

Detailed Review of Cranial Nerves

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Hammer & Nails icon indicates A Slide



Describing Skills You Should Perform In Lab

CN 1- Olfactory: Sense of Smell

- Check **air movement** thru ea nostril separately.
- **Smell** not usually assessed (unless sx)
 - use coffee grounds or other w/distinctive odor (e.g. mint, wintergreen, etc)
 - check ea nostril independently
 - detect odor when presented @ 10cm.



Hmmm..
Coffee!



Functional Assessment – Acuity (Cranial Nerve 2 – Optic)

- Using hand held card (held @ 14 inches) or Snellen wall chart, assess ea eye separately. Allow patient to wear glasses.
- Direct patient to read aloud line w/smallest lettering that they're able to see.



Hand Held Acuity Card



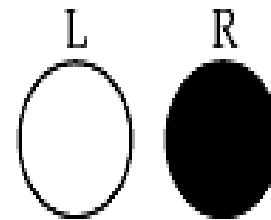
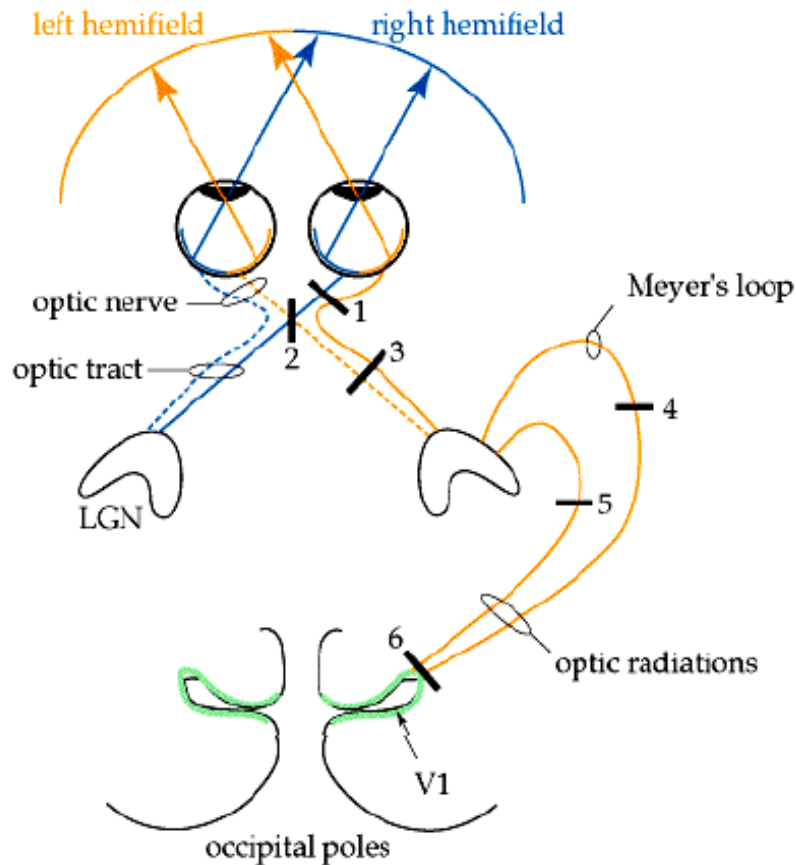
Functional Assessment – Acuity (cont)

- 20/20 =s patient can read at 20` with same accuracy as person with normal vision.
- 20/400 =s patient can read @ 20` what normal person can read from 400` (i.e. very poor acuity).
- If patient can't identify all items correctly, number missed is listed after a '-' sign (e.g. 20/80 -2, for 2 missed on 20/80 line).



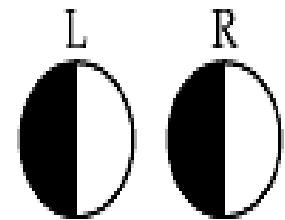
Snellen Chart For Acuity Testing

Functional Assessment - Visual Fields (Cranial Nerve 2 - Optic)



loss of vision
in R eye

Lesion #1



loss of vision in
left hemifield

Lesion #3

Images from: Wash Univ. School of Medicine, Dept Neuroscience
<http://thalamus.wustl.edu/course/basvis.html>

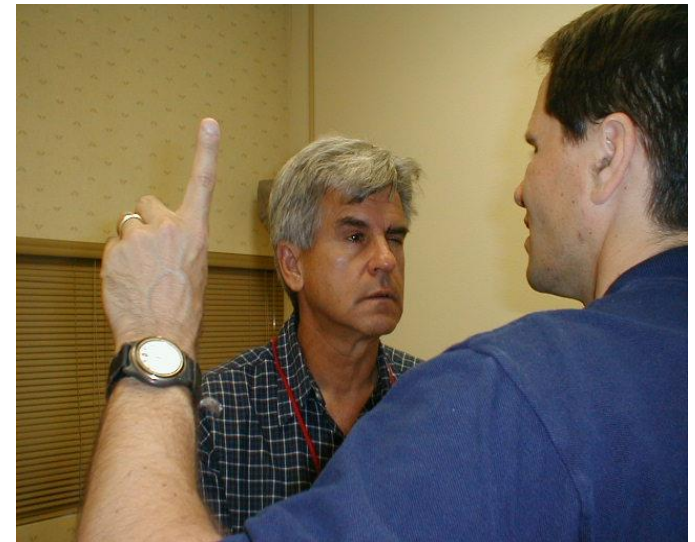
NEJM Interactive case – w/demo of visual field losses:

http://www.nejm.org/doi/full/10.1056/NEJMimc1306176?query=featured_home

CN 2 - Checking Visual Fields By Confrontation



- Face patient, roughly 1-2 ft apart, noses @ same level.
- Close your R eye, while patient closes their L. Keep other eyes open & look directly @ one another.
- Move your L arm out & away, keeping it ~ equidistant from the 2 of you. A raised index finger should be just outside your field of vision.



CN 2 - Checking Visual Fields By Confrontation (cont)



- Wiggle finger & bring it in towards your noses. You should both be able to detect it @ same time.
- Repeat, moving finger in from each direction. Use other hand to check medial field (i.e. starting in front of the closed eye).
- Then repeat for other eye.



Pupillary Response

- Pupils modulate amount of light entering eye (like shutter on camera)
- Dark conditions → dilate; Bright → constrict
- Pupils respond symmetrically to input from either eye
 - Direct response =s constriction in response to direct light
 - Consensual response =s constriction in response to light shined in opposite eye
- Light impulses travel away (afferents) from pupil via CN 2 & back (efferents) to ciliary muscles that control dilatation via CN 3

Pupillary Response Testing Technique



- Make sure room is dark → pupils a little dilated, yet not so dark that can't observe response – can use your hand to provide “shade” over eyes
- Shine light in R eye:
 - R pupil → constricts
 - Again shine light in R eye, but this time watch L pupil (should also constrict)
- Shine light in L eye:
 - L pupil → constricts
 - Again shine light in L eye, but this time watch R pupil (should also constrict)

Pupillary Response Testing Technique

- Swinging Flashlight Test
 - Looks for afferent pupil defect (CN II)
 - After observing each eye individually, move the flashlight between the left and right eye at a steady rate
 - See an example at Neuroexam.com:
 - <http://www.neuroexam.com/neuroexam/content.php?p=19>

Describing Pupillary Response

- Normal recorded as: **PERRLA** (**P**upils **E**qual, **R**ound, **R**eactive to **L**ight and **A**ccommodation) – w/accommodation = to constriction occurring when eyes follow finger brought in towards them, directly in middle (i.e. when looking “cross eyed”).
- Abnormal responses can be secondary to:
 - direct or indirect damage to either CN 2 or 3
 - Or parasympathetic injury to CN3 or damage to the sympathetic neurons
 - meds e.g. sympathomimetics (cocaine) → dilate, narcotics (heroin) → constrict.

Pupil Response Simulator

University of California, Davis School of
Medicine – Designed by Dr. Rick Lasslo,
M.D., M.S.

[http://cim.ucdavis.edu/EyeRelease/Interface/
pSim.htm](http://cim.ucdavis.edu/EyeRelease/Interface/pSim.htm)

CNs 3, 4 & 6

Extra Ocular Movements

- Eye movement dependent on Cranial Nerves 3, 4, and 6 & muscles they innervate.
- Allows smooth, coordinated movement in all directions of both eyes simultaneously
- There's some overlap between actions of muscles/nerves

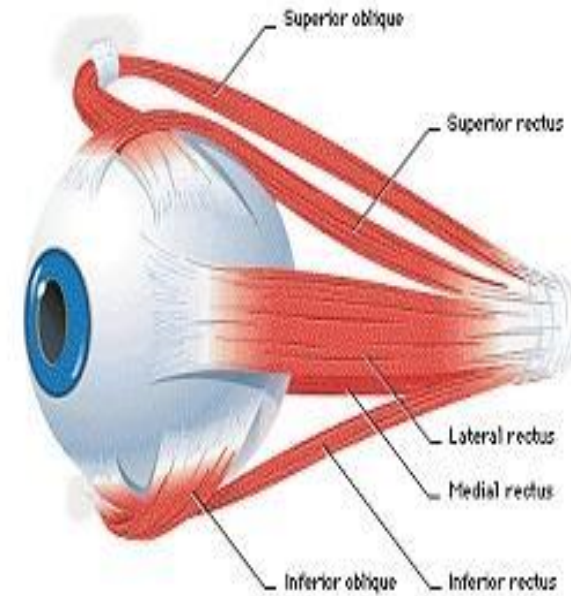


Image Courtesy of Leo D Bores, M.D. Occular Anatomy: http://www.e-sunbear.com/anatomy_01.html

Cranial Nerves (CNs) 3, 4 & 6

Extra Ocular Movements (cont)

- CN 6 (Abducens)
 - Lateral rectus muscle → moves eye laterally
- CN 4 (Trochlear)
 - Superior oblique muscle → moves eye down (depression) when looking towards nose; also rotates internally.
- CN 3 (Oculomotor)
 - All other muscles of eye movement – also raises eye lid & mediates pupillary constriction.

CNs & Muscles That Control Extra Ocular Movements

LR- Lateral Rectus

MR-Medial Rectus

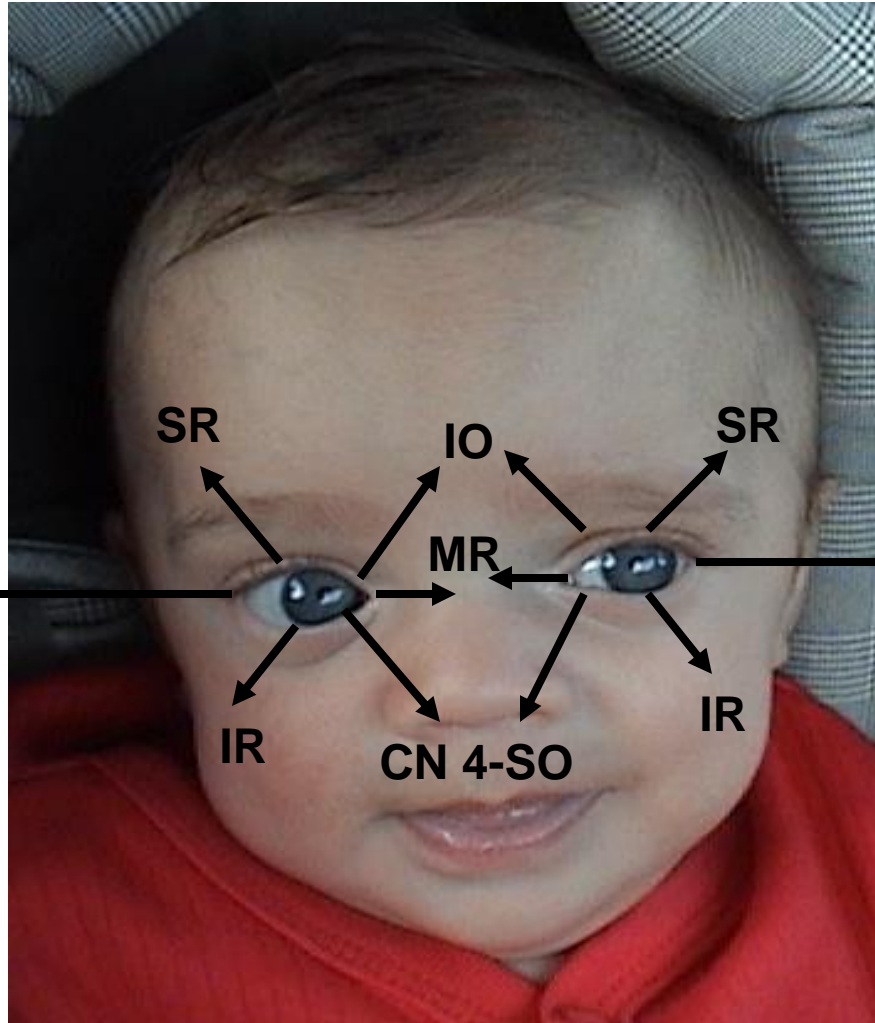
SR-Superior Rectus

IR-Inferior Rectus

SO-Superior Oblique

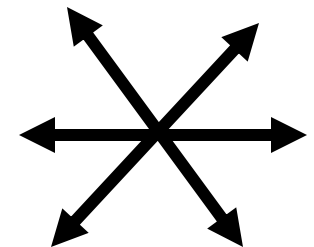
IO-Inferior Oblique

CN 6-LR



CN 6-LR

CN 4-SO



6 "Cardinal" Directions Movement

SO '4', LR '6', All The Rest '3'

Technique For Testing Extra- Ocular Movements



- To Test:
 - Patient keeps head immobile, following your finger w/their eyes as you trace letter “H”
 - Alternatively, direct them to follow finger w/their eyes as you trace large rectangle
- Eyes should move in all directions, in coordinated, smooth, symmetric fashion.
- Hold the eyes in lateral gaze for a second to look for nystagmus

Extra Ocular Eye Movement Simulator

University of California, Davis School of Medicine – Rick Lasslo, M.D., M.S.

[http://cim.ucdavis.edu/eyes/version1/eyesim
.htm](http://cim.ucdavis.edu/eyes/version1/eyesim.htm)

Function CN 5 - Trigeminal

- Sensation:
 - 3 regions of face: Ophthalmic, Maxillary & Mandibular
- Motor:
 - Temporalis & Masseter muscles

Function CN 5 – Trigeminal (cont)

Motor

Temporalis
(clench teeth)

Masseter (move
jaw side-side)



Sensory

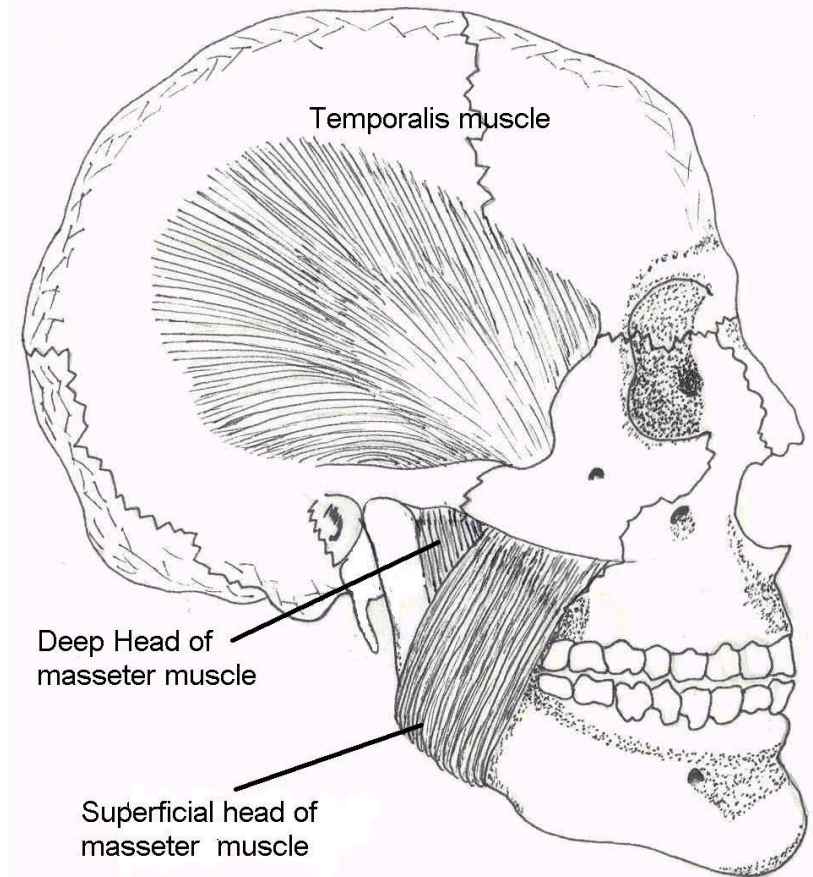
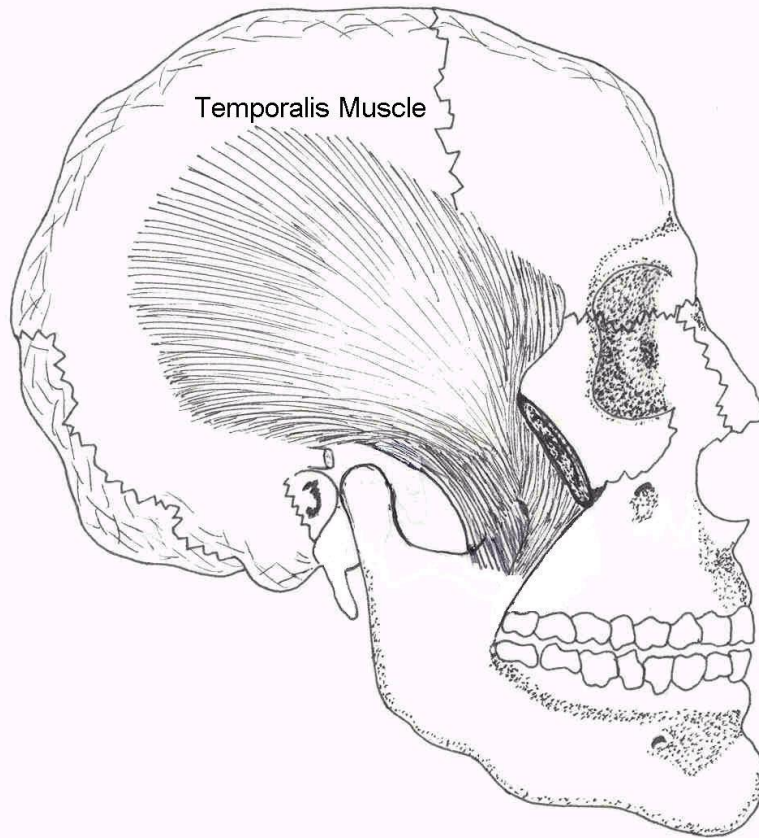
Ophthalmic (V1)

Maxillary (V2)

Mandibular (V3)

* Corneal Reflex: Blink when cornea touched - Sensory CN 5, Motor CN 7

Temporalis & Masseter Muscles



Oregon Health Sciences University:
<http://home.teleport.com/~bobh/>



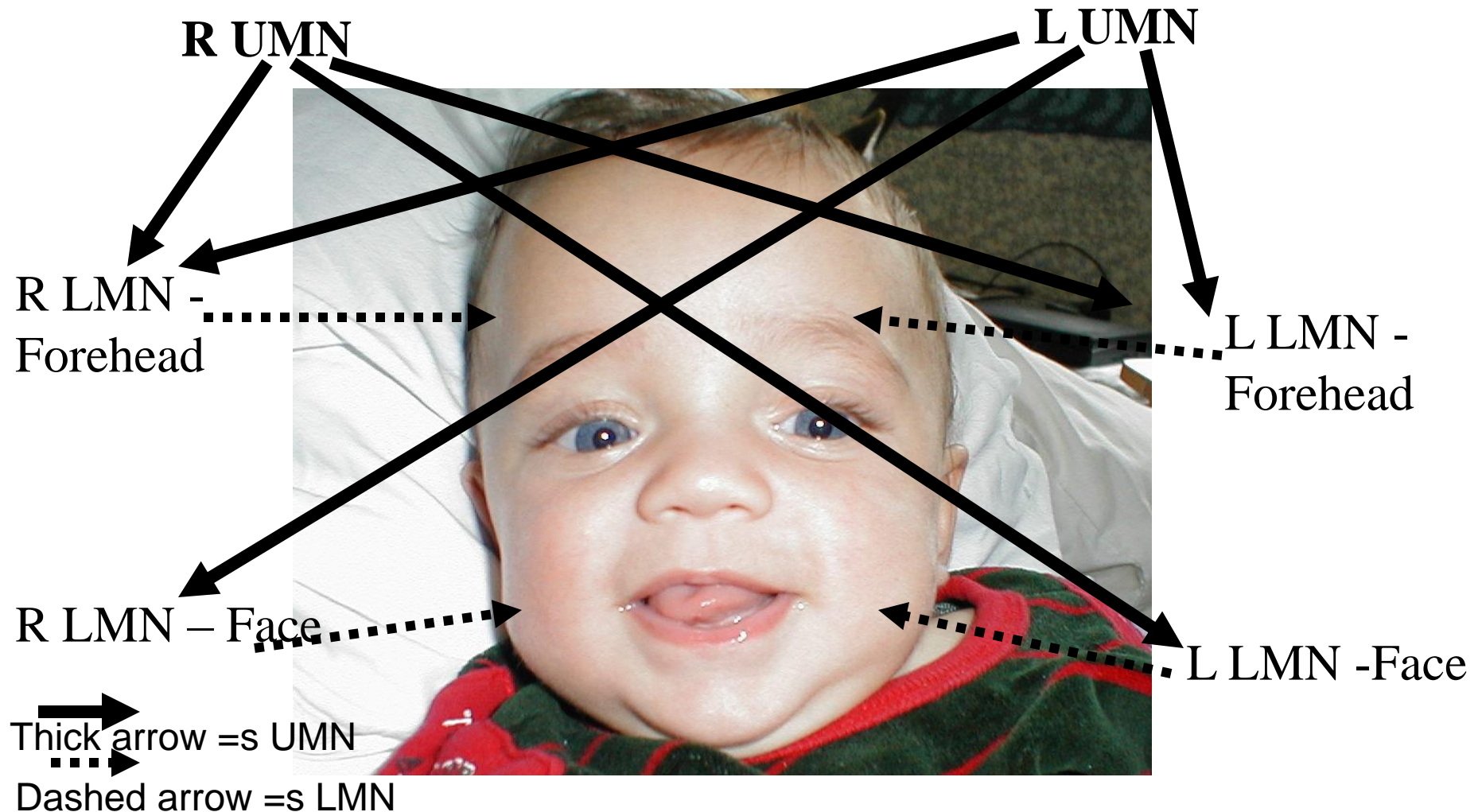
Testing CN 5 - Trigeminal

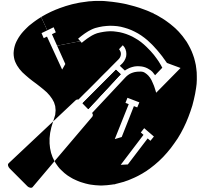
- Sensory:
 - Ask pt to close eyes
 - Touch ea of 3 areas (ophthalmic, maxillary, & mandibular) lightly, noting whether patient detects stimulus.
- Motor:
 - Palpate temporalis & mandibular areas as patient clenches & grinds teeth
- Corneal Reflex:
 - Tease out bit of cotton from q-tip - Sensory CN 5, Motor CN 7
 - Blink when touch cornea w/cotton wisp



Function CN 7 – Facial Nerve

Facial Symmetry & Expression - Precise Pattern of Innervation





CN 7 – Exam

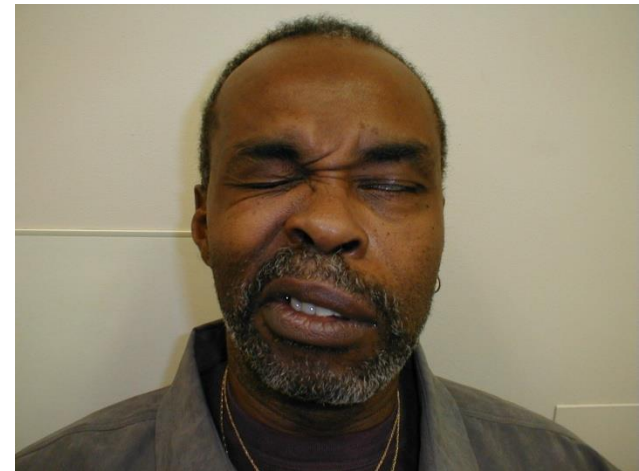
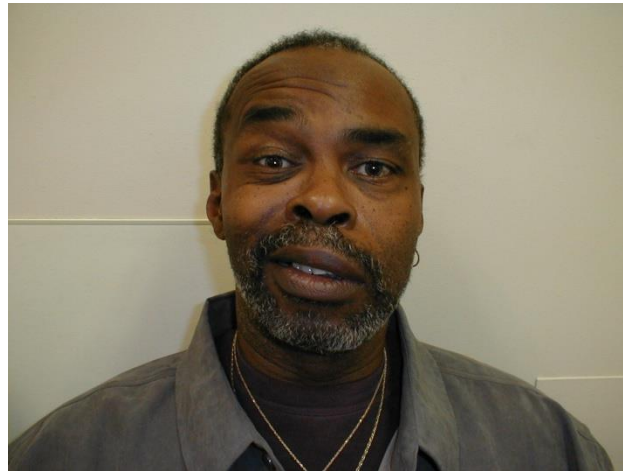
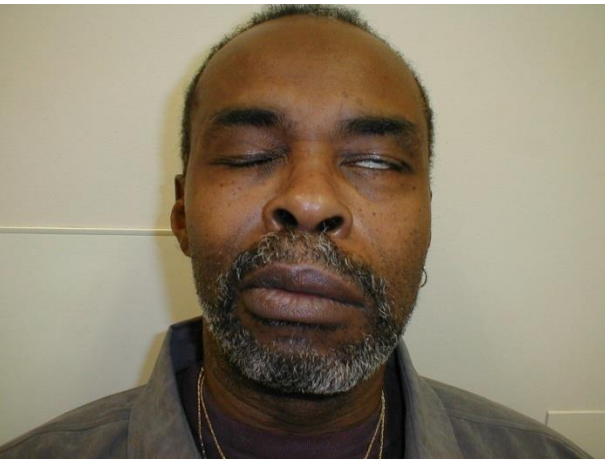
- Observe facial symmetry
- Wrinkle Forehead
- Keep eyes closed against resistance
- Smile, puff out cheeks
- Rarely you may need to check taste to the anterior 2/3 of the tongue



Cute.. and symmetric!

Pathology: Peripheral CN 7 (Bell's) Palsy

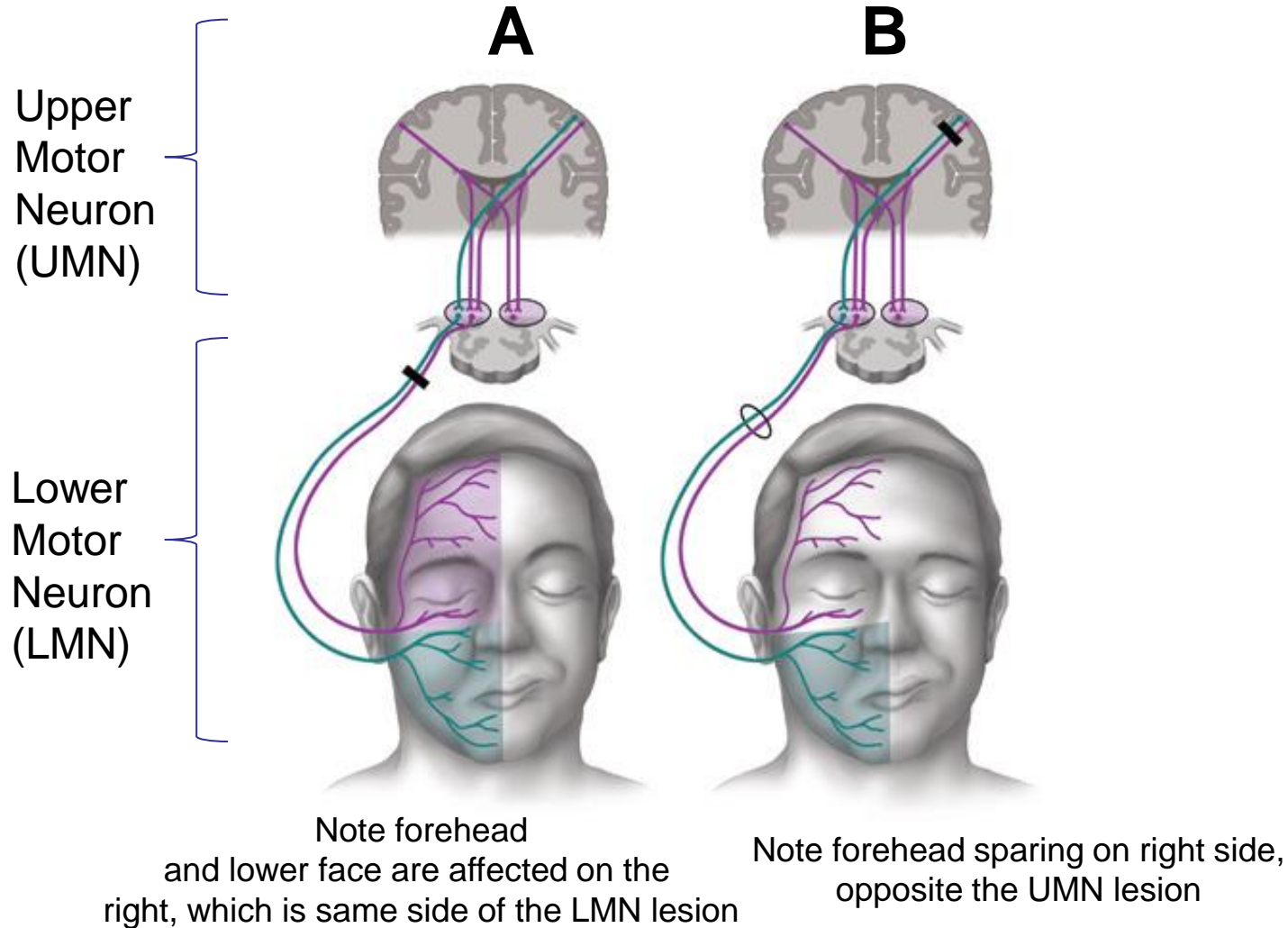
Patient can't close L eye, wrinkle L forehead or
raise L corner mouth → L CN 7 Peripheral (i.e. LMN)
Dysfunction

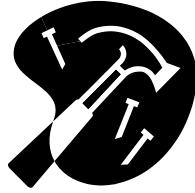


Central (i.e. UMN) CN 7 dysfunction (e.g. stroke) - not shown: Can wrinkle forehead bilaterally; will demonstrate loss of lower facial movement on side opposite stroke.

Comparison of a patient with (A) a facial nerve (Bell's Type - LMN) lesion and (B) a supra-nuclear (UMN) lesion w/forehead sparing

Tiemstra J et al. Bell's Palsy: Diagnosis and Management, Amer J Fam Practice, 2007;76(7):997-1002.
<http://www.aafp.org/afp/2007/1001/p997.pdf>





The Ear – Functional Anatomy & Testing (CN 8 – Acoustic)

- Crude tests hearing – rub fingers next to either ear; whisper & ask pt repeat words
- If sig hearing loss, determine Conductive (external canal up to but not including CN 8) v Sensorineural (CN 8)

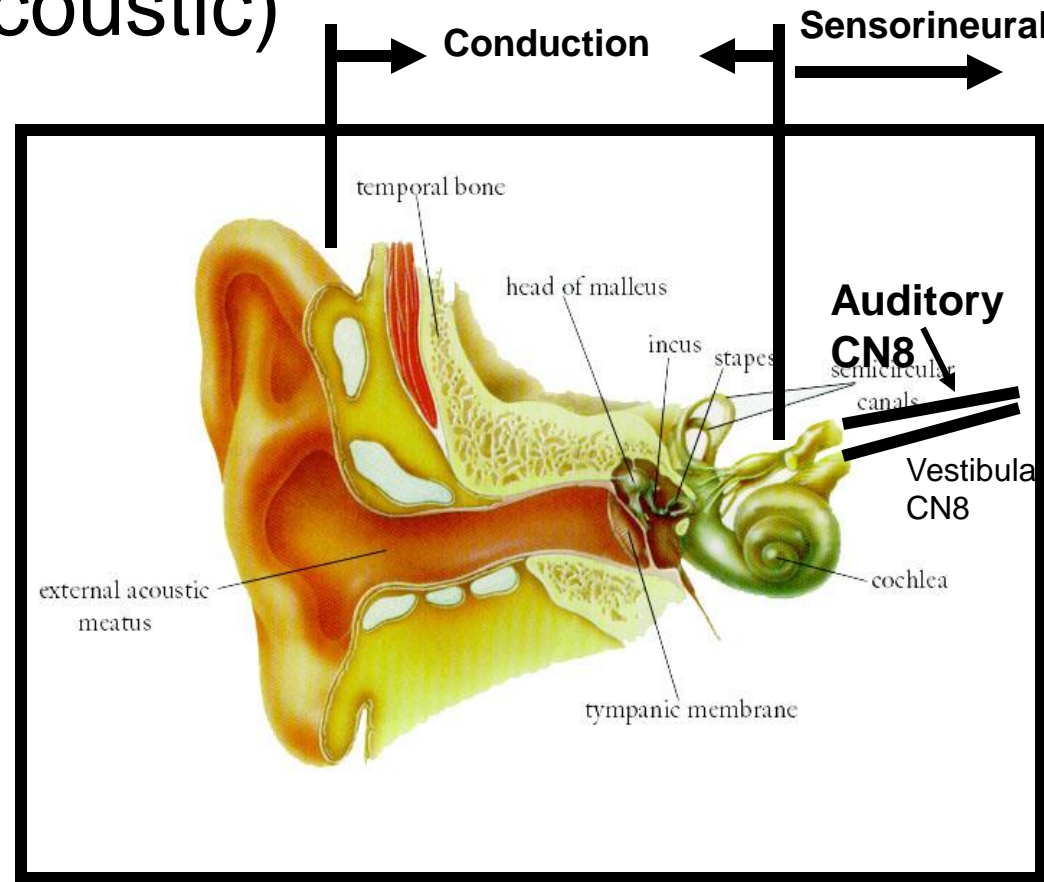


Image Courtesy: Online Otoscopy Tutorial
<http://www.uwcm.ac.uk:9080/otoscopy/index.htm>

CN 8 - Defining Cause of Hearing Loss - Weber Test



- 512 Hz tuning fork - this (& not 128Hz) is well w/in range normal hearing & used for testing
 - Get tuning fork vibrate → striking ends against heel of hand **or** Squeeze tips between thumb & 1st finger
- Place vibrating fork mid line skull
- Sound should be heard =ly R and L → bone conducts to both sides.





CN 8 - Weber Test (cont)

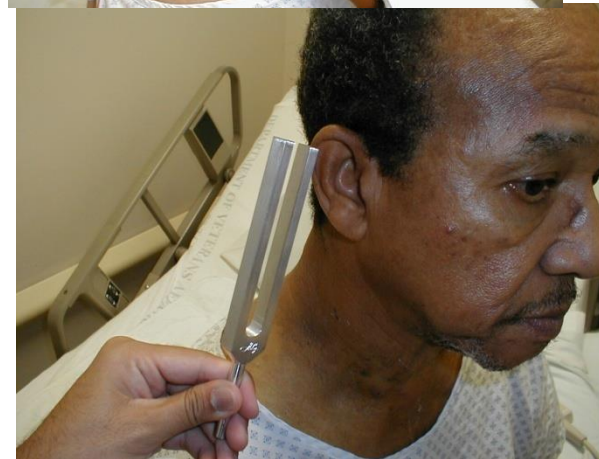
- If **conductive** hearing loss (e.g. obstructing wax in canal on L) → louder on L as less competing noise.
- If **sensorineural** on L → louder on R
- Finger in ear mimics conductive loss



CN 8 - Defining Cause of Hearing Loss - Rinne Test



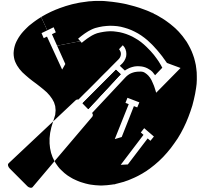
- Place vibrating 512 hz tuning fork on mastoid bone (behind ear).
- Patient states when can't hear sound.
- Place tines of fork next to ear → should hear it again – as air conducts better than bone.
- If BC better than AC, suggests **conductive** hearing loss.
- If **sensorineural** loss, then AC still > BC



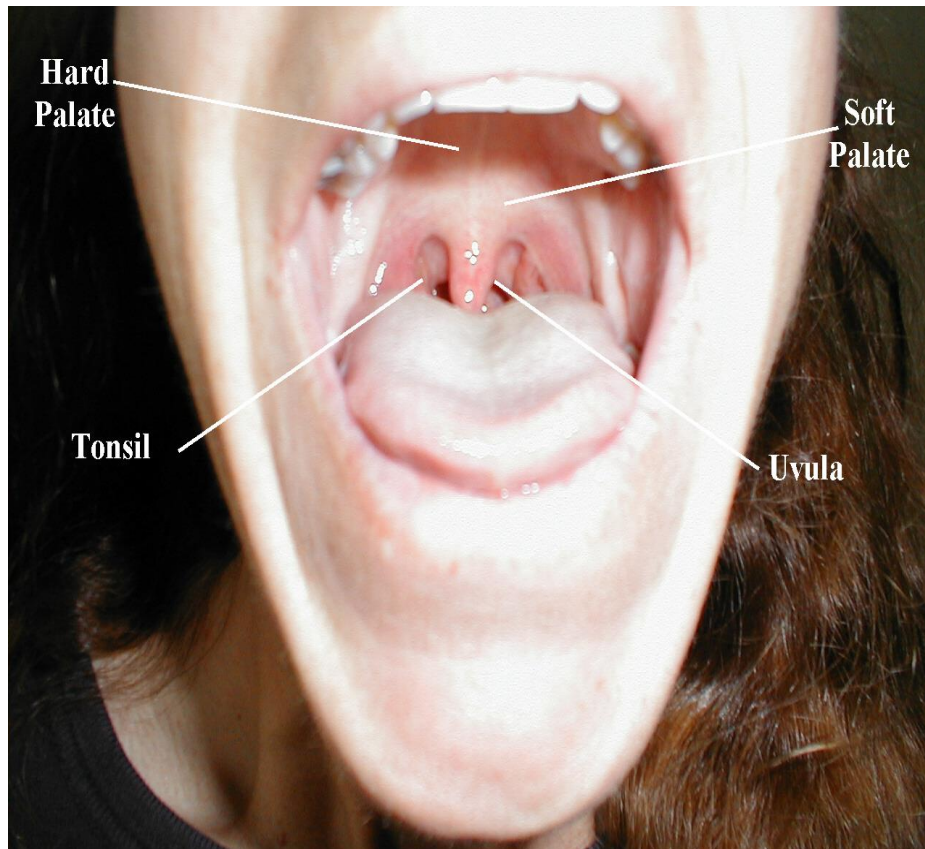
Note: Weber & Rinne difficult to perform in Anatomy lab due to competing noise – repeat @ home in quiet room!

CN 8 Vestibular Division

- You will not routinely test; only w/patients who present w/new onset “dizziness”
- If the patient has vertigo you will need to perform a Dix-Hallpike maneuver
- You can see an example of it here:
<http://www.neuroexam.com/neuroexam/content.php?p=23>



Oropharynx: Anatomy & Function CNs 9 (Glossopharyngeal), 10 (Vagus)



- **CN 9 & 10** are tested together
- Check to see uvula is midline
- Stick out tongue, say “**Ahh**” – use tongue depressor if can’t see
 - NI response: palate/uvula rise
 - We assume 9 is intact if the palate rises symmetrically thus we test 9 and 10 indirectly here
- **Gag Reflex** – provoked with tongue blade or q tip - CN 9 (afferent limb), 10 (efferent limb) – test this bilaterally
 - This directly tests 9 and 10

Hypoglossal CN 12

- **Tongue midline** when patient sticks it out → **CN 12**
 - check **strength** by directing patient push **tip** into **inside** of **either cheek** while you push from outside
 - Observe for atrophy or fasciculations

CN 9 & 12 Pathology

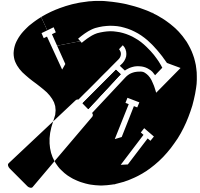


L CN 9 palsy: uvula
pulled to R



L CN 12 palsy: tongue
deviates L

Neck Movement (CN 11 – Spinal Accessory)



- **Turn head to L into R**
hand → function of **R Sternocleidomastoid (SCM)**
- **Turn head to R into L**
hand (**L SCM**)
- **Shrug shoulders** into your hands



Summary of Skills



- Wash Hands
- CN1 (Olfactory) Smell
- CN2 (Optic) Visual acuity; Visual fields
- CNs 2&3 (Optic, Occulomotor) Pupillary Response to light
- CNs 3, 4 & 6 (Occulomotor, Trochlear, Abduscens) Extra-Occular Movements
- CN 5 (Trigeminal) Facial sensation; Muscles Mastication (clench jaw, chew); Corneal reflex (w/CN 7)
- CN 7 (Facial) Facial expression
- CN 8 (Auditory) Hearing
- CN 9, 10 (Glosopharyngeal, Vagus) Raise palate (“ahh”), gag
- CN 12 (Hypoglossal) Tongue
- CN 11 (Spinal Accessory) Turn head against resistance, shrug shoulders



Time Target: < 15 minutes