Neurological Examination

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Objective

- Assess the 12 CN, motor and sensory system.
- Conduct mental status examination.
- Describe the components of mental status examination.
- Identify equipment needed to conduct a neurological examination.
- Describe historical data related to the neurological system.

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- Describe the functions of major components of nerves system.
- Name the major division of nervous system.
- Accurately record the assessment of the neurologic system.

1 Anatomy and Physiology

- The NS can be divided in to two parts i.e. CNS & PNS.
- The CNS includes the brain and spinal cord.
- The PNS includes the 12 pairs of CN, the 31 pairs of spinal nerves, and all other branches.
- The PNS carries message to CNS from the sensory receptors and from the CNS out to muscles and glands.

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Components of the CNS

1. Cerebral cortex: It is the cerebrums outer layer of nerve cell bodies, also called gray matter.

- The CC is the center for human's highest function governing thought, memory, reasoning, sensation and voluntary movement.

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- The cerebrum is divided into two hemisphere with each hemisphere divided into four lobes:
  - Frontal
  - Parietal
  - Temporal
  - Occipital

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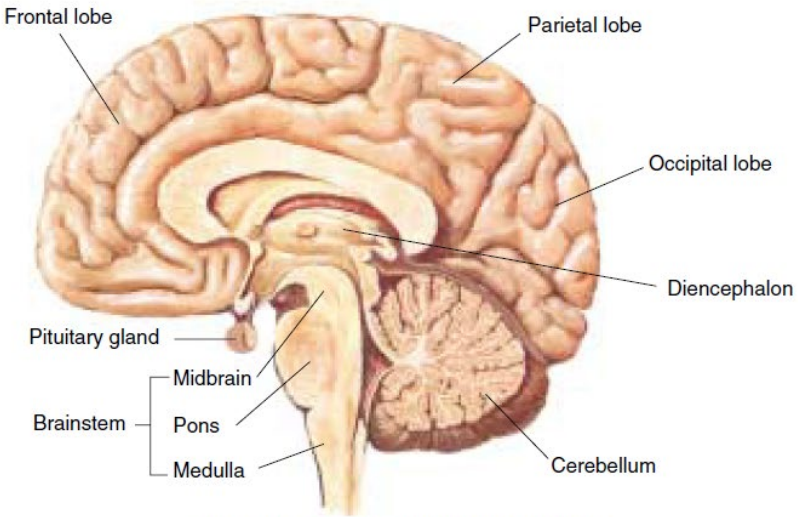
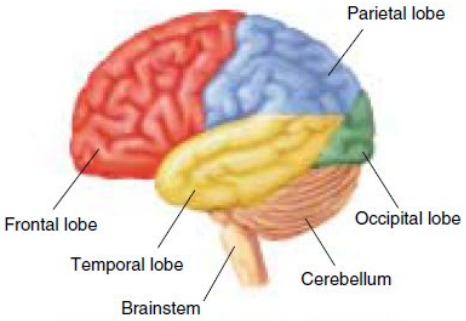


RIGHT HALF OF THE BRAIN, MEDIAL VIEW



LEFT LATERAL VIEW OF THE BRAIN

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- The FL is concerned with personality, behavior, emotion and intellectual functions.
- The PL is the primary center for sensation.
- The OL is the primary visual receptor center.
- The TL is the primary auditory reception center.

1 Cont…d

- Damage to any of these specific cortical areas produces corresponding loss of function like motor deficit, paralysis, loss of sensation or impaired ability to understand and process language.

2. Cerebellum: located under the occipital lobe that's is concerned with motor coordination of voluntary movements, equilibrium, and muscle tone from cerebral cortex. E.g. coordination needed in playing the piano.

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3. Brain stem: is the central core of brain consisting of midbrain, pons, and medulla. Located b/n the cerebrum and spinal cord, it connect pathways b/n the higher and lower structure.

- Midbrain: anterior part of brain stem that merges with the thalamus and hypothalamus. It contains many motor neurons and tracts.

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- Pons: the enlarged area containing the ascending and descending fiber tract.
- Medulla: continuation of the spinal cord connecting the brain and spinal cord. It has vital autonomic centers (respiration, heart, and GI function).

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- Spinal cord: is the long cylindrical structure that occupies the upper two third of vertebral canal (from medulla) till first or second lumbar vertebrae. It is the main high way for ascending & descending fiber tracts that connects the brain to the spinal nerves, it mediates reflexes. It transmit impulse to and from the brain.

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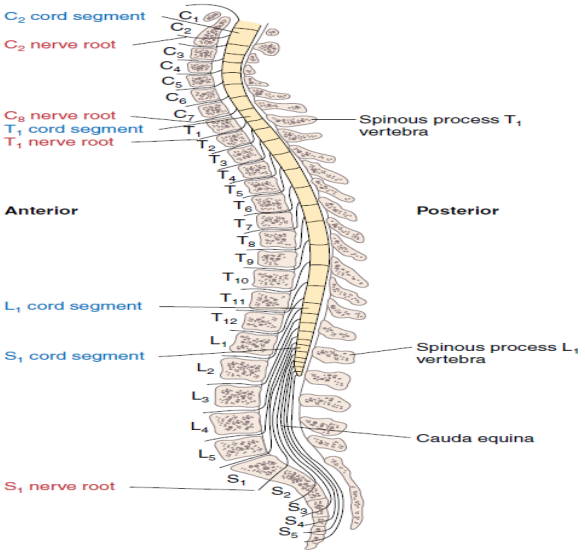

THE SPINAL CORD, LATERAL VIEW

1 Cont…d

Spinal nerves

- The 31 pairs of spinal nerves arise from the length of the spinal cord and supply the rest of the body.
- They include 8 pairs of cervical, 12 pairs of thoracic, 5 pairs of lumbar, 5 pairs of sacral and one pair of coccygeal.

Cont…d

- They are mixed nerves containing both sensory and motor fibers.
- The nerves exit the spinal cord and innervate a particular segment of the body.

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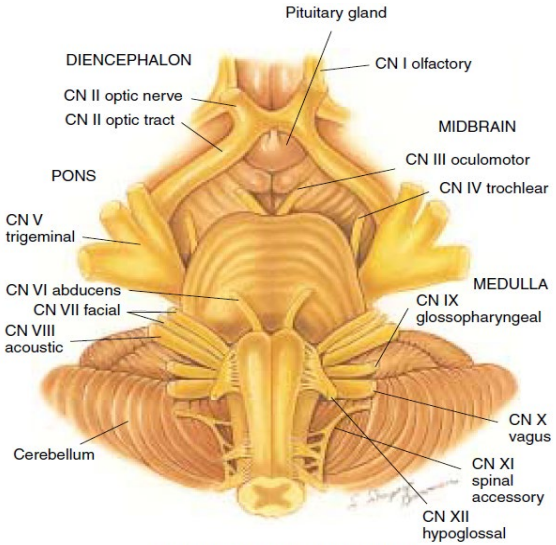
Cranial nerve

- CN II through XII- diencephalon & brainstem
- CN I and II- fiber tracts emerging from the brain.
- Some are specialized, producing smell, vision, or hearing (I, II, VIII).



INFERIOR SURFACE OF THE BRAIN

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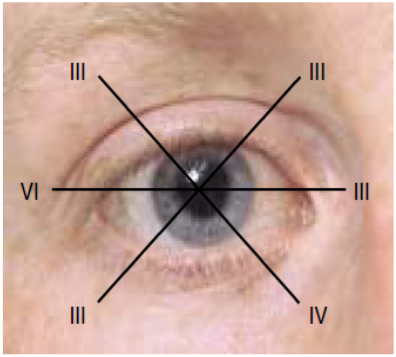
No.	Cranial Nerve	Function
I	Olfactory	Sense of smell
II	Optic	Vision
III	Oculomotor	Pupillary constriction, opening the eye, and most extraocular movements
IV	Trochlear	Downward, inward movement of the eye
VI	Abducens	Lateral deviation of the eye
V	Trigeminal	*Motor*—temporal and masseter muscles (jaw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



RIGHT EYE (CN III, IV, VI)

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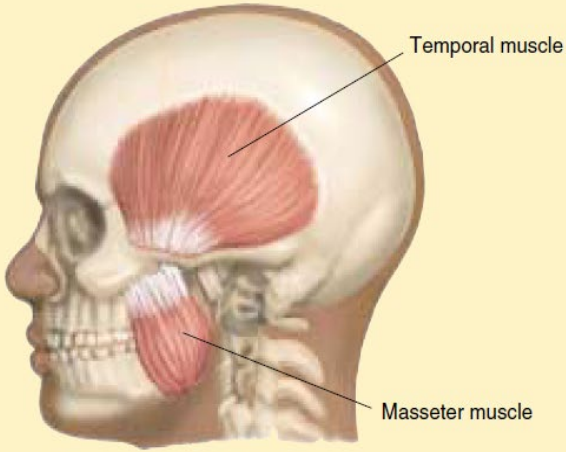
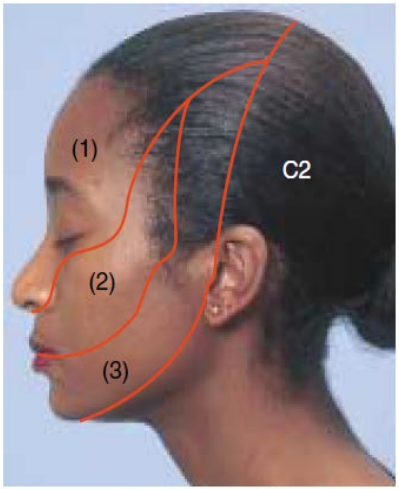


CN V—MOTOR



CN V—SENSORY

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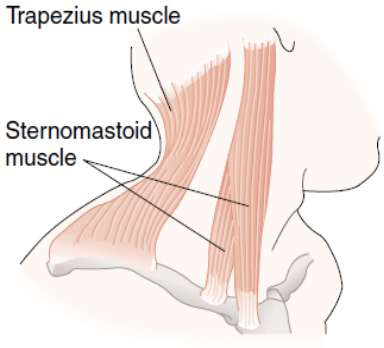
VII	Facial	*Motor*—facial movements, including those of facial expression, closing the eye, and closing the mouth *Sensory*—taste for salty, sweet, sour, and bitter substances on the anterior two thirds of the tongue
VIII	Acoustic	Hearing (cochlear division) and balance (vestibular division)
IX	Glossopharyngeal	*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



CN XI—MOTOR

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Spinal reflex

- Deep tendon reflex (mono synaptic, as few as two neuron) involves specific spinal segments.
- Ankle reflex- Sacral 1 primarily.
- Knee reflex- Lumbar 2, 3, 4.
- Supinator (brachioradialis) reflex- Cervical 5, 6.

Cont…d

- Biceps reflex- Cervical 5, 6.
- Triceps reflex- Cervical 6, 7
- Abdominal reflexes—
  - Upper Thoracic 8, 9, 10.
  - Lower Thoracic 10, 11, 12.
- Plantar responses- Lumbar 5, Sacral 1.

1 Cont…d

Reflex arc

- Reflexes are stimulus response activities of the body.
- They are fast , unlearned and involuntary reaction to stimuli.
- The reflex activity may be simple and take place at the level of the spinal cord, with interpretation at the cerebral level.

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Cont…d

- If the tendon of the knee is sharply stimulated with reflex hammer, the impulse follows the different nerve fibers, a synapse occurs in the spinal cord, the impulse is transmitted to the efferent nerve fibers, leading to an additional synapse and stimulation of muscle fibers.

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Cont…d

- As the muscle fibers contract, the lower leg moves , causing the knee jerk reaction.
- The individual is aware of the reflex after the lower leg moves and the brain has interpreted the activity. This is reflex arc.

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Motor Pathways

- The principal motor pathways are;
  - The corticospinal (pyramidal) tract.
  - The basal ganglia system.
  - The cerebellar system.

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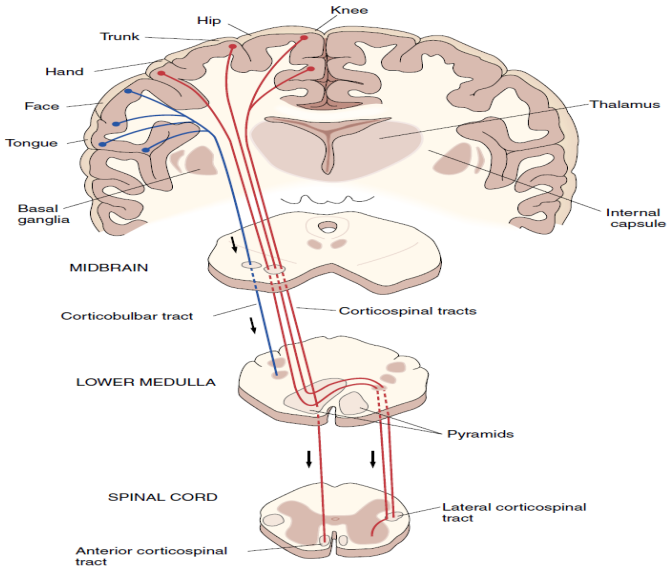

MOTOR PATHWAYS: CORTICOSPINAL AND CORTICOBULBAR TRACTS

Cont…d

- Sensory Pathways
  - Touch
  - Pain
  - Temperature
  - Position
  - Vibration

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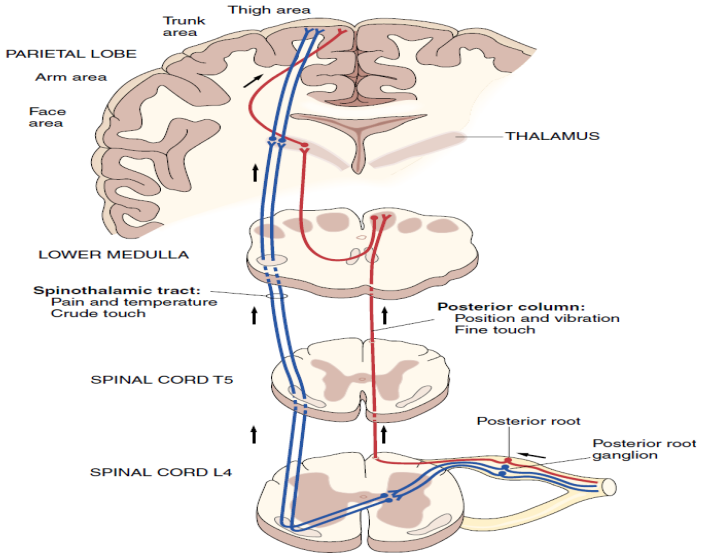

SENSORY PATHWAYS: SPINOTHALAMIC TRACT AND POSTERIOR COLUMNS

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Dermatome

- It is a circumscribed skin area that is supplied mainly from one spinal cord segment through a particular spinal nerve.

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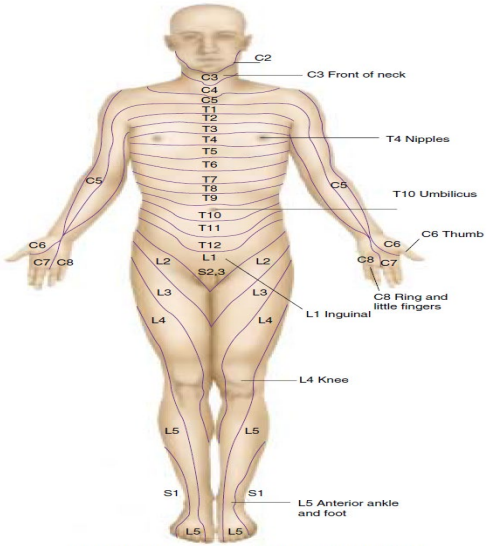
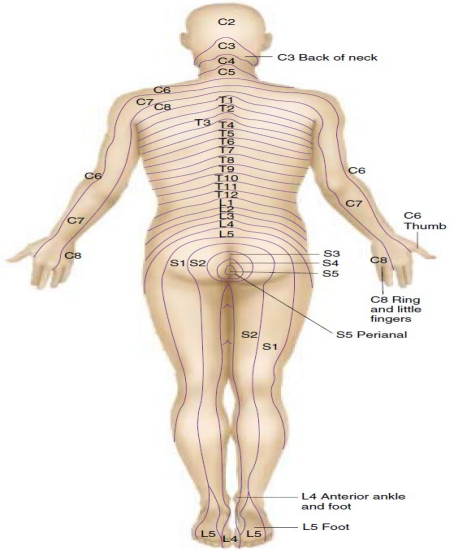


DERMATOMES INNERVATED BY POSTERIOR ROOTS



DERMATOMES INNERVATED BY POSTERIOR ROOTS

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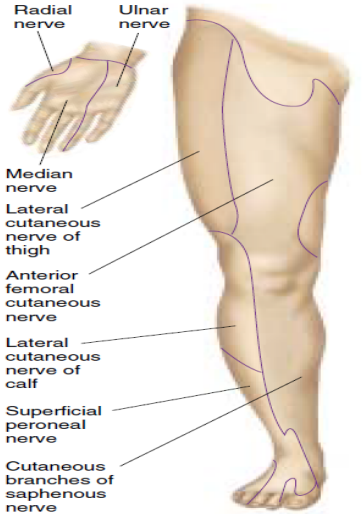
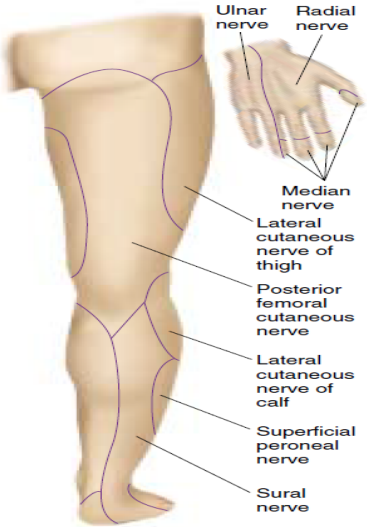


AREAS INNERVATED BY PERIPHERAL NERVES



AREAS INNERVATED BY PERIPHERAL NERVES

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Subjective Data

- Ask for head ache, head injury, dizziness/vertigo, seizures, tremors, weakness or incoordination, numbness or tingling, difficulty of swallowing, difficulty of speaking, significant past history.

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Objective Data

- Equipment needed: Penlight, tongue blade, sterile needle, cotton ball, tuning fork. percussion hammer, familiar aromatic substances (smell)

1 Cont…d

Remember

- Perform a screening neurologic examination on well persons who have no significant subjective data findings from the history.
- Perform a complete neurologic examination on persons who have neurologic concerns or sings of neurologic dysfunction.

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- Perform a neurologic recheck on persons who require periodic assessments.
- Integrate the steps of the neurologic examination with the examination of each particular part of the body. E.g. test CN while assessing the head and neck. But record all neurologic data as a functional unit and record them all together.

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- For complete neurologic examination, use the following sequence.

1. Mental status
2. Cranial nerves
3. Motor system
4. Sensory system
5. Reflexes

1 Method of Examination

1. Mental health assessment

- Mental status is a person's emotional and cognitive functioning. Mental status assessment include appearance, behavior cognition, and thought process. Or A, B, C, T.

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Cont…d

I. Appearance

- Posture is erect and position is relaxed.
- Body movements are voluntary, deliberate, coordinated, smooth and even.
- Dressing is appropriate for setting, season, age, gender, social group.
- Grooming and hygiene should be noted. Clean and well groomed, hair is neat and clean.
- Nail are clean.

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Cont…d

II. Behavior:

a. Level of consciousness- the person is awake, alert , and aware of stimuli from the env't and responds appropriate to stimuli.

b. Facial expression- look is appropriate to the situation and changes appropriately with the topic.

Cont…d

c. Speech- pace of conversation is moderate, and stream of talking is fluent. Articulation is clear and understandable.

d. Mood and affect-judge this by body language, facial expression, and by talking directly, “how do you feel today?”. The mood should be appropriate to the person’s place and condition and change appropriately with topics.

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Cont…d

III. Cognitive function

a. Orientation- assess

- Time:-day of week, date, and year.
- Place:-present location, name of city, zone.
- Person:-own name, age, type of work.

b. Attention:- (serial 7s) ask the person to begin with 100 and count backward by 7. Stop after 5 subtraction and check correct answers.

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Cont…d

- Disorientation occurs with organic brain disorders. Orientation is usually lost first to time, then to place, and rarely to person.

c. Recent memory- ask the 24 hour diet recall.

d. Remote memory- ask the person verifiable past events. E.g. birth day, past health, historical events relevant for that person.

1 Cont…d

e. New learning ability (give words)-say " I am going to say four words. I want you to remember them. In a few minutes I will ask you to recall them. Pick four words. E.g. fruit, glass, pen. Carrot.

Normal response is an accurate four word recall after a 10 minute delay, and at least three words remembered after 30 minutes.

1 Cont…d

f. Higher intellectual functioning

- These tests measure problem solving and reasoning abilities.
- Results are closely related to the person's general intelligence and educational background must be considered.

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Cont…d

- Information- how many days are there in a week? what day is today?
- Judgement- to assess judgment, note what the person says about job plans, social obligation and plans for the future. It needs to be realistic and rationale. E.g. what would you do if you find a stamped, addressed envelope lying on street.

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Cont…d

IV. Thought process and perceptions

a. Thought process: ask yourself, “ does this person make sense? Can I follow what the person is saying?” the way person thinks be logical, goal directed, coherent, and relevant. The person should complete a thought.

- Abnormal:- Illogical, unrealistic thought process, evidence of blocking.

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Cont…d

b. Thought content-what the person says should be consistent and logical.

c. Perception-the person should consistently aware of reality and congruent with yours. Ask how do people treat you? Do other people talk about you? Do you feel like you are being watched, or followed? How you heard your name when alone? Obsessions, compulsion are abnormalities of thought content.

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Cont…d

- Illusions, hallucinations- abnormalities of perception.
- Auditory and visual hallucinations occur with psychiatric and organic brain diseases.
- Tactile hallucinations occur with alcohol withdrawal.

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Cont…d

2. Motor system test

Cerebral function: Balance tests.

- Gait- observe as the person walks, turns and returns. Normally the gait is smooth, rhythmic and effortless. Ask the person to walk a straight line in a heel to toe fashion (tandem walking). Normally, the person can walk straight and stay balanced. Abnormal, staggering & loss of balance.

Cont…d

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Cont…d

- Romberg test-Ask the person to stand up with feet together and arms at the sides. Once in a stable position, ask the person to close the eyes and to hold the position. Wait about 20 second. Normal posture and balance are maintained.

Cont…d

- Positive Romberg sign is loss of balance with closing of eyes that occurs with cerebellar ataxia (multiple sclerosis, alcohol intoxication), loss of vestibular function & loss of proprioception.

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- Ask the person to hop, first on one leg, then the other. This demonstrate muscle strength, and cerebral function.

Coordination and skilled movements

- Rapid alternating movements (RAM)- ask the person to pat the knees with both hands, lift up , turn hands over, and pat the knees with the backs of hands. Then ask the person to do faster. Normally, this is done with equal turning and a quick turning and a quick rhythmic pace.

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Cont…d

- Alternatively, ask the person to touch the thumb to each finger on the same hands, starting with the index finger, then reverse direction, Normally, this can be done quickly and accurately. Abnormal lack of coordination with disease.

Cont…d

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Cont…d

- Finger to finger test- with the person's eyes open, ask to use the index finger to touch your finger, then the person's own nose. After a few times move your finger to a different spot. The person's movement should be smooth and accurate.

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Cont…d

- Finger to nose test-Ask the person to close the eyes and to stretch out the arms. Ask the person to touch the tip of his or her nose with each index finger, alternating hands and increasing speed. Normally done with accurate and smooth movement. Abnormal, misses nose.

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Cont…d

- Heel to shin test- test lower extremity coordination by asking the person, who is in a supine position, to place the heel on the opposite knee, and runs it down the shin from the knee to ankle. Normally, moves the heel in a straight line down the shin. Abnormally, lack of coordination; heel fall off shin.

1 Cont…d

3. Sensory system test

- Asking the person to identify various sensory stimuli tests the intactness of the peripheral nerve fibers, the sensory tracts and higher cortical discrimination.

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Cont…d

- Pain- pain is tested by the person's ability to perceive a pin prick. Using a sterile needle, lightly apply the sharp point or the dull to the person's body in a random and ask the person to say "sharp" or "dull"; depending on the sensation felt. Abnormal, hypoalgesia, analgesia & hyperalgesia (increased pain sensation).

1 Cont…d

- Light touch- apply a wisp of cotton to the skin randomly. Include the arms, forearms, hands, chest, legs. Ask the person to locate where touched. Compare symmetric points. Calloused skin is normally relatively insensitive and should be avoided. Abnormal, anesthesia (absence of touch sensation), hypesthesia (decreased sensitivity), and hyperesthesia (increased sensitivity).

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Cont…d

- Vibration-test the person's ability to feel vibration of a tuning fork over boney prominences. Strike on the heel of your hand, and hold the base on the bony surface of fingers and great toe. Ask the person to indicate when the vibration starts and stops. Loss of vibration sense occurs with peripheral neuropathy. E.g. diabetes and alcohol. Often this is the first sensation lost.

Cont…d

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Cont…d

- Stereogenesis-test the person ability to recognize objects by feeling their forms, size, and weight. With the eyes closed, place a familiar objects (paper, clip, key, coin, cotton ball or pencil) in the person's hand and ask the person to identify it. Normally will be explored and identified. Astereogenesis, unable to identify objects correctly that occurs in sensory cortex lesion.

Cont…d

- Number identification (graphesthesia)- With the blunt end of a pen or pencil, draw a large number in the patient's palm. Ask the person to report the number written in his/her palm. A normal person can identify most such numbers. Abnormal, inability to recognize numbers, like astereognosis, lesion in the sensory cortex.

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- *Position*- Grasp the patient's big toe, holding it by its sides between your thumb and index finger. Demonstrate "up" and "down" as you move the patient's toe clearly upward and downward. Then, with the patient's eyes closed, ask for a response of "up" or "down" when moving the toe in a small arc.

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4. Cranial nerves test

I	Smell
II	Visual acuity, visual fields, and ocular fundi
II, III	Pupillary reactions
III, IV, VI	Extraocular movements
V	Corneal reflexes, facial sensation, and jaw movements
VII	Facial movements
VIII	Hearing
IX, X	Swallowing and rise of the palate, gag reflex
V, VII, X, XII	Voice and speech
XI	Shoulder and neck movements
XII	Tongue symmetry and position

1 Cont…d

CN I: olfactory nerve

- Do not test routinely, test for those who report loss of smell. First, assess patency by occluding one nostril at a time and asking the person to sniff. Then, with the person's eyes closed, occlude one nostril and present an aromatic substance such as coffee, orange, soap. Any asymmetry in the sense of smell is important.
- Anosmia (a decrease or loss of smell).

1 Cont…d

CN II-Optic nerve

- Test visual acuity and test visual field by confrontation test (peripheral vision)

CN III, IV, and VI- Oculomotor, Trochlear, and Abducens nerve.

- Palpebral fissure are usually equal in width. Check pupils for size, regularity, equality, light reaction, and accommodation. Assess extra ocular movements by the cardinal position of gaze. Abnormal, ptosis, limited movement.

1 Cont…d

CN V- Trigeminal nerve

a. Motor function: assess the muscles of mastication by palpating the temporal and masseter muscle as the person clenches the teeth. Muscle should feel equally strong on both sides. Try to separate the jaws by pushing down on the chin; normally you cannot. Abnormal, decreased strength on one or both sides, asymmetry in jaw movement, and pain.

Cont…d

PALPATING TEMPORAL MUSCLES

PALPATING MASSETER MUSCLES

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Cont…d

b. Sensory function: with the person's eye closed, test touch sensation by touching a cotton wisp on forehead, cheeks and chin. Ask the person to say " Now", when ever the touch is felt. This test all the three division of nerve: ophthalmic, maxillary, and mandibular.

Cont…d

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Cont…d

c. Corneal reflex: with the person looking for ward, bring a wisp of cotton in from the side and lightly touch the cornea, not the conjunctiva. Normally the person will blink bilaterally. No blink, CN V lesion/paralysis.

Cont…d

1 Cont…d

CN VII- Facial nerve

a. Motor function: Note mobility and facial symmetry as the person smile, frown, close eyes tightly, lift eyebrows, show teeth and puff checks. Press the puffed checks and air should escape equally from both sides. Abnormal muscle weakness.

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Cont…d

b. Sensory function: Not routine, if indicated test sense of taste by applying to the tongue a cotton applicator covered a small amount of sugar, salt or lemon juice solution. Ask the person to identify the taste.

CN VIII- Acoustic nerve

- Test hearing acuity; voice test, tuning fork tests, Webber and Rinne's test.

1 Cont…d

CN IX and X- Glossopharyngeal and Vagus nerve

a. Motor function: depress the tongue with a tongue blade, and note pharyngeal movements as the person says “Ahhh”. Normally, uvula and soft palate rises in midline. Abnormal, uvula deviates to side.

1 Cont…d

CN XI- Spinal Accessory nerve

- Examine the sternomastoid and trapezius muscles for equal size and strength by asking the person to rotate the head forcibly against resistance applied to the side of chin and shrug shoulders against resistance. Should feel equally strong. Abnormal, atrophy, muscle weakness or paralysis.

Cont…d

1 Cont…d

CN XII- Hypoglossal nerve

- Inspect the tongue.
- There should be no wasting or tremor. Note midline position as the person protrudes the tongue.
- Lingual speech needs to be clear and distinct.

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Cont…d

5. Reflex test

- Reflex testing is usually the last part of the neurologic assessment. The client is usually in a sitting position.
- Hold the hand of the reflex hammer in your dominant hand b/n four thumb and index finger.

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- Use your wrist, and stimulate the reflex arc with a brisk tap to the tendon, not the muscle.
- Through continued practice and experience, you will learn the amount of forces to use.
- Strong force will cause pain, and too little force will not stimulate the arc.
- After striking the tendon, remove the hammer immediately.

Cont…d

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

1 Cont…d

Abnormal:-

- Absent or diminished reflexes: neuromuscular disease, spinal cord injury, or lower motor neuron disease.
- Hyperactive reflexes: upper motor neuron disease.

1 Cont…d

Step-1: Assess the biceps reflex (C5, C6)

- Support the clients lower arm with your non-dominant hand and arm. The arm needs to be slightly flexed at the elbow with palm up.
- Place the thumb of your non-dominant hand over the biceps tendon.
- Using the reflex hammer, briskly tap your thumb.
- Look for contraction of biceps muscle and slight flexion of the forearm.

Cont…d

PATIENT SITTING

PATIENT LYING DOWN

1 Cont…d

Step-2: Assess the triceps reflex (C6, C7)

- Support the client's elbow with your non-dominant hand.
- Sharply percuss the tendons just above the olecranon process with the reflex hammer.
- Observe contraction of the triceps muscle with extension of the lower arm.

Cont…d

PATIENT SITTING

PATIENT LYING DOWN

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Cont…d

Step-3: Assess the brachioradialis reflex (C5, C6)

- Position the client's arm, so the elbow is flexed and the hand is resting on the lap with palm down (pronation).
- Using the reflex hammer, briskly strike the tendon toward the radius about 2-3 inches above the wrist.
- Observe flexion of the lower arm and supination of hand.

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1 Cont…d

Step-4: Assess the patellar (knee) reflex (L2, L3, L4)

- Flex the leg at the knee.
- Palpate the patella to locate the patellar tendon inferior to the patella.
- Briskly strike the tendon with the reflex hammer.
- Note extension of lower leg and contraction of the quadriceps muscles.

Cont…d

PATIENT SITTING

Cont…d

1 Cont…d

Step-5: Assess the Achilles tendon (ankle) reflex (S1)

- Flex the leg at the knee.
- Dorsi flex the foot of the leg being examined.
- Hold the foot lightly in the non-dominant hand.
- Strike the Achilles tendon with the reflex hammer.
- Observe plantar flexion of the foot: the heel will “jump” from your hand.

Cont…d

PATIENT SITTING

Cont…d

PATIENT LYING DOWN

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Cont…d

Step-6: Assess the plantar reflex (L5, S1)

- Position the leg with a slight degree of external rotation at the hip.
- Stimulate the sole of the foot from the heel to the ball of the foot on the lateral aspect.
- Continue the stimulation across the ball of the foot to the great toe.
- Observe for plantar flexion, in which the toes curl toward the sole of the foot. It may be necessary to hold the ankle to prevent movement.

Cont…d

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- Babinski response is the framing of the toes with the great toe pointing toward the dorsum of the foot, called dorsiflexion of the toe. Abnormal in adult. May indicate upper motor neuron disease (+ve Babinski sign). Normal during infancy.

1 Cont…d

Meningeal assessment

- Ask the client to flex the neck by bringing the chin down to touch the chest.
- Observe the degree of range of motion and the absence or presence of pain.
- The client should be able to flex the neck about 45^{o} without pain.

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Cont…d

- When the client complains of pain and has a decrease in the flexion motion, you will observe the Brudzinski sign.
- With the client in a supine position, assist the client with neck flexion.
- Observe the legs.
- The sign is positive when neck flexion causes flexion of the leg and thighs.

1 Nursing Diagnosis

- Reflex incontinence related to cerebral loss as manifested by lack of awareness of bladder filling.
- Impaired verbal communication related to communication barrier as manifested by inability to name words.
- Sensory perceptual alteration related to neurological impairment as manifested by stumbling.

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Thank you for your attention!!!