Assessment of Neurological System

NUR 206

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Objectives

At the end of this unit the student will be able to:

- Describe the components of the central and peripheral nervous systems and their function.
- Discuss the physiologic function of the nervous system involving motor and sensory pathways and spinal reflexes.
- Identify health history data relevant to neurological problems.
- Identify the five main components of the neurological exam.
- Differentiate between normal & abnormal findings detected on the neurological exam.
- Identify the cranial nerves, their function, and testing.
- Identify specific techniques to test the motor functions.
- Identify specific techniques to test the sensory functions.
- Identify specific techniques used to assess deep tendon and cutaneous reflexes.
- Discuss common diagnostic tests for the system.

The Neurologic System

- Central Nervous System
  - Brain
  - Spinal Cord

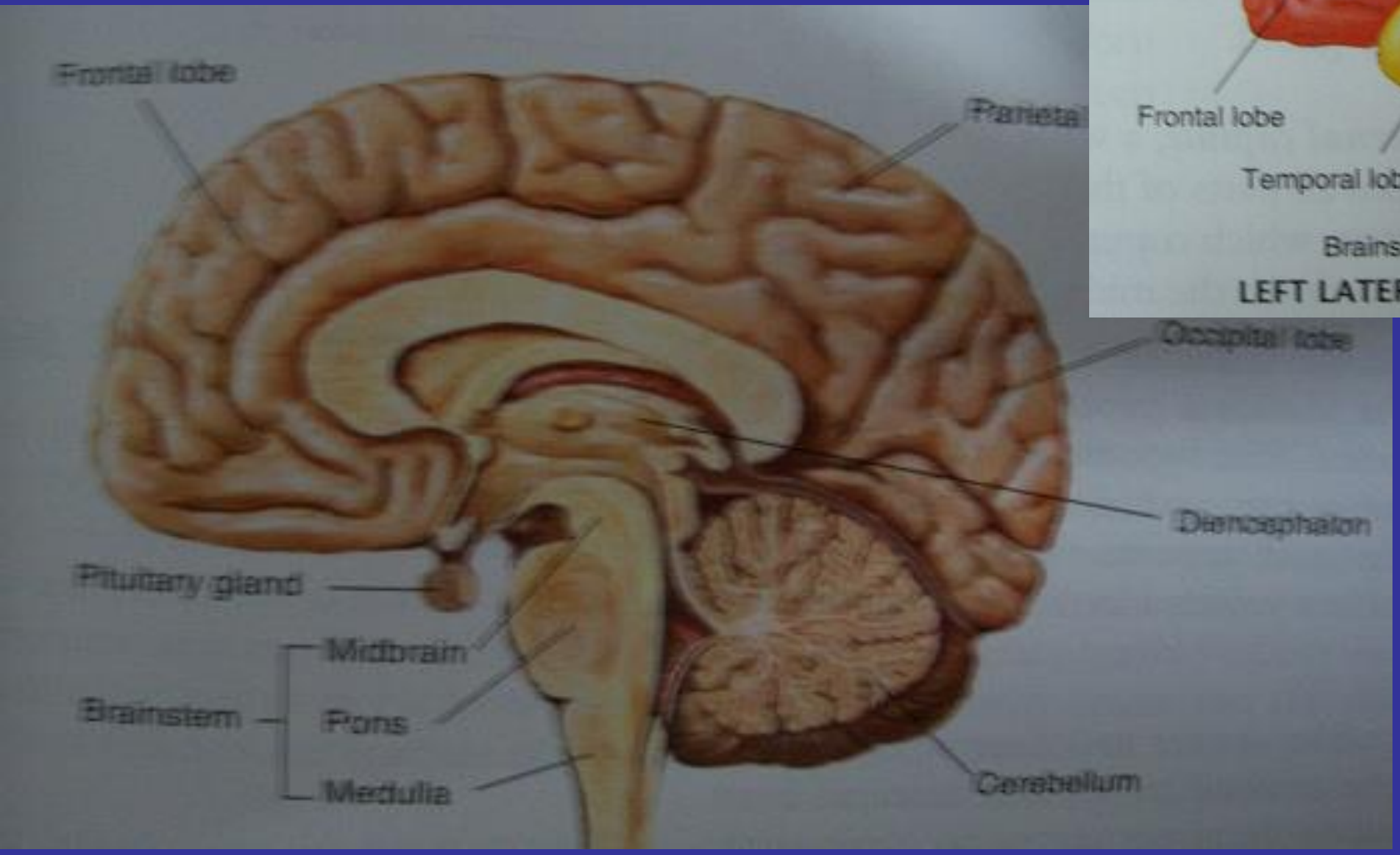
- Peripheral Nervous System
  - Cranial Nerves (12)
  - Spinal Nerves & Peripheral Nerves (31 pair)

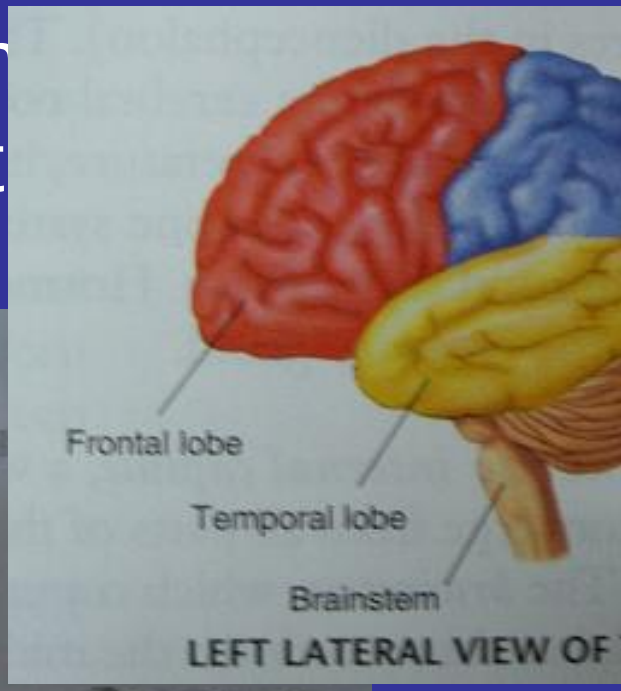
(nerve: bundle of fibers outside of CNS)

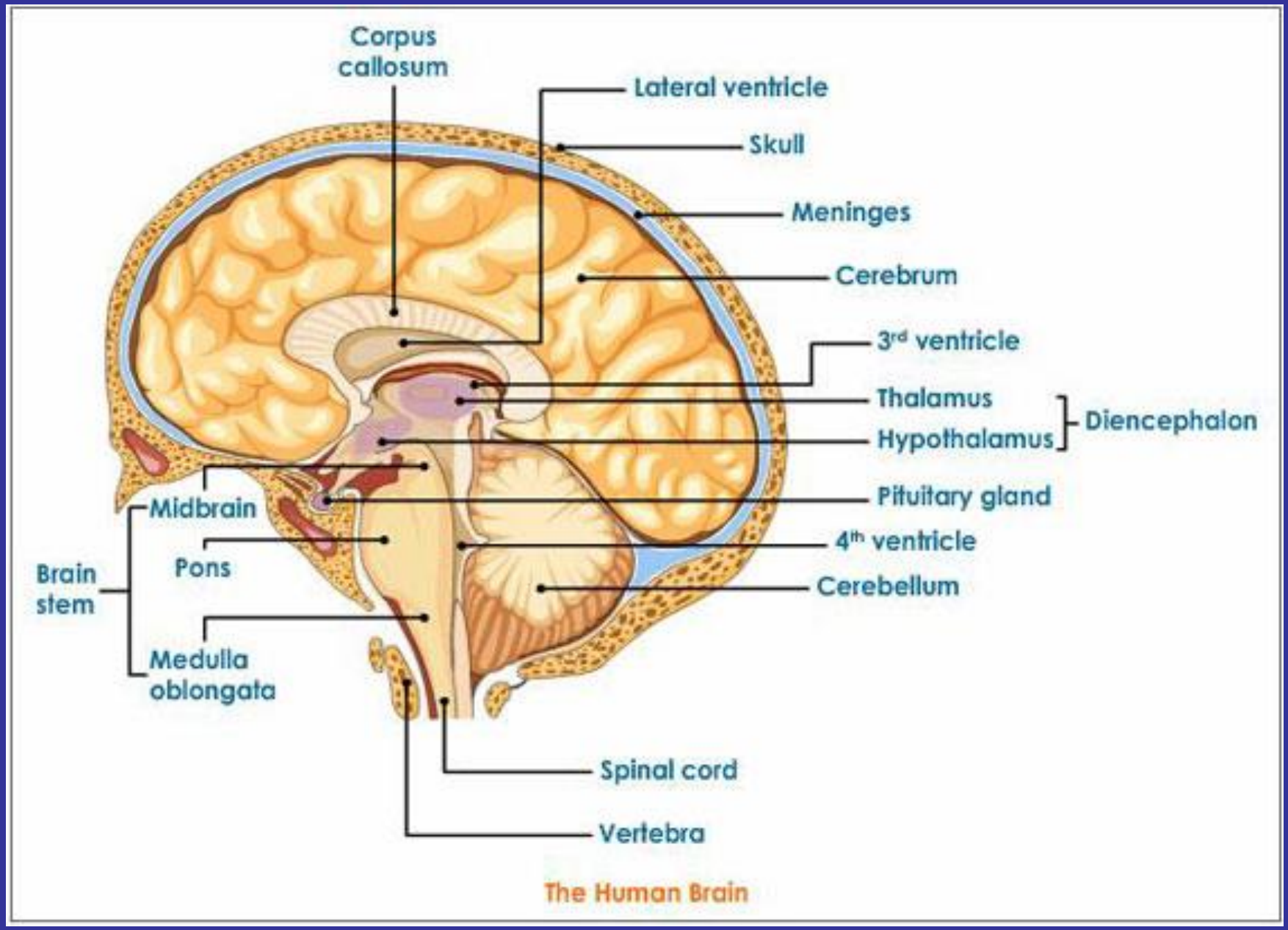
Central Nervous System: Anatomy

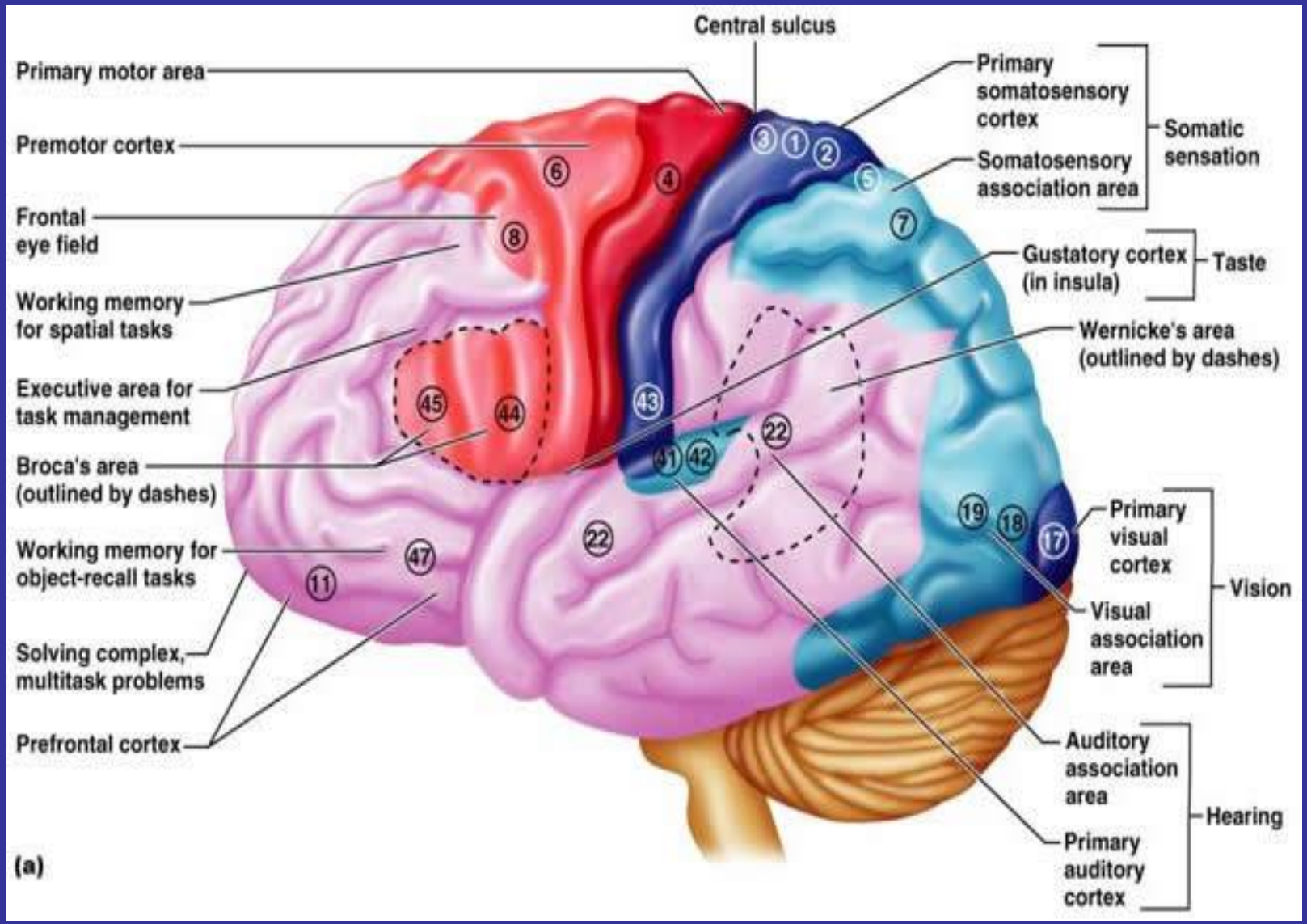
- Brain (4 regions)
  - Cerebrum -two hemispheres Rt. & Lt. (each: 4 lobes)
    - frontal, parietal, occipital, temporal
  - Diencephalon
  - Cerebellum
  - Brain Stem
- Spinal Cord
  - Ascending spinal tracts
    - Sensory
  - Descending spinal tracts
    - Motor

Review of Anatomy and Ph
Central Nervous Syst
a. Brain






Corpus callosum
Lateral ventricle
Skull
Meninges
Cerebrum
3rd ventricle
Thalamus
Hypothalamus
Diencephalon
Pituitary gland
4th ventricle
Cerebellum
Midbrain
Pons
Brain stem
Medulla oblongata
Spinal cord
Vertebra
The Human Brain


Central sulcus
Primary motor area
Premotor cortex
Frontal eye field
Working memory for spatial tasks
Executive area for task management
Broca's area (outlined by dashes)
Working memory for object-recall tasks
Solving complex, multitask problems
Prefrontal cortex
Primary somatosensory cortex
Somatosensory association area
Somatic sensation
Gustatory cortex (in insula)
Taste
Wernicke's area (outlined by dashes)
Primary visual cortex
Visual association area
Vision
Auditory association area
Primary auditory cortex
Hearing
(a)

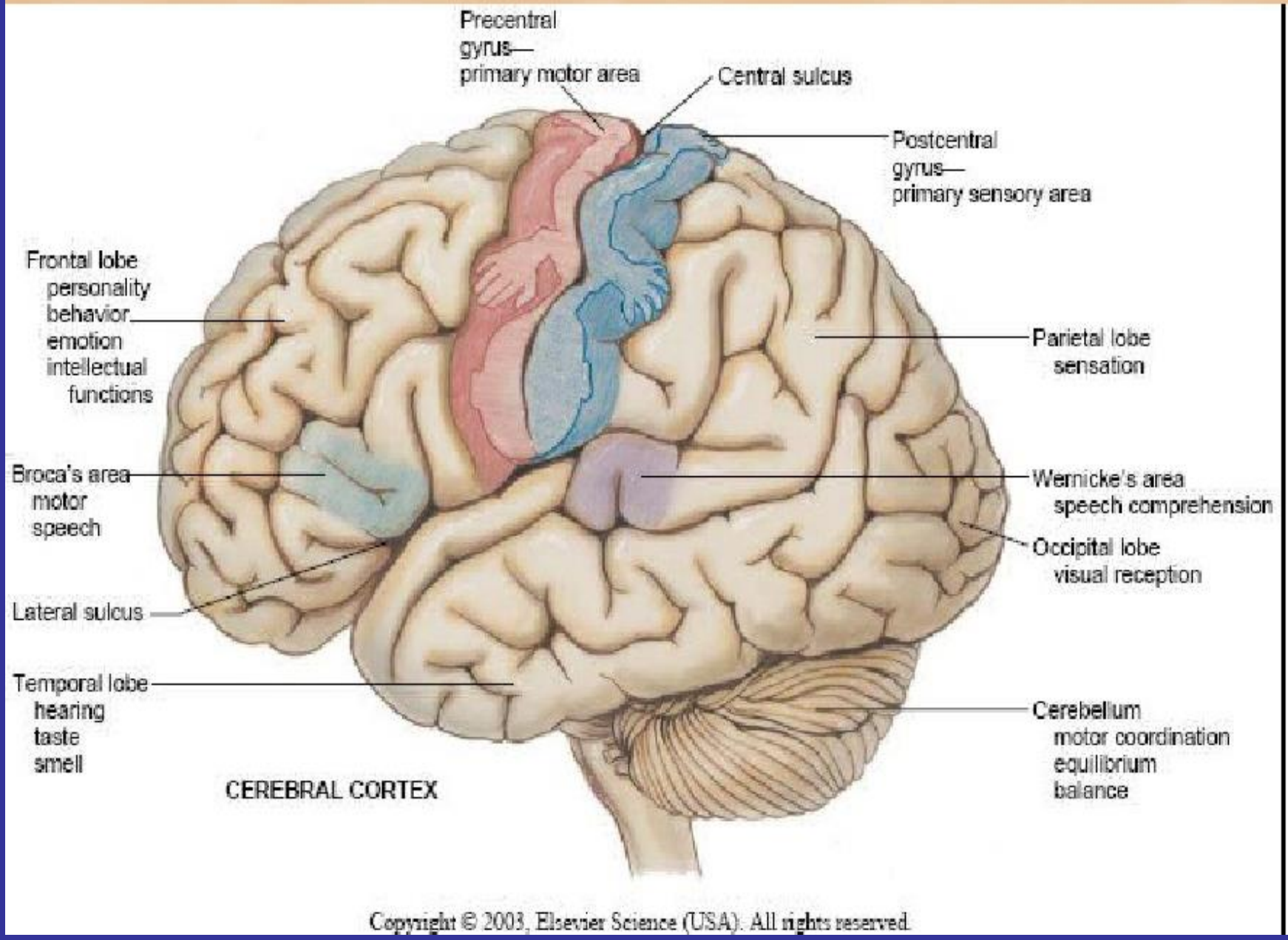
Cerebrum center for highest functions: thought, memory, reasoning, sensation, and voluntary movement.

Lobes

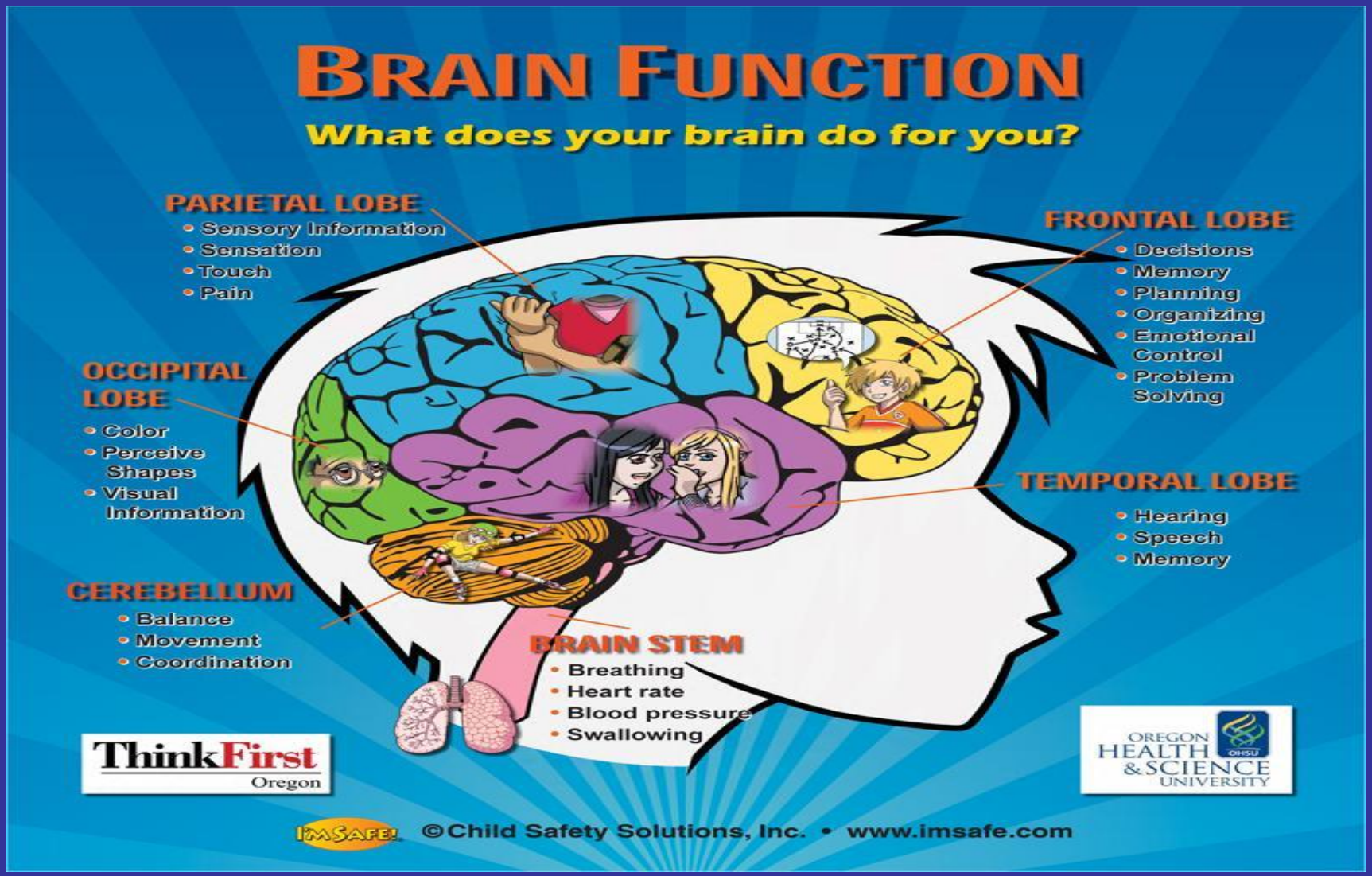
- **Frontal**
  - Personality, behavior, emotions, intellect
- **Parietal**
  - Primary center for sensation
- **Occipital**
  - Primary visual receptor center
- **Temporal**
  - Primary auditory receptor center

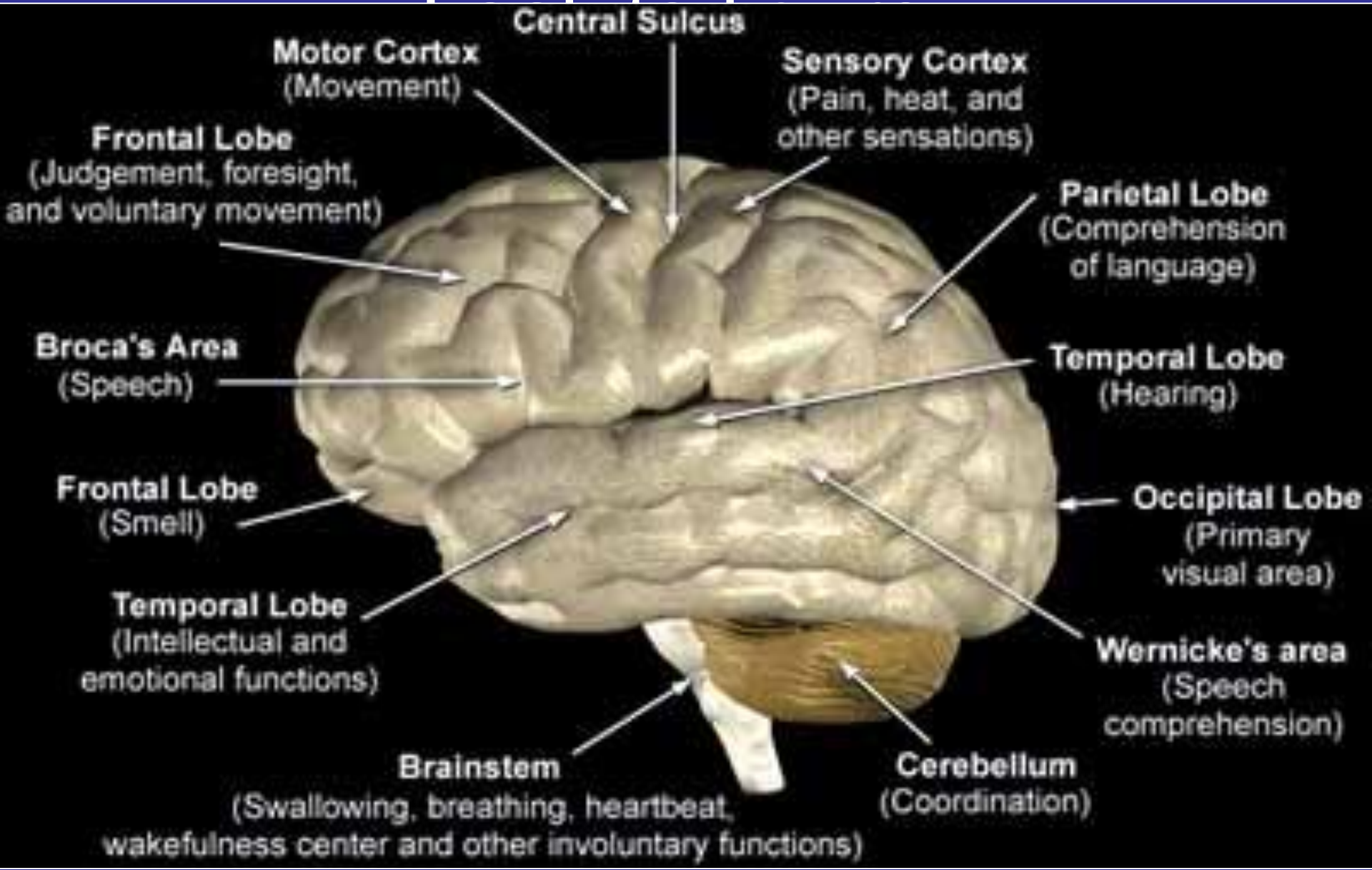
Communication areas

- Wernike's area in temporal lobe is associated with language comprehension
  - Receptive aphasia
- Broca area in frontal lobe responsible for motor speech
  - Expressive aphasia



Central nervous system



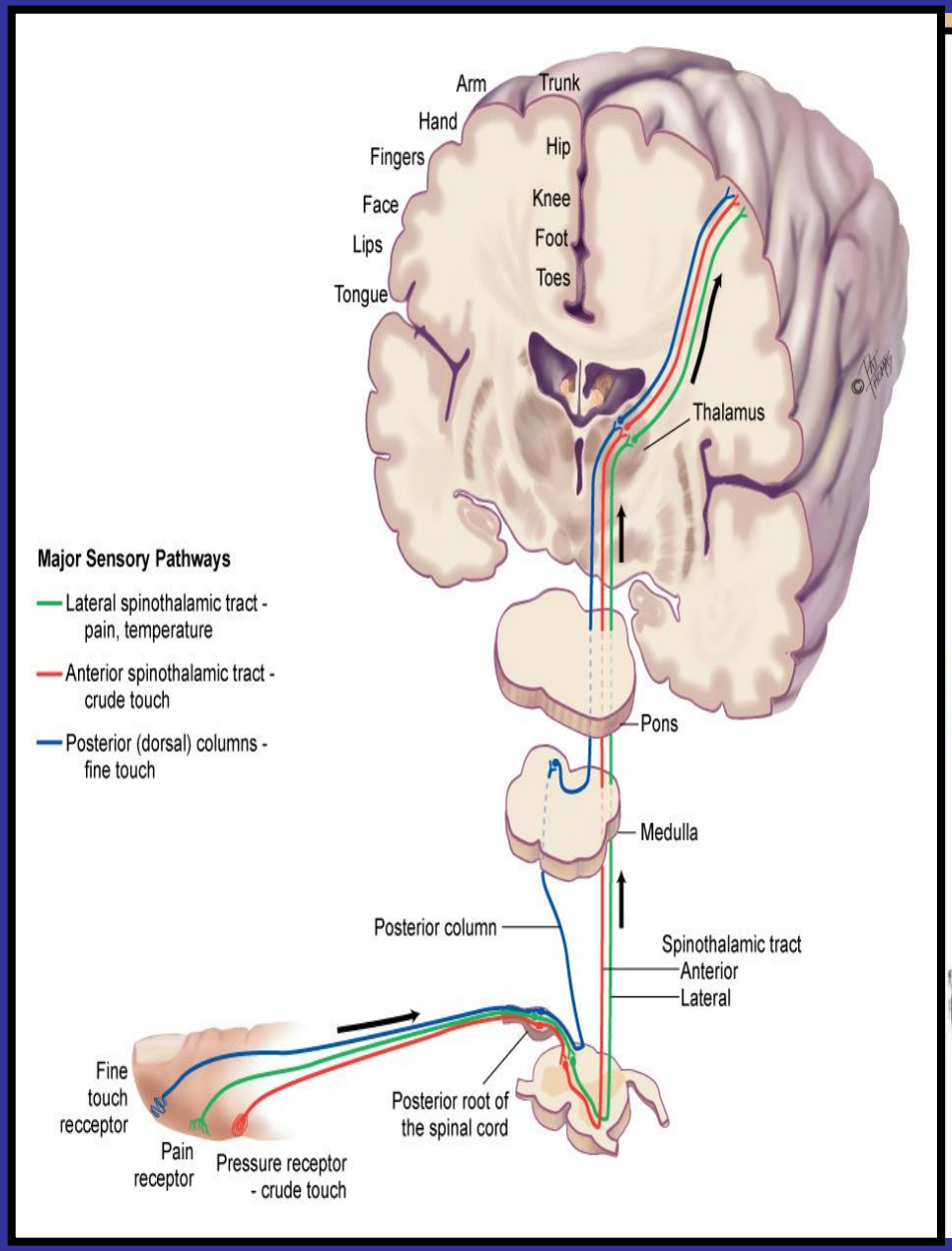

Central Sulcus
Motor Cortex
(Movement)
Sensory Cortex
(Pain, heat, and
other sensations)
Frontal Lobe
(Judgement, foresight,
and voluntary movement)
Parietal Lobe
(Comprehension
of language)
Broca's Area
(Speech)
Temporal Lobe
(Hearing)
Frontal Lobe
(Smell)
Occipital Lobe
(Primary
visual area)
Temporal Lobe
(Intellectual and
emotional functions)
Wernicke's area
(Speech
comprehension)
Brainstem
(Swallowing, breathing, heartbeat,
wakefulness center and other involuntary functions)
Cerebellum
(Coordination)

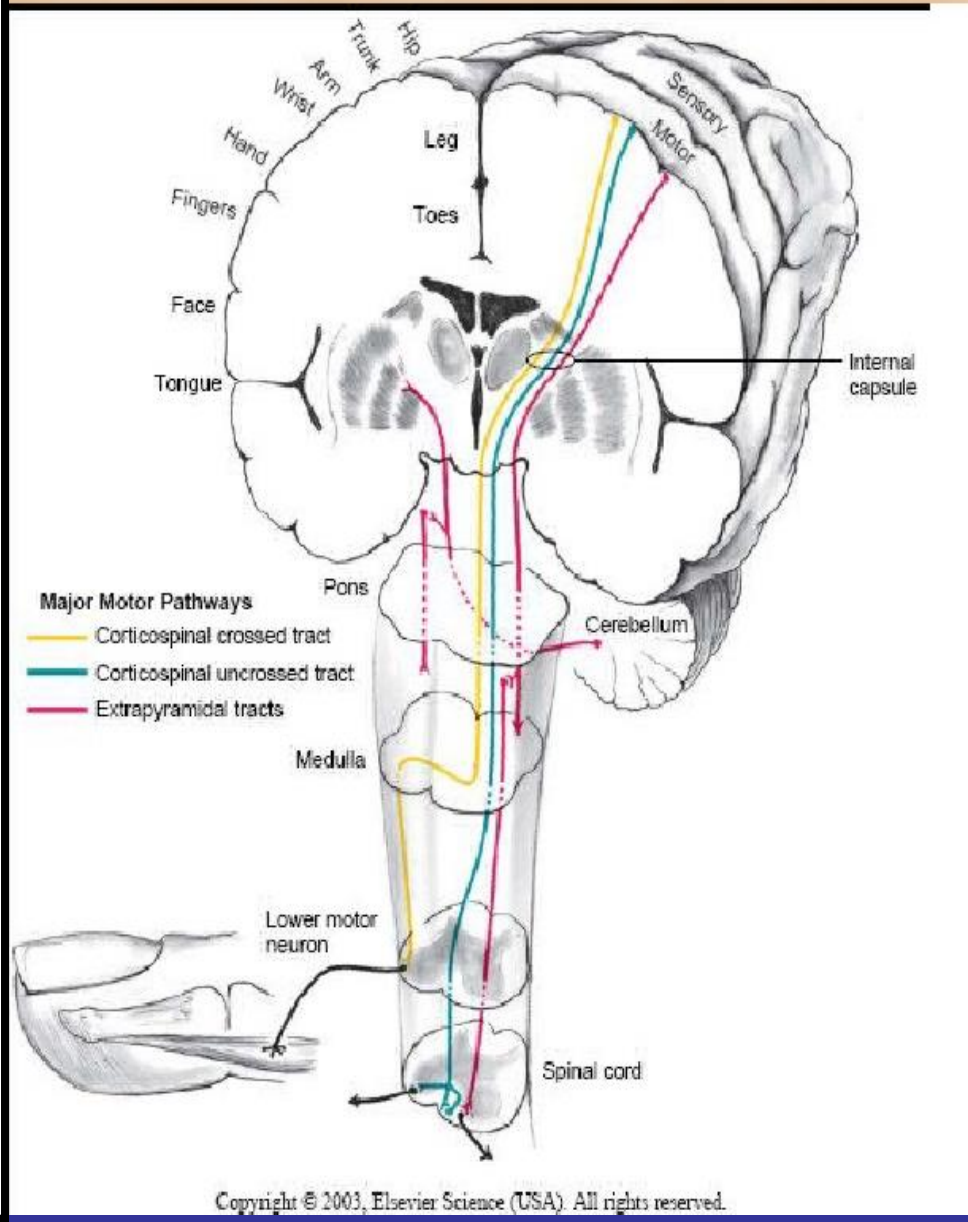
- **Diencephalon: consists of**
  - **thalamus :** processes sensory impulses and relay them into cerebral cortex
  - **Hypothalamus: maintain homeostasis: control many vital functions:** temperature, heart rate, BP, sleep, pituitary gland, coordinator of autonomic nervous system (ANS) activity & emotional status**.**
- **Cerebellum**
  - receives **sensory & motor input**
  - **coordinates** muscle tone, **balance** and equilibrium
- **Brain Stem**
  - the pathway between cerebrum and spinal cord
  - controls **many involuntary functions (breathing,) autonomic nervous system**)
  - **the 12 cranial nerves arise from its structures**

Central Nervous System
b. Spinal Cord

- Spinal cord
  - Starts from medulla to L1 or L2 vertebrae:
    - Cervical (C1-8)
    - Thoracic (T1-12)
    - Lumbar (L1-5)
    - Sacral (S1-5)
    - Coccygeal (C1)
  - **Contains motor and sensory nerve pathways**
  - The level of nerve roots exiting the cord differ from the nearest vertebral level.
  - Mediate reflexes
    - Lumbar puncture is performed at L_{3-4}.

Corticospinal (pyramidal tract)
Basal ganglia system(extrapyramidal)





Cross sectional representation

Upper motor neuron systems damaged **above the crossover of its tract in medulla**: motor impairment develop on opposite or contralateral side.

..

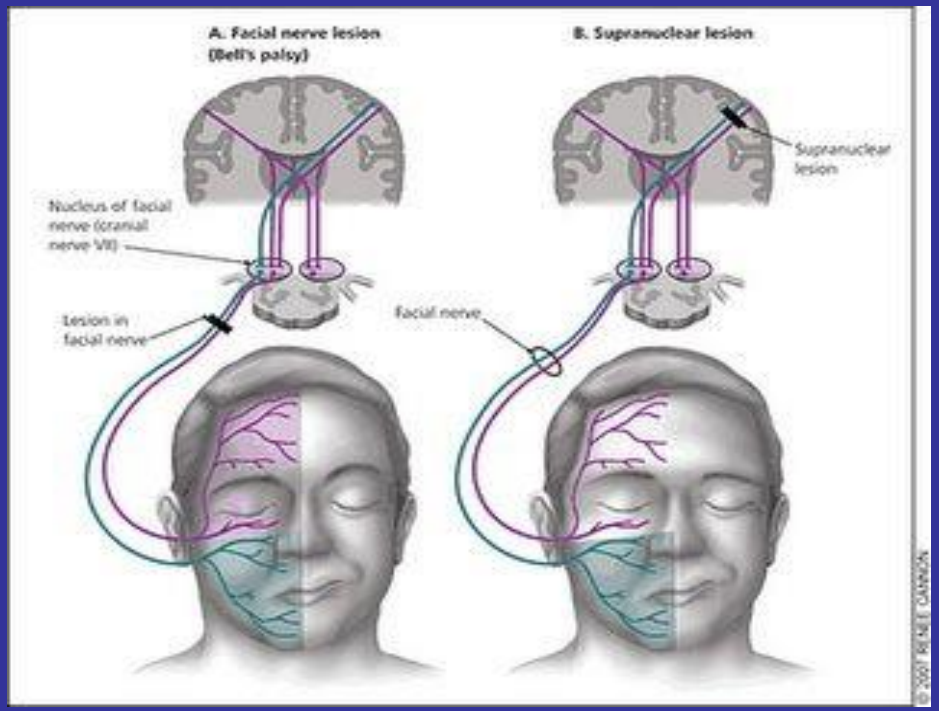
Damage **below the crossover**: motor impairment occurs on the same or ipsilateral side of the body

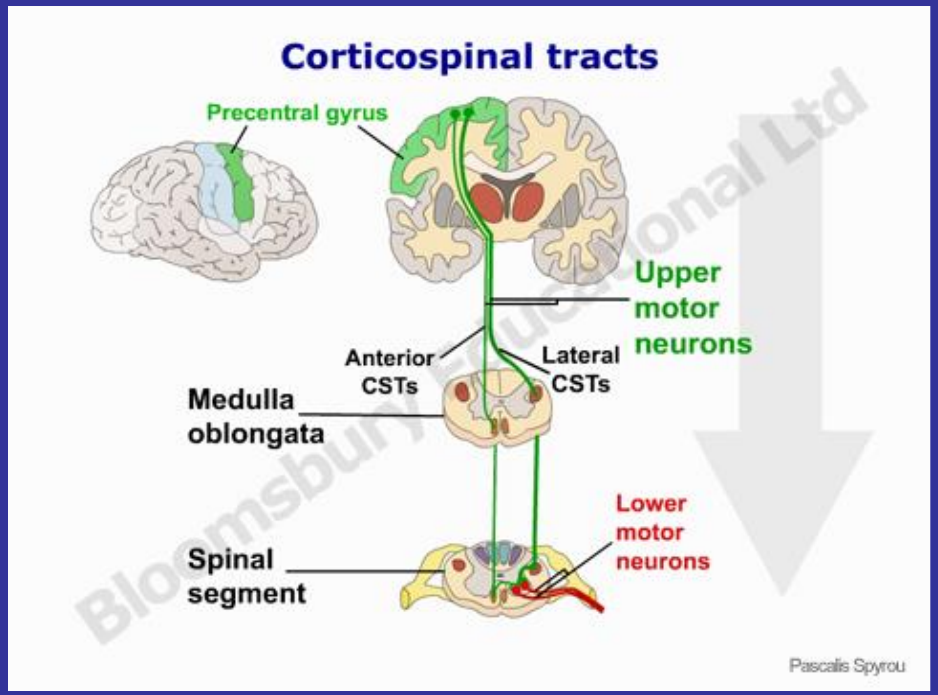
..

Upper motor neuron lesion, muscle tone increased and deep tendon reflexes exaggerated (**spastic type of paralysis**)

..

Damage to lower motor neuron: causes weakness & paralysis, muscle tone and reflexes are decreased or absent **(flaccid type paralysis)**



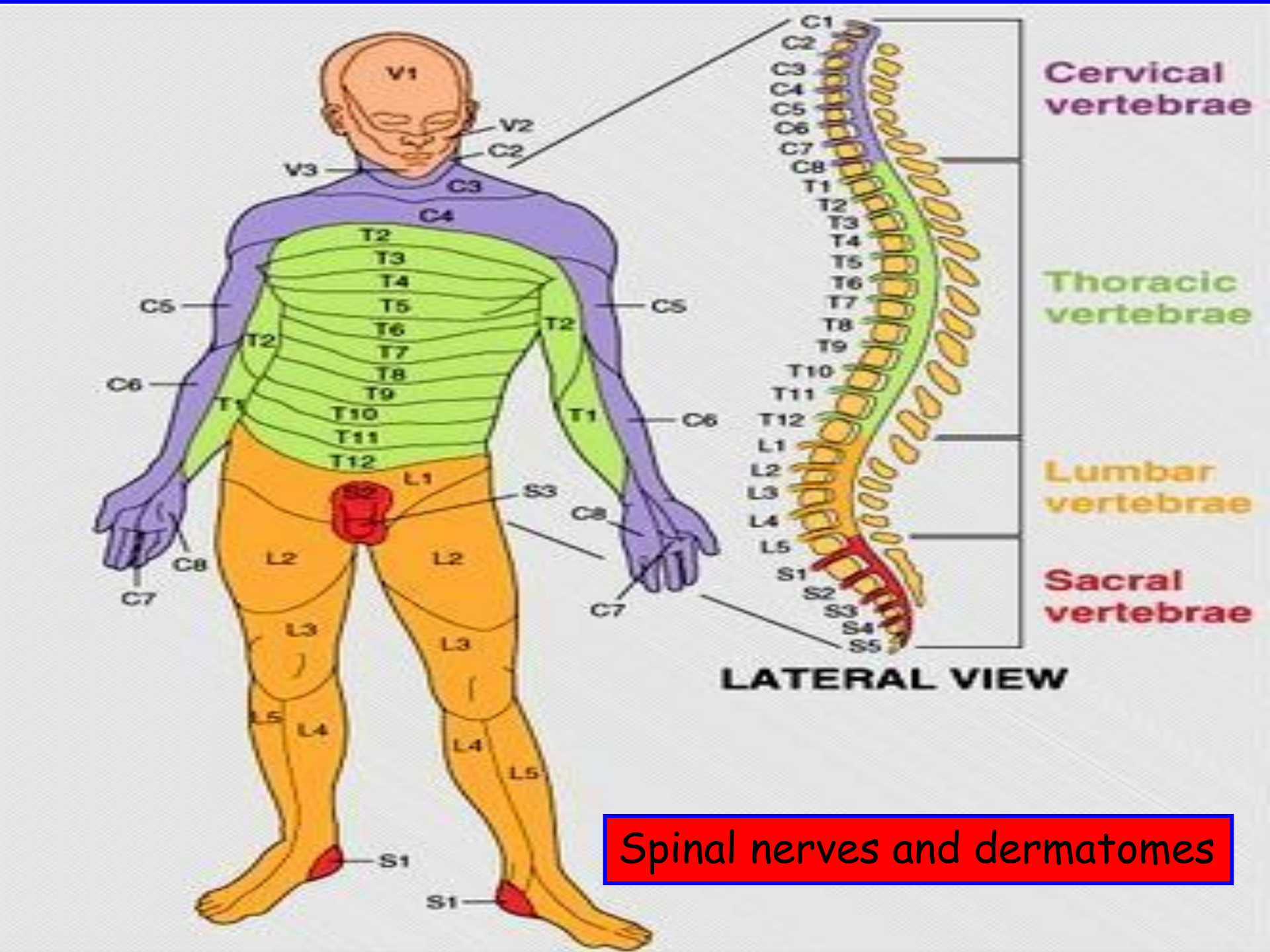


Peripheral Nervous System

1. Cranial Nerves (12)
   - **I – XII**
   - Each nerve has a function
2. Spinal and Peripheral Nerves
   - **31 pairs** of nerves attached to the spinal cord
   - **Cary nerve impulses to and from the cord**
   - Each nerve has
     - **Anterior root: motor fibers**
     - **Posterior root: sensory fibers**

Peripheral Nervous System

- Spinal nerve: consist of anterior and posterior roots merging together
    - When spinal nerves join other similar roots from other levels, they form ***peripheral nerves.***
- **Peripheral nerves** has
  - Afferent fibers: **Posterior root :** (sensory)
  - Efferent fibers: **Anterior root:** (motor)


V1
V2
C2
V3
C3
C4
T2
T3
T4
T5
T6
T7
T8
T9
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T11
T12
L1
S3
C5
C5
T2
T2
C6
C6
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T11
T12
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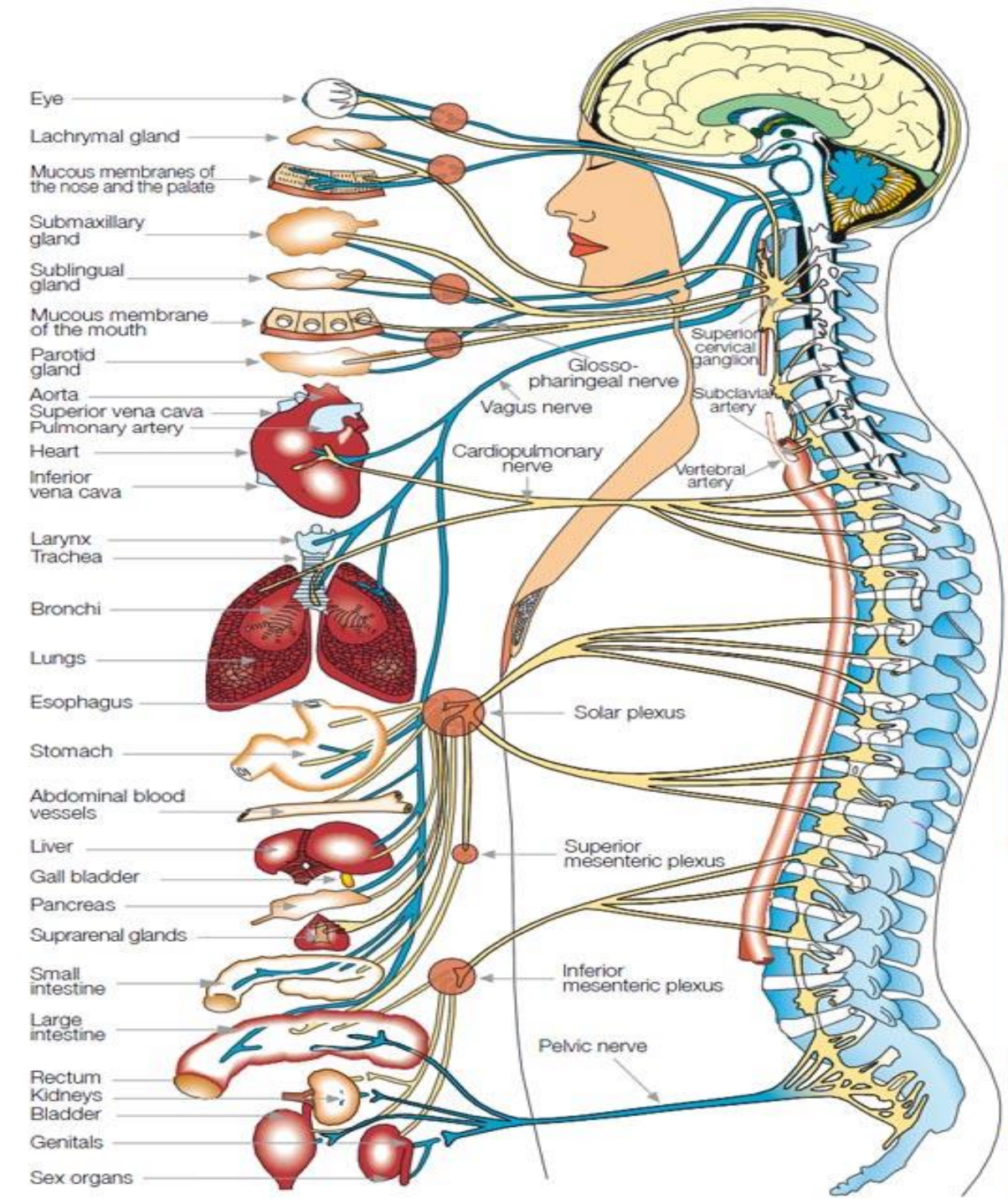
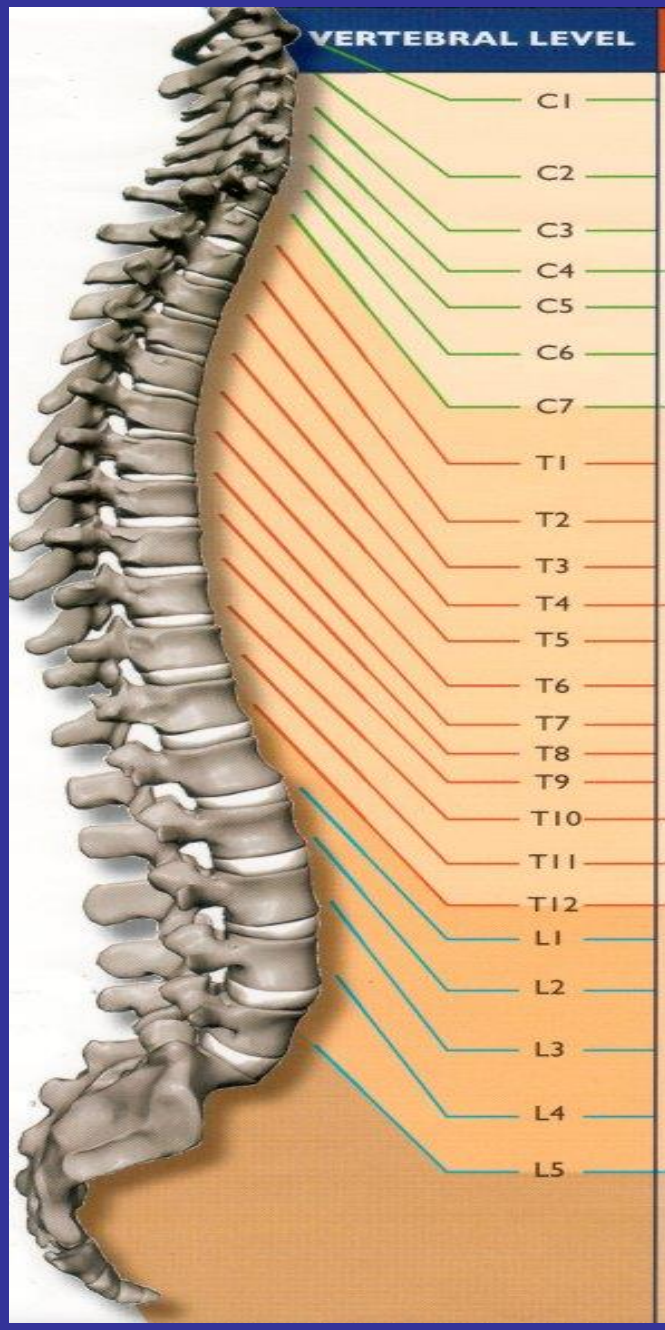
L4
L5
S1
S2
S3
S4
S5
Cervical vertebrae
Thoracic vertebrae
Lumbar vertebrae
Sacral vertebrae
LATERAL VIEW
Spinal nerves and dermatomes

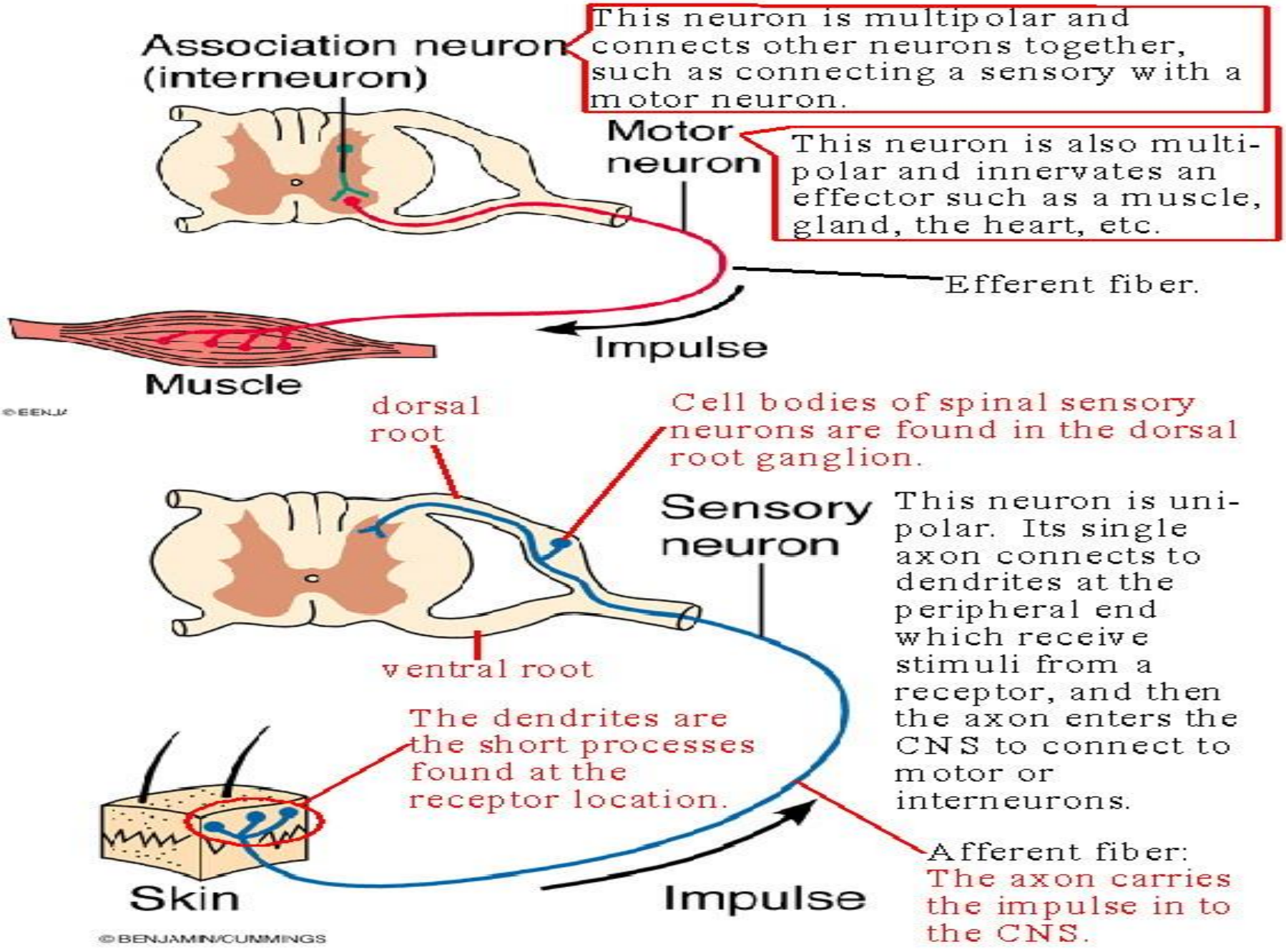


VERTEBRAE	AREAS AND PARTS OF THE BODY	POSSIBLE SYMPTOMS
CERVICAL		
C 1	• Back of the head	Headaches (including migraines, aches or pain at the back of the head, behind the eyes or in the temples, tension across the forehead, throbbing or pulsating discomfort at the top or back of head)
C 2	• Various areas of the head	
C 3	• Side and front of the neck	
C 4	• Upper back of the neck	Jaw muscle, or joint aches or pains
C 5	• Middle of neck and upper part of arms	
C 6	• Lower part of neck, arms and elbows	Dizziness, nervousness, vertigo
C 7	• Lower part of arms, shoulders	Soreness, tension and tightness felt in back of neck and throat area
DORSAL		
D 1	• Hands, wrists, fingers, thyroid	Pain, soreness, and restriction in the shoulder area
D 2	• Heart, its valves and coronary arteries	Bursitis, tendonitis
D 3	• Lungs, bronchial tubes, pleura, chest	Pain and soreness in arms, hands, elbows and /or fingers
D 4	• Gall bladder, common duct	
D 5	• Liver, solar plexus	Chest pains, tightness or constriction asthma, difficulty breathing
D 6	• Stomach, mid-back area	Middle or lower mid-back pain, discomfort and soreness
D 7	• Pancreas, duodenum	Various and numerous symptoms from trouble or malfunctioning of: – Thyroid – Heart – Lungs – Gall bladder – Liver – Stomach – Pancreas – Spleen – Adrenal glands – Kidneys
D 8	• Spleen, lower mid-back	
D 9	• Adrenal glands	
D 10	• Kidneys	
D 11	• Ureters	
D 12	• Small intestine, upper/lower back	
LUMBAR		– Small and large intestines – Sex organs – Uterus – Bladder – Prostate glands
L 1	• Ilocecal valve, large intestine	
L 2	• Appendix, abdomen, upper leg	
L 3	• Sex organs, uterus, bladder, knees	Low back pain, aches and soreness
L 4	• Prostate gland, lower back	Trouble walking
L 5	• Sciatic nerve, lower legs, ankles, feet	Leg, knee, ankle and foot soreness and pain
SACRO	• Hip bones, buttocks	Sciatica, pain or soreness in the hip and buttocks
COXIS	• Rectum, anus	Rectal trouble

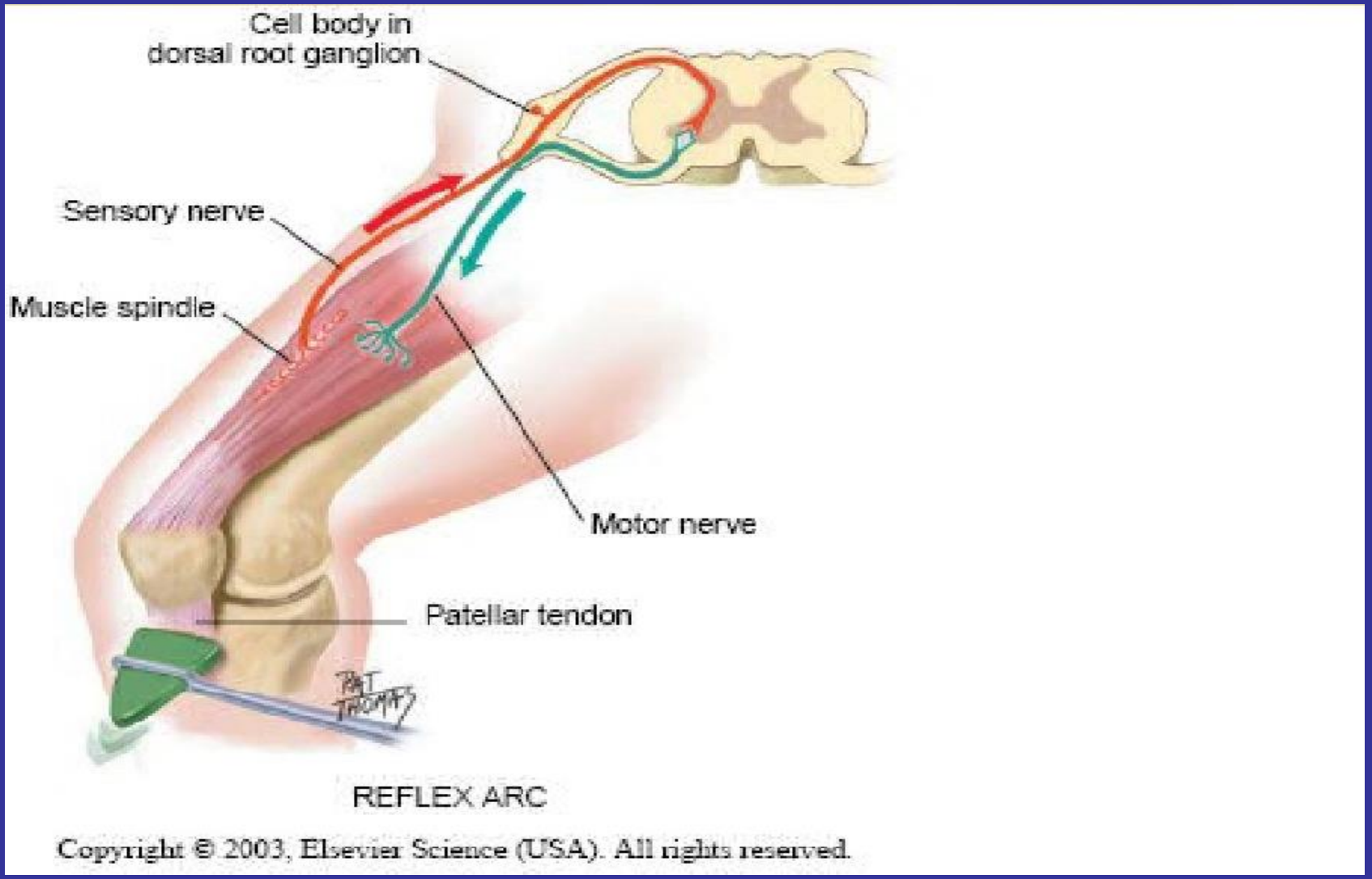


VERTEBRAL LEVEL	NERVE ROOT*	INNERVATION	POSSIBLE SYMPTOMS
C1	C1	Intracranial Blood Vessels • Eyes • Lacrimal Gland • Parotid Gland • Scalp • Base of Skull • Neck Muscles • Diaphragm	Headaches • Migraine Headaches • Dizziness • Sinus Problems • Allergies • Head Colds • Fatigue • Vision Problems • Runny Nose • Sore Throat • Stiff Neck • Cough • Croup • Arm Pain • Hand and Finger Numbness or Tingling • Asthma • Heart Conditions • High Blood Pressure
C2	C2		
C3	C3		
C4	C4		
C5	C5	• Neck Muscles • Shoulders • Elbows • Arms • Wrists • Hands • Fingers • Esophagus • Heart • Lungs • Chest	
C6	C6		
C7	C7		
	C8		
T1	T1	Arms • Esophagus • Heart • Lungs • Chest • Larynx • Trachea	Wrist, Hand and Finger Numbness or Pain • Middle Back Pain • Congestion • Difficulty Breathing • Asthma • High Blood Pressure • Heart Conditions • Bronchitis • Pneumonia • Gallbladder Conditions • Jaundice • Liver Conditions • Stomach Problems • Ulcers • Gastritis • Kidney Problems
T2	T2		
T3	T3		
T4	T4		
T5	T5	Gallbladder • Liver • Diaphragm • Stomach • Pancreas • Spleen • Kidneys • Small Intestine • Appendix • Adrenals	
T6	T6		
T7	T7		
T8	T8		
T9	T9		
T10	T10		
T11	T11	Small Intestines • Colon • Uterus	
T12	T12	Uterus • Colon • Buttocks	
L1	L1	Large Intestines • Buttocks • Groin • Reproductive Organs • Colon • Thighs • Knees • Legs • Feet	Constipation • Colitis • Diarrhea • Gas Pain • Irritable Bowel • Bladder Problems • Menstrual Problems • Low Back Pain • Pain or Numbness in Legs
L2	L2		
L3	L3		
L4	L4		
L5	L5		
	SACRAL	Buttocks • Reproductive Organs • Bladder • Prostate Gland • Legs • Ankles • Feet • Toes	Constipation • Diarrhea • Bladder Problems • Menstrual Problems • Lower Back Pain • Pain or Numbness in Legs

Functional Classes of Neurons



Reflex Arc



REFLEX ARC

Health History

- **Headache**

Location, severity, how long it lasts, any **associated symptoms**, **visual changes, weakness, loss of sensation**, whether **affected by cough, sneezing, and sudden movement** of the head, (can increase ICP. **E.g subarachnoid hemorrhage**)

- **Dizziness or Vertigo**

Any associated symptoms, such as double vision (**Diplopia**), difficulty forming words (**dysarthria**), difficulty with gait or balance (**ataxia**)—these may happen in **TIA (transient ischemic attack) or stroke**.

Vertigo: a perception that the room is spinning or rotating. E.g **inner-ear problem, brainstem tumor**.

- **Generalized, proximal, or distal weakness**

  TIA may be **generalized**, in the **face**, or **other part** of the body. **Exact meaning of weakness**. Any paralysis or inability to move a part of the body?

- **Focal weakness** may arise from **ischemic, vascular, or mass lesions** in the **CNS** or from **peripheral nervous system disorders.**
- **Proximal or distal** weakness:
  - in the **arms** (**proximal**: combing hair, reaching something on a shelf) (**distal**: opening a can, using a hand tool like scissors)
  - in the **legs** (**proximal**: getting out of chair, taking a high step up), (**distal**: frequent tripping).
  - weakness worse with repeated effort and better with rest (**myasthenia gravis**).

Health History

- **Changes in sensation: numbness, abnormal or loss of sensations.**
  - **Numbness**, clarify its meaning and location: loss, **difficulty moving or altered sensation**, such as **tingling or pins and needles.**
  - **Paresthesia** (Peculiar **sensation** **without an obvious stimulus**: tingling, prickling, feeling of warmth, coldness or pressure)
  - **Dysesthesia** (distorted **sensation** in **response to a stimulus** & may last longer than the stimulus itself: light touch or pin prick as a burning, or tingling sensation that is irritating or unpleasant).

- **Loss of consciousness, syncope, or near syncope:** what they mean by loss of consciousness, black out completely? Voices could still be heard?
  - Syncope (a transient LOC),
  - near syncope or pre-syncope are the symptoms of feeling faint, light-headed, weak, but without actual loss of consciousness.

Health History

- Types of syncope (table at text book), such as:
  - Vasodepressor syncope (the common faint)
  - Postural hypotension (orthostatic)
  - Cough syncope
  - Cardiovascular disorders causing syncope, such as arrhythmias, aortic stenosis, cardiomyopathy, MI, massive pulmonary embolism
  - Disorders resembling syncope: hypocapnia, hypoglycemia, hysterical fainting

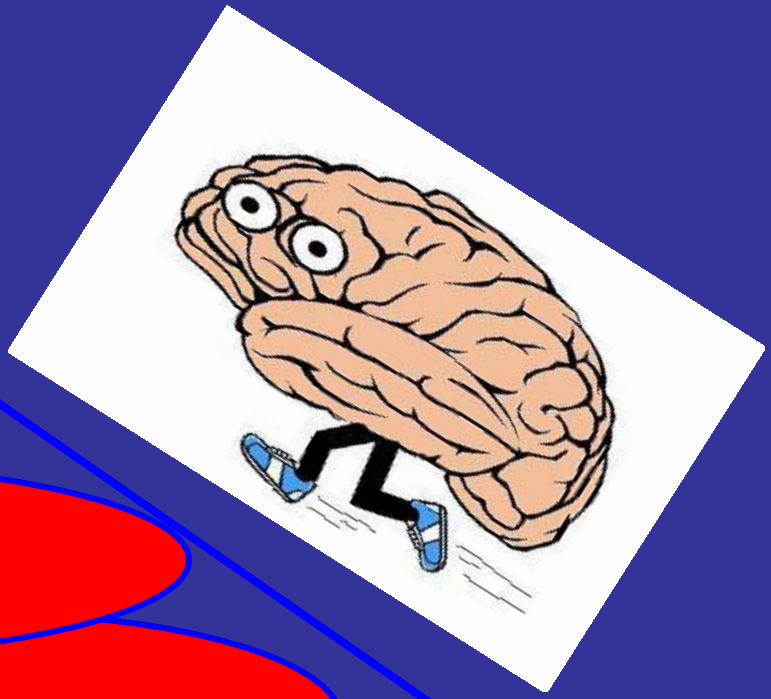
Health History

- **Seizures** : Observed episode? What did patient look like before, during, and after? Seizure-like movement of arms or legs? Incontinence in bladder or bowel? Drowsiness or impaired memory?
  - **Seizure** is a paroxysmal disorder caused by sudden excessive electrical discharge in the cerebral cortex or its underlying structures. There may be several types.
  - For both **syncope and seizures** **ask about any history of prior head injury**

- **Tremors or involuntary movements**: trembling, shakiness, or body movements the patient is unable to control.

Sequence of complete neurological examination

- Reflexes
- Sensory system
- Motor system
- Cranial nerves
- Mental status



Techniques of the Neuro Exam

- **Mental status**
- **Cranial nerves I through XII**
- **Motor system**
- **Sensory system**
- **Reflexes**
- Three important aspects concerning the neurological exam:
  - ***Mental status*** intactness.
  - ***Symmetry*** of Right and left sides
  - ***Location of the lesion*** if any asymmetry. If the findings are *asymmetric or abnormal*, does the causative *lesion lie* in the central nervous system or the peripheral nervous system?

Components of mental examination:

A, S, M , T, C

Appearance & **b**ehavior , **S**peech & language, **Mood, T**hought process, and **C**ognitive functions

Mental Status

1. Appearance and behavior

a. **Level of consciousness:** alertness or state of awareness of the environment (awake, alert). Understanding questions, responding appropriately and reasonably quickly, keeping track of the topic—phasing out as in falling asleep or silent.

- If the patient seems to be un alert & even not wake, you would want to assess the level of consciousness (arousal) in this situation techniques & patient response:
  - **Alertness:** arousal intact, the person opens the eyes, looks at you, responds fully and appropriately to stimuli.
  - **Lethargy:** speak in a **loud voice**. An abnormal response would be the patient appears **drowsy**, but opens the eyes and looks at you, responds to your questions, and **then falls asleep**.

Mental Status

a. Level of consciousness: continued

- Obtundation: shake gently as if awakening a sleeper. An obtunded patient opens the eyes and looks at you, but **responds slowly and somewhat confused**. **Alertness and interest** in the environment are **decreased**.

- Stupor: **arouses from sleep only after painful stimulus**, pinch a tendon, rub the sternum, and roll a pencil across a nail bed. **Slow or absent verbal response. Lapses into unresponsiveness when stimulus is gone.**

- Coma: repeated painful stimuli. **Unarousable and with eyes closed.**

LOC (Arousal): Techniques and Patient Response

Level of Consciousness (Arousal): Techniques and Patient Response

Level	Technique
Alertness	Speak to the patient in a normal tone of voice. An alert patient opens the eyes, looks at you, and responds fully and appropriate to stimuli (arousal intact).
Lethargy	Speak to the patient in a loud voice. For example, call the patient name or ask "How are you?"
Obtundation	Shake the patient gently as if awakening a sleeper.
Stupor	Apply a painful stimulus. For example, pinch a tendon, rub the sternum, or roll a pencil across a nail bed. (No stronger stimuli needed!)
Coma	Apply repeated painful stimuli.

Mental Status

1. Appearance and behavior: continued

b. Posture and motor behavior: body posture and patient's ability to relax. Movements. Voluntary control.

- **Tense posture**, restless, fidgety from anxiety
- **Crying,** pacing, handwringing with **agitated**
- **Hopeless**, slumped, and **slowed** movements with depression

–Singing, dancing, and expansive movements

c. Dressing, grooming, personal hygiene

d. **Facial expression:** anxiety, depression, **apathy,** anger

e. Manner, affect, and relationship to persons and things: affect is the feeling tone that is usually episodic, expressed through facial expression, voice, body movements. Such as Anger, hostility, suspiciousness

Mental Status

2. **Speech and language**: language is expressing, receiving, and comprehending words. Note the characteristics, and if any disorders of speech: look for those affecting the voice, the articulation of words, the production and comprehension of language.

- **Loudness:** loud or soft? ***Aphonia*** refers to **loss of voice** from defects in larynx or its nerve supply. ***Dysphonia*** less severe **impairment in volume**, **quality, and pitch** (from vocal cord paralysis as in CN X)

Mental Status

2. **Speech and language** : continued
   - **Articulation of words** *dysarthria* (*defective articulation*) *defect in muscle control of speech (lips, tongue, pharynx, palate*) occurs from **motor lesions** in the central or peripheral nervous system. Aphasia: **disorder of language**: Defect in expressing speech, writing or signs, defect in understanding speech or writing, results from lesions in the dominant cerebral hemisphere (CNS: communication center)

3. **Mood**: Explore the **patient's perception** of their mood. Sadness, joy, euphoria, anger

Mental Status

4. Thoughts and perception

a. Thought processes: the logic, relevance, organization, coherence of the patient's thought as it leads to selected goals, or how people think. Disorders of thought processes.

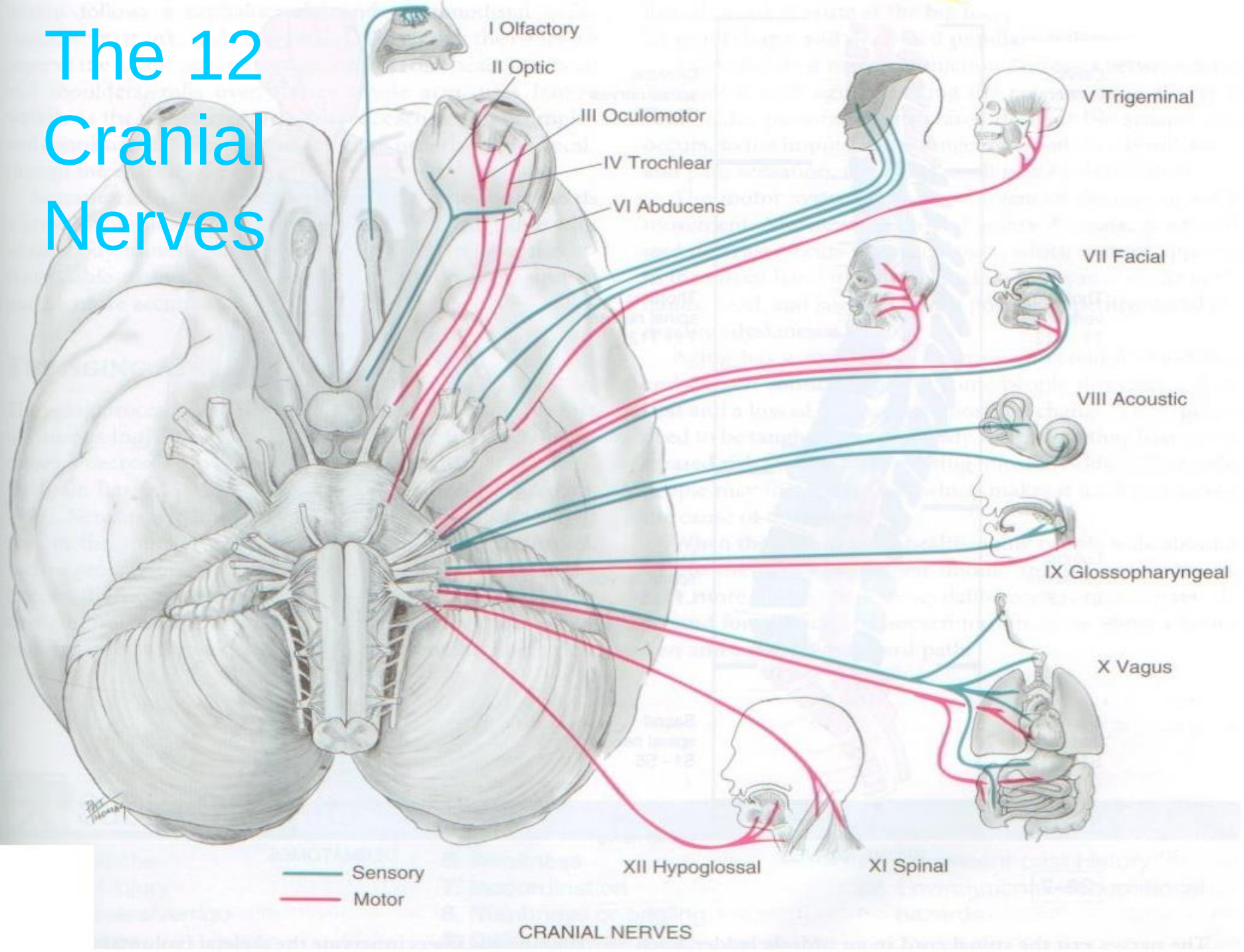
e.g. flight of ideas

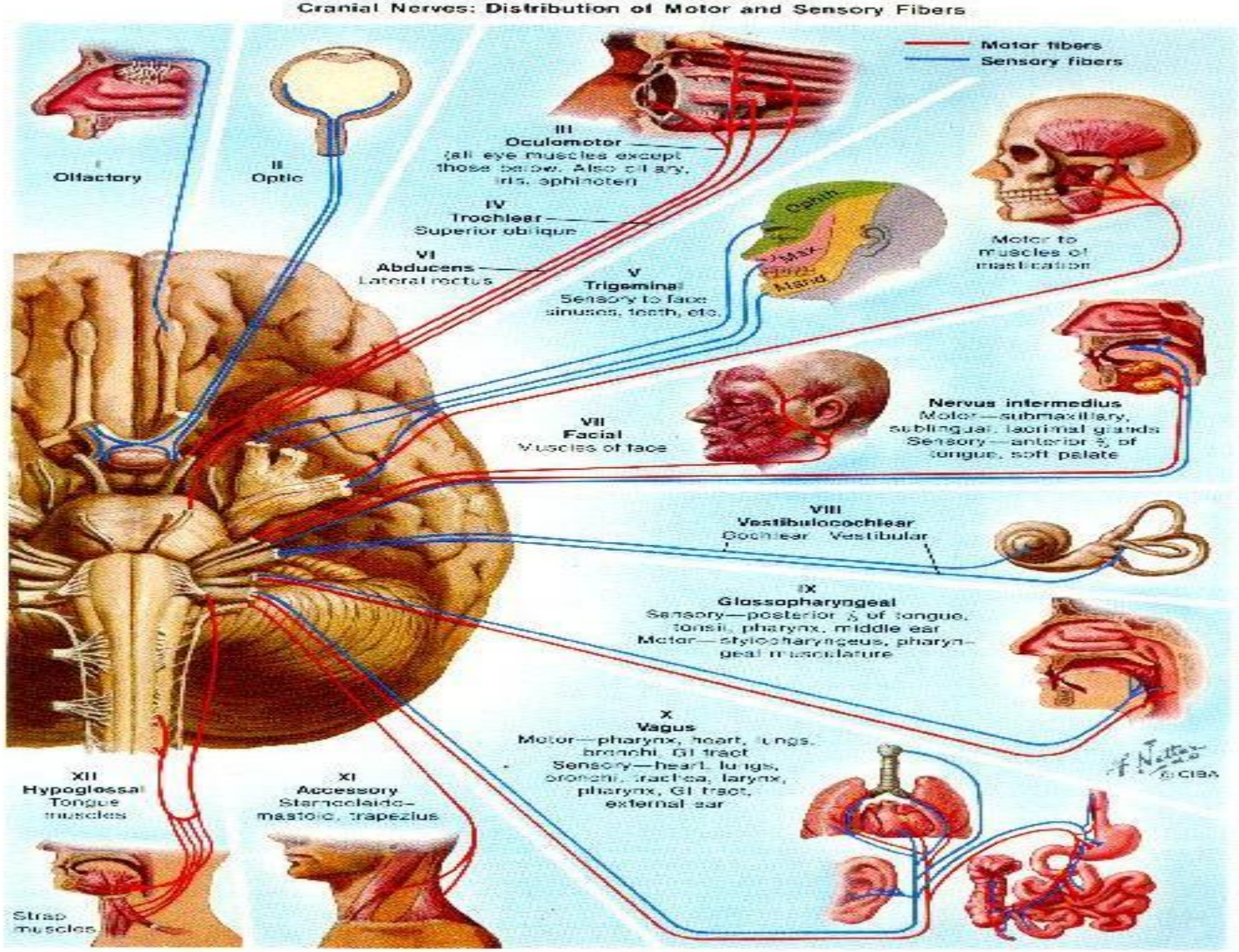
b. Perceptions: **sensory awareness of objects in the environment** and their interrelationship (external stimuli) & internal stimuli, such as dreams or hallucinations. Inquire about false perceptions: ***Illusions*** (**misinterpretation of real external stimuli**), may occur in grief reactions. Delirium, PTSD, schizophrenia. ***Hallucinations*** (auditory, visual, olfactory, gustatory, tactile, or somatic without stimulus). Delirium, dementia, post traumatic stress disorder, schizophrenia

5. **Cognitive function**

- Orientation: requires memory or attention. Being aware to **person, place, and time**.
- Attention: **ability to focus on one task or activity**. A person who has impaired attention has difficulty giving a history or responding to questions.
- Remote memory: long term memory, refers to intervals of years.
- Recent memory: short term memory, refers to minutes, hours, or days.
- New learning ability: immediate repetition of material, followed by storage or retention of information.

The 12 Cranial Nerves

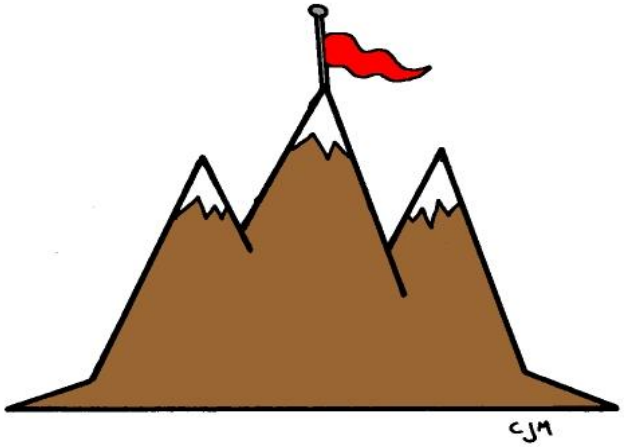



Cranial Nerves: Distribution of Motor and Sensory Fibers
Motor fibers
Sensory fibers
I
Olfactory
II
Optic
III
Oculomotor
(all eye muscles except those below. Also ciliary, iris, sphincter)
IV
Trochlear
Superior obliquus
VI
Abducens
Lateral rectus
V
Trigeminal
Sensory to face: sinuses, teeth, etc.
Motor to muscles of mastication
VII
Facial
Muscles of face
Nervus intermedius
Motor—submaxillary, sublingual, lacrimal glands
Sensory—anterior ⅔ of tongue, soft palate
VIII
Vestibulocochlear
Cochlear
Vestibular
IX
Glossopharyngeal
Sensory—posterior ⅓ of tongue, tonsil, pharynx, middle ear
Motor—stylopharyngeus, pharyngeal musculature
X
Vagus
Motor—pharynx, heart, lungs, bronchi, GI tract
Sensory—heart, lungs, bronchi, trachea, larynx, pharynx, GI tract, external ear
XII
Hypoglossal
Tongue muscles
XI
Accessory
Sternocleidomastoid, trapezius
Strap muscles
© CIBA

CRANIAL NERVE MNEMONIC

S = Sensory	M = Motor	B = Both

O	Olfactory	O	On	S	Some
O	Optic	O	Old	S	Say
O	Oculomotor	O	Olympus	M	Marry
T	Trochlear	T	Towering	M	Money
T	Trigeminal	T	Tops	B	But
A	Abducens	A	A	M	My
F	Facial	F	Finn	B	Brother
A	Acoustic	A	And	S	Says
G	Glossopharyngeal	G	German	B	Bad
V	Vagus Nerve	V	Viewed	B	Business
S	Spinal	S	Some	M	Marry
H	Hypoglossal	H	Hops	M	Money



The Cranial Nerves

No.	Cranial Nerve	Function
I	Olfactory	Sense of smell
II	Optic	Vision
III	Oculomotor	Pupillary constriction, opening the eye, and most extraocular movements
IV	Trochlear	Downward, inward movement of the eye
VI	Abducens	Lateral deviation of the eye
V	Trigeminal	*Motor*—temporal and masseter muscles (jaw clenching), also lateral movement of the jaw *Sensory*—facial. The nerve has three divisions: (1) ophthalmic, (2) maxillary, and (3) mandibular.

Anosmia: decrease or loss of smell in smokers, cocaine use, allergies

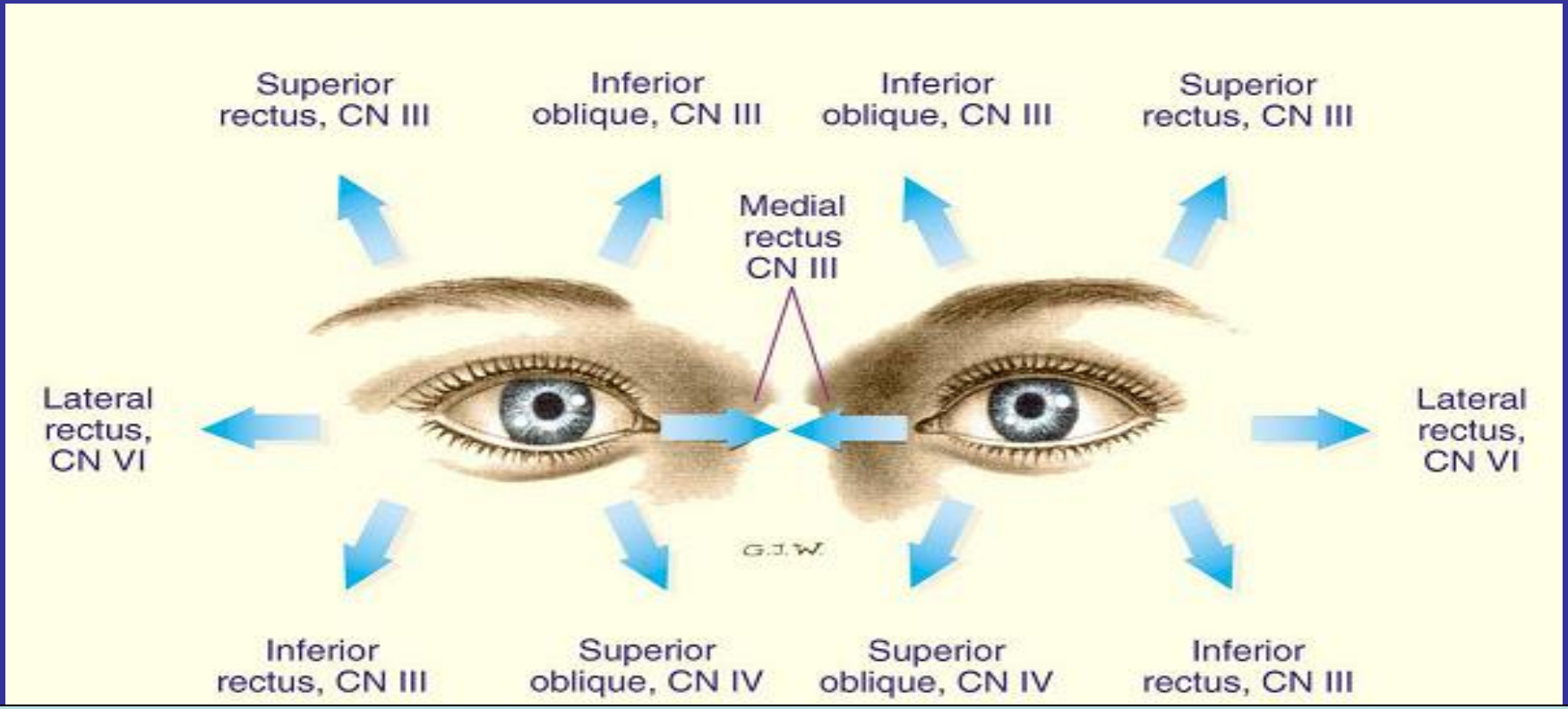
Visual acuity, visual fields, & ocular fundi

- Olfactory: make the patient smell, close one naris and make sure it is open: coffee vanilla…
- Optic nerve: visual acuity, optic fundi exam, visual field by confrontation.
- **CN III:**

Anisocoria: if difference in size of pupils more than 0.4

Cranial Nerves II and III—Optic and Oculomotor. Inspect th size and shape of the pupils, and compare one side with the other. Test th *pupillary reactions to light*; if these are abnormal, examine the *near respon* also (see p. 149).

Oculomotor (CN – III)
Trochlear (CN – IV)
Abducens (CN – VI)



Ptosis: eyelid drooping

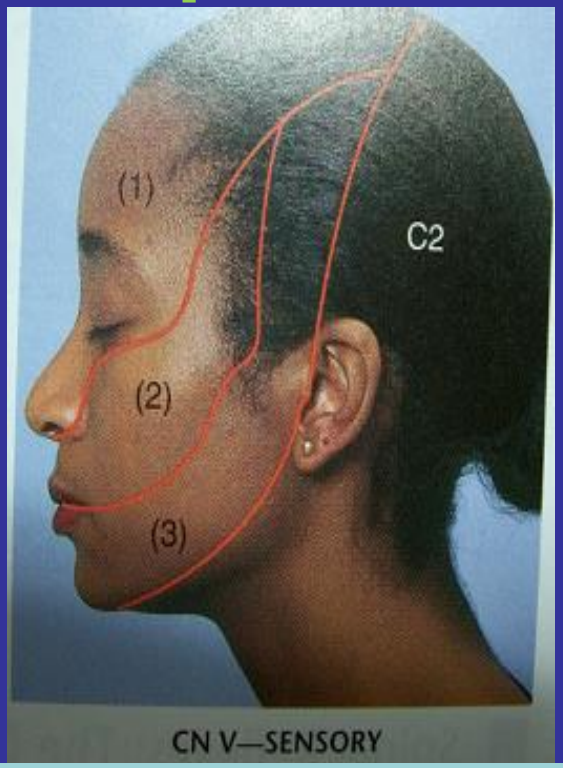
Strabismus: (deviated gaze) or limited movement of eye: **Lazy eye**

Nystagmus: back-and-forth oscillation/movement of the eyes (can be jerky or rndular) p

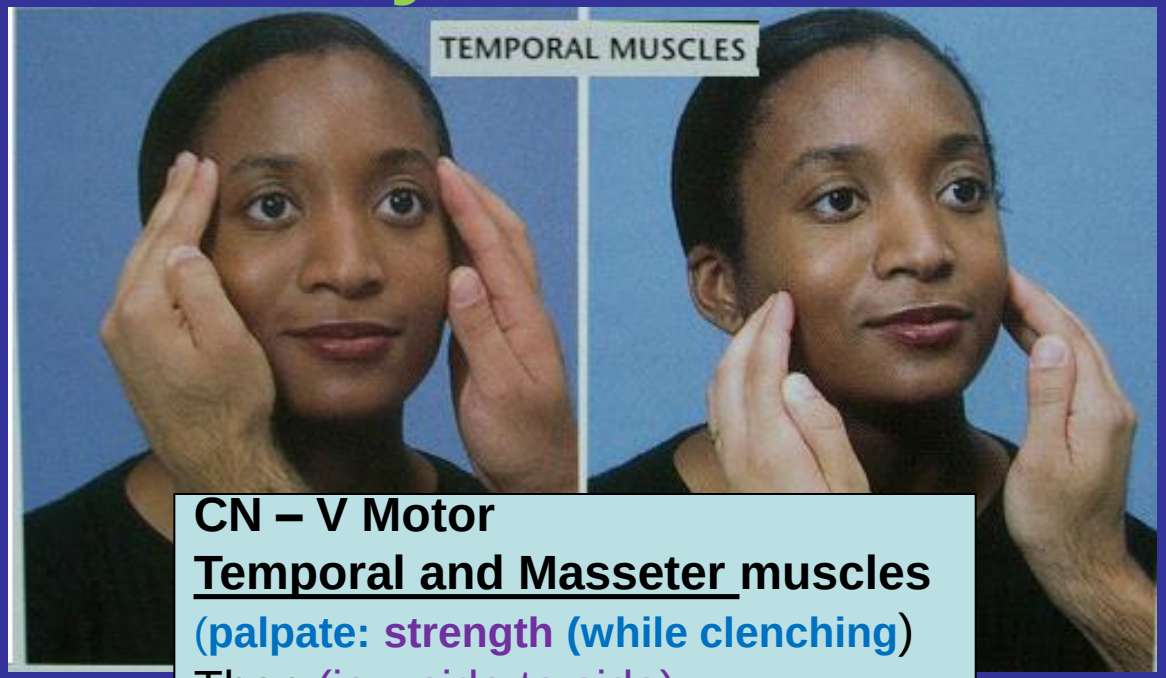
Cranial Nerves III, IV, and VI—Oculomotor, Trochlear, and Abducens. Test the *extraocular movements* in the six cardinal directions of gaze, and look for loss of conjugate movements in any of the six directions. Check convergence of the eyes. Identify any nystagmus, noting the direction of gaze in which it appears, the plane in which movements occur (horizontal, vertical, rotary, or mixed), and the direction of the quick and slow components (see pp. 149–151).

Look for *ptosis* (drooping of the upper eyelids). A slight difference in the width of the palpebral fissures may be noted in about one third of all normal people.

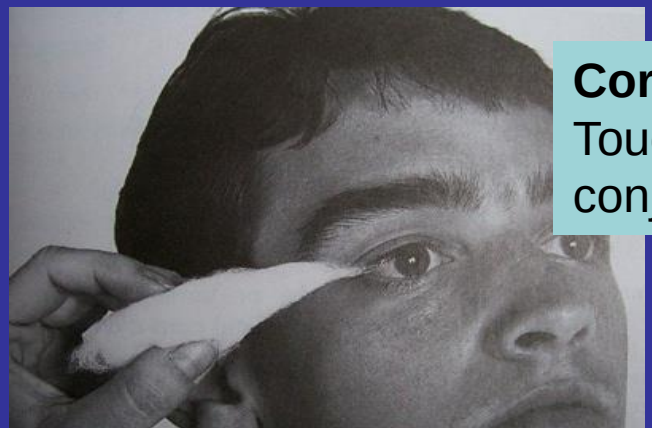
Trigeminal (CN – V)
Ophthalmic, Maxillary &Mandibular



Sensory: eye close
<u>Forehead, cheeks & jaw</u>
(**sensation for 1)** pain **(sharp: dull)**, **2)** temp (**hot : cold**) **3)** light touch (**cotton**)



CN – V Motor
<u>Temporal and Masseter</u> muscles
(**palpate: strength (while clenching**)
Then (jaw side to side)



Corneal reflex
Touch cornea & conjunctiva

The Cranial Nerves

VII	**Facial**	*Motor*—facial movements, including those of facial expression, closing the eye, and closing the mouth
		Sensory—taste for salty, sweet, sour, and bitter substances on the anterior two thirds of the tongue
VIII	**Acoustic**	Hearing (cochlear division) and balance (vestibular division)
IX	**Glossopharyngeal**	*Motor*—pharynx *Sensory*—posterior portions of the eardrum and ear canal, the pharynx, and the posterior tongue, including taste (salty, sweet, sour, bitter)
X	**Vagus**	*Motor*—palate, pharynx, and larynx *Sensory*—pharynx and larynx
XI	**Spinal accessory**	*Motor*—the sternomastoid and upper portion of the trapezius
XII	**Hypoglossal**	*Motor*—tongue

Is not done routinely

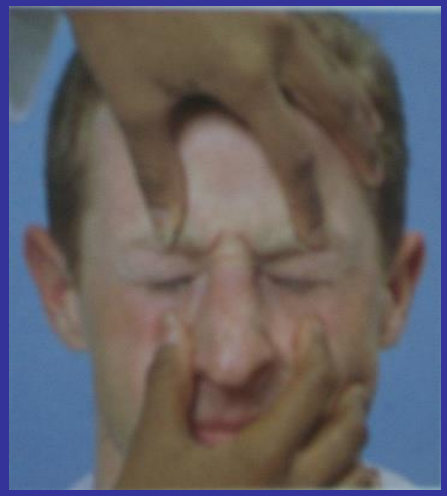
Whisper, weber, & Rinne test

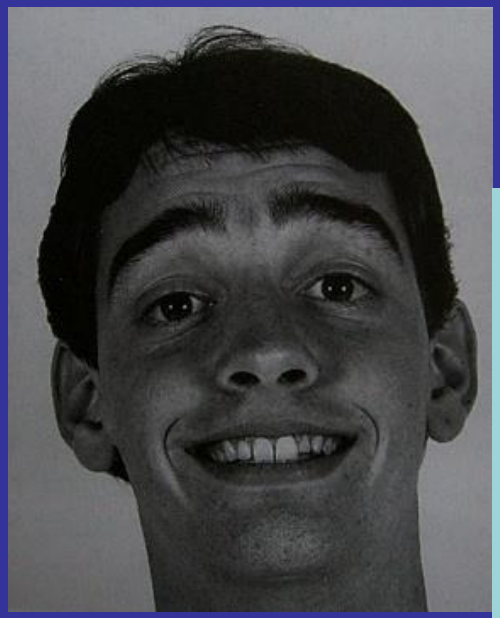
Tongue deviation toward the paralyzed side; dysarthria: poor articulation.

- -Insp. tongue on the floor of mouth
-Protrude tongue; move it side to side; push it against each cheek
- listen to pt. articulation of words : (CNs: V, VII, X, XII)

Facial Nerve (CN - VII)

Bell's Palsy





Note any muscle weakness and symmetry of movement

Frown,
Smile
Raise eyebrows
Close both eyes tightly
Show upper &lower teeth
Puff out both cheeks

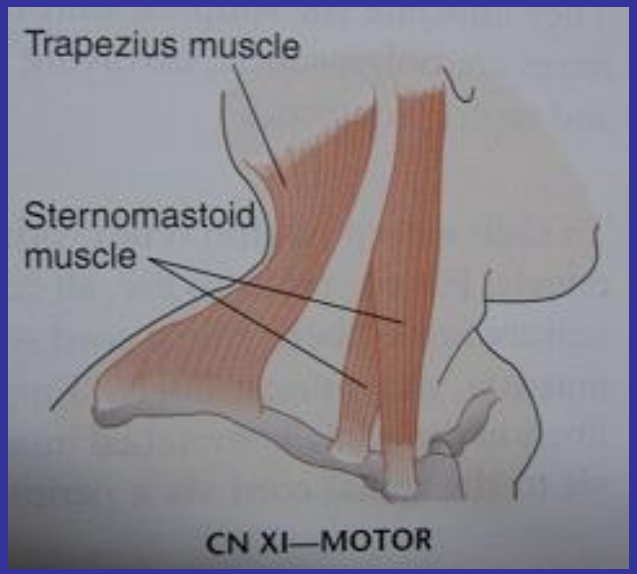
CN-VIII

Cranial Nerve VIII—Acoustic. Assess *hearing*. If hearing loss is present, (1) test for *lateralization*, and (2) compare *air and bone conduction*

Glossopharyngeal & Vagus Nerve
CN – IX & X

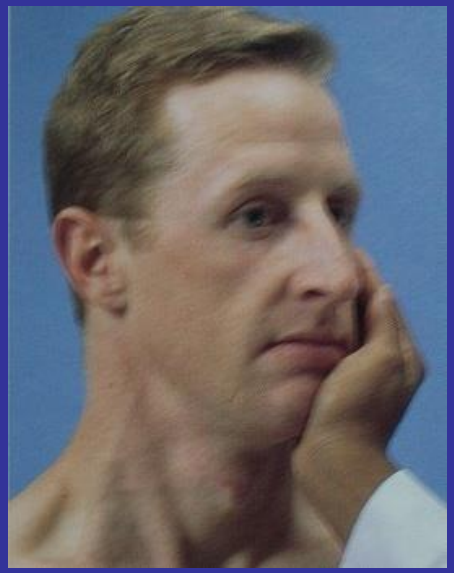
- **Motor:**
  - Depress the tongue
  - Say **"ahhh" or yawn** and note the uvula and soft palate rise
  - **Gag reflex**
  - **Voice Abnormalities**: hoarseness (vocal cord paralysis), nasal voice (palate paralysis) difficulty
  - **swallowing** (pharyngeal or palatal paralysis)
- **Sensory:**
  - Taste at posterior 1/3 of tongue

Spinal Accessory Nerve (CN - XI)



-pt shrug shoulders upward against your hand: strength & contraction of trapezii

- Pt turn his head to each side against your hand: strength & contraction of opposite sternomastoid



Cranial nerve XII

-Insp. tongue on the floor of mouth

-**Protrude** tongue; move it **side to side**; push **it against each cheek**

-**Tongue deviation toward the paralyzed side; -**

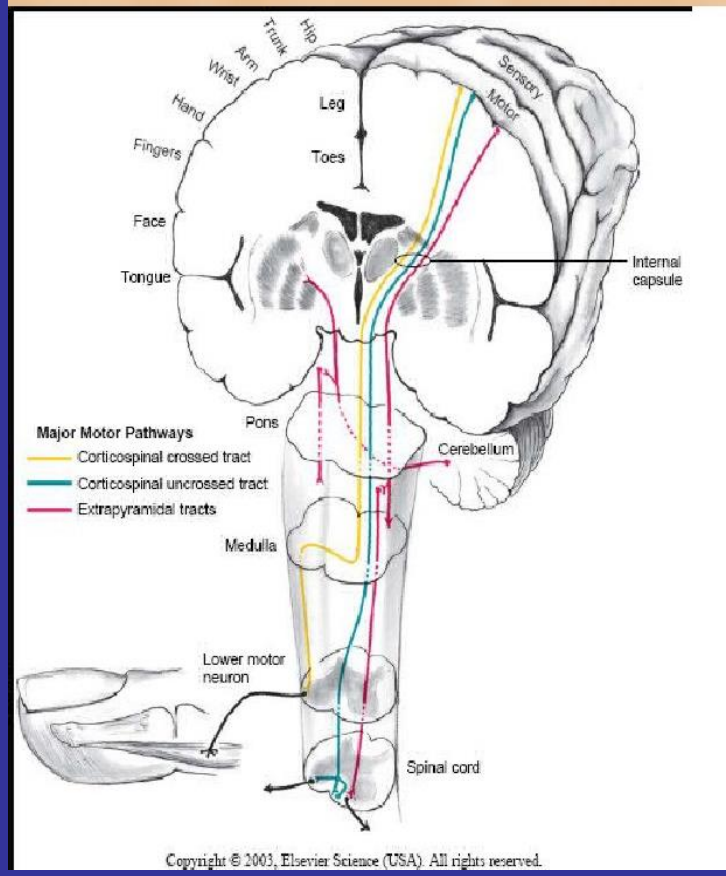
-dysarthria: poor articulation.

Inspect the patient's tongue as it lies on the floor of the mouth. Look for any atrophy or *fasciculations* (fine, flickering, irregular movements in small groups of muscle fibers). Some coarser restless movements are often seen in a normal tongue. Then, with the patient's tongue protruded, look for asymmetry, atrophy, or deviation from the midline. Ask the patient to move the tongue from side to side, and note the symmetry of the movement. In ambiguous cases, ask the patient to push the tongue against the inside of each cheek in turn as you palpate externally for strength.

Listen to pt articulation of words: CNs: V, VII, X, XII

Central Nervous System: Function

- Spinal Cord
  - Motor Pathways
    - **Corticospinal (Pyramidal)**
      - voluntary movement
      - especially skilled, purposeful
    - **Extrapyramidal**
      - maintains muscle tone
      - controls gross body movement
    - **Cerebellar**
      - coordinates movement
      - maintains equilibrium and posture
- Any lesion in any of these affects motor and reflex activity



Inspect & palpate the motor system

.Body position: during movement & at rest.

.Muscle bulk: size & contours

.Muscle tone

.Muscle strength

.Involuntary movement

Size/ Bulk

- **Normal finding**
  - ✓ Symmetric bilaterally
- **Abnormal finding**
  - ✓ Atrophy: loss of muscle bulk or wasting. Happen in muscle disuse, injury to lower motor neuron disease such as polio, diabetic neuropathy.
  - ✓ Hypertrophy: an increase in bulk (by exercise)

strength

- **Normal finding**

✓ Strong

- **Abnormal finding**

✓ Paresis or weakness

✓ Paralysis or plegia

(hemiplegia , paraplegia , quadriplegia)

Strength: test muscle power

Paresis or weakness: diminished strength

Paralysis or plegia: is absence of strength

Hemiparesis (weakness) **or hemiplegia**: paralysis of one side of the body

Assessment of the Motor System

- Grading Muscle Strength:
  - 5: Full ROM against gravity, full resistance. **(normal)**
  - 4: Full ROM against gravity, some resistance.
  - 3: Full active ROM against gravity.
  - 2: Full active ROM with gravity eliminated (Passive motion).
  - 1: Slight contraction barely detected
  - 0: No contraction.

Tone

is the normal degree of tension (**contraction**) in voluntary relaxed muscle

- Normal finding

✓ Note a mild , even resistance to movement (passive stretch)

- Abnormal finding

✓ Pain with motion

✓ Decreased resistance: related to peripheral disease in nervous system, cerebellum, or spinal injury

✓ Flaccidity: **hypotonic (** ↓resistance)

✓ Spasticity (increase resistance at the extremes of range)

✓ Rigidity (increase resistance &Limited range motion in both direction)

Involuntary movement

- Normal finding
  - ✓ No involuntary movement occur
- Abnormal finding
  - ✓ Tic
  - ✓ Tremor
  - ✓ Chorea

Tics: repetitive twitching of a muscle group at inappropriate time

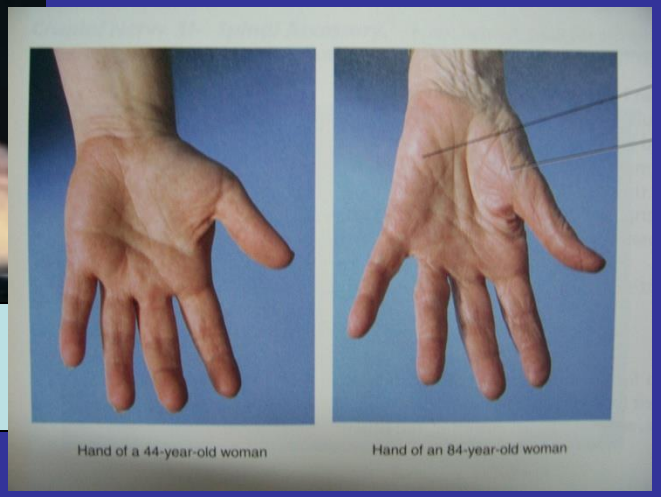
Tremor: involuntary contraction of opposing muscle group in a rhythmic movement as in Parkinson's disease

Chorea: sudden, **rapid jerky**, purposeless movement as in Huntington's disease

Assessment of the Motor System
Common Abnormalities of Muscles

Tics

Atrophy of thenar eminence



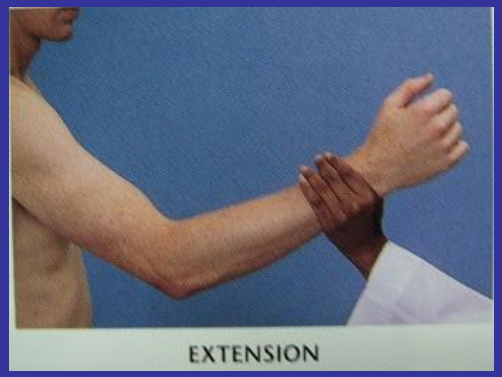
Tremor

Chorea

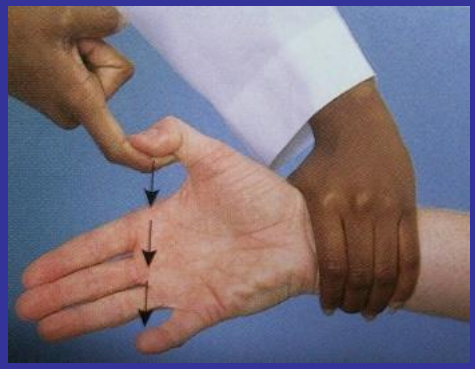
Assessment of the Motor System
Common Abnormalities of Muscles

Test Grip

Flaccid



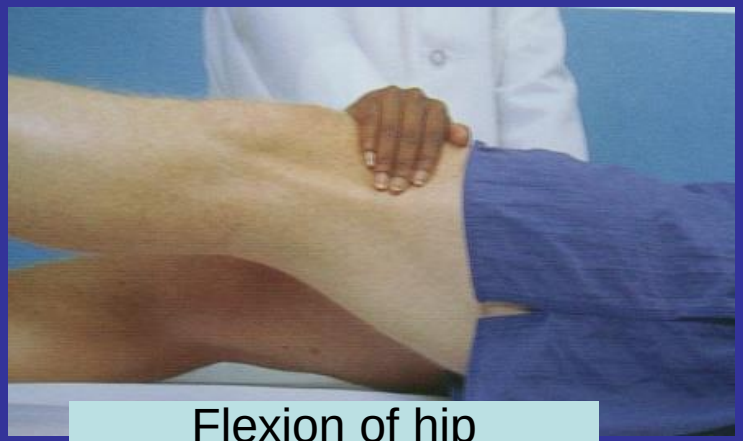
Finger abduction



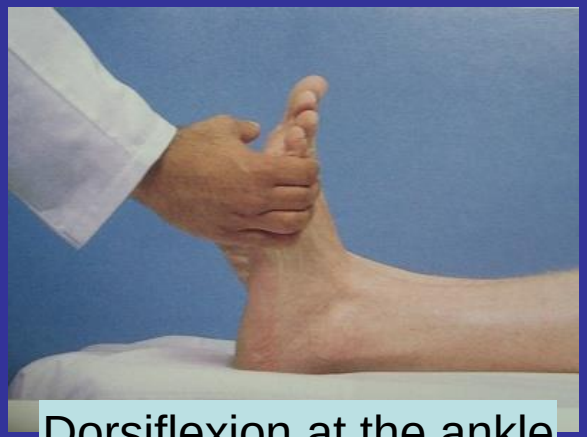
Opposition of thump

Assessment of the Motor System

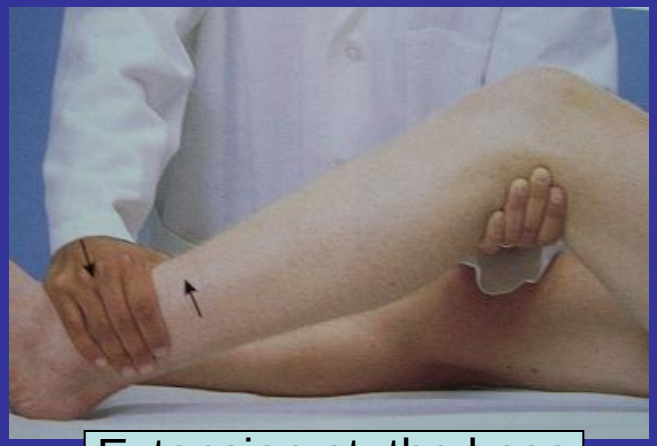
Common Abnormalities of Muscles



Flexion of hip



Dorsiflexion at the ankle



Extension at the knee

Plantar flexion at the ankle

Assessment of the Motor System

- **Coordination and Skilled Movement**
  - Rapid alternating movements
    - Observe speed, rhythm, and smoothness

Rapid alternate movement

-Tape the distal joint of the thumb with the tip of the index finger

Assessment of Cerebellar Function

Point-to-point movements:

-Legs-Heel-to-shin test:
Rt. Heel on Lt knee-shine-big toe

Heel-to-shin

-Arms-Finger-to-nose test

Assessment of the Motor System

- **Cerebellar Function**

-Balance tests

- **Gait**: walk across the room-turn-come back: smooth, rhythmic, and effortless with opposite arm swinging coordinated; smooth turn
  - Ataxia: uncoordinated or unsteady gate
- **Tandem walking**: walk in heel-to-toe fashion to assess for coordination problems
- **Hop in place**
- **Shallow knee bend**
- **Rise from a sitting position**

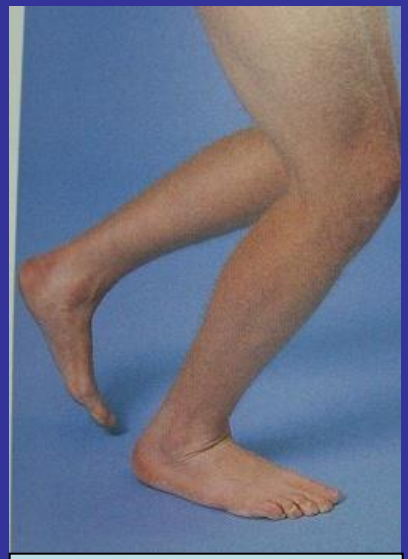
Tandem walking

Assessment of the Motor System

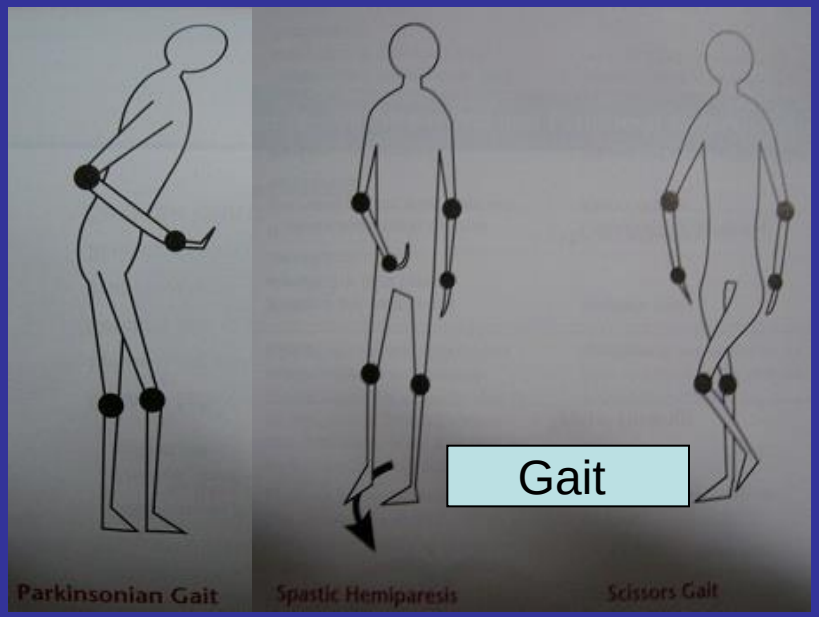
- Cerebellar Function
  - **Stance (posture):**
    - **Romberg test**: test of position test, patient stand feet together, eyes closed, for 30-60 sec.
      - Positive: when lose balance, sways, widens base of feet to avoid falling
        - » Occur when patient has multiple sclerosis, alcohol intoxication
    - **Pronator drift test**:
      - stand for 20-30 sec, **arms up, palms up, eyes closed;**
      - then instruct the ***patient to keep arms up, tap the arms briskly downward***, the patient should be able to keep arms up back smoothly.
      - **Abnormal finding**: downward drift of arm with flexion of elbow and fingers; or

        Pronator Drift: pronation of one arm: (corticospinal tract lesion)
        - » Sideward or upward drift suggests loss of position sense.

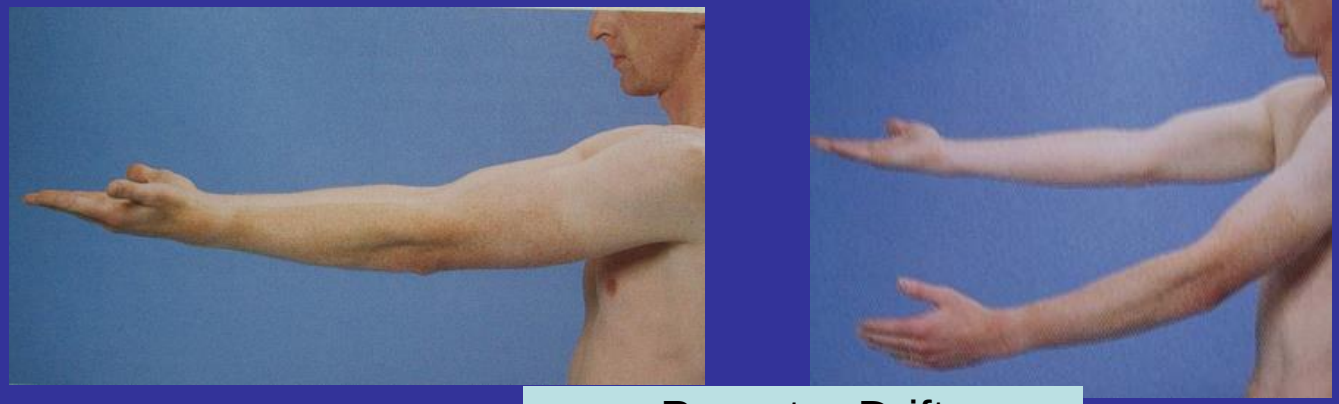
Assessment of Cerebellar Function



Hop in place



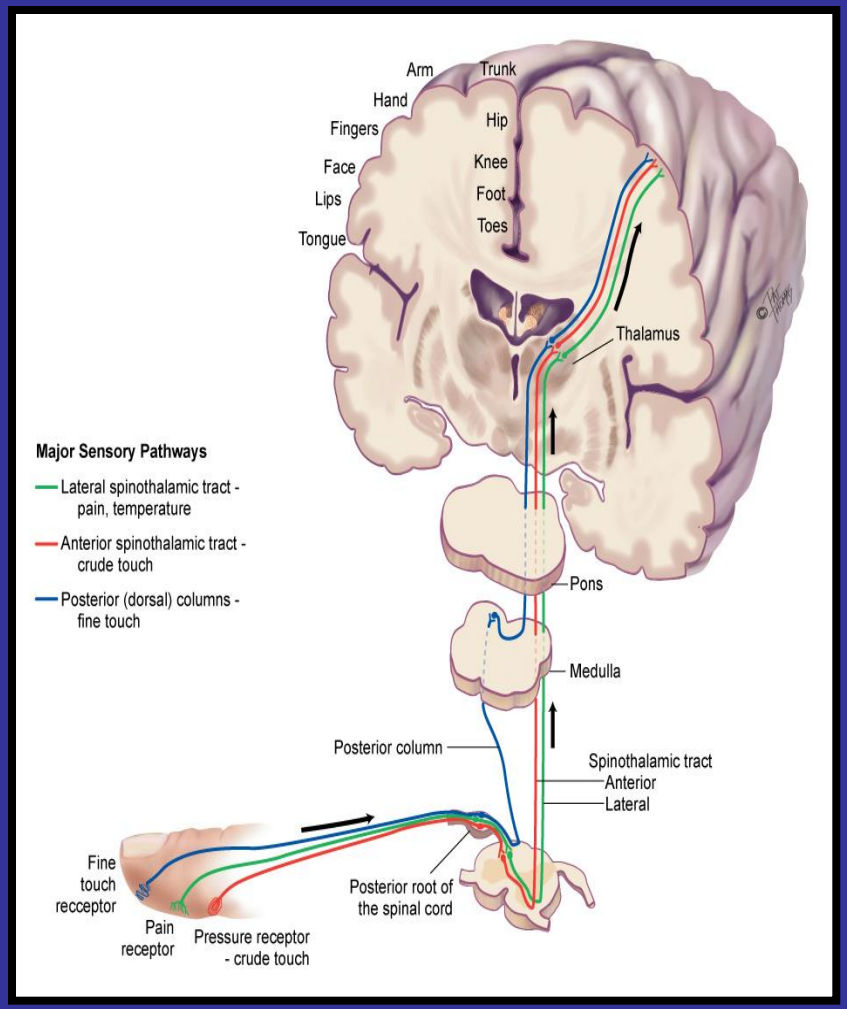
Gait



Pronator Drift

Central Nervous System: Function

- Spinal Cord
  - **Sensory Pathways**
    - **Spinothalamic**
      - **light and crude touch**
      - **pain**
      - **temperature**
    - **Posterior Column (discriminatory sensations)**
      - **body position**
      - **vibration**
      - **fine touch**
      - **2 point discrimination**
      - **stereognosis**



Assessment of the Sensory System

- Careful **attention** is paid to areas where there are:
  - Numbness or pain
  - Motor or reflex abnormalities (spinal cord injury)
  - Trophic changes (skin atrophy, ulceration, excessive sweating)
- To accurately identify deficits:
  - Compare symmetric areas
  - Compare distal with proximal areas
  - Vary the pace of your testing

Assessment of the Sensory System

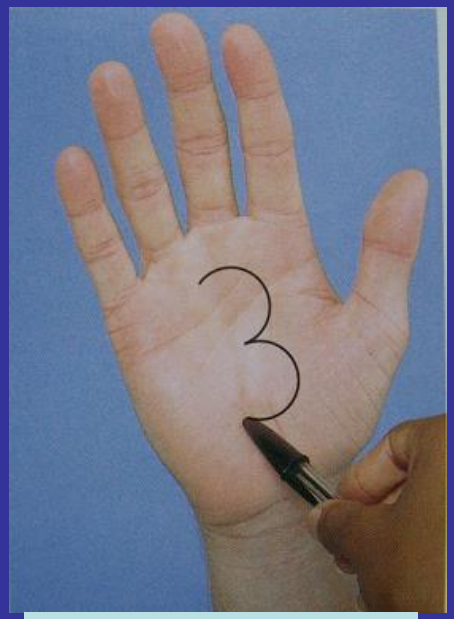
- **Pain**: sharp or dull?
  - Analgesia: absence of pain sensation
  - Hypalgesia: decreased sensitivity to pain
  - Hyperalgesia: increased sensitivity to pain
- **Temperature**: not necessarily performed if pain sensation is normal.
  - Hot or cold sensation?
- **Light Touch**: with a "**wisp of cotton**" touch skin lightly; avoid pressure.
  - Anesthesia: absence of touch sensation
  - Hypesthesia: is a decreased sensitivity to touch
  - Hyperesthesia: increased sensitivity to touch.
- **Vibration**: using **low pitch tuning fork 128 Hz**
  - Start from distal interpharangeal joints (to proximal if there is abnormalities)
  - Usually first sensation to be lost
  - Common causes of lost of sensation of vibration is (DM, alcoholism, vitamin B_{12} deficiency, posterior column disease)

Assessment of the Sensory System continued

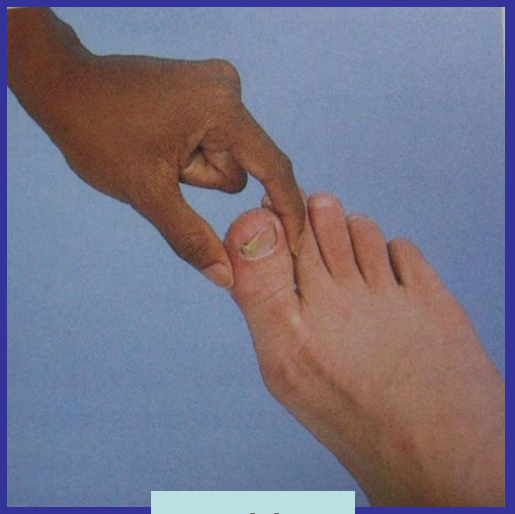
- **Positioning:** using your thumb and index finger pull big toe "up" and "down" (**closed eyes)**
  - Loss of positioning indicate posterior column disease or peripheral root/nerve lesion.
- **Discriminative Sensations**: while **eyes are closing**
  - **Stereognosis** (object identification by feeling)
  - **Graphesthesi**a (number identification by feeling)
  - **Lesions in the sensory cortex** can cause astereognosis (inability to recognize objects placed in the hand).
- **Two-point discrimination** (***alternate 2 point with one point touch***)
- **Point localization** ***(touch a point of pt skin then open eye to point to place touched)***
- **Extinction**: ask patient if feels your touch when you simultaneously stimulate areas on both sides of the body.

Assessment of the Sensory System

Two-Point Discrimination

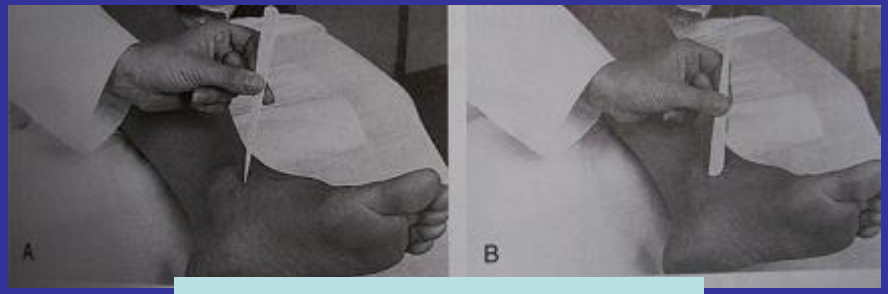


Graphesthesia



position

Vibration



Pain; Sharp-dull

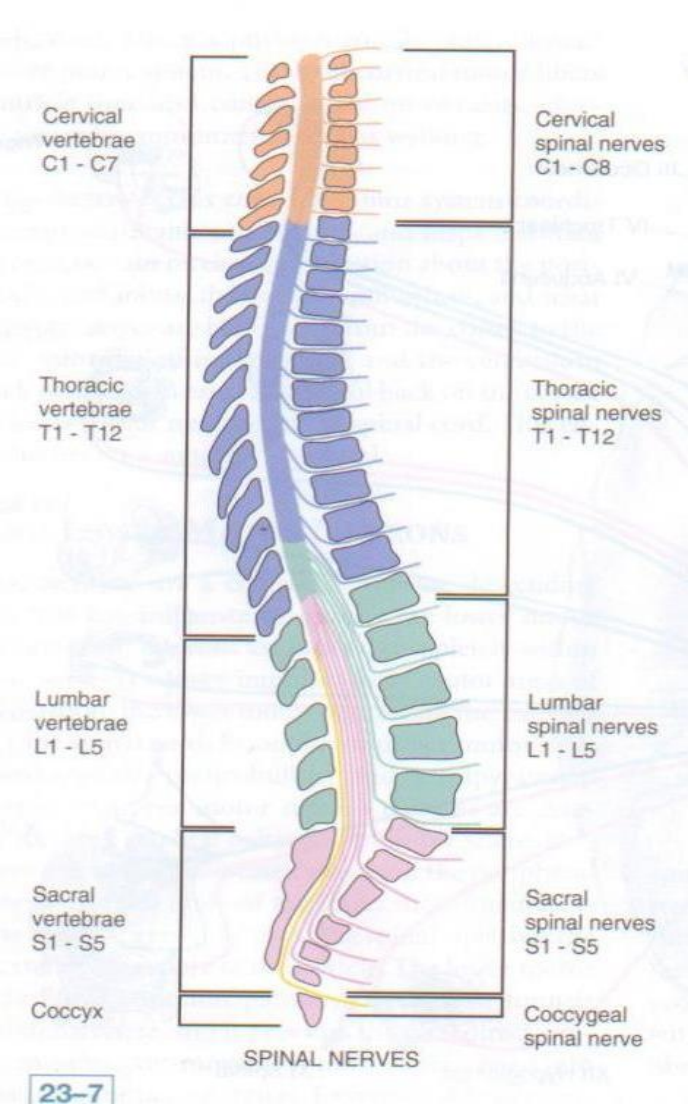
Reflexes

A- Stretch, or Deep Tendon Reflexes (DTRs)

1. **Biceps Reflex** (C5 to C6) —Just anterior to the elbow
2. **Triceps Reflex** (C7 ,C7) –Just posterior to the elbow.
3. **Brachioradialis Reflex** (C5 to C6) -- About 10 cm above the wrist on the radial aspect of forearm .
4. **Quadriceps Reflex** (“ **Knee Jerk** “) (L2, L3, L4) –Just below the patella
5. **Achilles Reflex** (“**Ankel Jerk** “) (**S1**) just behind the ankle

B- Superficial reflexes: stimulating the skin: coetaneous reflexes

1. **plantar Reflex** (L5, S1)
2. Abdominal reflexes :
   1. upper (thoracic 8, 9, 10)
   2. lower (thoracic 10, 11, 12)



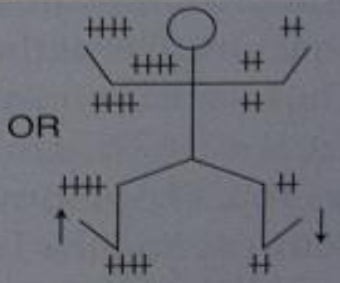
Deep Tendon Reflexes

Reflexes are usually graded on a 0 to 4+ scale:

4+	Very brisk, hyperactive, with *clonus* (rhythmic oscillations between flexion and extension)
3+	Brisker than average; possibly but not necessarily indicative of disease
2+	Average; normal
1+	Somewhat diminished; low normal
0	No response

	Biceps	Triceps	Brach	Knee	Ankle	Pl
RT	4+	4+	4+	4+	4+	↑
LT	2+	2+	2+	2+	1+	↓

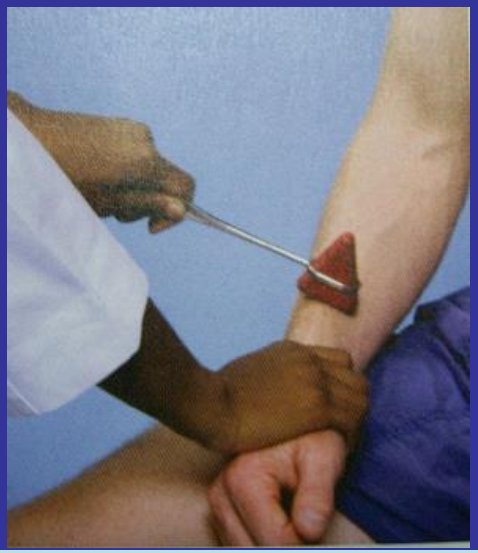
OR



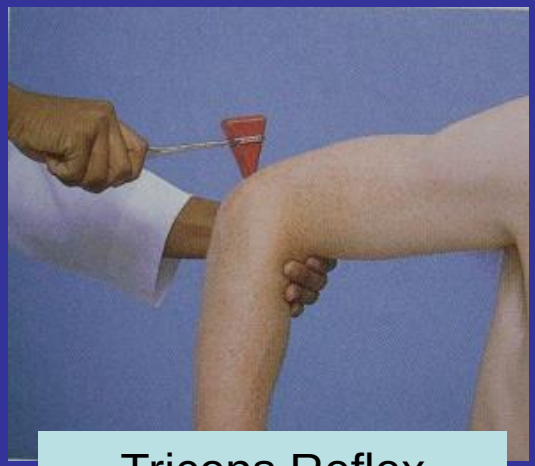
- Biceps reflex (C5, C6)
- Triceps Reflex (C6, C7)
- Brachioradialis reflex (C5, C6)
- Abdominal Reflex (T8, 9, 10, 11, 12): if patient obese, retract pt. umbilicus away from the side to be stimulated.
- Knee Reflex (L2, 3, 4)
- Ankle Reflex: S1

Deep Tendon Reflexes

Reinforcement of knee reflex (if symmetrically diminished or absent



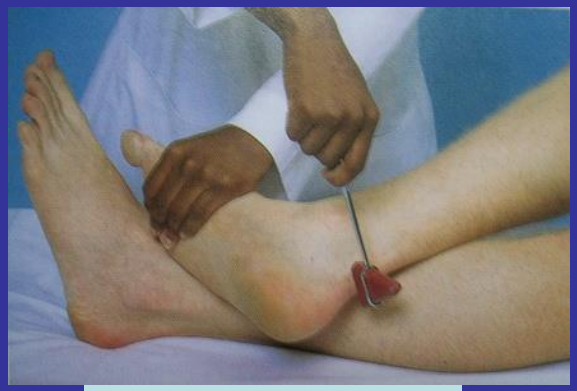
Brachioradialis Reflex (supinator)



Triceps Reflex (extention)

Biceps Reflex, pt. sitting (flexion)

Deep Tendon Reflexes



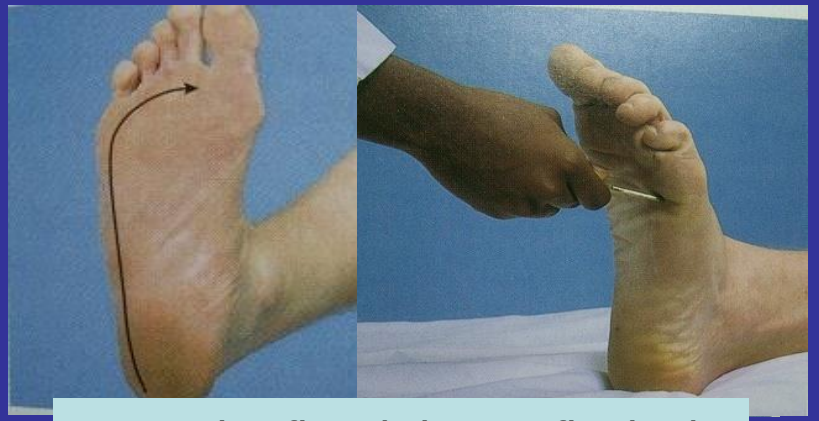
Ankle Reflex

Knee Reflex, pt. sitting

Superficial Reflexes

1. **Planter Response** (L5, S1):

stroke lateral aspect of sole from heal to ball of foot)



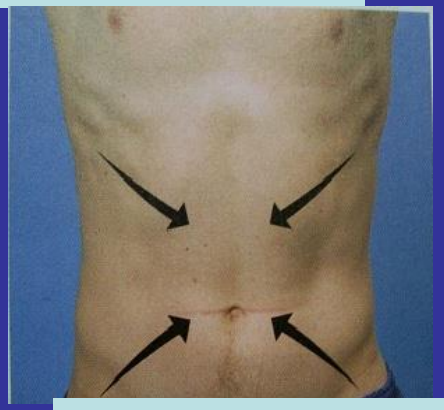
Normal reflex (Planter flexion)

Abnormal response, babinski response

Babinski Response

2. Abdominal reflex

- upper (thoracic 8, 9, 10)
- lower (thoracic 10, 11, 12)



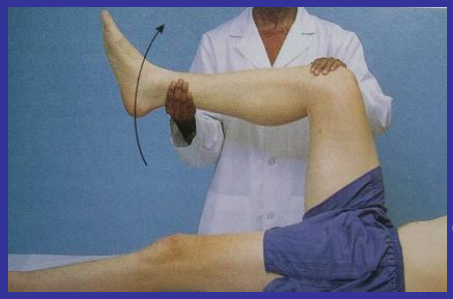
Abdominal Reflex

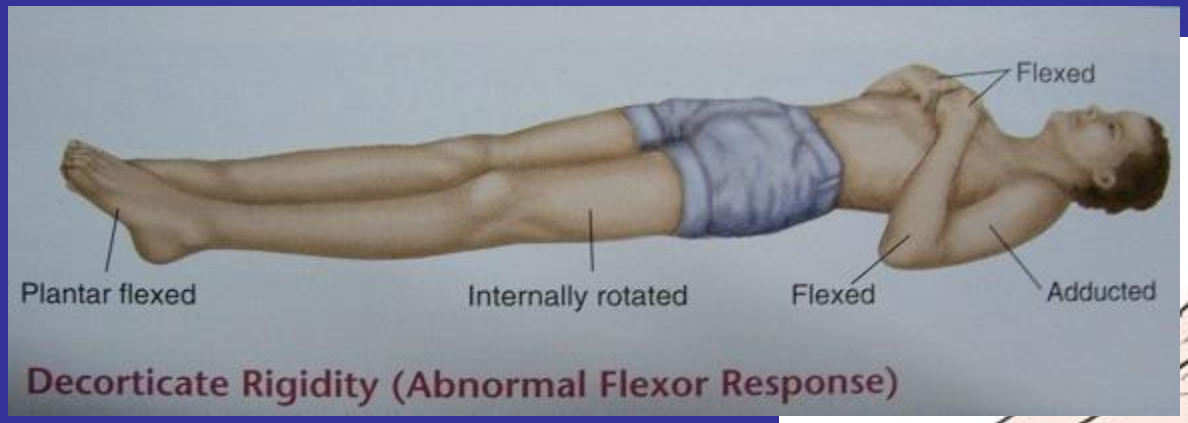
***Clonus:** performed if other reflexes are hyperactive.

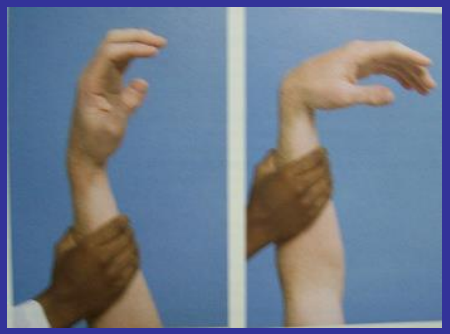
Abnormal: sustained **clonus**: rhythmic oscillation between dorsiflexion and planter flexion

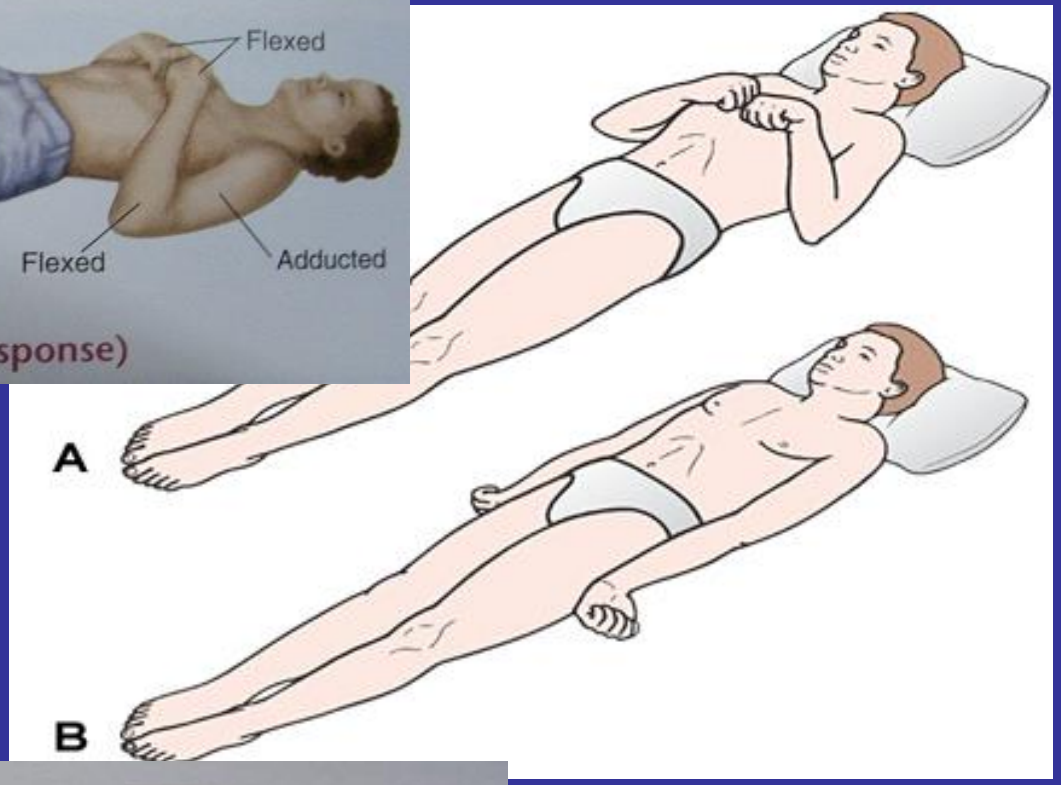
Special Techniques

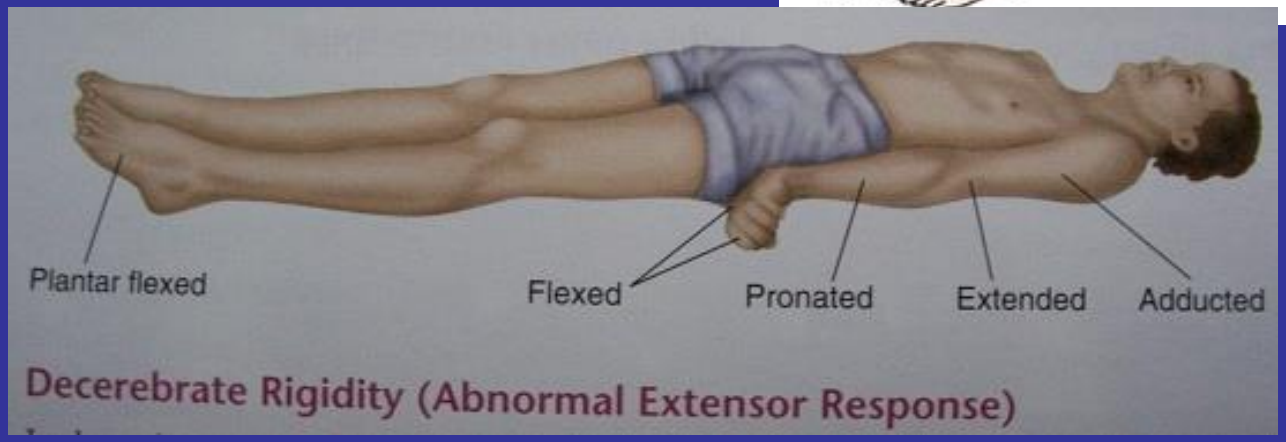
- **Asterixis** (**stop traffic** 1-2 min): sudden brief, nonrhythmic flexion of hands & fingers. (**metabolic encephalopathy)**
- **Brudzinski's Sign**: positive if flexion of hip and knees as you flex the neck. **(meningeal inflammation)**
- **Kernig's Sign**: Positive if pain and increased resistance to extending the knee when flex leg at the hip and knee and then straighten the knee.
  - Both brudzinski's and Kernig's sign suggest **meningeal inflammation/irritation.**











Posture & Muscle tone

Diagnostic tests

1. Computed tomography (CT) :

- it used to detect intracranial bleeding, space-occupying lesions, cerebral edema, infarction, hydrocephalus, cerebral atrophy, & shift of brain structure.
- may or may not require injection of a dye

- Preprocedure intervention

1. Obtained informed consent
2. Assess allergies
3. Instruct client to lie still & flat during the test
4. Instruct client to hold his/her breath when requested
5. Initiate an intravenous line if prescribed
6. Remove object from the head
7. Assess for claustrophobia
8. Inform client of possible mechanical noises as the scanning occur
9. Inform client that there may be a hot flushed sensation & metallic taste in the mouth when the dye is injected

- postprocedure intervention

1. Provide replacement fluids because diuresis from the dye is expected
2. Monitor for an allergic reaction to the dye
3. Assess dye injection site for bleeding or hematoma, & monitor the extremity for color, warmth, & presence of distal pulse

2. Magnetic resonance imaging (MRI)

- Is noninvasive procedure that identifies type of tissue, tumors, & vascular abnormalities. It is similar to CT scanning but provide more detailed picture

- Preprocedure intervention

1. Remove all metal object from the client
2. Determine if the client has a pacemaker, implanted defibrillator, or other metal implant such as hip prosthesis or vascular clips because these clients cannot have this test performed
3. Remove IV fluid pumps during the test
4. Provide precaution for the client who is attached to pulse oximeter because it can cause a burn during testing if coiled around the body and body part
5. Assess for claustrophobia
6. Instruct the client that he or she will need to remain still during the procedure

- Postprocedure:

1. Client resume normal activities
2. Expect diuresis if a contrast agent used

MRI

FIGURE 60-16 Technician explains what to expect during an MRI.

3. Lumber puncture

- Insertion of spinal needle through the **L3-L4** interspace into the lumber subarachnoid space to **obtain CSF, measure CSF fluid or pressure, or instill air, dye, or medication.**
- The test is contraindicated in the clients with increased ICP because rapid decrease in pressure around the spinal cord leading to brain herniation.
- Preprocedure intervention:

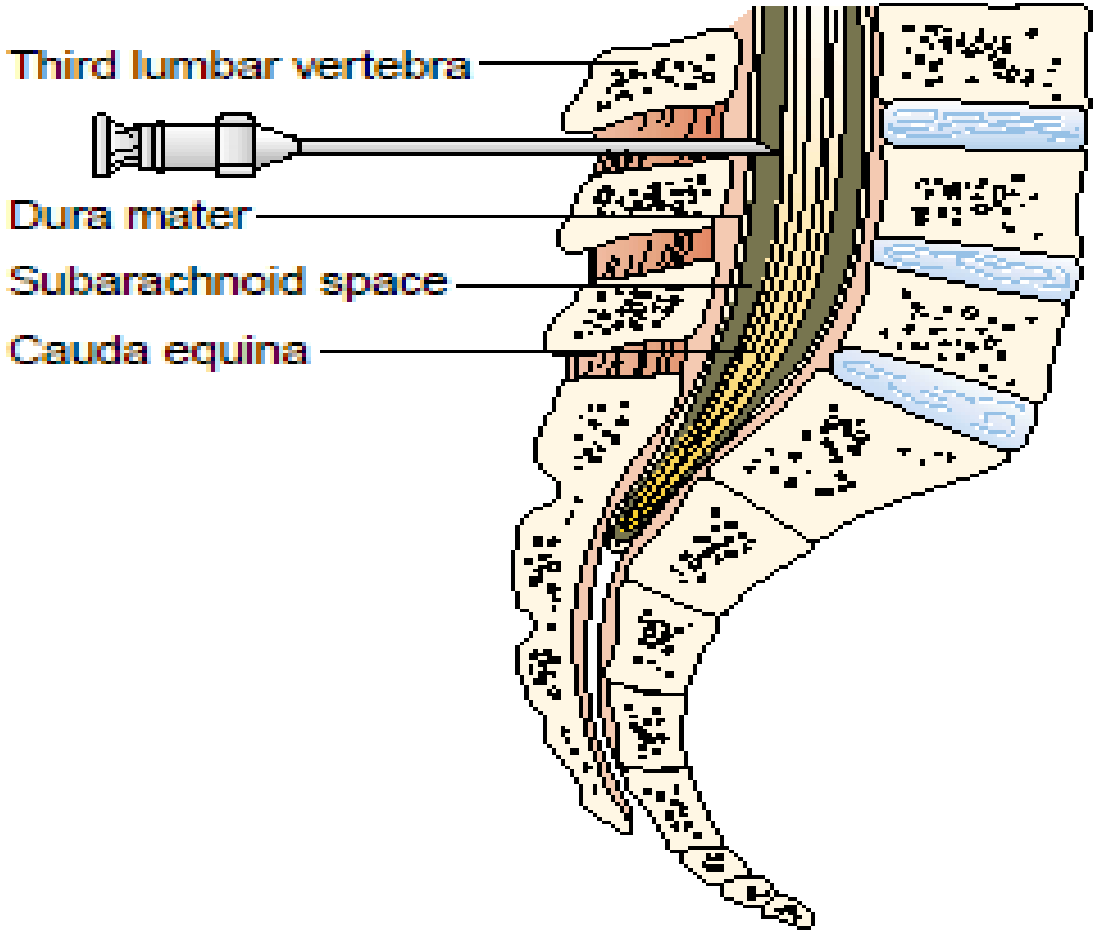
1. Informed consent
2. Have the client empty the bladder

- **Intervention during procedure**

1. Position the client in a lateral recumbent position & have the client draw the **knees up to the abdomen and chin onto the chest**
2. Maintain strict asepsis

- Postprocedure intervention

1. Monitor vital sign, neurological signs that may indicate leakage of CSF
2. Position the client flat as prescribed
3. Encourage fluids to replace CSF obtained
4. Monitor intake and output


Third lumbar vertebra
Dura mater
Subarachnoid space
Cauda equina

Fetal position

4. Electroencephalography

- **Graphic recording of the electrical activity of the superficial layer of the cerebral cortex**
- Preprocedural intervention

1. Wash the client hair
2. Inform the client that the electrodes are attached to the head and that electricity does not enter the head
3. Withhold stimulant such as coffee, tea, & caffeine beverages, antidepressants, tranquilizer & anticonvulsants for 24 to 48 hr before the test
4. Allow the client to have breakfast

- Postprocedural intervention : Wash the client hair


That's the whole thing
Really?