
Neurologic Examination

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Equipment Needed

- Reflex Hammer
- 128 and 512 (or 1024) Hz Tuning Forks
- A Snellen Eye Chart or Pocket Vision Card
- Pen Light or Otoscope
- Wooden Handled Cotton Swabs
- Paper Clips

General Considerations

- Always consider left to right symmetry
- Consider central vs. peripheral deficits
- Organize your thinking into seven categories:
 1. Mental Status
 2. Cranial Nerves
 3. Motor
 4. Coordination and Gait
 5. Reflexes
 6. Sensory
 7. Special Tests

Mental Status

The [Mini Mental Status Examination](#) is a useful screening tool. The full mental status exam is discussed in [much more detail](#) during the second year.

Cranial Nerves

Observation

- Ptosis (III)
- Facial Droop or Asymmetry (VII)
- Hoarse Voice (X)
- Articulation of Words (V, VII, X, XII)
- Abnormal Eye Position (III, IV, VI)
- Abnormal or Asymmetrical Pupils (II, III)

I - Olfactory

Not Normally Tested [1]

II - Optic

- Examine the Optic Fundi
- Test Visual Acuity
 1. Allow the patient to use their glasses or contact lens if available. You are interested in the patient's best **corrected** vision.
 2. Position the patient 20 feet in front of the Snellen eye chart (or hold a Rosenbaum pocket card at a 14 inch "reading" distance).
 3. Have the patient cover one eye at a time with a card.
 4. Ask the patient to read progressively smaller letters until they can go no further.
 5. Record the smallest line the patient read successfully (20/20, 20/30, etc.) [2]
 6. Repeat with the other eye.
- Screen Visual Fields by Confrontation
 0. Stand two feet in front of the patient and have them look into your eyes.
 1. Hold your hands about one foot away from the patient's ears, and wiggle a finger on one hand. [3]
 2. Ask the patient to indicate which side they see the finger move.
 3. Repeat two or three times to test both temporal fields.
 4. If an abnormality is suspected, test the four quadrants of each eye while asking the patient to cover the opposite eye with a card. ++ [4]
- Test Pupillary Reactions to Light
 0. Dim the room lights as necessary.
 1. Ask the patient to look into the distance.
 2. Shine a bright light obliquely into each pupil in turn.
 3. Look for both the direct (same eye) and consensual (other eye) reactions.
 4. Record pupil size in mm and any asymmetry or irregularity.
 5. If abnormal, proceed with the test for accommodation.
- Test Pupillary Reactions to Accommodation [5] ++
 0. Hold your finger about 10cm from the patient's nose.
 1. Ask them to alternate looking into the distance and at your finger.
 2. Observe the pupillary response in each eye.



III - Oculomotor

- Observe for Ptosis
- Test Extraocular Movements
 1. Stand or sit 3 to 6 feet in front of the patient.
 2. Ask the patient to follow your finger with their eyes without moving their head.

3. Check gaze in the six cardinal directions using a cross or "H" pattern.
 4. Pause during upward and lateral gaze to check for nystagmus. [6]
 5. Check convergence by moving your finger toward the bridge of the patient's nose.
- Test Pupillary Reactions to Light ([See Above](#))

IV - Trochlear

Test Extraocular Movements (Inward and Down Movement, [See Above](#))

V - Trigeminal

- Test Temporal and Masseter Muscle Strength
 1. Ask patient to both open their mouth and clench their teeth.
 2. Palpate the temporal and masseter muscles as they do this.
- Test the Three Divisions for Pain Sensation
 1. Explain what you intend to do.
 2. Use a suitable sharp object to test the forehead, cheeks, and jaw on both sides. [7]
 3. Substitute a blunt object occasionally and ask the patient to report "sharp" or "dull."
- If you find an abnormality then:
 1. Test the three divisions for temperature sensation with a tuning fork heated or cooled by water. ++
 2. Test the three divisions for sensation to light touch using a wisp of cotton. ++
- Test the Corneal Reflex ++
 1. Ask the patient to look up and away.
 2. From the other side, touch the cornea lightly with a fine wisp of cotton.
 3. Look for the normal blink reaction of **both** eyes.
 4. Repeat on the other side.
 5. Use of contact lens may decrease this response.



VI - Abducens

Test Extraocular Movements (Lateral Movement, [See Above](#))

VII - Facial

- Observe for Any Facial Droop or Asymmetry
- Ask Patient to do the following, note any lag, weakness, or asymmetry:
 1. Raise eyebrows [8]
 2. Close both eyes to resistance
 3. Smile

4. Frown
 5. Show teeth
 6. Puff out cheeks
- Test the Corneal Reflex ([See Above](#)) ++

VIII - Acoustic

- Screen Hearing [9]
 1. Face the patient and hold out your arms with your fingers near each ear.
 2. Rub your fingers together on one side while moving the fingers noiselessly on the other.
 3. Ask the patient to tell you when and on which side they hear the rubbing.
 4. Increase intensity as needed and note any assymetry.
 5. If abnormal, proceed with the Weber and Rinne tests.
- Test for Lateralization (Weber) ++
 1. Use a 512 Hz or 1024 Hz tuning fork.
 2. Start the fork vibrating by tapping it on your opposite hand.
 3. Place the base of the tuning fork firmly on top of the patient's head.
 4. Ask the patient where the sound appears to be coming from (normally in the midline).
- Compare Air and Bone Conduction (Rinne) ++
 1. Use a 512 Hz or 1024 Hz tuning fork.
 2. Start the fork vibrating by tapping it on your opposite hand.
 3. Place the base of the tuning fork against the mastoid bone behind the ear.
 4. When the patient no longer hears the sound, hold the end of the fork near the patient's ear (air conduction is normally greater than bone conduction).
- Vestibular Function is Not Normally Tested

IX - Glossopharyngeal

[See Vagus Nerve](#)

X - Vagus

- Listen to the patient's voice, is it hoarse or nasal?
- Ask Patient to Swallow
- Ask Patient to Say "Ah"
 - Watch the movements of the soft palate and the pharynx.
- Test Gag Reflex (Unconscious/Uncooperative Patient) ++
 1. Stimulate the back of the throat on each side.
 2. It is normal to gag after each stimulus.

XI - Accessory

- From behind, look for atrophy or assymetry of the trapezius muscles.
- Ask patient to shrug shoulders against resistance.

- Ask patient to turn their head against resistance. Watch and palpate the sternomastoid muscle on the opposite side.

XII - Hypoglossal

- Listen to the articulation of the patient's words.
- Observe the tongue as it lies in the mouth
- Ask patient to:
 1. Protrude tongue [10]
 2. Move tongue from side to side

Motor

Observation

- Involuntary Movements
- Muscle Symmetry
 - Left to Right
 - Proximal vs. Distal
- Atrophy
 - Pay particular attention to the hands, shoulders, and thighs.
- Gait

Muscle Tone

1. Ask the patient to relax.
2. Flex and extend the patient's fingers, wrist, and elbow.
3. Flex and extend patient's ankle and knee.
4. There is normally a small, continuous resistance to passive movement.
5. Observe for decreased (flaccid) or increased (rigid/spastic) tone.

Muscle Strength

- Test strength by having the patient move against your resistance.
- Always compare one side to the other.
- Grade strength on a scale from 0 to 5 "out of five":

Grading Motor Strength	
Grade	Description
0/5	No muscle movement
1/5	Visible muscle movement, but no movement at the joint
2/5	Movement at the joint, but not against gravity
3/5	Movement against gravity, but not against added resistance

4/5	Movement against resistance, but less than normal
5/5	Normal strength

- Test the following:
 1. Flexion at the elbow (C5, C6, biceps)
 2. Extension at the elbow (C6, C7, C8, triceps)
 3. Extension at the wrist (C6, C7, C8, radial nerve)
 4. Squeeze two of your fingers as hard as possible ("grip," C7, C8, T1) [10]
 5. Finger abduction (C8, T1, ulnar nerve)
 6. Opposition of the thumb (C8, T1, median nerve)
 7. Flexion at the hip (L2, L3, L4, iliopsoas)
 8. Adduction at the hips (L2, L3, L4, adductors)
 9. Abduction at the hips (L4, L5, S1, gluteus medius and minimus)
 10. Extension at the hips (S1, gluteus maximus) [12]
 11. Extension at the knee (L2, L3, L4, quadriceps) [10]
 12. Flexion at the knee (L4, L5, S1, S2, hamstrings)
 13. Dorsiflexion at the ankle (L4, L5)
 14. Plantar flexion (S1) [12]

Pronator Drift

1. Ask the patient to stand for 20-30 seconds with both arms straight forward, palms up, and eyes closed.
2. Instruct the patient to keep the arms still while you tap them briskly downward.
3. The patient will not be able to maintain extension and supination (and "drift into pronation) with upper motor neuron disease.

Coordination and Gait

Rapid Alternating Movements

1. Ask the patient to strike one hand on the thigh, raise the hand, turn it over, and then strike it back down as fast as possible.
2. Ask the patient to tap the distal thumb with the tip of the index finger as fast as possible.
3. Ask the patient to tap your hand with the ball of each foot as fast as possible.

Point-to-Point Movements

1. Ask the patient to touch your index finger and their nose alternately several times. Move your finger about as the patient performs this task.
2. Hold your finger still so that the patient can touch it with one arm and finger outstretched. Ask the patient to move their arm and return to your finger with their eyes closed.

3. Ask the patient to place one heel on the opposite knee and run it down the shin to the big toe. Repeat with the patient's eyes closed.

Romberg

1. Be prepared to catch the patient if they are unstable.
2. Ask the patient to stand with the feet together and eyes closed for 5-10 seconds without support.
3. The test is said to be positive if the patient becomes unstable (indicating a vestibular or proprioceptive problem).

Gait

Ask the patient to:

1. Walk across the room, turn and come back
2. Walk heel-to-toe in a straight line
3. Walk on their toes in a straight line
4. Walk on their heels in a straight line
5. Hop in place on each foot
6. Do a shallow knee bend
7. Rise from a sitting position

Reflexes

Deep Tendon Reflexes

- The patient must be relaxed and positioned properly before starting.
- Reflex response depends on the force of your stimulus. Use no more force than you need to provoke a definite response.
- Reflexes can be reinforced by having the patient perform isometric contraction of other muscles (clenched teeth).
- Reflexes should be graded on a 0 to 4 "plus" scale:

Tendon Reflex Grading Scale	
Grade	Description
0	Absent
1+ or +	Hypoactive
2+ or ++	"Normal"
3+ or +++	Hyperactive without clonus
4+ or ++++	Hyperactive with clonus

- Biceps (C5, C6)
 1. The patient's arm should be partially flexed at the elbow with the palm down.
 2. Place your thumb or finger firmly on the biceps tendon.
 3. Strike your finger with the reflex hammer.
 4. You should feel the response even if you can't see it.
- Triceps (C6, C7)
 1. Support the upper arm and let the patient's forearm hang free.
 2. Strike the triceps tendon above the elbow with the broad side of the hammer.
 3. If the patient is sitting or lying down, flex the patient's arm at the elbow and hold it close to the chest.
- Brachioradialis (C5, C6)
 1. Have the patient rest the forearm on the abdomen or lap.
 2. Strike the radius about 1-2 inches above the wrist.
 3. Watch for flexion and supination of the forearm.
- Abdominal (T8, T9, T10, T11, T12)
 1. Use a blunt object such as a key or tongue blade.
 2. Stroke the abdomen lightly on each side in an inward and downward direction above (T8, T9, T10) and below the umbilicus (T10, T11, T12).
 3. Note the contraction of the abdominal muscles and deviation of the umbilicus towards the stimulus.
- Knee (L2, L3, L4)
 1. Have the patient sit or lie down with the knee flexed.
 2. Strike the patellar tendon just below the patella.
 3. Note contraction of the quadriceps and extension of the knee.
- Ankle (S1, S2)
 1. Dorsiflex the foot at the ankle.
 2. Strike the Achilles tendon.
 3. Watch and feel for plantar flexion at the ankle.

Clonus

If the reflexes seem hyperactive, test for ankle clonus: [++](#)

1. Support the knee in a partly flexed position.
2. With the patient relaxed, quickly dorsiflex the foot.
3. Observe for rhythmic oscillations.



Plantar Response (Babinski)

1. Stroke the lateral aspect of the sole of each foot with the end of a reflex hammer or key.
2. Note movement of the toes, normally flexion (withdrawal).
3. Extension of the big toe with fanning of the other toes is abnormal. This is referred to as a positive Babinski.

Sensory

General

- Explain each test before you do it.
- Unless otherwise specified, the patient's eyes should be closed during the actual testing.
- Compare symmetrical areas on the two sides of the body.
- Also compare distal and proximal areas of the extremities.
- When you detect an area of sensory loss map out its boundaries in detail.

Vibration

- Use a low pitched tuning fork (128Hz).
 1. Test with a **non-vibrating** tuning fork first to ensure that the patient is responding to the correct stimulus.
 2. Place the stem of the fork over the distal interphalangeal joint of the patient's index fingers and big toes.
 3. Ask the patient to tell you if they feel the vibration.
- If vibration sense is impaired proceed proximally: [++](#)
 1. Wrists
 2. Elbows
 3. Medial malleoli
 4. Patellas
 5. Anterior superior iliac spines
 6. Spinous processes
 7. Clavicles

Subjective Light Touch

- Use your fingers to touch the skin lightly on both sides simultaneously. [[13](#)]
- Test several areas on both the upper and lower extremities.
- Ask the patient to tell you if there is difference from side to side or other "strange" sensations.

Position Sense

1. Grasp the patient's big toe and hold it away from the other toes to avoid friction. [++](#)
2. Show the patient "up" and "down."
3. With the patient's eyes closed ask the patient to identify the direction you move the toe.
4. If position sense is impaired move proximally to test the ankle joint. [++](#)
5. Test the fingers in a similar fashion.

6. If indicated move proximally to the metacarpophalangeal joints, wrists, and elbows. ++

Dermatomal Testing

If vibration, position sense, and subjective light touch are normal in the fingers and toes you may assume the rest of this exam will be normal. ++

Pain

- Use a suitable sharp object to test "sharp" or "dull" sensation. [7]
- Test the following areas:
 1. Shoulders (C4)
 2. Inner and outer aspects of the forearms (C6 and T1)
 3. Thumbs and little fingers (C6 and C8)
 4. Front of both thighs (L2)
 5. Medial and lateral aspect of both calves (L4 and L5)
 6. Little toes (S1)

Temperature

- Often omitted if pain sensation is normal. ++
- Use a tuning fork heated or cooled by water and ask the patient to identify "hot" or "cold."
- Test the following areas:
 1. Shoulders (C4)
 2. Inner and outer aspects of the forearms (C6 and T1)
 3. Thumbs and little fingers (C6 and C8)
 4. Front of both thighs (L2)
 5. Medial and lateral aspect of both calves (L4 and L5)
 6. Little toes (S1)

Light Touch

- Use a fine whip of cotton or your fingers to touch the skin lightly.
- Ask the patient to respond whenever a touch is felt.
- Test the following areas:
 1. Shoulders (C4)
 2. Inner and outer aspects of the forearms (C6 and T1)
 3. Thumbs and little fingers (C6 and C8)
 4. Front of both thighs (L2)
 5. Medial and lateral aspect of both calves (L4 and L5)
 6. Little toes (S1)

Discrimination

Since these tests are dependent on touch and position sense, they cannot be performed when the tests above are clearly abnormal. ++

- Graphesthesia
 1. With the blunt end of a pen or pencil, draw a large number in the patient's palm.
 2. Ask the patient to identify the number.
- Stereognosis
 1. Use as an alternative to graphesthesia. ++
 2. Place a familiar object in the patient's hand (coin, paper clip, pencil, etc.).
 3. Ask the patient to tell you what it is.
- Two Point Discrimination
 1. Use in situations where more quantitative data are needed, such as following the progression of a cortical lesion. ++
 2. Use an opened paper clip to touch the patient's finger pads in two places simultaneously.
 3. Alternate irregularly with one point touch.
 4. Ask the patient to identify "one" or "two."
 5. Find the minimal distance at which the patient can discriminate.

Notes

1. For more information refer to *A Guide to Physical Examination and History Taking, Sixth Edition* by Barbara Bates, published by Lippincott in 1995.
2. Visual acuity is reported as a pair of numbers (20/20) where the first number is how far the patient is from the chart and the second number is the distance from which the "normal" eye can read a line of letters. For example, 20/40 means that at 20 feet the patient can only read letters a "normal" person can read from twice that distance.
3. You may, instead of wiggling a finger, raise one or two fingers (unilaterally or bilaterally) and have the patient state how many fingers (total, both sides) they see. To test for **neglect**, on some trials wiggle your right and left fingers simultaneously. The patient should see movement in both hands.
4. Additional Testing - Tests marked with (++) may be skipped unless an abnormality is suspected.
5. PERRLA is a common abbreviation that stands for "Pupils Equal Round Reactive to Light and Accommodation." The use of this term is so routine that it is often used incorrectly. If you did not specifically check the accommodation reaction use the term PERRL. Pupils with a diminished response to light but a normal response to accommodation (Argyll-Robertson Pupils) are a sign of neurosyphilis.
6. Nystagmus is a rhythmic oscillation of the eyes. Horizontal nystagmus is described as being either "leftward" or "rightward" based on the direction of the **fast** component.

7. Testing Pain Sensation - Use a new object for each patient. Break a wooden cotton swab to create a sharp end. The cotton end can be used for a dull stimulus. Do **not** go from patient to patient with a safety pin. Do **not** use non-disposable instruments such as those found in certain reflex hammers. Do **not** use very sharp items such as hypodermic needles.
8. Central vs Peripheral - With a unilateral central nervous system lesion (stroke), function is preserved over the upper part of the face (forehead, eyebrows, eyelids). With a peripheral nerve lesion (Bell's Palsy), the entire face is involved.
9. The hearing screening procedure presented by Bates on page 181 is more complex than necessary. The technique presented in this syllabus is preferred.
10. Deviation of the tongue or jaw is **toward** the side of the lesion.
11. Although it is often tested, grip strength is **not** a particularly good test in this context. Grip strength may be omitted if finger abduction and thumb opposition have been tested.
12. The "anti-gravity" muscles are difficult to assess adequately with manual testing. Useful alternatives include: walk on toes (plantarflexion); rise from a chair without using the arms (hip extensors and knee extensors); step up on a step, once with each leg (hip extensors and knee extensors).
13. Subjective light touch is a quick survey for "strange" or asymmetrical sensations only, not a formal test of dermatomes.