Cranial Nerves/ Pupils

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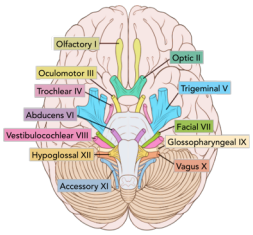
Outline

- Cranial Nerves Overview
- Extraocular muscles
- Motility Exam
- Pupils and Innervation
- Pupil Exam
- Nerve Palsies
- Practice Cases



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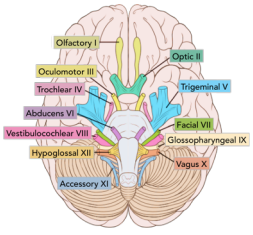
Cranial Nerves Overview

1) General functions of cranial nerves
   a) Special sensory
      i) Sight, smell, hearing
   b) Motor
      i) Muscles
   c) Sensory
      i) Touch
   d) Mixed (combination)



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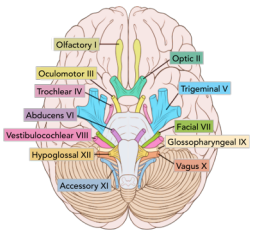
Cranial Nerves Overview (simplified)

1) Olfactory - Smell
2) Optic - Sight (from retina)
3) Oculomotor - Eyelid and eyeball
4) Trochlear - One eye muscle
5) Trigeminal - Sensation to face and muscles of mastication
6) Abducens - One eye muscle
7) Facial - Muscles of the face
8) Vestibulocochlear - inner ear
9) Glossopharyngeal - several functions including taste
10) Vagus - output to viscera (intestines)
11) Accessory - Neck and shoulders
12) Hypoglossal - Tongue



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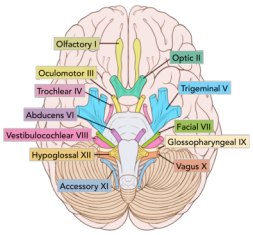

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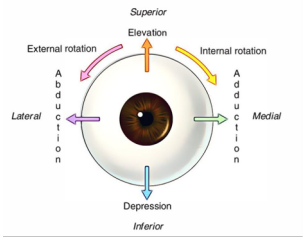
Extraocular muscles



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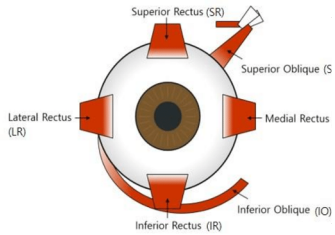
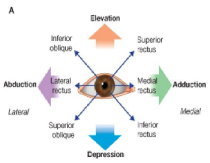
Extraocular muscles





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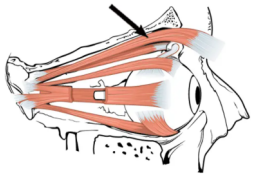
Extraocular muscles

- Levator palpebrae superioris (aka "the levator")
- Responsible for voluntary eyelid opening
- Yoked with the other EOM muscles



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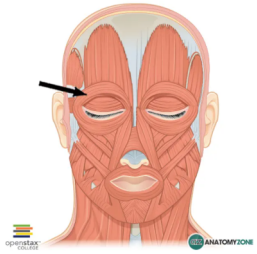
Extraocular muscles

- Orbicularis Oculi
- Part of one of many muscles of facial expression
- Involved in voluntary closing of the eye and blinking



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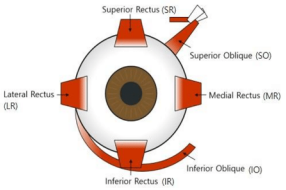
Extraocular muscles - Innervation

1) CN 3: Oculomotor nerve
   a) All EOM except SO and LR
   b) Levator = opening the eye
2) CN 4: Trochlear
   a) Superior oblique (SO)
3) CN 6: Abducens
   a) Lateral rectus (LR)
   b) "Abducts" the eye
4) CN 7: Facial Nerve
   a) Muscles of facial expression
   b) Including orbicularis = closing the eye



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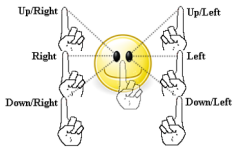
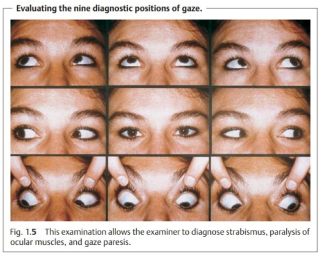
Extraocular muscles - Examination





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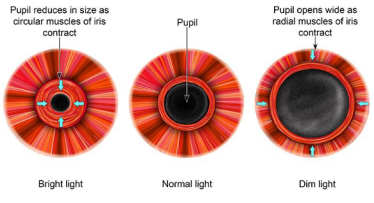
Pupils - Muscles



Miosis Mydriasis

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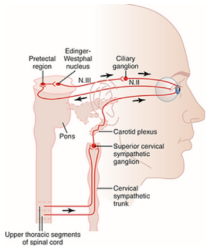
Pupils - Innervation

1) Constriction
   a) Innervated by **parasympathetics**
   b) Exits at brainstem
   c) ***Travels with CN III (oculomotor)***
2) Dilation
   a) Innervated by **sympathetics**
   b) Exits at spinal cord
   c) Travels within the thorax and then with the carotid artery



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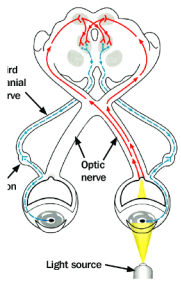
Pupils - Light reflex pathway

1) Afferent pathway
   a) Light into eye -> retina -> optic nerve to brainstem
2) Efferent pathway
   a) Brainstem -> pupil via CN III (as discussed in last slide)
   b) This signal is sent **bilaterally**



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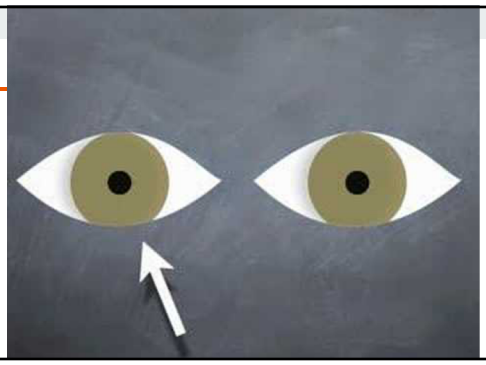

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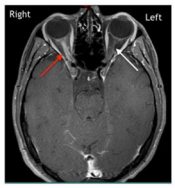
"Nerve" Palsies - Optic neuritis (cranial nerve 2)

1) Typical optic neuritis:
2) Etiology: autoimmune inflammation in the optic nerve
3) Most commonly seen in young females
4) Signs/symptoms
   a) Unilateral vision loss
   b) RAPD
   c) Pain with eye movement
5) Associated with multiple sclerosis



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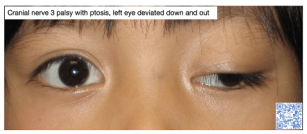
Nerve Palsies - CN 3

1) Reminder:
   a) CN 3 innervates 4/6 of the extraocular muscles + levator + parasympathetics to pupil
   b) Affected side:
      i) Eye is **down and out**
      ii) Ptosis
      iii) +/- blown pupil (mydriasis)***
   c) Most common acquired etiologies: ischemic stroke, aneurysm



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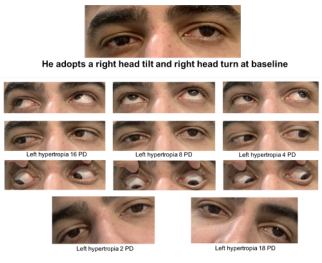
Nerve Palsies - CN 4

1) Reminder:
   a) CN 4 innervates solely the superior oblique
      i) Intorsion, depression, some abduction
   b) Affected side:
      i) Eye is **hypertropic** (elevated)
   c) Example: Left CN 4 palsy
      i) Left hypertropia (**S**)
      ii) Worse on right gaze (**O**)
      iii) Worse left head tilt (**S**)
   d) Most common acquired etiology: trauma



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Nerve Palsies - CN 6

1) Reminder:
   a) CN 4 innervates solely the lateral rectus
      i) Pure abduction
   b) Affected side:
      i) Lateral gaze deficiency
   c) Most common acquired etiology: Elevated intracranial pressure

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Summary: CN 3, 4, 6

1) CN 3: Eye is “down and out” with droopy lid, consider aneurysm if pupil is blown
2) CN 4: Patient tilts head away from lesion, consider trauma or congenital
3) CN 6: Patient appears to be “cross-eyed,” consider increased intracranial pressure

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“Nerve” Palsies - Horner's syndrome

1) Loss of sympathetic innervation to one side of the face
2) Reminder:
   a) Sympathetics dilate the pupil, elevate the lid (Muller’s muscle), increase sweating
   b) Patient will present with **ptosis, miosis, +/- anhidrosis**
   c) Numerous etiologies

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Case 1:

1) 29 year old woman with a history of obesity presents with several months of headaches, nausea/vomiting, and more recent double vision. What cranial nerve do you suspect? What might you see on her dilated fundus exam?

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Case 1:

1) Increased intracranial pressure
2) Associated with right CN 6 palsy
3) Optic disc edema (shown on right)
4) Given history, would suspect IIH (idiopathic cranial hypertension) but this is a diagnosis of exclusion

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Case 2:

1) A 60 year old diabetic male presents complaining of diplopia. You see this on exam. Upon lifting the left lid, you notice the left pupil is significantly larger than the right. What is your diagnosis? What do you suspect is the etiology?

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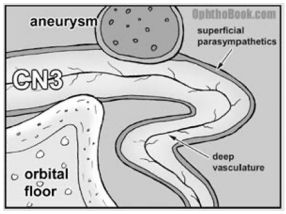
Case 2:

1) CN 3 palsy
   a) Eye down and out
   b) Ptosis
2) Etiology likely compressive lesion (aneurysm)
   a) Mydriasis
3) Urgent brain imaging



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