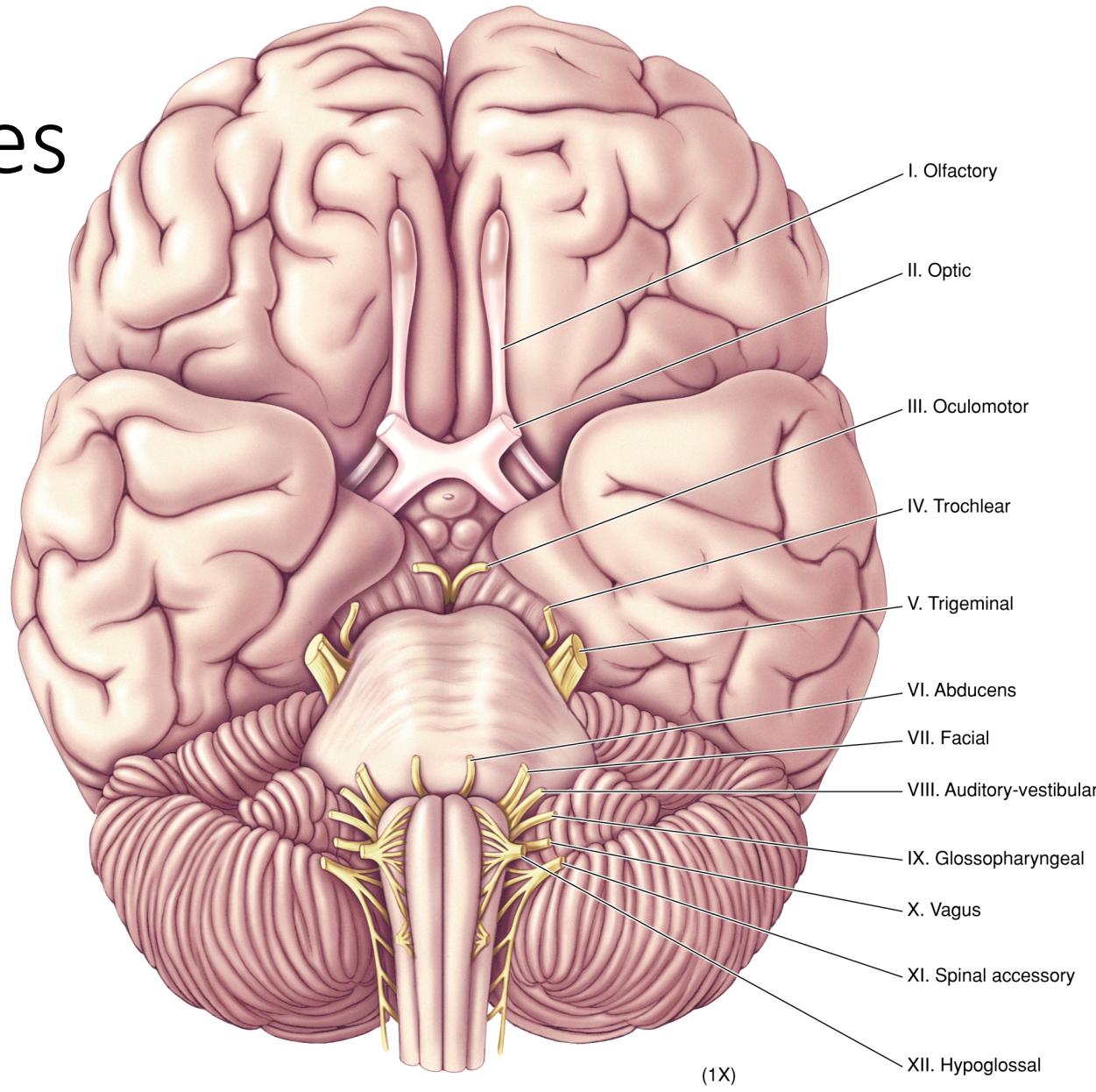
from: Pinel
(2013)

Patient History (cont'd)

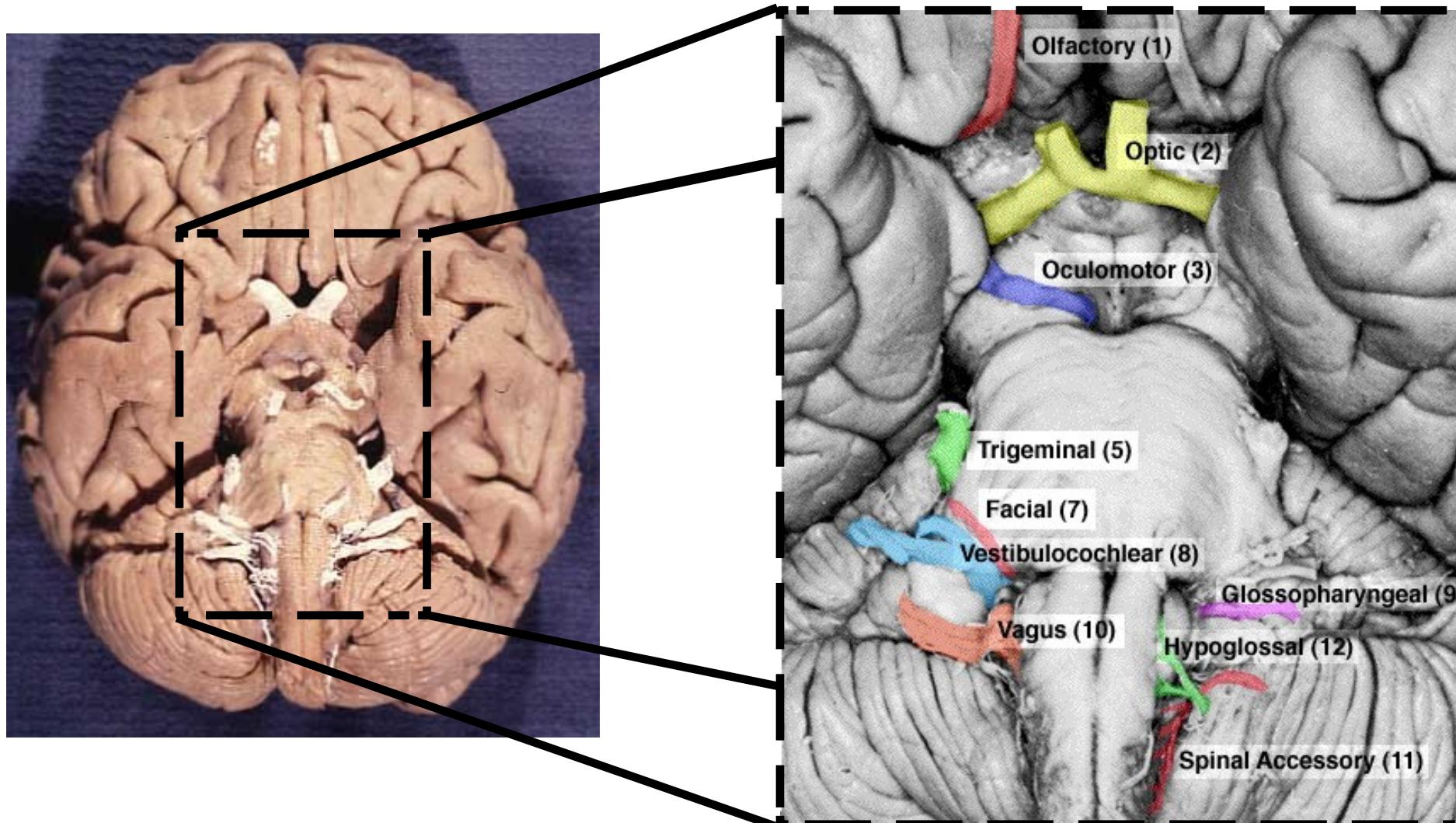
- Past medical history
- Use of medication and/or recreational drugs
- Family medical history
- Disease Process:
 - temporal profile: sudden vs. gradual; acute vs. chronic
 - change over time: static, improvement, worsening
 - identify triggers/relievers of symptoms
 - gauge severity of symptoms



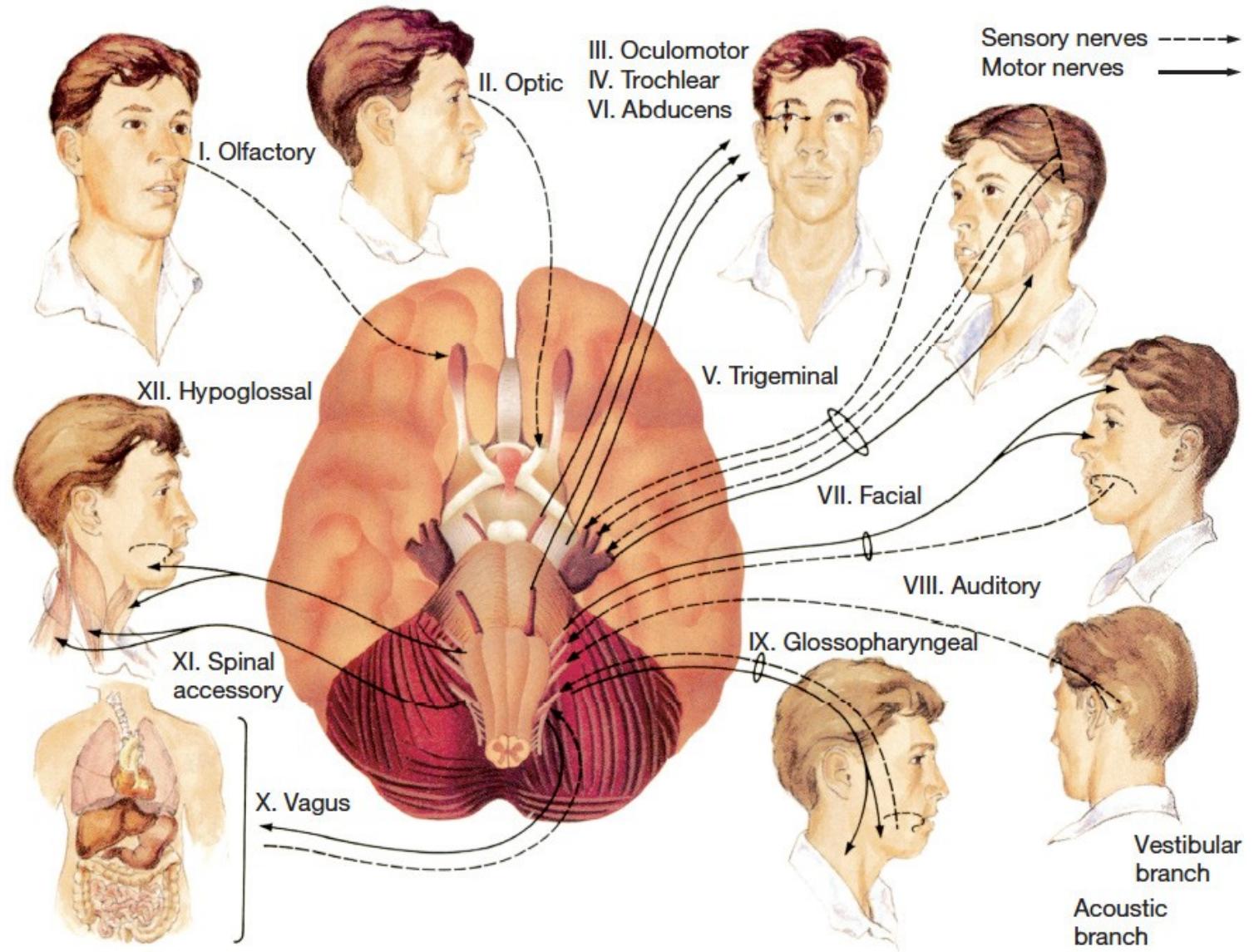
Cranial nerves



Cranial Nerves



Cranial Nerves



Cranial Nerves

I	Olfactory	Sensory	Smell
II	Optic	Sensory	Vision
III	Oculomotor	Motor	Most eye movement, eyelid movement
IV	Trochlear	Motor	Eye movement
V	Trigeminal	Both	Facial sensation, movement of biting/chewing/swallowing jaw muscles
VI	Abducens	Motor	Eye movement
VII	Facial	Both	Taste from anterior tongue, a little facial sensation, all muscles of facial expression
VIII	Vestibulocochlear	Sensory	Sound, sense of balance
IX	Glossopharyngeal	Both	Taste and sensation from posterior tongue, muscles of pharynx (speech, swallowing)
X	Vagus	Both	Outer ear canal sensation, motor control of heart, lungs, viscera, larynx (speech), more
XI	Accessory	Motor	Movement of muscles of head rotation and shoulder shrug
XII	Hypoglossal	Motor	Movement of tongue muscles (speech, swallowing)

“How am I going to remember these?”

I	Olfactory	Sensory	Smell
II	Optic	Sensory	Vision
III	Oculomotor	Motor	Most eye movement, eyelid movement
IV	Trochlear	Motor	Eye movement
V	Trigeminal	Both	Facial sensation, movement of biting/chewing/swallowing jaw muscles
VI	Abducens	Motor	Eye movement
VII	Facial	Both	Taste from anterior tongue, a little facial sensation, all muscles of facial expression
VIII	Vestibulocochlear	Sensory	Sound, sense of balance
IX	Glossopharyngeal	Both	Taste and sensation from posterior tongue, muscles of pharynx (speech, swallowing)
X	Vagus	Both	Outer ear canal sensation, motor control of heart, lungs, viscera, larynx (speech), more
XI	Accessory	Motor	Movement of muscles of head rotation and shoulder shrug
XII	Hypoglossal	Motor	Movement of tongue muscles (speech, swallowing)

“On old Olympus’ towering top a Finn and German viewed some hops”

“How am I going to remember these?”

I	Olfactory	Sensory	Smell
II	Optic	Sensory	Vision
III	Oculomotor	Motor	Most eye movement, eyelid movement
IV	Trochlear	Motor	Eye movement
V	Trigeminal	Both	Facial sensation, movement of biting/chewing/swallowing jaw muscles
VI	Abducens	Motor	Eye movement
VII	Facial	Both	Taste from anterior tongue, a little facial sensation, all muscles of facial expression
VIII	Vestibulocochlear	Sensory	Sound, sense of balance
IX	Glossopharyngeal	Both	Taste and sensation from posterior tongue, muscles of pharynx (speech, swallowing)
X	Vagus	Both	Outer ear canal sensation, motor control of heart, lungs, viscera, larynx (speech), more
XI	Accessory	Motor	Movement of muscles of head rotation and shoulder shrug
XII	Hypoglossal	Motor	Movement of tongue muscles (speech, swallowing)

“Some say money matters, but my brother says big brains matter more”

Cranial nerves

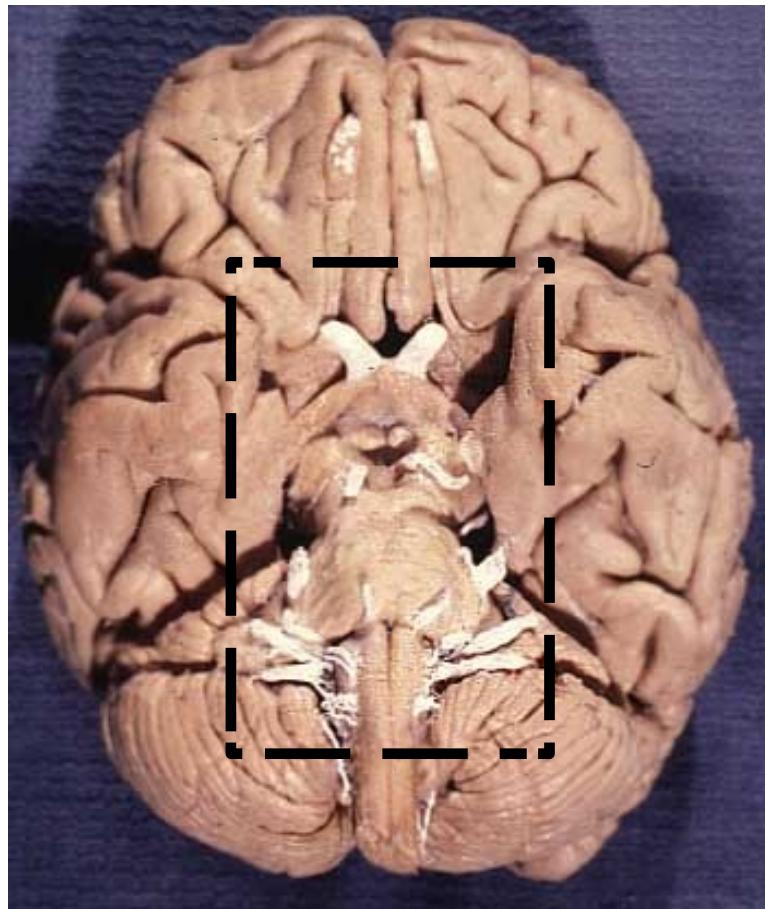


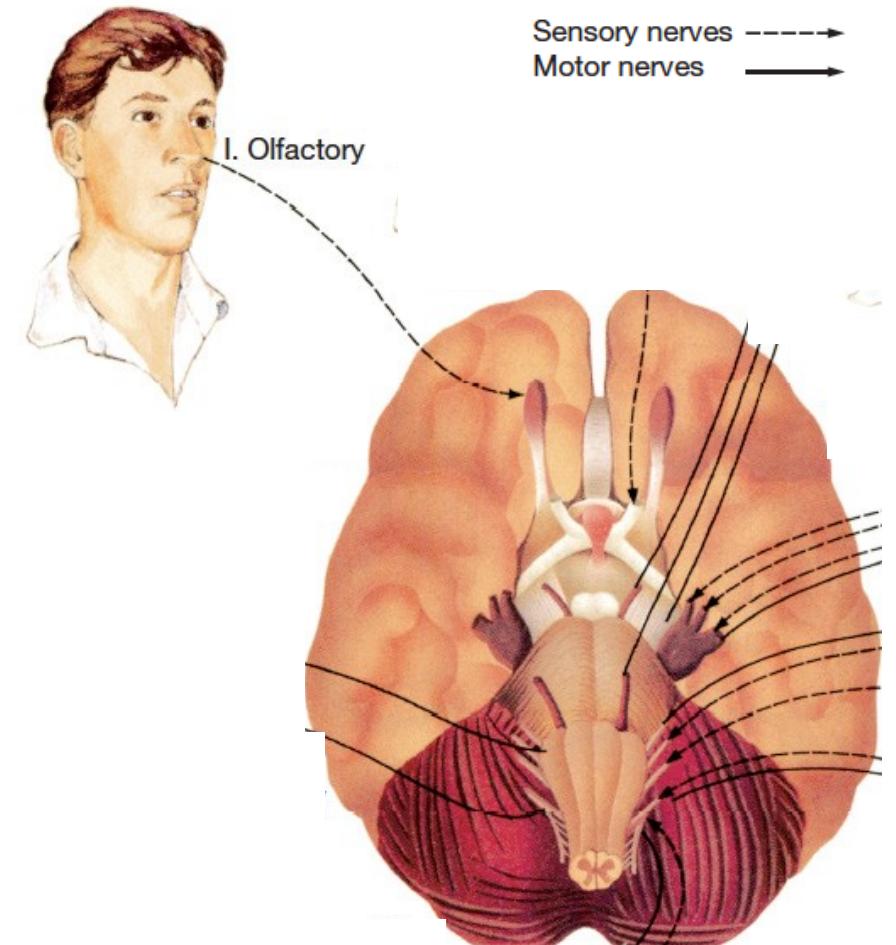
Image from: realmagick.com/cranial-nerves/

<https://www.youtube.com/watch?v=sJBpai74tIU>



Cranial Nerves I & II

I – Olfactory



from: Pinel
(2013)

Cranial Nerves I & II

I – Olfactory

- Ethmoid ridge, cribiform plate, and TBI

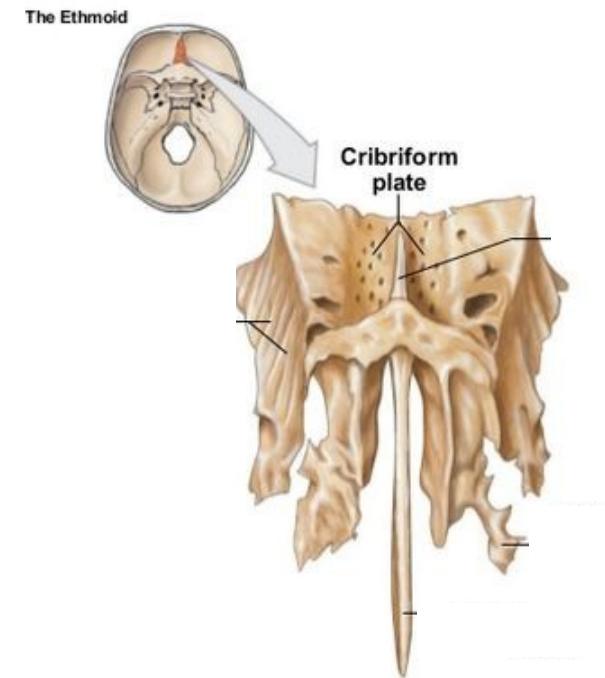


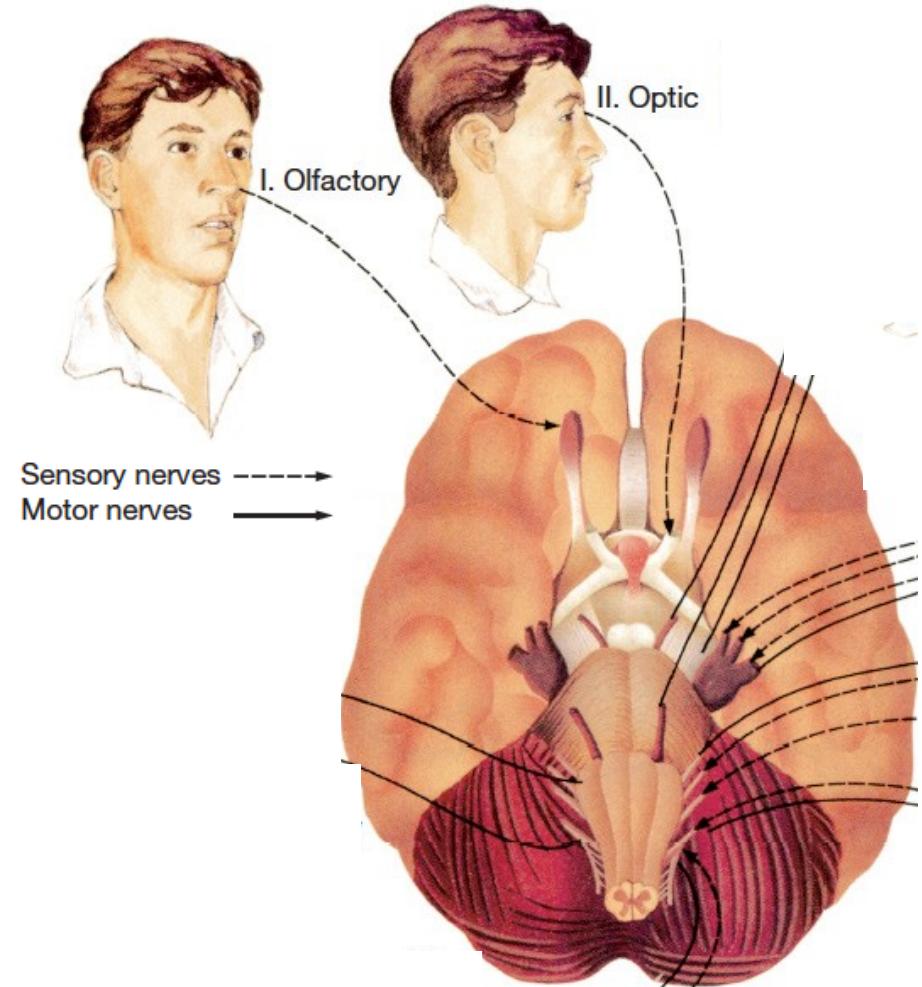
Image from: s-media-cache-ak0.pinimg.com/564x/5b/53/e8/5b53e80ccdd39d550c- 993496cf009633.jpg

Cranial Nerves I & II

I – Olfactory

- Ethmoid ridge and TBI

II – Optic



from: Pinel (2013)

Cranial Nerves I & II

I – Olfactory

- Ethmoid ridge and TBI

II – Optic

- Standard visual acuity tests for each eye

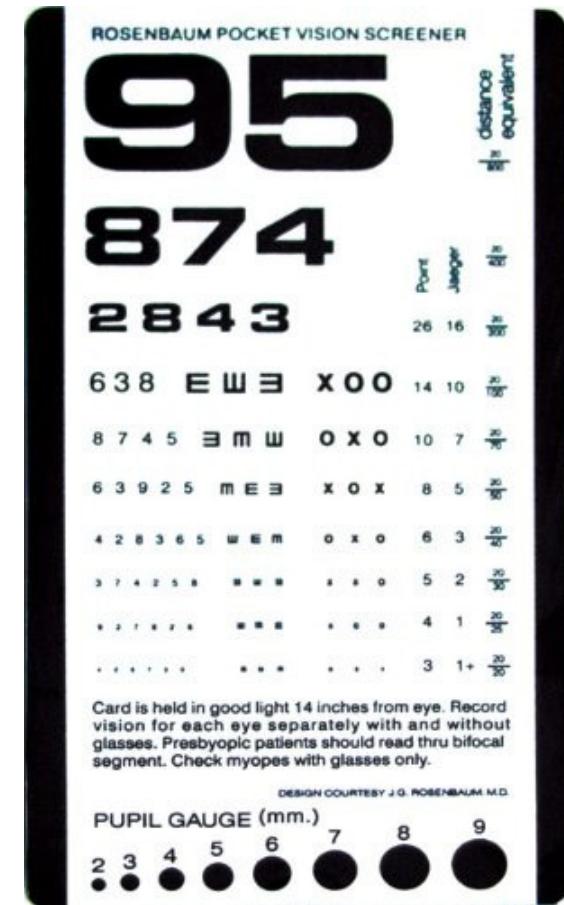


Image from: images-na.ssl-images-amazon.com/images/I/51KtFYWzQiL.jpg

Cranial Nerves I & II

I – Olfactory

- Ethmoid ridge and TBI

II – Optic

- Standard visual acuity tests for each eye
- Visual field confrontation

Normal Fundus

Optic Disc

Macula

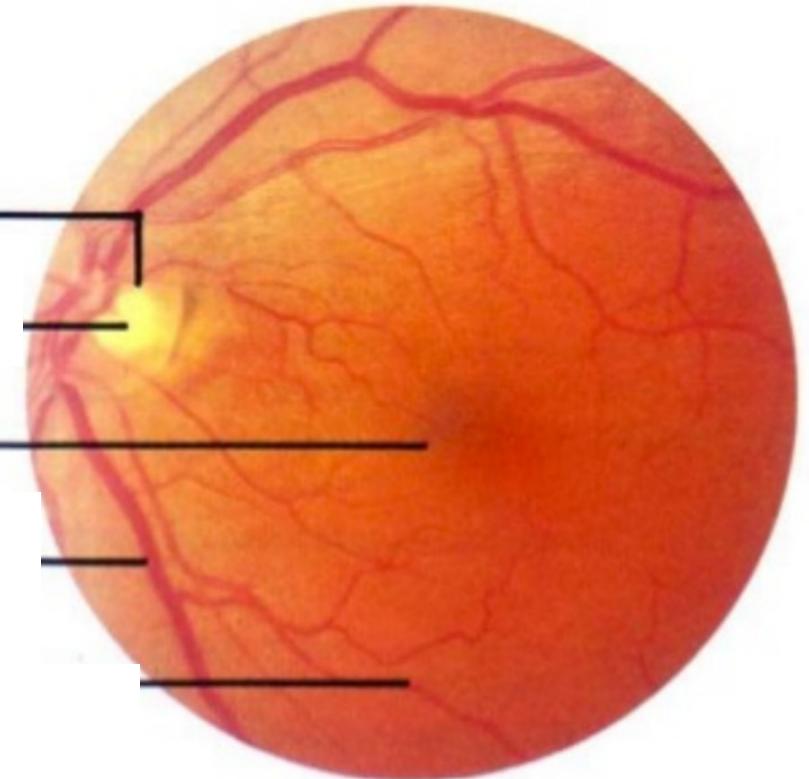


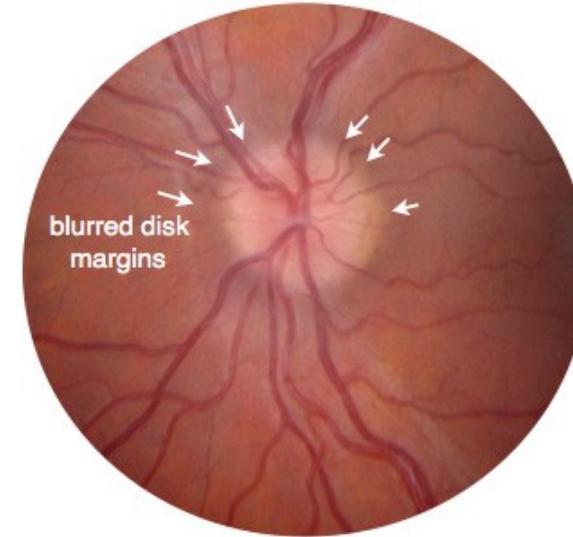
Image from: image.slidesharecdn.com/funduscopyha-140220225412-phpapp02/95/funduscopy-23-638.jpg?cb=1392937100

I – Olfactory

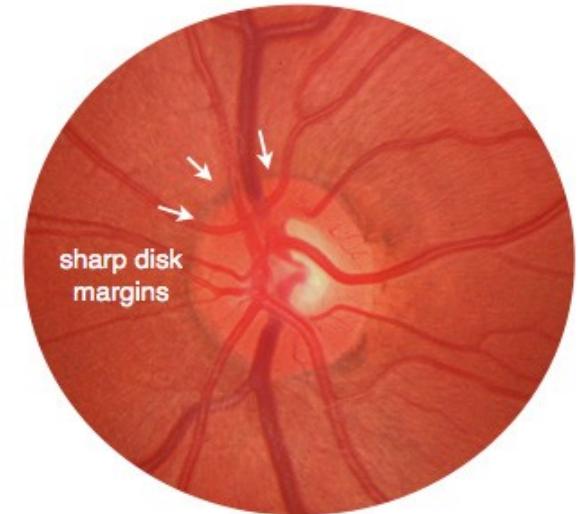
- Ethmoid ridge and TBI

II – Optic

- Standard visual acuity tests
- Visual field confrontation
- Papilledema and intracranial pressure



Papilledema



Normal Optic Disk

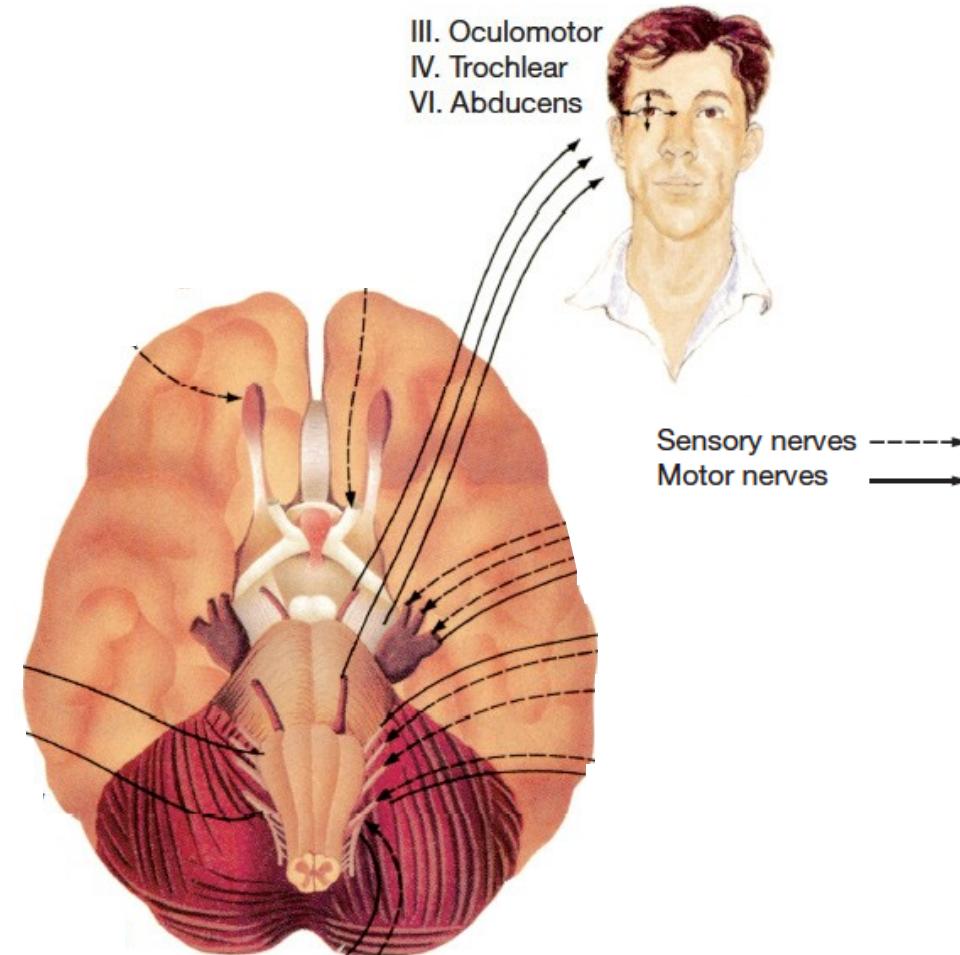
Image from: d96yk7yh4rpig.cloudfront.net/wp-content/uploads/2015/01/image-papilledema.jpg

Cranial Nerves III, IV, and VI

III – Oculomotor

IV – Trochlear

VI - Abducens



Cranial Nerves III, IV, and VI

III – Oculomotor

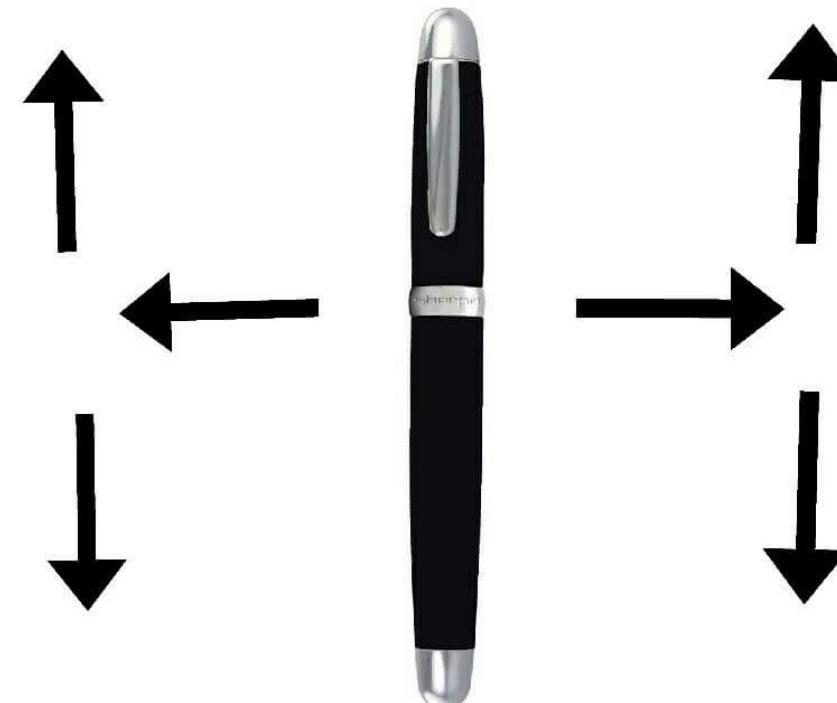
IV – Trochlear

VI - Abducens

- Follow an object/light without moving their head
- Gaze restrictions

ASK PATIENT TO FIX
THEIR EYES ON THE PEN.

DO 'H' MOVEMENT AND
ASK PATIENT TO FOLLOW,
WITHOUT MOVING THEIR HEAD

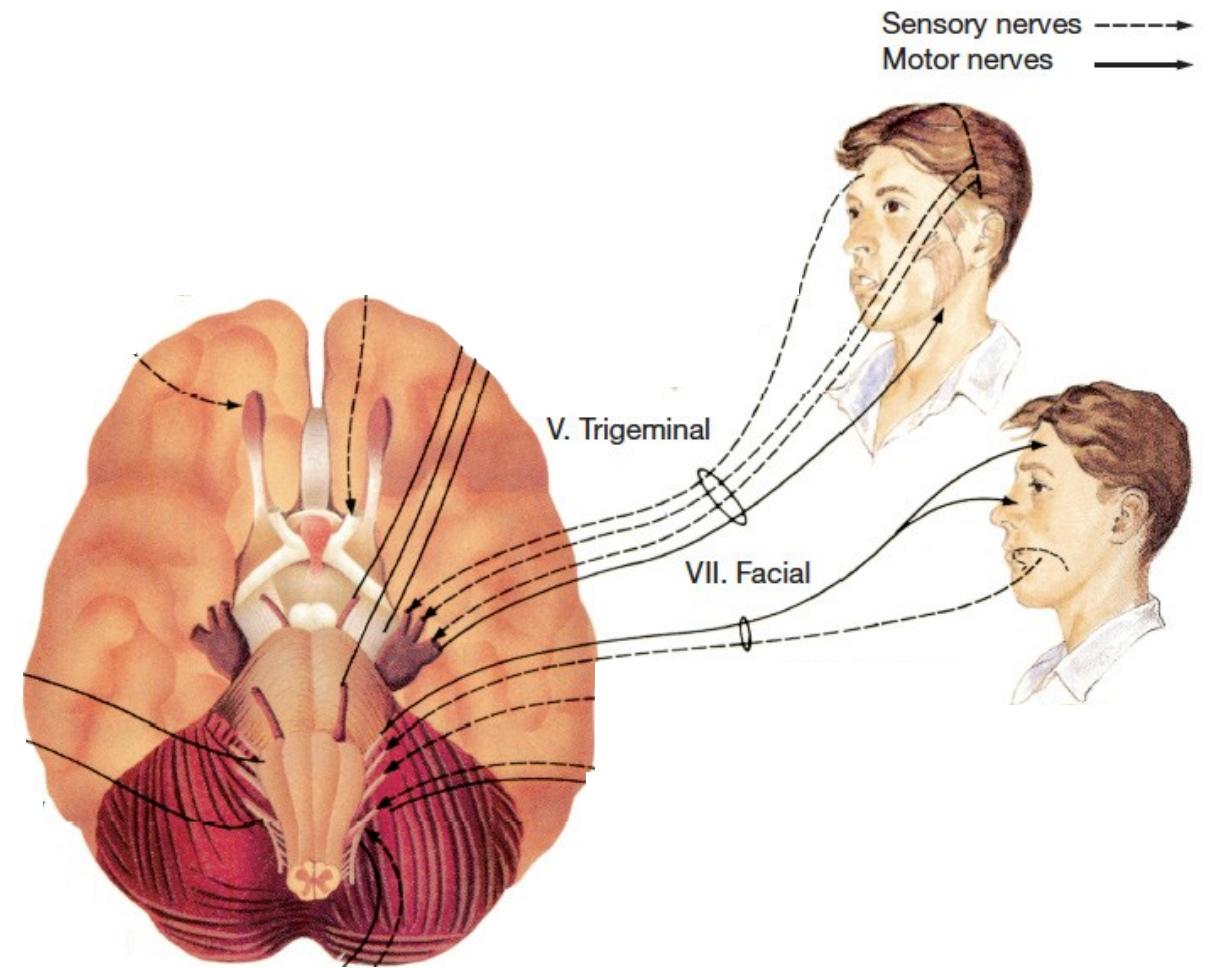


PicCollage

Cranial Nerves V & VII

V – Trigeminal

VII - Facial



V – Trigeminal

- Facial somatosensation

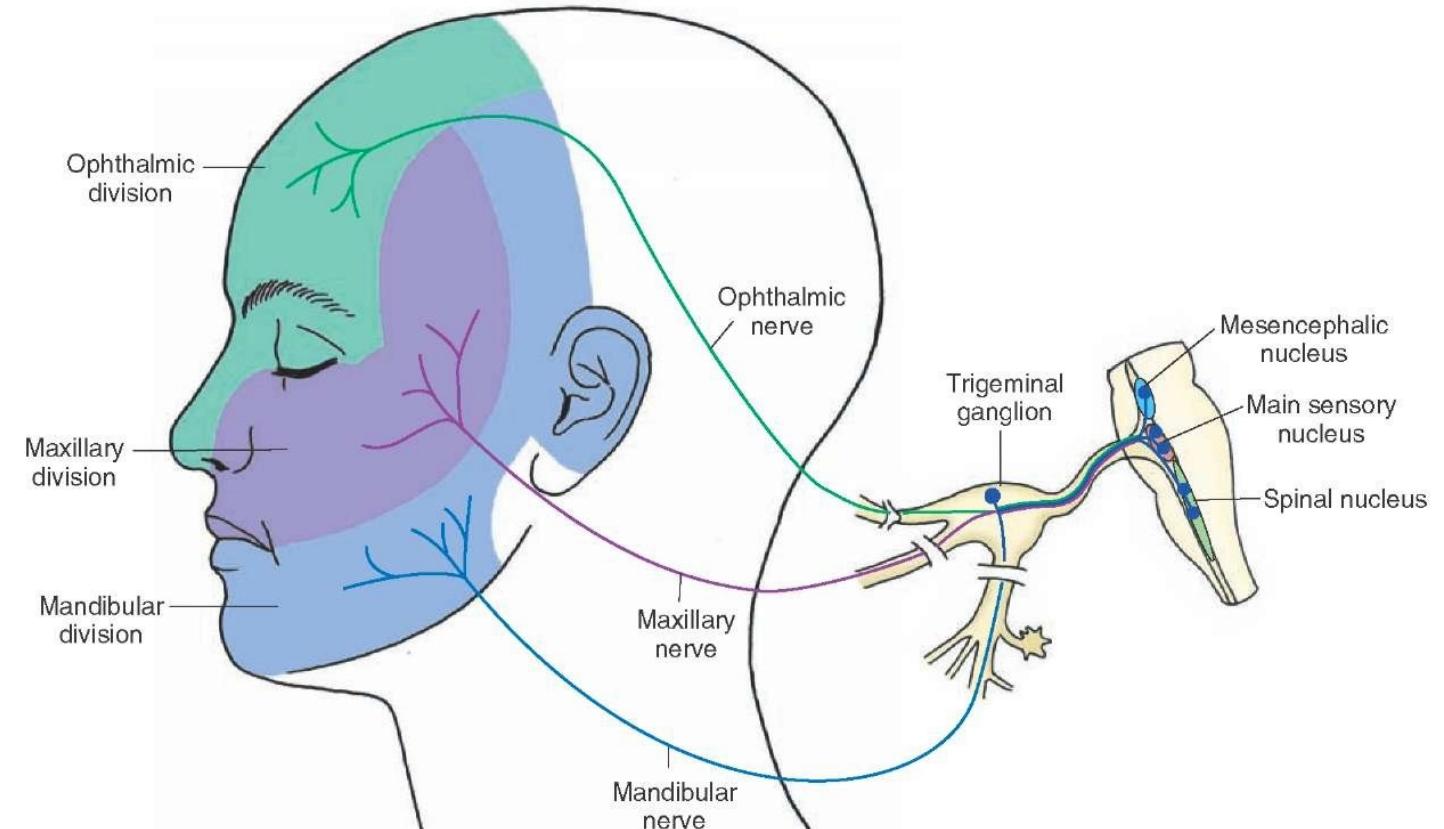


Image from: what-when-how.com/wp-content/uploads/2012/04/tmp15F36.jpg

Cranial Nerves V & VII

V – Trigeminal

- Facial somatosensation
- Motor function

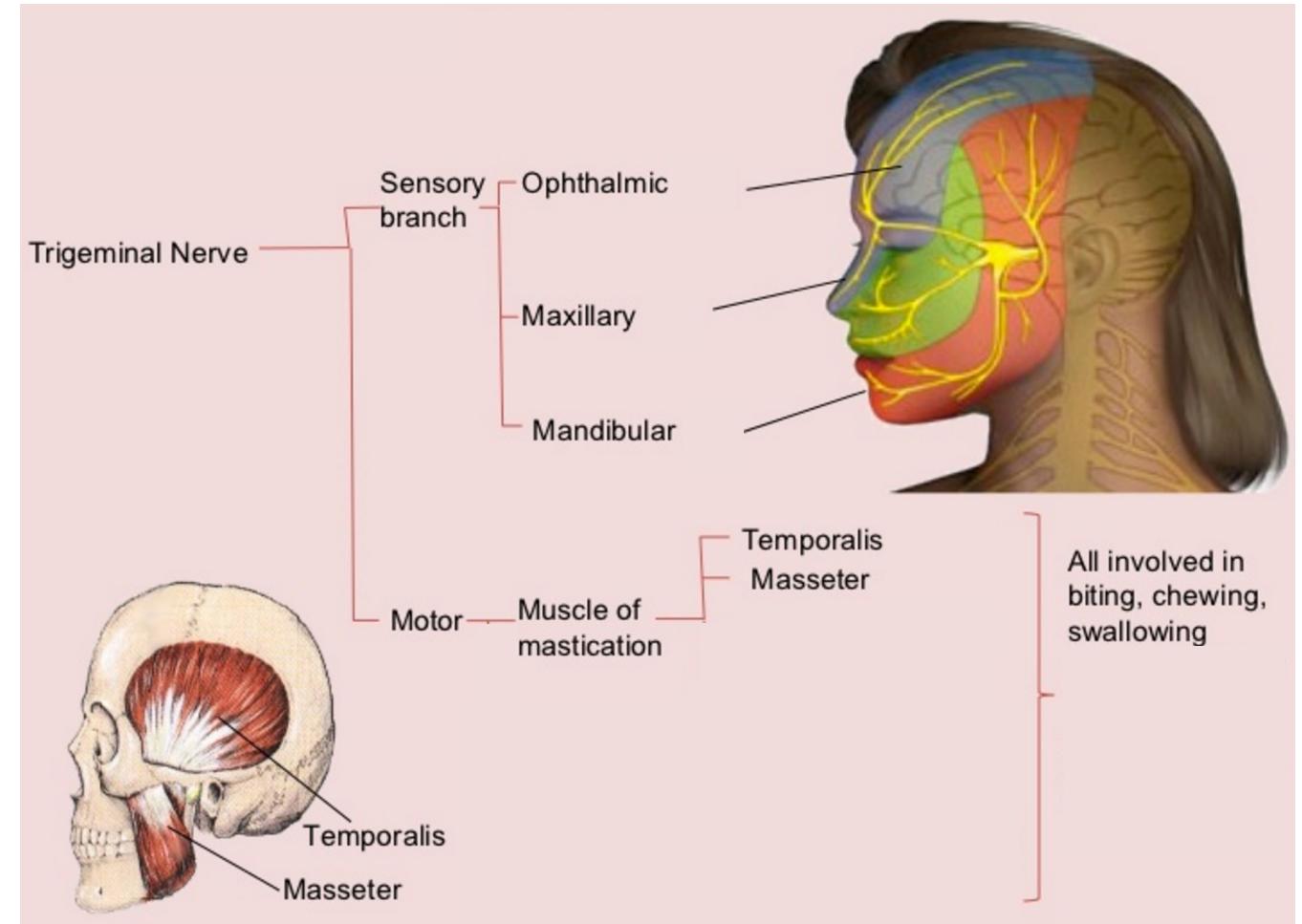


Image from: image.slidesharecdn.com/cranialnerveexamination-111106073102-phpapp02/95/cranial-nerve-examination-24-728.jpg?cb=1320567149

Cranial Nerves V & VII

V – Trigeminal

- Facial somatosensation
- Motor function

SENSORY

USE COTTON AND TOUCH THESE AREAS:

FOREHEAD
MAXILLA (CHEEK)
MANDIBLE (JAW)

ASK PATIENT "CAN YOU FEEL?"

REFLEX

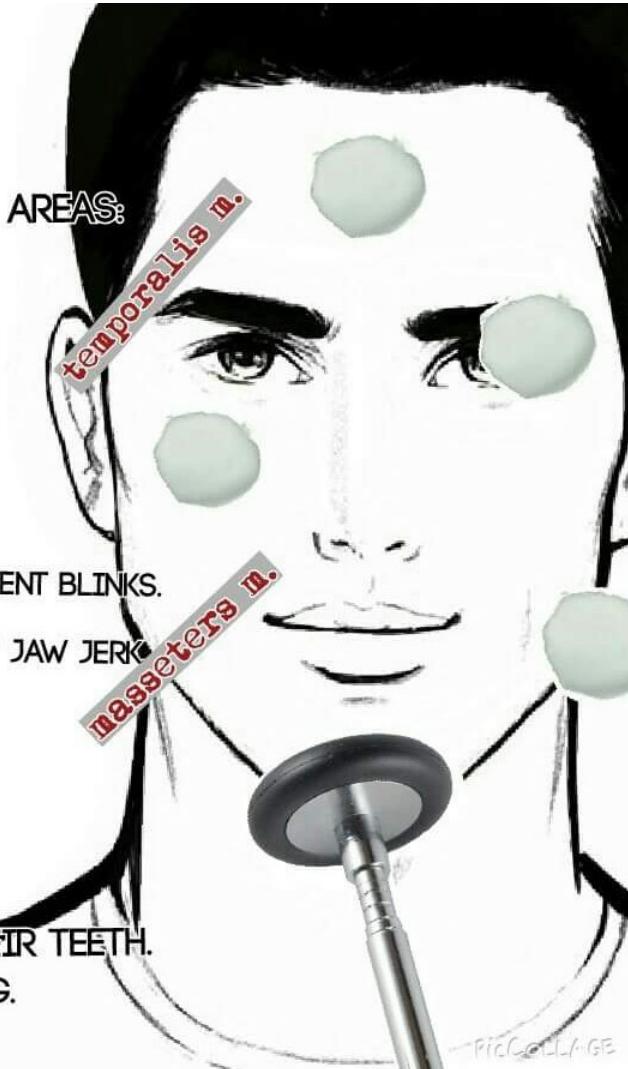
PLACE COTTON ON CORNEA, SEE IF PATIENT BLINKS.

&
USE TENDON HAMMER TO DEMONSTRATE JAW JERK

MOTOR

PLACE YOUR FINGER ON :
MASSESTER MUSCLE
TEMPORALIS MUSCLE

THEN, ASK PATIENT TO CLINCH THEIR TEETH.
FEEL THE MUSCLE CONTRACTING.



Cranial Nerves V & VII

V – Trigeminal

- Facial somatosensation
- Motor function

VII - Facial

ASK PATIENT TO LOOK UP & WRINKLE THEIR FOREHEAD.

ASK PATIENT TO SMILE.



OBSERVE PATIENT'S NASOLABIAL FOLD.

ASK PATIENT TO CLOSE EYELIDS.



ASK YOURSELF "IS IT SYMMETRICAL?"

piccollage

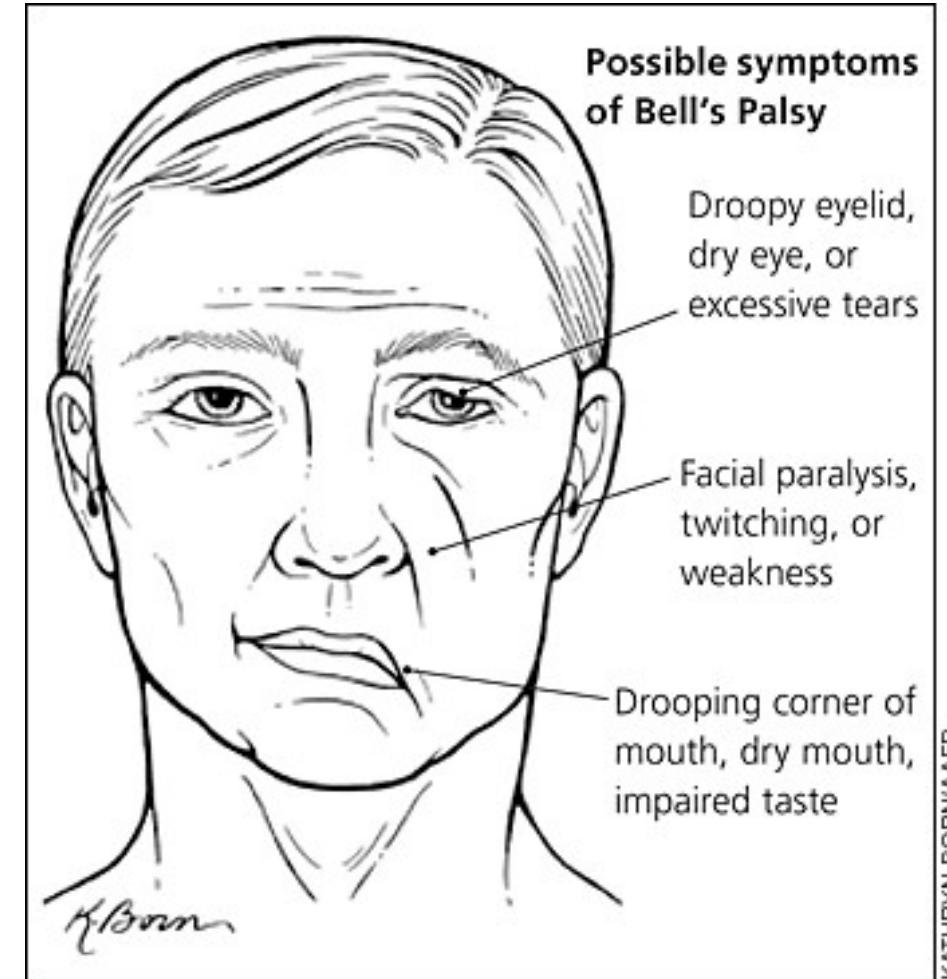
Cranial Nerves V & VII

V – Trigeminal

- Facial somatosensation
- Motor function

VII - Facial

- Facial asymmetries



KATHRYN BORN/AAFP

Cranial Nerves VIII, IX, X, XI & XII

VIII – Vestibulocochlear

- Auditory perception

1.
**CLOSE
ONE
EAR**



2.
**WHISPER TO
ANOTHER EAR**

3.
ASK PATIENT
"CAN YOU TELL ME WHAT YOU HEARD?"

DO RT. & LT. SIDE

Cranial Nerves VIII, IX, X, XI & XII

VIII – Vestibulocochlear

- Auditory perception

IX – Glossopharyngeal

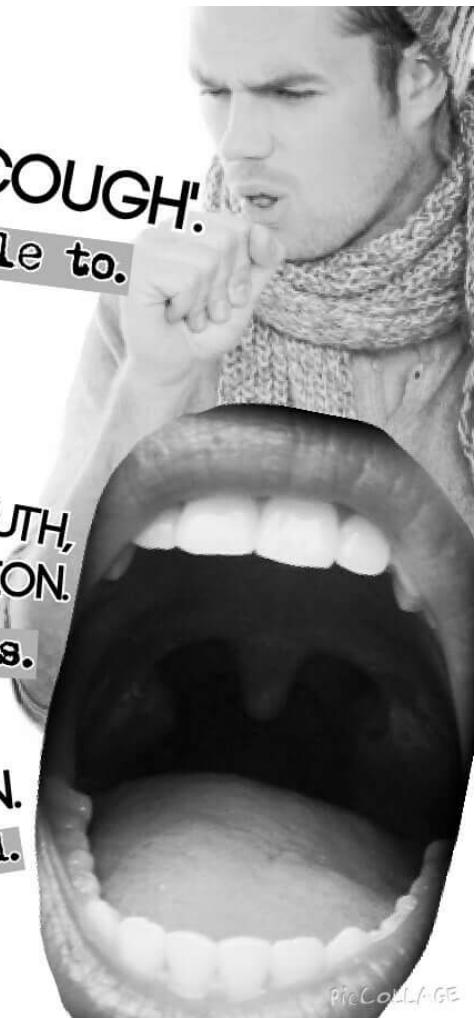
X - Vagus

- Swallowing and voice
- Gag reflex

ASK PATIENT TO 'COUGH'.
patient should be able to.

ASK PATIENT TO OPEN HIS MOUTH,
AND SAY 'AAA' UPON INSTRUCTION.
palate should move upwards.

OBSERVE UVULA POSITION.
should be centrally located.



piccollage

Cranial Nerves VIII, IX, X, XI & XII

VIII – Vestibulocochlear

- Auditory perception

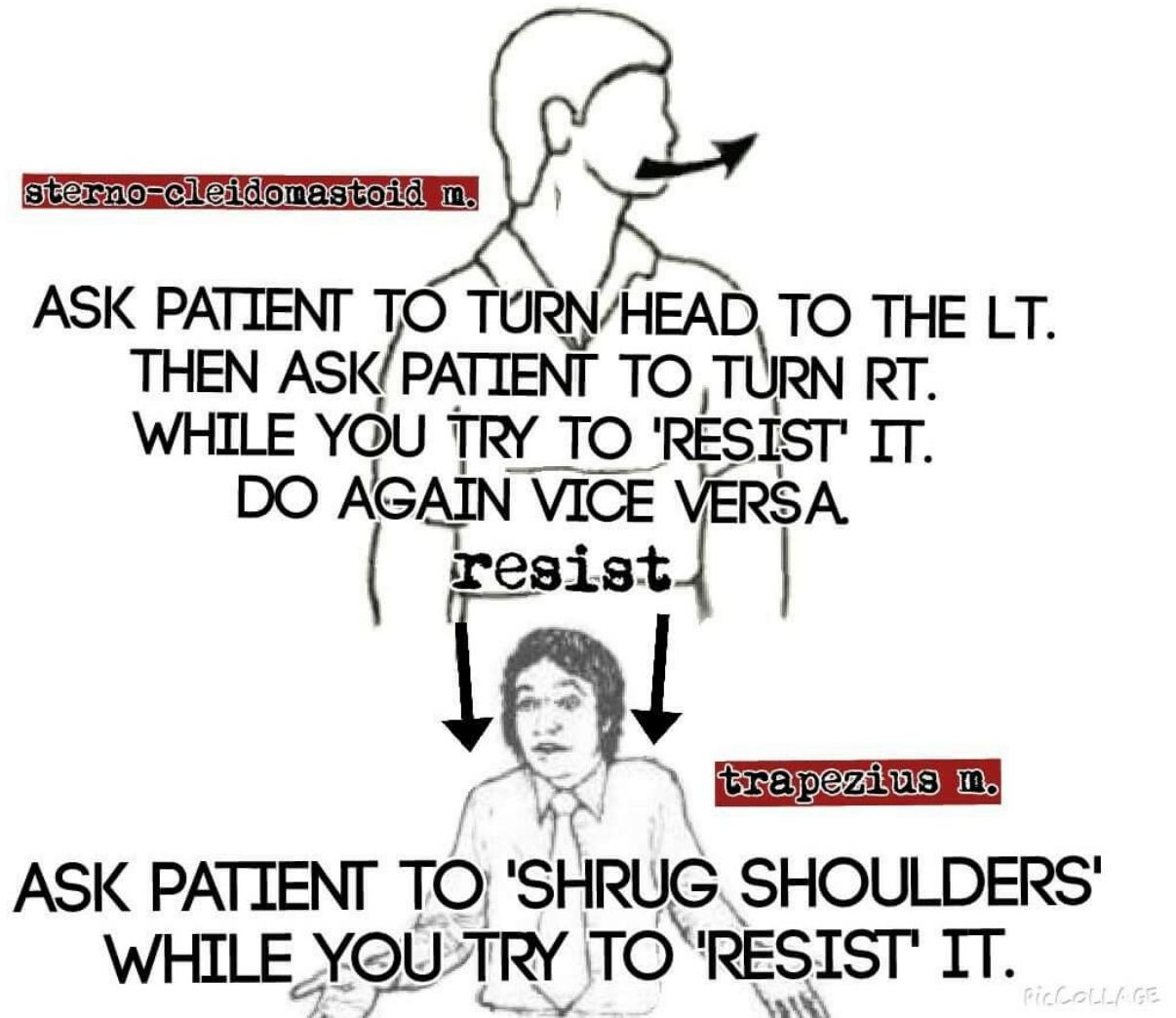
IX – Glossopharyngeal

X – Vagus

- Swallowing and voice
- Gag reflex

XI – Accessory

- Shrugging of shoulders
- Head resistance



Cranial Nerves VIII, IX, X, XI & XII

VIII – Vestibulocochlear

- Auditory perception

IX – Glossopharyngeal

X – Vagus

- Swallowing and voice
- Gag reflex

XI – Accessory

- Shrugging of shoulders
- Head resistance

XII – Hypoglossal

- Stick out the tongue, lateral movement

ASK PATIENT TO 'PUSH TONGUE AGAINST CHEEK'.



PALPATE AND ASSESS FOR THE STRENGTH.

NAFN

PicCollage

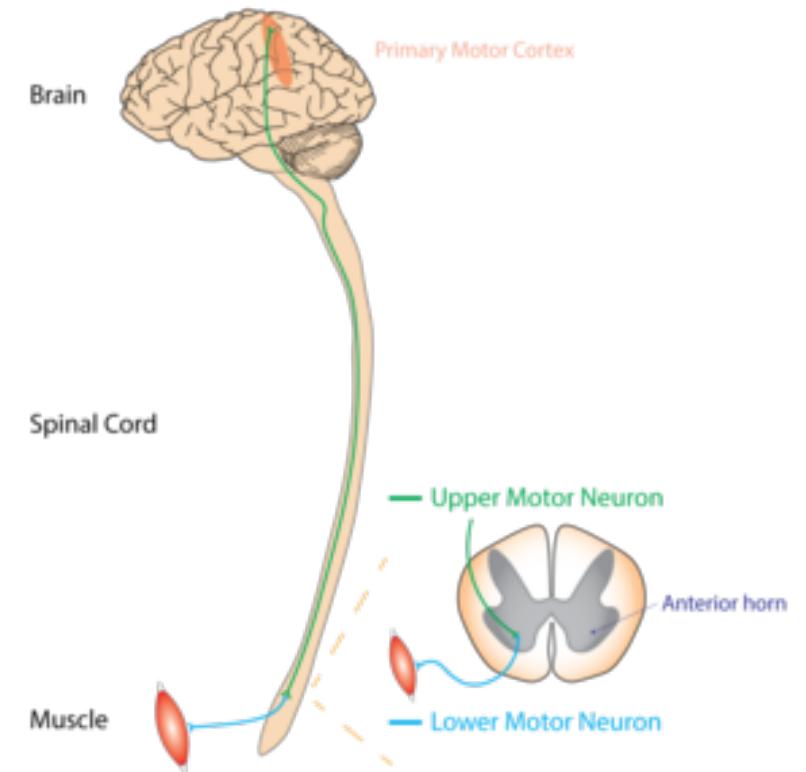
Motor Function

Key features to examine:

- Gross appearance of muscle
- Muscle tone, strength

Upper vs. lower motor lesions:

- Effect on reflexes



Somatosensory Function

- Pain
- Light touch and proprioception
- Testing for astereognosis
- Testing for agaphesthesia



Image from:
cloud.med.nyu.edu/modules/pub/neurosurgery/cranials.html

Coordination

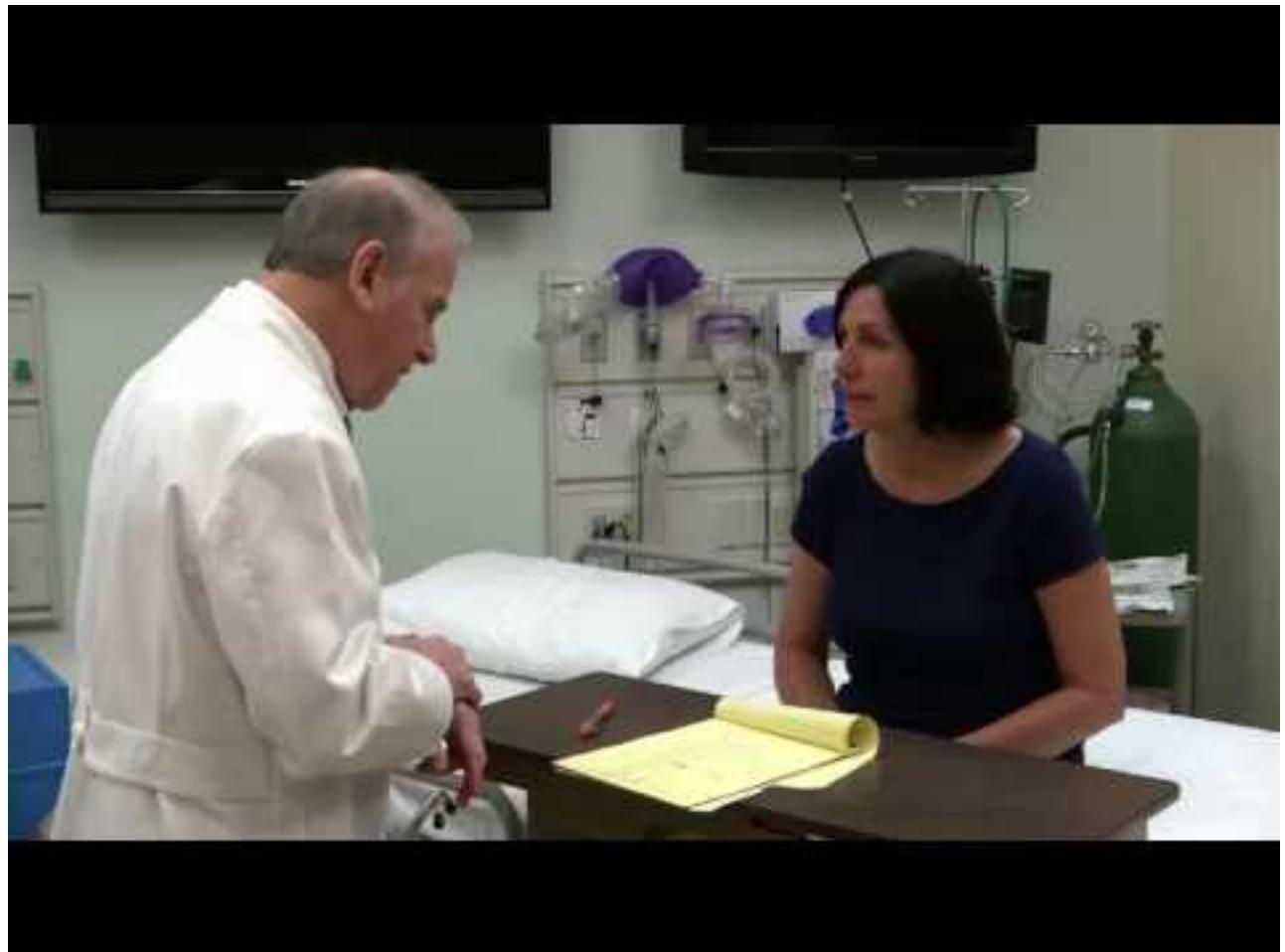
- Quick, alternating movements
- Point-to-point movement
- Heel-to-shin test
- Standing/sitting
- Gait
- Romberg test



Mental Status Exam (MSE)

<https://www.youtube.com/watch?v=14s9jMf4vR8>

- Attention and orientation
- Language
- Memory
- Visuospatial function
- Executive functions

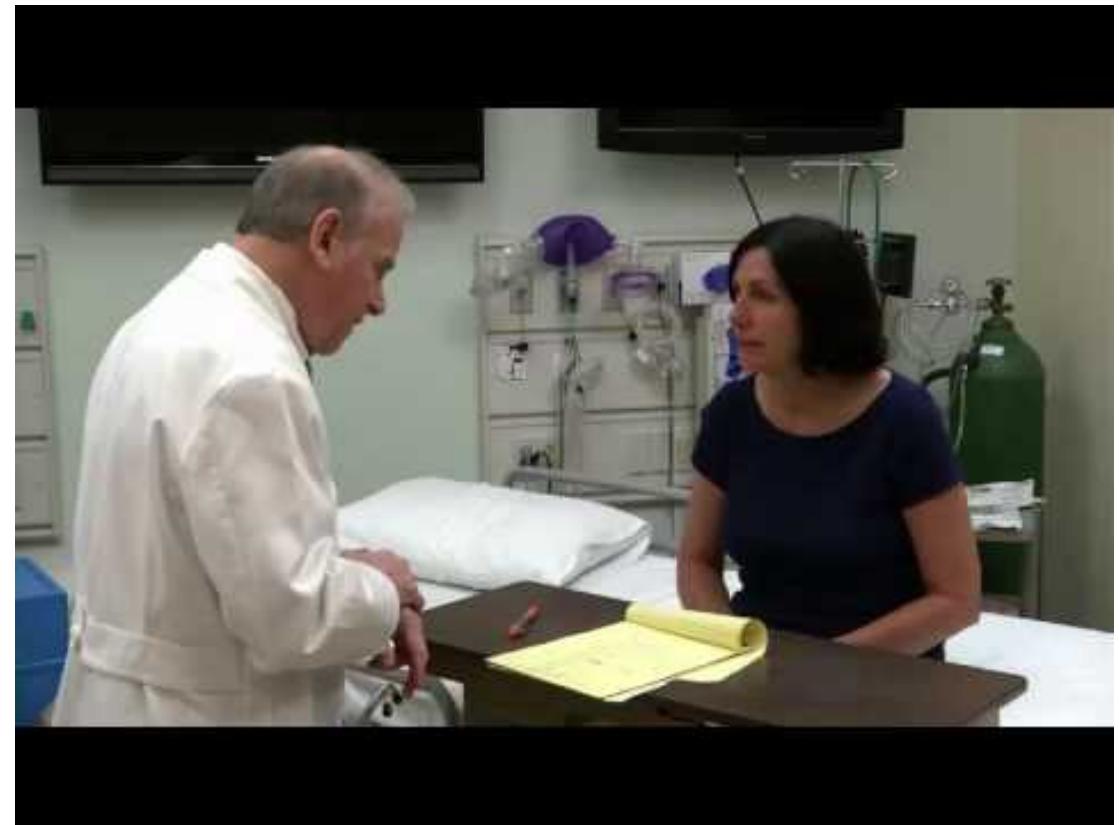


MSE: Attention and orientation

- Observe the patient's alertness
- Spelling a word backwards
- Counting backwards from 20
- Auditory vigilance
- Current whereabouts, time

Regions involved:

- Focal cortical or subcortical regions
- Origin may be diffuse (e.g., toxin)



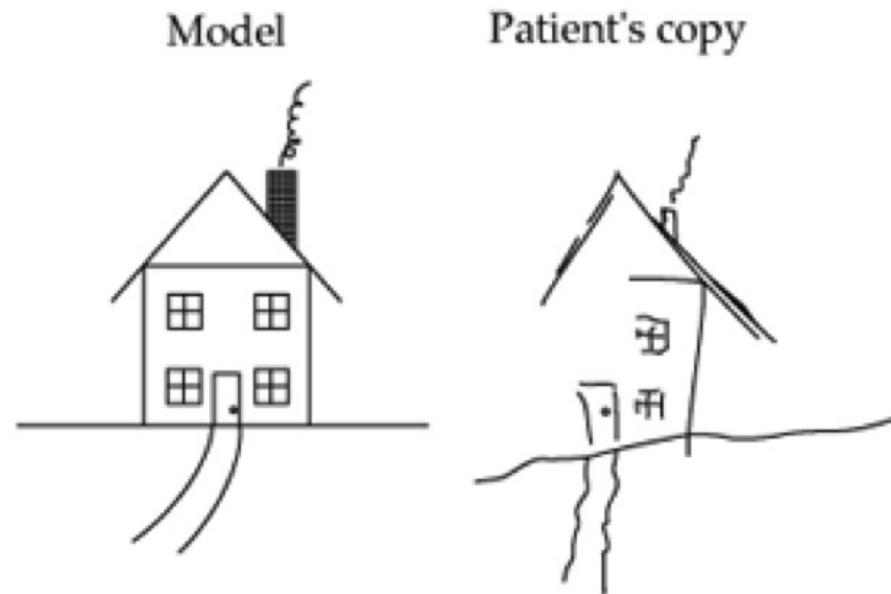
MSE: Attentional Problems

Contralateral Neglect = failure to attend to left side of world

Anosognosia = failure of individual to self-reflect that they have a disorder

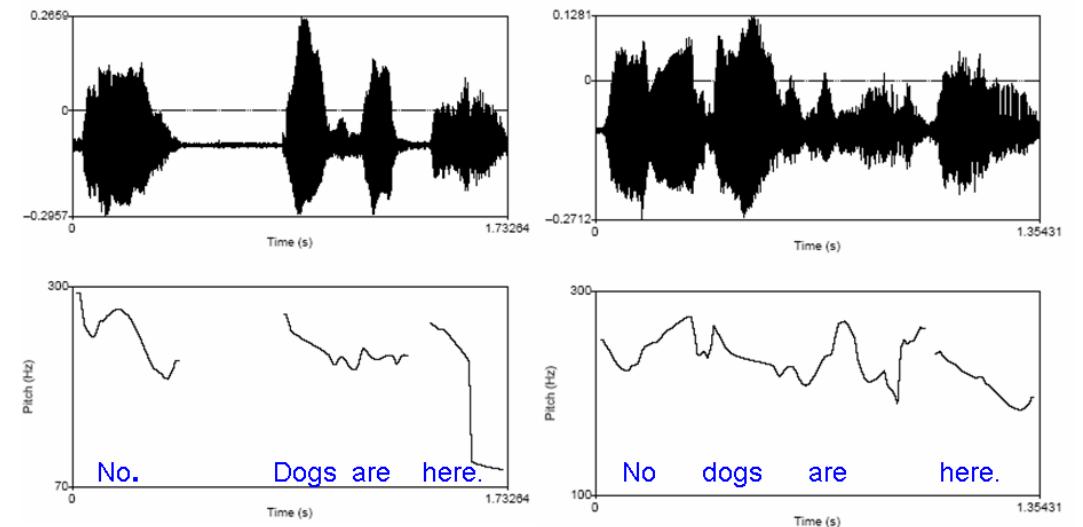
Regions involved:

- Right hemisphere's attention network
- Commonly right parietal lobe



MSE: Language

- Fluency
- Naming
- Repetition
- Prosody
- Comprehension
- Reading
- Writing
- Praxis



Prosody example

MSE: Language Problems

Aphasia = Problems with language production and/or comprehension

Alexia = Problems with reading

Agraphia = Problems with writing

Regions involved:

- Focal or diffuse damage to the left hemisphere language network



MSE: Memory

- Digit span
- Pointing span
- Verbal, visual object learning
- Past public/personal events
- Factual knowledge

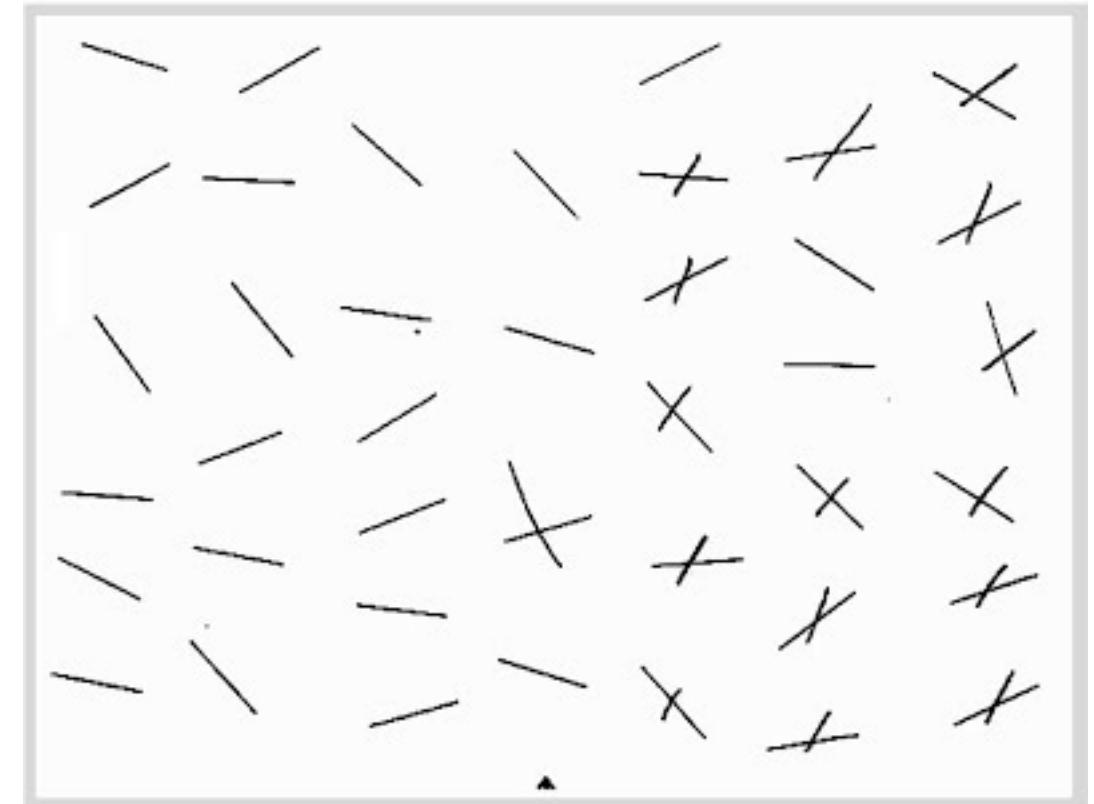
Regions involved:

- Medial temporal structures (e.g., hippocampus), thalamus, basal forebrain, prefrontal cortex



MSE: Visuospatial Function

- Line cancellation
- Copy of geometric designs
- Judgment of line orientation
- Object/face/color recognition



MSE: Visuospatial Problems

Prosopagnosia = Failure to recognize faces

Regions involved:

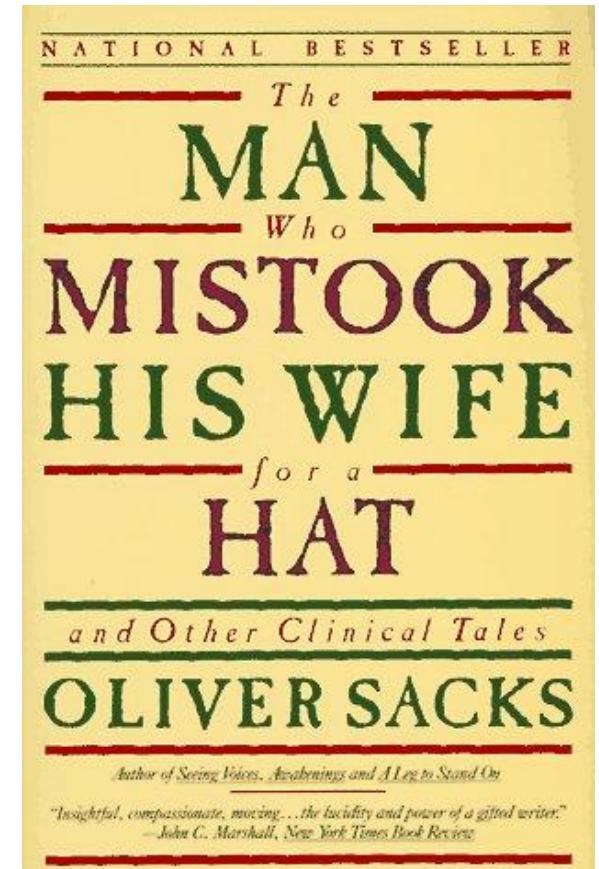
- Ventral side of temporal lobe (e.g. fusiform gyrus)

Constructional Apraxia = Difficulty putting pieces of an object together

Dressing Apraxia = Difficulty getting dressed

Regions involved:

- Right hemisphere's attention network



MSE: Executive Function

- Judgement
- Verbal fluency
- *Luria 3-step (fist-edge-palm)
- *Drawing loops, alternating patterns
- *Oral trail making test (part B)

*Tests of perseverative behavior

ORAL TRAIL MAKING TEST (OTMT)

short test of basic auditory attention and set-shifting.

It is an oral version of the Trail Making Test (TMT) and was first described by Ricker and Axelrod in 1994.

The oTMT removes the visual and graphomotor components of the written TMT. As with the TMT, there are 2 parts: A and B.

In part A, the patient counts out loud from 1 to 25 as quickly as possible.

In part B, the patient is instructed to alternate between numbers and letters (e.g. 1-A-2-B-3-C) until he/she reaches 13.

If the patient makes a mistake on either task, they are directed back to the last correct item (for part A) or item pair (for part B) and must continue from there

Regions involved:

- Prefrontal cortex and/or associated projections