

# Essential Neurological Examination

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# Components of Neurological Examination

- Mental Status
- Cranial Nerves
- Motor
- Coordination
- Reflexes
- Sensory
- Gait



# Mental Status

- Check for orientation x 3
  - time
  - place
  - person



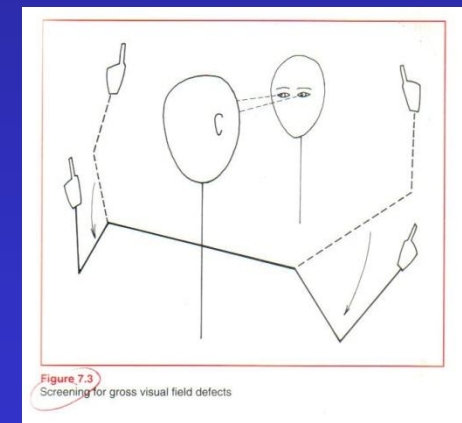
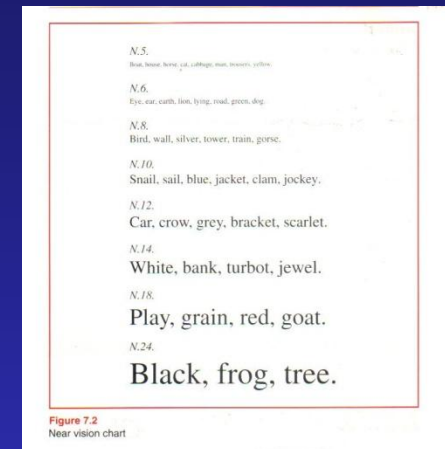
# Cranial Nerve 1

- Olfactory nerve:
  - Smelling of vinegar, perfume
  - Skull base lesion



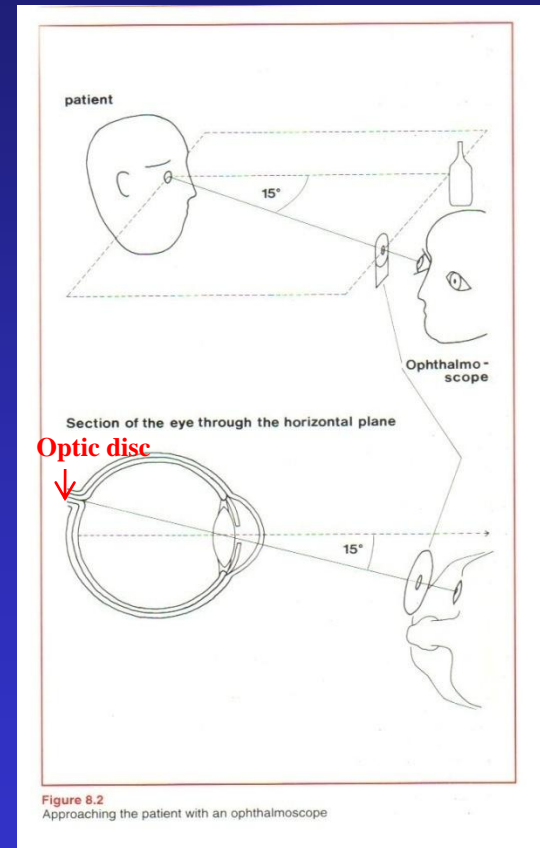
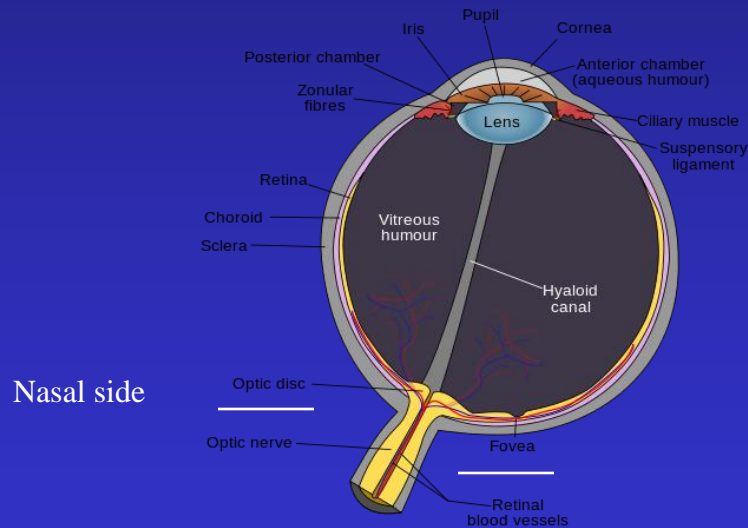
# Cranial Nerve 2

- Optic nerve:
  - Visual acuity: with eyeglasses if needed, one eye at one time, using the “near card”
  - Visual field: Look at examiner’s nose, 50 cm apart, 30 cm above followed by 30 cm below patient’s eye level. Examiner waves the index finger.
  - Fundus: Papilledema, optic disk pallor



# Approaching the Patient with an Ophthalmoscope

- The optic disc is 3 to 4 mm to the nasal side of the fovea

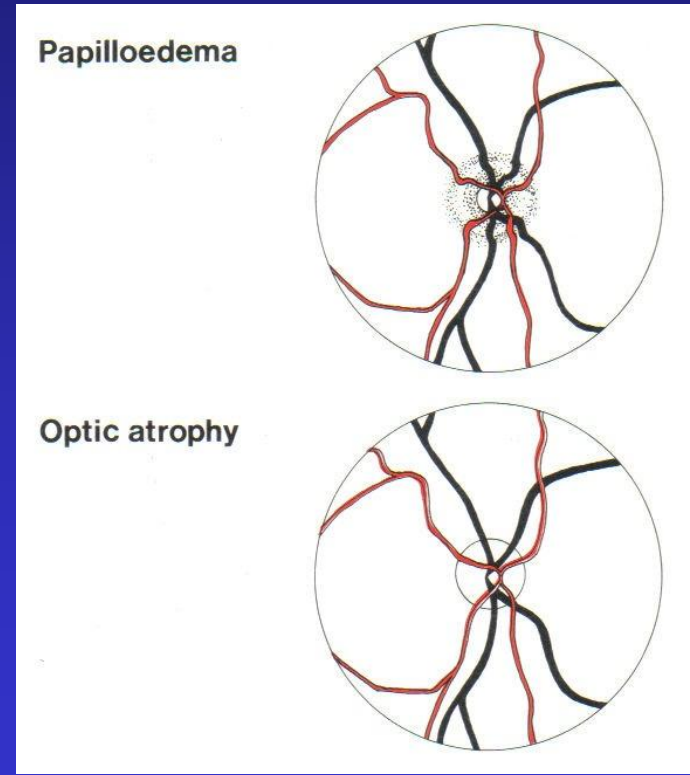
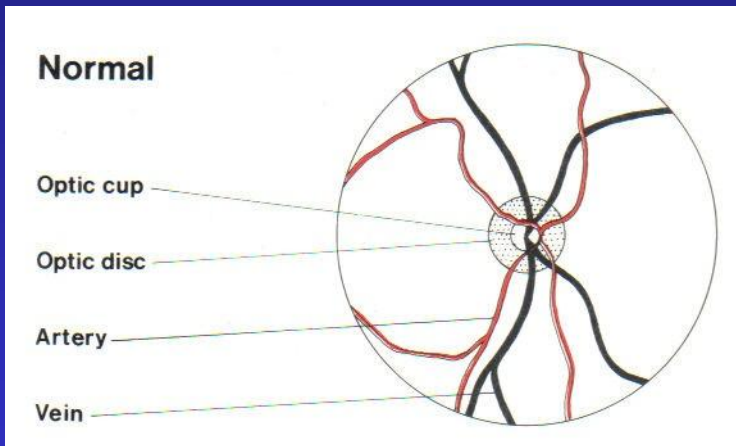


Start 30 cm away, 15 degree from the line of patient's eye fixation at the same horizontal plane of the eye, approach until within 1-2 cm of patient's eye



# Fundus Appearance

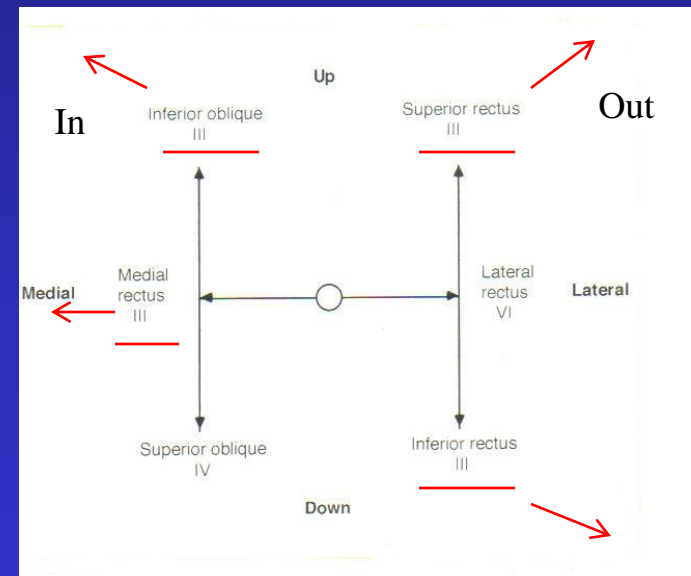
Disc swelling, blurred disc margin,  
e.g. Intracranial hypertension



Optic neuropathy, pale disc,  
e.g. optic neuritis

# Cranial Nerve 3

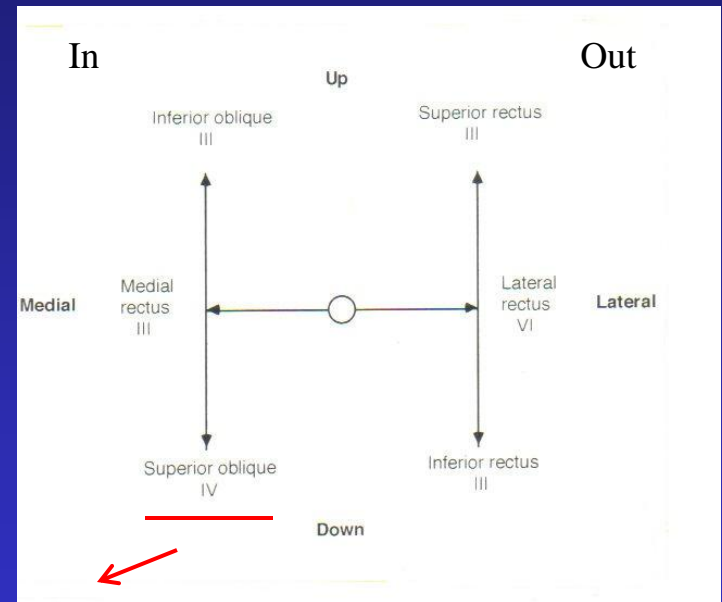
- Oculomotor nerve:
  - Eyelids: look for drooping eyelid (levator palpebrae muscle)
  - Pupils (sphincter pupillae muscle)
    - Shape and symmetry: equal size?
    - Reactivity to light: Using the swinging flashlight test (optic nerve senses the light, oculomotor nerve constricts the pupils)
  - Extraocular movements: to fixate on and follow examiner's finger in all directions of gaze (inferior rectus, superior rectus, medial rectus, inferior oblique)





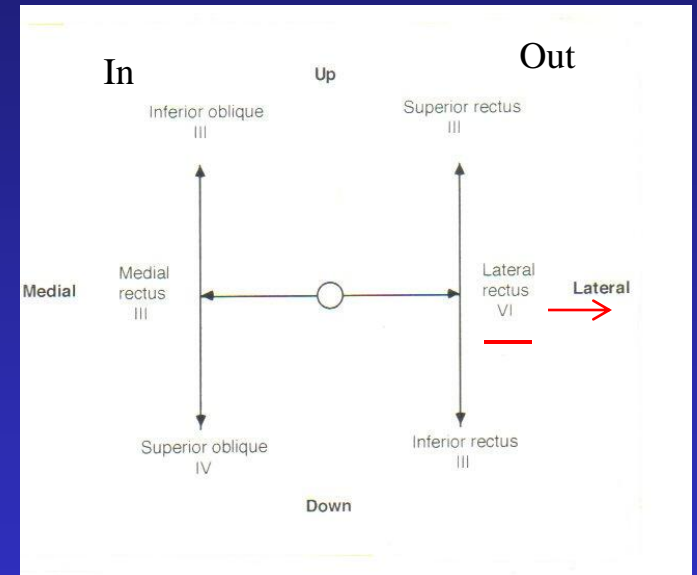
# Cranial Nerve 4

- Trochlear nerve:
  - Superior oblique muscle
  - Depression and intortion of the eye ball. Lesion causes inferomedial gaze palsy)



# Cranial Nerve 6

- Abducens nerve:
  - Lateral rectus muscle
  - Lateral gaze
  - Lateral gaze palsy raises the suspicion of increased intracranial pressure (e.g. pseudotumor cerebri, exerting downward pressure on the brainstem, causing the nerve to stretch along the clivus which is posterior to the sphenoid sinus. )



# CN 3,4,6 – Extraocular Eye Movement

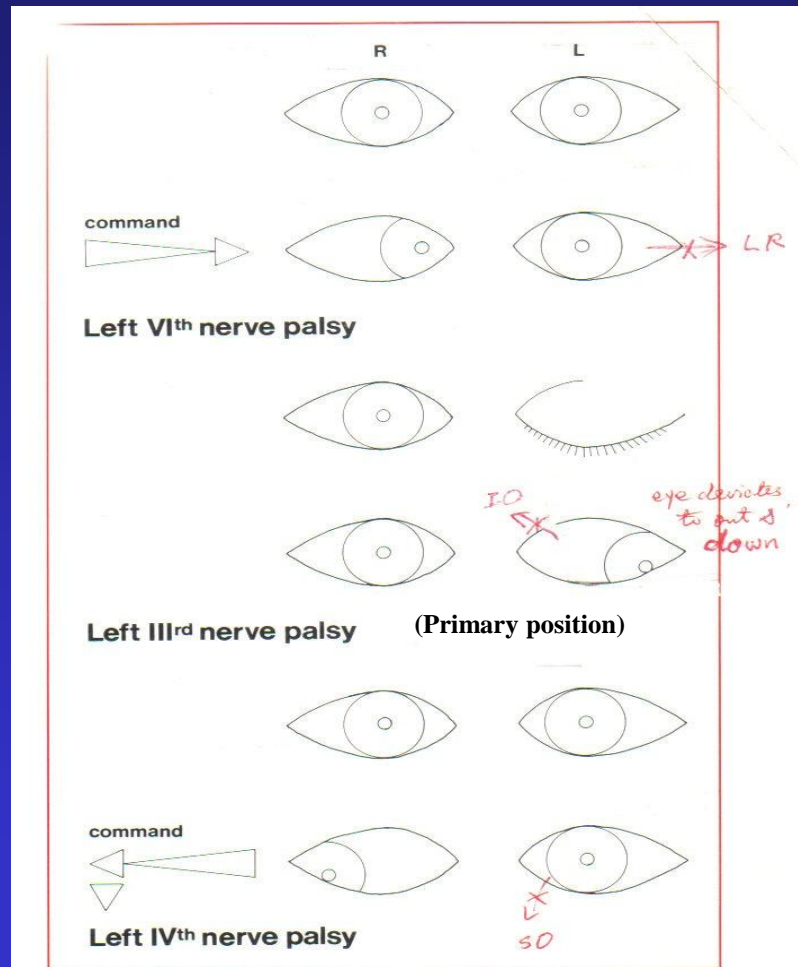
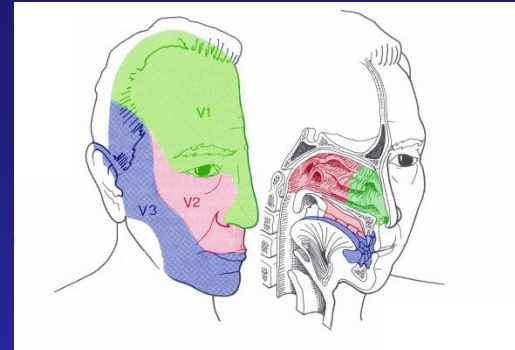


Figure 9.4  
Single nerve palsies



# Cranial Nerve 5

- Trigeminal nerve:
  - Sensory: Check deficits to light touch, pinprick, and temperature (face, eye, tongue, partial oropharynx)
    - V1: Forehead
      - Also check corneal reflex: light touch to the cornea with a cotton wisp
    - V2: Cheek
    - V3: Chin
  - Motor: Checking for asymmetry of lateral jaw movements (medial and lateral pterygoid muscles innervated by V3, move the jaw from side to side, jaw deviates to the paralyzed side)



Common mistakes:

- the conjunctiva is touched instead of the cornea (Fig. 11.3)

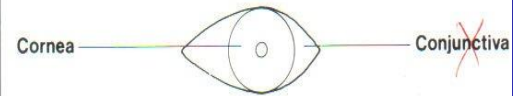
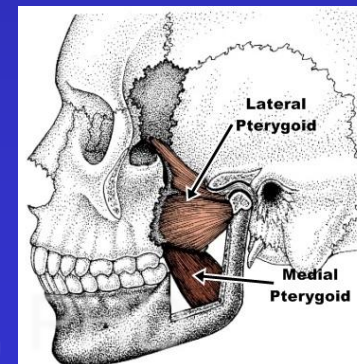
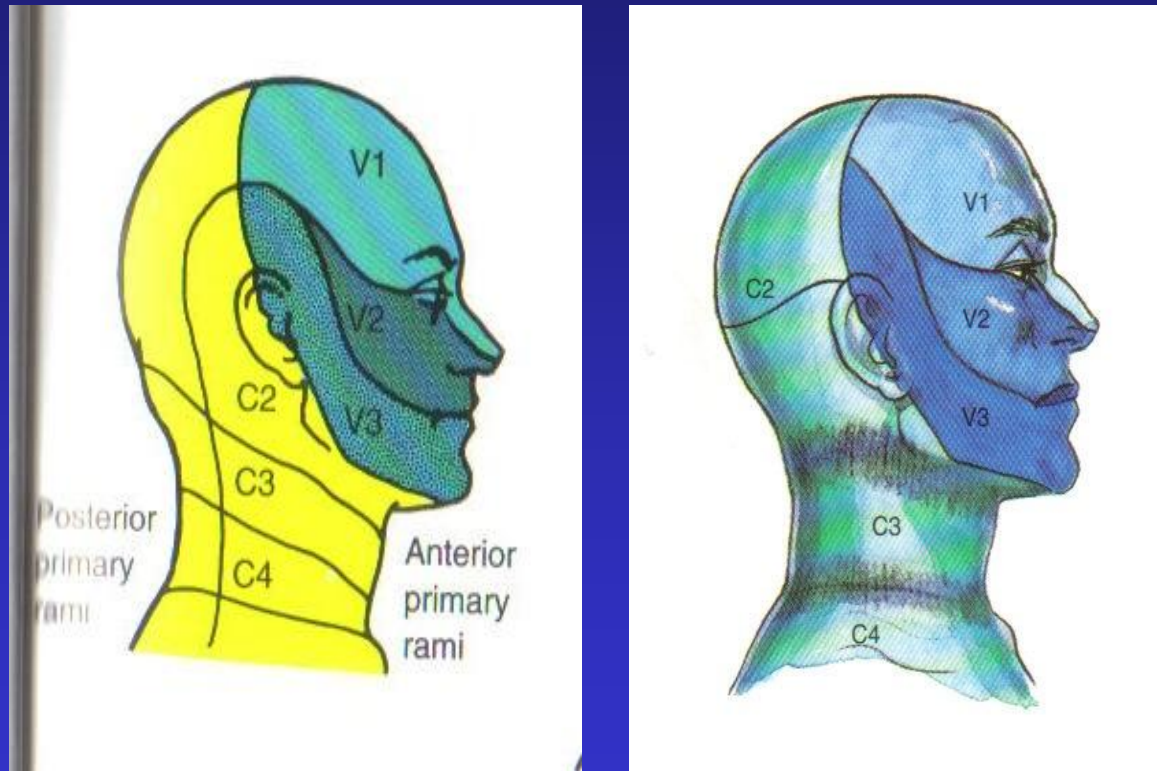


Figure 11.3

Corneal reflex: Touch the cornea!



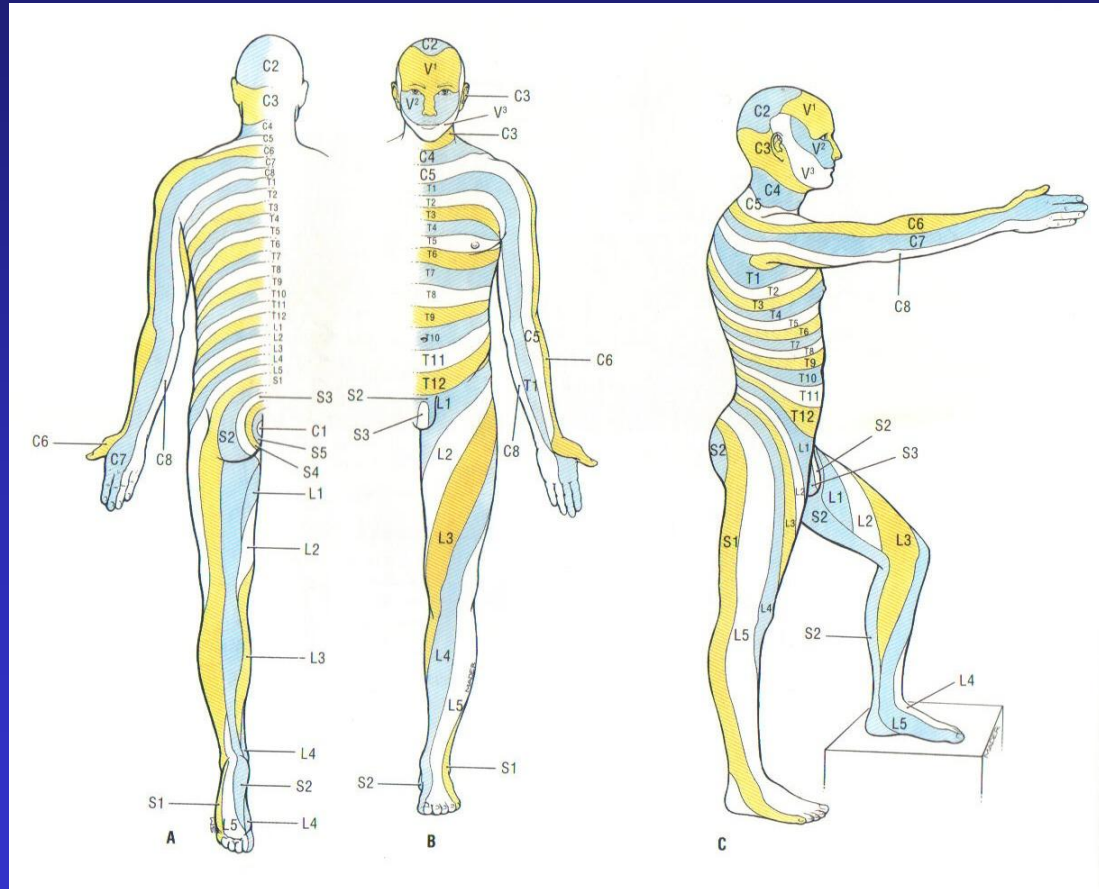
# V1, 2, 3 and C2, 3 Sensory Distribution (Controversial of C2 and C3 Dermatome)



David L Brown. Atlas of Regional Anesthesia. 1999,  
page 137 & 181

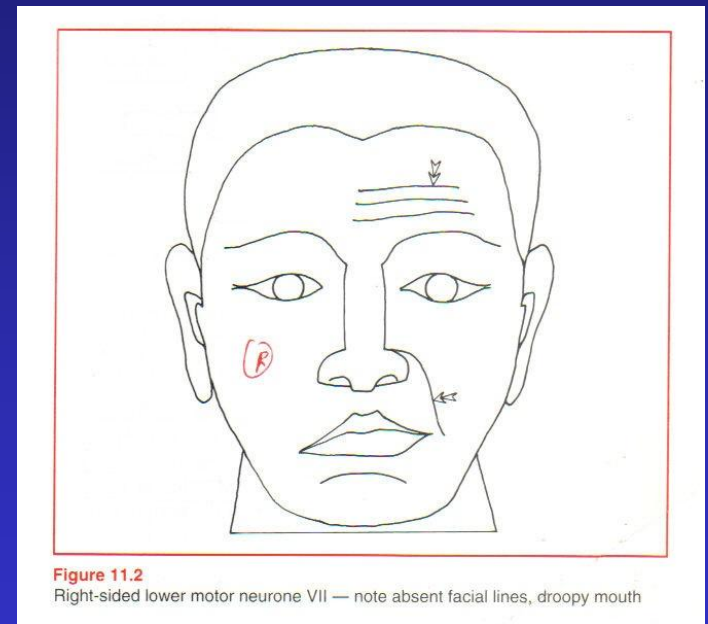


# V1, 2, 3 and C2, 3 Sensory Distribution (Controversial of C2 and C3 Dermatome)



# Cranial Nerve 7

- Facial nerve:
  - Facial muscle: ask the patient to raise the eyebrows, close the eye, bare the teeth



- Taste: anterior 2/3 of tongue

(Right Bell's Palsy)





# Cranial Nerve 8

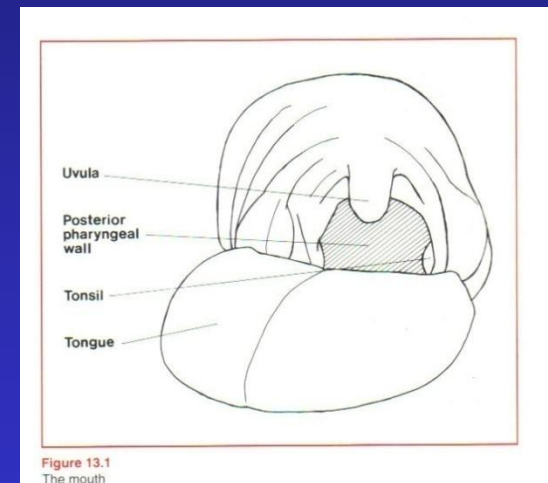
- Vestibulocochlear nerve:
  - Balance: associated with vertigo
  - Hearing (use 512 Hz tuning fork):
    - Weber's test: striking the tuning fork and placing it against the middle of the forehead
      - **Conductive** deafness: lateralization to the **affected** ear, middle ear.
      - **Sensorineural** deafness: lateralization to the **better** ear, inner ear
    - Rinne test: striking the tuning fork and place it on the mastoid process until the tone no longer being heard, then place it over the external auditory meatus
      - **Conductive** deafness: not hear the sound over the external auditory meatus (**bony conduction BC > AC air conduction**)
      - **Sensorineural** deafness: still hear the sound over the external auditory meatus (**AC > BC**)





# Cranial Nerve 9 & 10

- Glossopharyngeal nerve:
  - Sensation back of tongue, pharynx, middle ear
  - Taste: posterior 1/3 tongue
- Vagus nerve:
  - Soft palate muscle: soft palate elevation
    - Ask the patient to say “Ah”
- Gag reflex:
  - CN 9 sensory input
  - CN 10 motor output-Ambiguus nucleus.
  - Lightly touching the posterior oropharynx with a cotton swab
    - May be absent in older patients



# Cranial Nerve 11

- Spinal accessory nerve:
  - Sternocleidomastoid muscle: head rotation and tilt to the **opposite** side
    - Flex and turn the head to each side against resistance
  - Trapezius muscle: shoulder elevation.
    - Shrug the shoulders against resistance



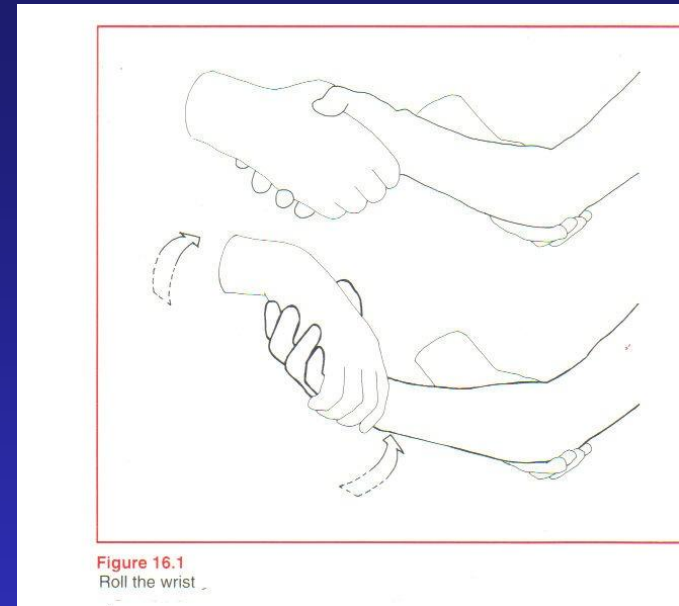
# Cranial Nerve 12

- Hypoglossal nerve:
  - Tongue muscle
  - Stick out the tongue
    - Deviate to the **weak** side
  - Push it into each cheek



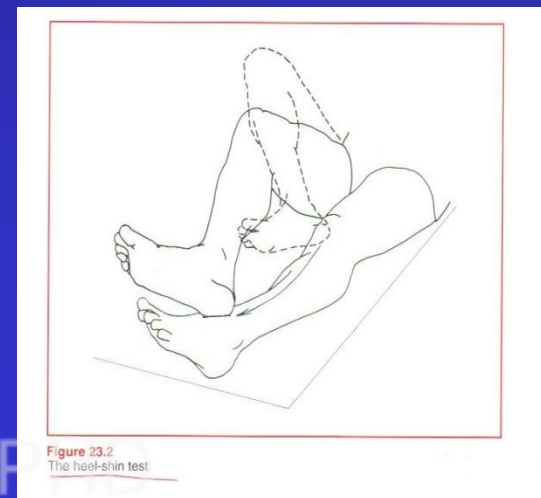
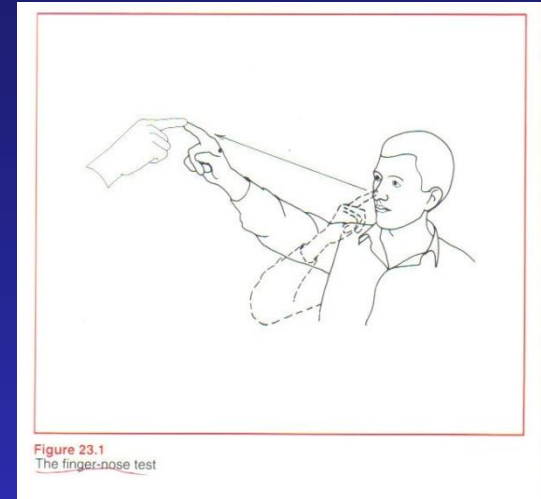
# Motor

- Muscular bulk: check atrophy (myopathy)
- Muscular tone: look for spasticity (stroke)
- Muscular strength: grade the strength
  - 0: no muscle contraction visible
  - 1: barely visible muscle contraction
  - 2: active movement of part of limb with gravity eliminated
  - 3: active movement of part of limb against gravity
  - 4: active movement against moderate resistance
    - 4- : against slight resistance
    - 4+ : against strong resistance
  - 5: normal power



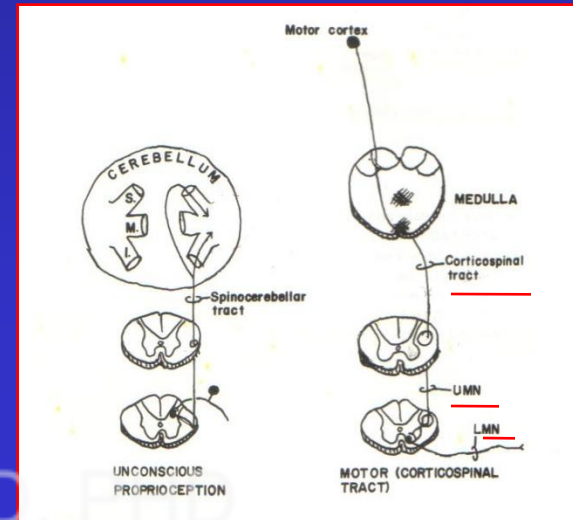
# Coordination

- Involving sensory feedback, motor output, integration center (mainly by cerebellum)
- Tests:
  - Finger-to-nose test:
    - Alternatively touch a fingertip to the nose and examiner's finger
  - Heel-to-shin test:
    - Slide the heel up and down the front of the shin

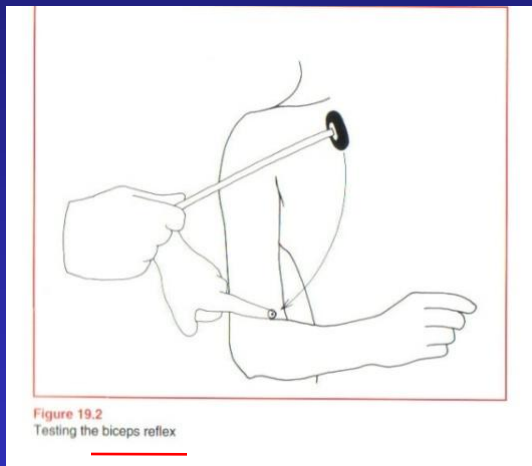


# Reflexes – Deep Tendon Reflex

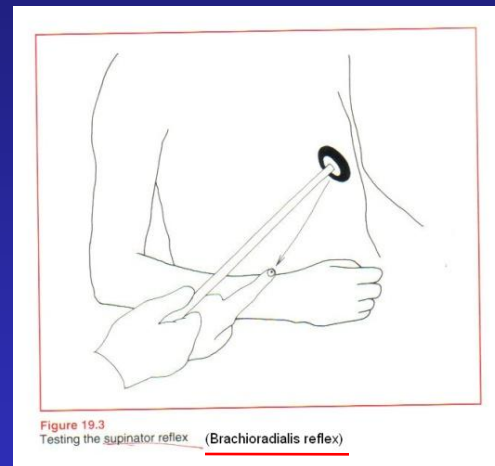
- Striking the muscle tendon with a reflex hammer
  - Increased reflex in upper motor neuron (corticospinal tract) lesion.
  - Decreased in lower motor neuron lesion (motor neurons, ventral nerve root, peripheral nerve disease, and muscle diseases)
  - Grading:
    - 4 + : increase with clonus
    - 3 + : increased without clonus
    - 2 + : normal
    - 1 + : decreased
    - 0 : absent



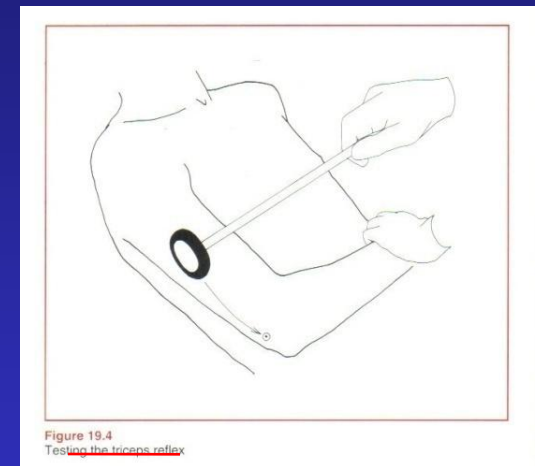
# Bicep, Brachioradialis (Supinator), Triceps Reflex



C5



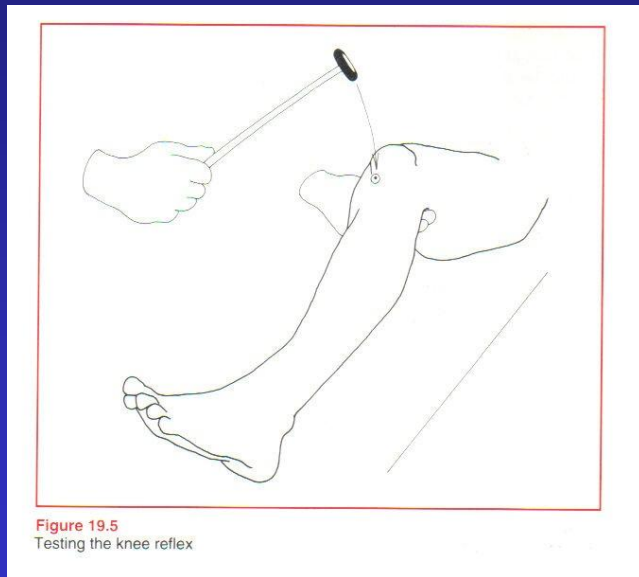
C6



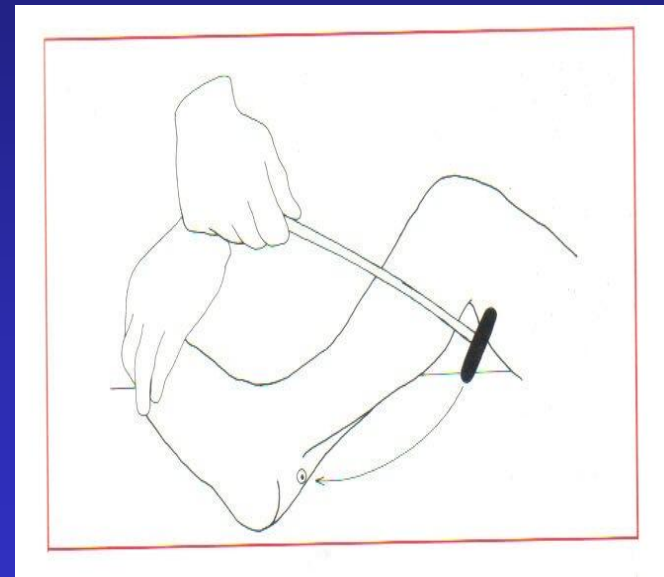
C7



# Patellar and Ankle Jerk (Achilles) Reflex



L3, 4

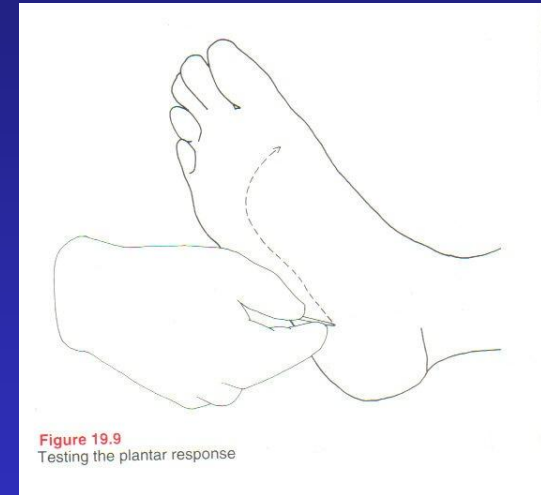


S1, 2



# Reflexes – Plantar Reflex

- Babinski's sign (upper motor neuron lesion):
  - Firmly stroke the sole of the patient's foot, beginning at the heel and following up the lateral margin and across the ball of the foot to the base of the big toe
  - Negative: The **toes all flex**, is flexor plantar response
  - Positive: **Big toe extends, the other toes spread**, is extensor plantar response
  - No response: **no toe movement**
    - Normal, insensitive to test
    - Profound motor weakness to extend the big toe
    - Sensory abnormality
  - Withdrawal response: If **big toe extends, the other toes extend** and **ankle reflexes**, need to repeat test more gently

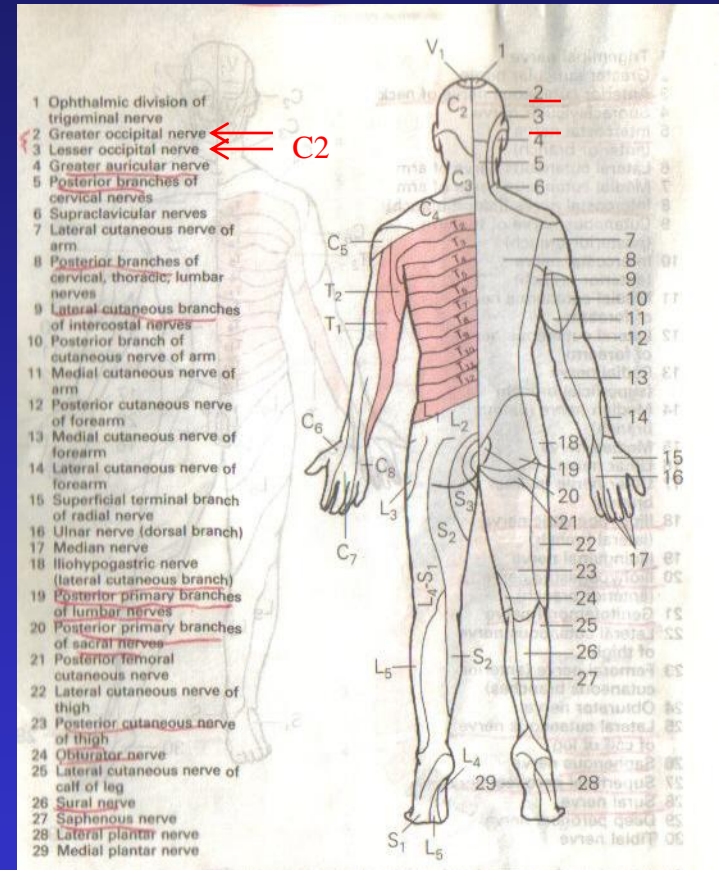
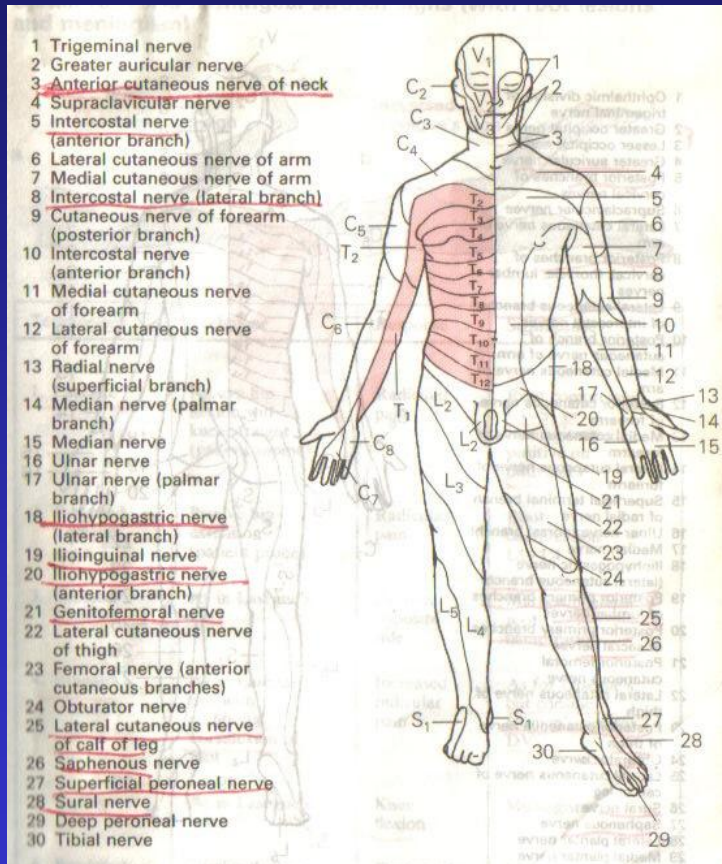


# Sensory - Primary Sensory Modalities

- Light touch
- Pinprick
- Temperature
- Vibration (128 HZ)
- Joint position (Proprioception)



# Dermatome and Peripheral Nerves



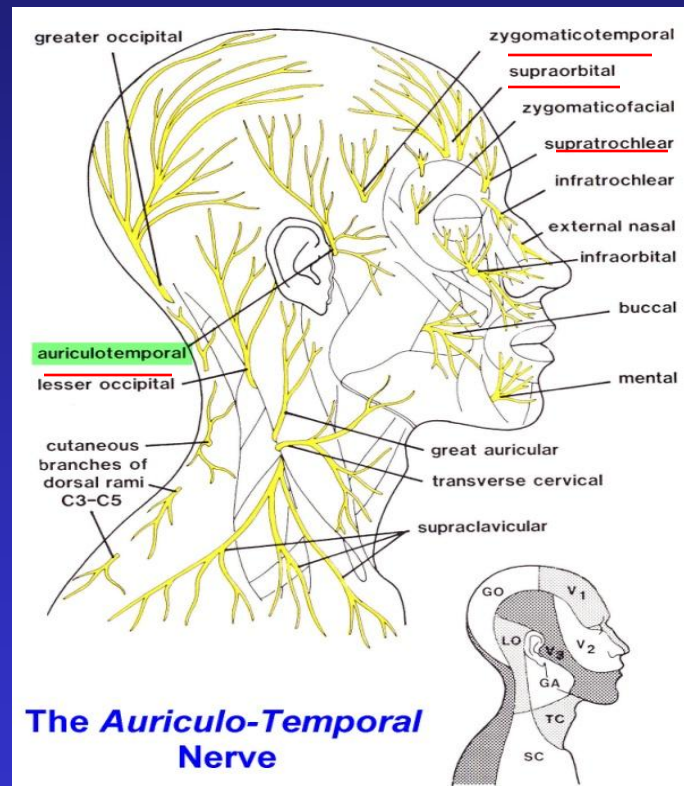
Greater and lesser occipital nerves:

C1: motor fiber only

C2 primary, the nerve block relieves almost all kinds of headaches including migraine and cluster headache, except cervicogenic headache and high or low CSF pressure headache (my personal experience)



# Frontoorbital and Temporal Nerve Innervations



V1 terminal branch: supraorbital and supratrochlear nerve

V2 terminal branch: zygomaticotemporal nerve

V3 terminal branch: auriculotemporal nerve

# Sensory - Cortical Sensory Modalities

- Graphesthesia:
  - The ability to recognize writing on the skin purely by the sensation of touch.
  - Close the eye and identify a number traced on the palm
  - Positive if cannot identify: contralateral parietal lobe damage, or damage to the dorsal columns pathway at any point between the tested point and the contralateral parietal lobe.
- Stereognosis:
  - The ability to perceive and recognize the form of an object using cues from texture, size, spatial properties, and temperature
  - Close the eye and identify a key, coin, paperclip
  - Test the intact of contralateral parietal lobe, and posterior column



# Gait

- Casual walking
- Toe walking: lower extremity strength  $> 4/5$
- Tandem gait test: walk a straight line, touching toe to heel
  - To test ataxia, cerebellar dysfunction, drunk driving test
- Romberg's test: stand with feet together and eyes close
  - Loss of joint positional sense:
    - Posterior column: cervical spondylosis, B12 deficiency
    - Peripheral neuropathy
  - Cannot proceed the test if the patient cannot stand and fall with eye open
    - Cerebellar and central/peripheral vestibular syndrome





# Suggested Readings:

- Memorix Neurology by Peter Berlitz, 1996
- Neurological Examination Made Easy by Geraint Fuller, 1995
- Clinical Neurological Neuroanatomy Made Ridiculously Simple, by Stephen Goldberg, 1990
- David L Brown. Atlas of Regional Anesthesia, 1999

