

THE NEUROLOGIC EXAMINATION

I. Introduction

The nervous system is less accessible to inspection, palpation, percussion, and auscultation than most other organ systems. Instead, the nervous system is treated as a “black box” that is analyzed by examining what goes in and what goes out, and from this determining whether the box is performing its functions correctly. Fortunately, the nervous system has many kinds of input and output, because it is the principal organ system responsible for regulating an animal’s interactions with the environment. The neurologic examination is a systematic assessment of the nervous system’s output in response to various forms of input.

In the broadest terms, all input to the nervous system enters via sensory nerves, and all output is mediated by muscles. The processing that occurs between input and output can be extremely complicated. For example, consider what is involved in responding to the question, “What time is it?” A person must (1) hear the question (2) identify the noises as recognizable words (3) interpret the words (4) generate a motor program designed to bring a clock or watch into view (5) transmit the program to the correct muscles (6) activate the muscles with the correct timing and force so that the movement does not undershoot or overshoot the target (7) see the face of the watch or clock (8) analyze the shapes into a coherent visual picture (9) interpret the picture (10) translate the time into words (11) generate a motor program designed to activate the oral and laryngeal muscles involved in producing those words (12) transmit the program to the correct muscles (13) activate the muscles with the correct timing and force. Furthermore, each of these steps involves many component processes. A malfunction at any step along the way could result in an incorrect or absent response. The type of error may help to identify the specific site of malfunction, but usually more information is necessary. This is provided by presenting a variety of different tasks that involve different combinations of sensory inputs, central processing, and motor outputs, identifying the tasks that are performed incorrectly, and determining whether those tasks share a common input pathway, output pathway, or central processing step.

It is convenient to classify the nervous system functions into the general categories listed in the table. The mental status portion of the examination involves tasks that require sophisticated central processing by the brain. The twelve cranial nerves are considered separately from the peripheral nerves derived from spinal nerve roots because they have unique functions and are located in precise locations, so that examination abnormalities often have very specific implications regarding the site of nervous system damage. In rough terms, the mental status examination assesses the cerebral cortex and the cranial nerve examination assesses the brainstem; both are essentially independent of spinal cord function. The remainder of the neurologic examination consists of assessment of sensory input from and motor output to the trunk and the four limbs. This involves pathways that traverse the entire nervous system, from the cortex, through the brainstem and spinal cord, via nerve root, plexus,

and peripheral nerve to muscle or sensory end organ. An individual abnormality on this portion of the examination provides very little information about the level of nervous system damage, but a particular combination of abnormalities may be very informative.

All of the components of the neurologic examination require at least some degree of central processing between input and output. Reflexes are the nervous system functions for which that central processing is minimized. They are automatic output functions triggered by specific input, without any need for conscious deliberation (although they can be modified by cortical activity). They result from fixed connections between incoming sensory nerves and exiting motor nerves at the same level of the spinal cord or brainstem. Because they are based on such local circuits, reflex abnormalities provide very useful information in determining the site of nervous system damage. In fact, most spinal cord reflexes are modulated by chronic inhibition from higher levels of the nervous system. This helps to amplify the information derived from reflex abnormalities: damage to the nervous system at the level of the reflex circuit causes the reflex to be diminished, whereas damage at higher levels causes it to be exaggerated. Because they do not require conscious deliberation, reflexes are also very helpful in examining uncooperative patients.

There are fairly broad ranges of “normal findings” for most components of the neurologic examination. For example, some normal individuals have much better language skills than others, some are stronger than others, some have bigger pupils than others, and some have brisker reflexes than others. This makes it difficult to decide whether a given finding is truly outside the range of normal. In part, this decision is based on experience and common sense (e.g., if a college graduate can not remember the current year or the name of the president, this is probably abnormal; if a ten year old boy can not overcome the examiner on formal strength testing, this is normal). For many parts of the examination, patients can be used as their own controls. For example, mild weakness of elbow flexion is probably significant in a young weight lifter in whom all other muscles are extremely strong, and probably not in a patient who has been bedridden and “weak all over.” Similarly, a brisk biceps reflex is much more significant when the contralateral biceps reflex is normal or reduced than when they are symmetric. To facilitate such comparisons, the two sides of the body should be compared directly at each step of the examination. For example, it is best to examine the strength of the right biceps immediately after examining the left biceps, rather than completing the examination of the entire left upper extremity before proceeding to the right.

The following material provides a concrete description of examination techniques. No diagrams are included. This written text should be supplemented with the videotape available at your lab sessions and in the LRC, and/or with the illustrations in the recommended texts by Bates and Judge. A complete neurologic examination will also be demonstrated in the lecture.

To avoid confusion, only one technique for performing each part of the neurologic examination is presented here. Many variations exist. Some can be found in standard textbooks (including the ones by Bates and Judge); others may be suggested by instructors in the laboratory session or by various teachers at later stages of your career. There are also many useful tests that are not even included in the present material, which is intended to describe only the most routine components of the examination. In time, you should develop your own examination style, incorporating examination techniques from multiple sources. There is no standard order in which to perform the examination – the sequence shown in the table is useful conceptually and for written or oral presentations, but is not intended to guide the order in which you actually do the tests.

II. Mental Status

A. **Level of Alertness**

This is simply assessed in the course of the history and physical; no special testing is required. Does the patient respond briskly to questions and instructions? Is the patient inattentive, sleepy, or unresponsive?

B. **Language**

1. **Fluency.** This is also assessed throughout the course of the patient interaction, without involving special testing. Are the patient's phrases and sentences of normal length, spoken smoothly and at a normal rate, with normal grammatical structures? Note that fluency is independent of content – speech can be completely fluent and still be nonsense.

2. **Comprehension.** This is often adequately assessed through the routine history and physical, but can also be tested explicitly. Give the patient progressively more complex commands, such as one-step (“Touch your nose.”), two-step (“Touch your nose, then stick out your tongue.”), and three-step (“Touch your nose, then stick out your tongue, and then raise your right foot”). Commands that require a body part to cross the midline (“Touch your right ear with your left thumb.”) are more complex than those that don't. Increasingly complex grammatical structures can also be used (“Touch the coin with the pencil”; “With the comb, touch the coin.”). Ask the patient progressively more complex questions, either yes-no (“Does a stone sink in water?”, “Do you put on your shoes before your stockings?”) or otherwise. Again, more complex grammatical structures such as passive voice or possessive may be useful (“Is my aunt's uncle a man or a woman?”; “If a lion was killed by a tiger, which one is still alive?”).

3. **Repetition.** Ask the patient to repeat phrases or sentences of progressively greater length or complexity (e.g., “It is cold outside.”; “We all went over there together.”; “The lawyer's closing argument convinced the jury.”; “The final movement of the symphony was disappointing.”).

4. **Naming.** This is partly assessed in routine conversation – does the patient often pause and grope for words? It should also be tested explicitly, by asking the patient to name items as you point to them (e.g., shirt, shoe, phone, collar, lapel, shoelace, heel, receiver). Less common objects are generally harder to name, and parts of an object are harder to name than the entire object.

5. **Reading.** Ask the patient to read a paragraph aloud. Listen for omitted or added words, or for word substitutions. Ask the patient to summarize the meaning of the paragraph.

6. **Writing.** Ask the patient to write an original sentence, and to write a sentence from dictation. Again, look for omitted or added words, or for word substitutions.

C. Memory

1. **Immediate.** Ask the patient to repeat a string of seven digits immediately after you complete it. Lengthen or shorten the string until you find the longest string the patient can repeat correctly. This is called a *digit span*. NOTE: This is traditionally categorized as “immediate memory,” but it is really more appropriately considered “*attention*.”

2. **Short-term.** Ask the patient to memorize three unrelated words (e.g., baseball, horse, shirt), then distract the patient for five minutes (usually by performing other parts of the exam). Then ask the patient to recall the list. If the patient misses an item, give clues (e.g., “One was an animal.”), and if this isn’t enough, offer a multiple choice (e.g., “It was either a cat, a bear, or a horse.”).

3. **Long-term.** Test *recent* memory, including orientation to time (day, date, month, season, year), place (state, city, building), and person (patient’s full name). Recent memory also includes events of the past few days or weeks, such as “Who are the current candidates for president?” or (assuming an independent source is available for verification) “What did you have for supper last night?” *Remote* memory can be tested by asking for the names of the presidents in reverse order as far back as the patient can remember, important historical events and dates, etc., and also by asking about details of personal life such as birthdate, names and ages of children and grandchildren, and work history (again, assuming independent verification is available).

D. Calculation.

Ask some straightforward computation problems (e.g., $5+8=?$; $6\times 7=?$; $31-18=?$) and some “word problems” (e.g., “How many nickles are there in \$1.35?”; “How many quarters in \$3.75?” “What is the change from a dollar if you buy six pieces of candy that cost twelve cents each?”).

E. Construction.

Ask the patient to draw a clock, including all the numbers, and to place the hands at 4:10. Ask the patient to draw a cube; for patients who have trouble doing so, draw a cube and ask them to copy it.

F. Abstraction.

Ask the patient to explain similarities (e.g., “What do an apple and an orange have in common?”; “... a basketball and a grapefruit...?”; “...a tent and a cabin...?”; “...a bicycle and an airplane...?”; “...a sculpture and a symphony...?”) and differences (e.g., “What’s the difference between a radio and a television?”; “...a river and a lake?”; “...a baby and a midget?”; “...character and reputation?”).

III. Cranial Nerves

A. Olfaction.

This need not be tested routinely. It is tested by having the patient occlude one nostril and identify a common scent (e.g., coffee, peppermint, cinnamon) placed under the other nostril.

B. Vision.

1. Visual Fields. Have the patient cover his or her left eye. Stand facing the patient from two arms-lengths away, close your right eye, and stretch your arms forward and to the sides so that the hands are at the vertical midline of your vision and just barely visible in your peripheral vision. They should be the same distance from you and the patient. Hold the index finger on each hand extended. Wiggle the finger on either the left, right, or both hands, and ask the patient to identify where the movement occurs while looking directly at your nose. Move your arms upward so that your hands are at roughly “1:00-2:00” and “10:00-11:00”, and repeat the task. Move your hands down to roughly “4:00-5:00” and “7:00-8:00” and test again. Then test all three positions using the patient’s left eye (and your right eye).

2. Acuity. Place a hand-held visual acuity card 14 inches in front of the patient’s right eye, while the left eye is covered (and with the patient wearing his or her usual corrective lenses). Ask the patient to read the lowest line on the chart (20/20). If the patient can not do so, move up a line, and continue doing so until you reach a line where the majority of items are read correctly. Note which line this is, and how many errors the patient makes on this line. Repeat the process for the left eye.

3. Funduscopic examination. See the chapter entitled “Comprehensive Ophthalmology Examination.”

C. Pupillary Light Reflex.

Reduce the room illumination as much as possible. Shine a penlight on the bridge of the patient's nose, so that you can see both pupils without directing light at either of them. Check that they are the same size. Now move the penlight so that it is directly shining on the right pupil, and check to see that both pupils have constricted to the same size. Next, move the penlight back to the bridge of the nose so that both pupils dilate, and then shine the light directly on the left pupil, again checking for equal constriction of the two eyes. Finally, move the penlight rapidly from the left pupil to the right – the pupil size should not change. Swing the light back to the left pupil – again, the pupil size should remain constant. Repeat this “swinging” maneuver several times to be sure there is no consistent tendency for the pupils to be larger when the light is directed at one eye than when it is directed at the other one.

D. Eye Movements.

Observe the patient's eyelids for *ptosis*. Have the patient fixate on your finger held about two feet away, in the vertical and horizontal midline. Observe for *nystagmus* – a repetitive, quick movement of the eyes in one direction, followed by a slow return of the eyes in the opposite direction, several times in a row. Ask the patient to avoid any movement of the head, but to continue watching your finger as you slowly move it to the patient's right. Observe the smoothness and range of the patient's eye movements. Keep your finger at the far right of the patient's gaze for several seconds while observing for nystagmus. Move your finger slowly to the patient's left and repeat the observations. Return your finger to the vertical and horizontal midline, then move it slowly up, repeating the observations. Then move your finger slowly down and repeat the observations. Finally, return to the midline position, and move your finger diagonally down and to the left; then return to the midline and move your finger down and to the right.

E. Facial Sensation.

Lightly touch the patient's right forehead ONCE, and then do the same on the opposite side. Ask the patient if the two stimuli felt the same. Repeat this procedure on the cheek and on the chin. This is usually adequate testing. In some circumstances, the testing should be repeated applying light pressure with a pin. The *corneal reflex* is not routinely necessary, but is useful in uncooperative patients or when the rest of the exam suggests that there may be a problem with facial sensation or strength. It is tested by having the patient look to the far left, then touching the patient's right eye with a fine wisp of cotton (introduced from the patient's right field of vision) and observing the reflexive blink that occurs in each eye. The process is then repeated with the left eye.

- F. Facial Strength.**
1. **Muscles of mastication.** Have the patient open the jaw against resistance, then close the jaw against resistance. Have the patient move the chin side to side.
 2. **Muscles of facial expression.** Have the patient close his or her eyes tightly. Observe whether the lashes are buried equally on the two sides, and whether you can open either eye manually. Then have the patient look up and wrinkle the forehead; note whether the two sides are equally wrinkled. Have the patient smile, and observe whether one side of the face is activated more quickly or more completely than other.
- G. Hearing.** For bedside examination purposes, it usually suffices to perform a quick screen by holding your fingers a few inches away from the patient's ear and rubbing them softly. Alternatively, you can hold your hand up as a sound screen and whisper a few numbers from behind your hand while rhythmically tapping the opposite ear to keep it from contributing, then ask the patient to repeat the numbers to you. Each ear should be tested separately. When there is reduced auditory acuity in one or both ears, additional information can be obtained from the Weber and Rinne tests (described in the textbooks), but these are still imprecise.
- H. Palatal Movement.** Ask the patient to say "aaah" or yawn, and observe whether the two sides of the palate move fully and symmetrically. The palate is most readily visualized if the patient is sitting or standing, rather than supine. There is generally no need to test the *gag reflex* in a screening neurologic examination. When there is reason to suspect reduced palatal sensation or strength, the reflex can be checked by observing the response when you touch the posterior pharynx on one side with a cotton swab, and then comparing to the response elicited by touching the other side.
- I. Dysarthria.** Note if the patient's speech is slurred, nasal, strangled, or irregular in rate or volume.
- J. Head Rotation.** Have the patient turn the head all the way to the left. Place your hand on the left side of the chin and ask the patient to press against your hand while you try to turn the head back to the right, palpating the right sternocleidomastoid muscle with your other hand at the same time. Repeat the process for rightward head rotation.
- K. Shoulder Elevation.** Ask the patient to shrug the shoulders while you resist the movement with your hands.
- L. Tongue Movement.** Have the patient protrude the tongue and move it rapidly from side to side, then push it into the left side of the mouth while you push against it from outside the left cheek, and then do the same on the right side of the mouth.

IV. Motor

A. **Gait.** Observe the patient's *casual* gait, preferably with the patient unaware of being observed. Have the patient walk toward you while walking on the *heels*, then walk away from you walking on *tiptoes*. Finally, have the patient walk in *tandem*, placing one foot directly in front of the other as if walking on a tightrope (the "drunk driving test"). Note if the patient is unsteady with any of these maneuvers, or if there is any asymmetry of movement. Also look for *festination*, an involuntary tendency for steps to accelerate and become smaller.

B. **Coordination.**

1. **Finger tapping.** Ask the patient to make a fist with the right hand, then extend the thumb and index finger and tap the index finger on the tip of the thumb as quickly as possible. Repeat with the left hand. Observe for speed, accuracy, and regularity of rhythm.
2. **Rapid alternating movements.** Have the patient alternately pronate and supinate the right hand against a stable surface (such as a table, or the patient's own thigh or left hand) as rapidly as possible; repeat for the left hand. Again, observe speed, accuracy and rhythm.
3. **Finger-to-nose testing.** Ask the patient to use the tip of his or her right index finger to touch the tip of your index finger, then the patient's nose, then your finger again, and so forth. Hold your finger so that it is near the extreme of the patient's reach, and move it to several different positions during the testing. Repeat the test using the patient's left arm. Observe for accuracy and tremor.
4. **Heel-to-shin testing.** Have the patient lie supine, place the right heel on the left knee, and then move the heel smoothly down the shin to the ankle. Repeat using the left heel on the right shin. Again, observe for accuracy and tremor.

C. **Involuntary Movements.**

Observe the patient throughout the history and physical for *tremor*, *myoclonus* (rapid shock-like muscle jerks), *chorea* (rapid, jerky twitches, similar to myoclonus but more random in location and more likely to blend into one another), *athetosis* (slow, writhing movements of the limbs), *ballismus* (large amplitude flinging limb movements), *tics* (abrupt, stereotyped coordinated movements or vocalizations), *dystonia* (maintenance of an abnormal posture or repetitive twisting movements), or other involuntary motor activity.

D. **Pronator Drift.**

Ask the patient to stretch out the arms so that they are level and fully extended, with the palms facing straight up – then to close the eyes. Watch for five to ten seconds to see if either arm tends to pronate (so that the palm turns inward) and drift downward.

E. Individual Muscles.

1. **Strength.** For a screening examination of strength, the following upper extremity movements should be tested: shoulder abduction, elbow extension, elbow flexion, wrist extension, wrist flexion, finger extension, finger flexion, and finger abduction. In the lower extremities, the following movements should be tested: hip flexion, hip extension, knee flexion, knee extension, ankle dorsiflexion, and ankle plantar flexion.

For each movement, place the limb near the middle of its range, and then ask the patient to resist you as you try to move the limb from that position. For example, in testing shoulder abduction, the patient's arms should be horizontal forming a letter "T" with the body, and the patient should try to maintain that position while you press down on both arms at a point between the shoulder and the elbow. In general, you should place one hand above the joint being examined and exert pressure with your other hand just below the joint, to isolate the specific movement you are trying to test. The most common convention for grading muscle strength is the 0 to 5 Medical Research Council (MRC) scale:

0 = no contraction

1 = visible muscle twitch but no movement of the joint

2 = weak contraction insufficient to overcome gravity

3 = weak contraction able to overcome gravity but no additional resistance

4 = weak contraction able to overcome some resistance but not full resistance

5 = normal; able to overcome full resistance

Note that this scale is insensitive to subtle differences in strength – in particular, grade 4 covers a wide range of possibilities.

2. **Bulk.** While testing strength, the muscles active in each movement should be inspected and palpated for evidence of *atrophy*. *Fasciculations* (random, involuntary muscle twitches) should also be noted.

3. **Tone.** Ask the patient to relax and let you manipulate the limbs passively. This is harder for most patients than you might imagine, and you may need to try to distract them by engaging them in unrelated conversation, or ask them to let their limbs go limp, "like a wet noodle." Several forms of increased resistance to passive manipulation are distinguished. *Spasticity* depends on the limb position and the velocity with which the limb is moved, classically resulting in a "clasp-knife phenomenon" when the limb is moved rapidly: the limb moves freely for a short distance, but then there is a "catch" and you must use progressively more force to move the limb until at a certain point there is a sudden release and you can move the limb freely again. Spasticity is generally greatest in the flexors of the upper extremity and the extensors of the lower extremity. *Rigidity*, in contrast, is characterized by increased resistance throughout the movement. "*Lead-pipe rigidity*" applies to resistance that is uniform throughout the movement. "*Cogwheel rigidity*" is characterized by rhythmic interruption of the resistance, producing a ratchet-like

effect. Rigidity is often enhanced by distracting the patient. *Paratonia* is increased resistance that becomes less prominent when the patient is distracted.

V. Reflexes

- A. **Tendon Reflexes.** The reflexes at the biceps, triceps, brachioradialis, knee, and ankle are the ones commonly tested. The joint under consideration should be at about 90° and fully relaxed – it is often helpful to cradle the joint in your own arm to support it. With your other arm, hold the end of the hammer and let the head of the hammer drop like a pendulum so that it strikes the tendon (specifically, just anterior to the elbow for the biceps reflex, just posterior to the elbow for the triceps reflex, about 2 inches above the wrist on the radial aspect of the forearm for the brachioradialis reflex, just below the patella for the knee reflex, and just behind the ankle for the ankle reflex). Aim can sometimes be improved by striking your finger or thumb after positioning it across the tendon. You should strive to develop a technique that results in a reproducible level of force from one occasion to the next. The most reliable information comes from using the least force necessary to elicit the reflex – in many cases, your fingers are sufficient and the hammer is not even necessary. At the other extreme, when a patient has reflexes that are difficult to elicit, you can amplify them by using reinforcement procedures: ask the patient to clench his or her teeth or (when testing lower extremity reflexes) to hook together the flexed fingers of both hands and pull. This is also known as the Jendrassik maneuver.

Reflexes are graded on an essentially subjective scale:

- 0 = absent
- 1 = reduced (hypoactive)
- 2 = normal
- 3 = increased (hyperactive)
- 4 = clonus

Clonus is a rhythmic series of muscle contractions induced by stretching the tendon. It most commonly occurs at the ankle, where it is typically elicited by suddenly dorsiflexing the patient's foot and maintaining light upward pressure on the sole. Some examiners use a grade of '5' to designate sustained clonus, reserving '4' for unsustained clonus that eventually fades after 2 to 10 beats. Also, some examiners include a reflex grade of '1/2' to indicate a reflex that can only be obtained using reinforcement.

- B. **Plantar Response.** Using a blunt, narrow surface (e.g., a tongue blade, key, or the handle of a reflex hammer), stroke the sole of the patient's foot on the lateral edge, starting near the heel and proceeding along the lateral edge almost to the base of the little toe, then curve the path medially just proximal to the base of the other toes. This should take the form of a smooth 'J' stroke. Always start by applying minimal pressure. This is usually adequate, but if no response occurs, repeat the maneuver with greater pressure.

The normal response is for all the toes to flex (a “flexor plantar response”). When there is damage to the central nervous system motor pathways, an abnormal reflex occurs: The great toe extends (dorsiflexes) and the other toes fan out. This is called an extensor plantar response; it is also known as a Babinski sign.

- C. **Superficial Reflexes.** These include the abdominal reflexes and the cremasteric reflexes. They are described in standard textbooks. They are not relevant to standard screening examinations.
- D. **Primitive Reflexes.** These are also called *frontal release signs*. They include the grasp, root, snout, and palmomentar reflexes. Again, they are described in standard textbooks, but they are of limited clinical utility except in children.

VI. Sensory

- A. **Light Touch.** Have the patient close his or her eyes and tell you whether you are touching the left hand, right hand, or both simultaneously. Repeat this several times, using as a stimulus a single light touch applied sometimes to the medial aspect of the hand and sometimes to the lateral aspect. Note whether the patient consistently fails to detect stimulation in one location. Also note whether the patient consistently “*extinguishes*” the stimulus on one side of the body when both sides are *stimulated simultaneously*. Next, touch the patient ONCE lightly on the medial aspect of each hand simultaneously, and ask if they feel the same. Ask the same question for the lateral aspect of each hand. If any abnormalities are detected, extend your region of testing proximally in the limb to map out the precise area of abnormality. Perform analogous testing on the feet.
- B. **Pain/Temperature.** Explain to the patient that you will be touching each finger with either the sharp or the dull end of a safety pin, and demonstrate each. Be sure the safety pin is previously unused. Then, with the patient’s eyes closed, lightly touch the palmar aspect of the thumb with the sharp point of the pin, and ask the patient to say “sharp” or “dull”. Repeat this for each finger of each hand, usually using the sharp point but including one dull stimulus on each hand to be sure the patient is paying attention. Next, touch the patient with the pin ONCE lightly on the medial aspect of each hand, and ask if they feel equally sharp. Ask the same question for the lateral aspect of each hand. If any abnormalities are detected, extend your region of testing proximally in the limb to map out the precise area of abnormality. Perform analogous testing on the feet.
It is not usually necessary to test both pain and temperature --either will suffice. You can test temperature in a fashion analogous to pain; a reasonable stimulus is the flat portion of a tuning fork after it has been immersed in cold water and dried.
- C. **Joint Position Sense.** With the finger and thumb of one hand, stabilize the distal interphalangeal (DIP) joint of the patient’s left hand by holding it on the medial and lateral aspects. With the finger and thumb of your other hand, hold the medial and lateral aspects of the tip of the thumb, and move it slightly up or down. Have the

patient close his or her eyes and identify the direction of movement. Repeat several times. Most normal patients can identify movements of a few degrees or less. Perform analogous testing of the patient's right thumb and both great toes. If abnormalities are detected, proceed to more proximal joints in the same limb until a joint is found where position sense is intact. The **Romberg test** also helps to assess position sense. Have the patient stand with both feet together, and then note whether the patient can maintain balance after closing his or her eyes.

- D. Vibration.** Tap a 128 Hz tuning fork lightly against a solid surface to produce a slight vibration. With the patient's eyes closed, hold the non-vibrating end of the tuning fork firmly on the DIP joint of the patient's left thumb, and ask the patient if the vibration is detectable. Let the vibration fade until the patient no longer detects it, then apply the tuning fork to your own thumb to see if you can still feel any vibration. Repeat this testing on the patient's right thumb and both great toes. For one of the limbs, stop the vibration before applying the tuning fork to the limb, to be sure that the patient is paying attention – if not, clarify to the patient that you are only interested in actual vibration, not just pressure. If any abnormalities are detected, apply the tuning fork to progressively more proximal joints until one is found where the vibration is detected normally.
- E. Double Simultaneous Stimulation.** See A.
- F. Graphesthesia.** Ask the patient to close the eyes and identify a number from 0 to 9 that you draw on his or her index finger using a ballpoint pen (with the stylette in!). Repeat with several other numbers, and compare to the other hand. Perform analogous testing on the feet, but your drawing may need to be larger there.
- G. Stereognosis.** Ask the patient to close the eyes and identify a small object (e.g., nickel, dime, quarter, penny, key, paper clip) you place in his or her right hand. Test the left hand in the same way.

Organization of the Neurologic Examination

I. Mental status

- A. Level of alertness
- B. Language
 - 1. Comprehension
 - 2. Fluency
 - 3. Repetition
 - 4. Reading
 - 5. Writing
- C. Memory
 - 1. Immediate
 - 2. Short-term
 - 3. Long-term
 - a. Recent (including orientation to place and time)
 - b. Remote
- D. Calculation
- E. Construction
- F. Abstraction

II. Cranial nerves

- A. Olfaction (CN1)
- B. Vision (CN2)
 - 1. Visual fields
 - 2. Visual acuity
 - 3. Fundoscopic examination
- C. Pupillary light reflex (CNs 2,3)
- D. Eye movements (CNs 3, 4, 6)
- E. Facial Sensation (CN5)
- F. Facial Strength
 - 1. Muscles of mastication (CN 5)
 - 2. Muscles of facial expression (CN 7)

G Hearing (CN 8)

- H. Palatal movement (CNs 9,10)
- I. Dysarthria (CNs 9, 10, 12)
- J. Head rotation (CN 11)
- K. Shoulder elevation (CN 11)
- L. Tongue movements (CN 12)

III. Motor

- A. Gait
- B. Coordination
- C. Involuntary movements
- D. Pronator drift
- E. Individual muscles
 - 1. Strength
 - 2. Bulk
 - 3. Tone (resistance to passive manipulation)

IV. Reflexes

- A. Tendon reflexes
- B. Plantar responses
- C. Superficial reflexes
- D. "Primitive" reflexes

V. Sensory

- A. Light touch
- B. Pain/temperature
- C. Joint position sense
- D. Vibration
- E. Double simultaneous stimulation
- F. Graphesthesia
- G. Stereognosis