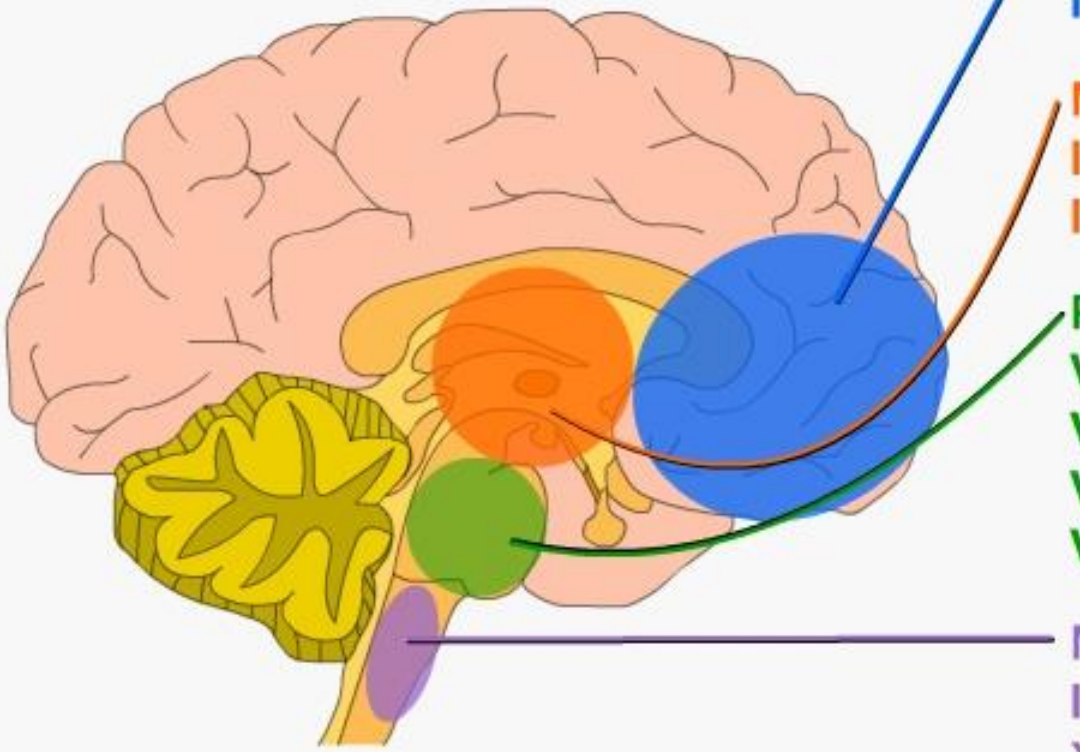
EXAMINATION OF THE CRANIAL NERVES

Location of cranial nuclei



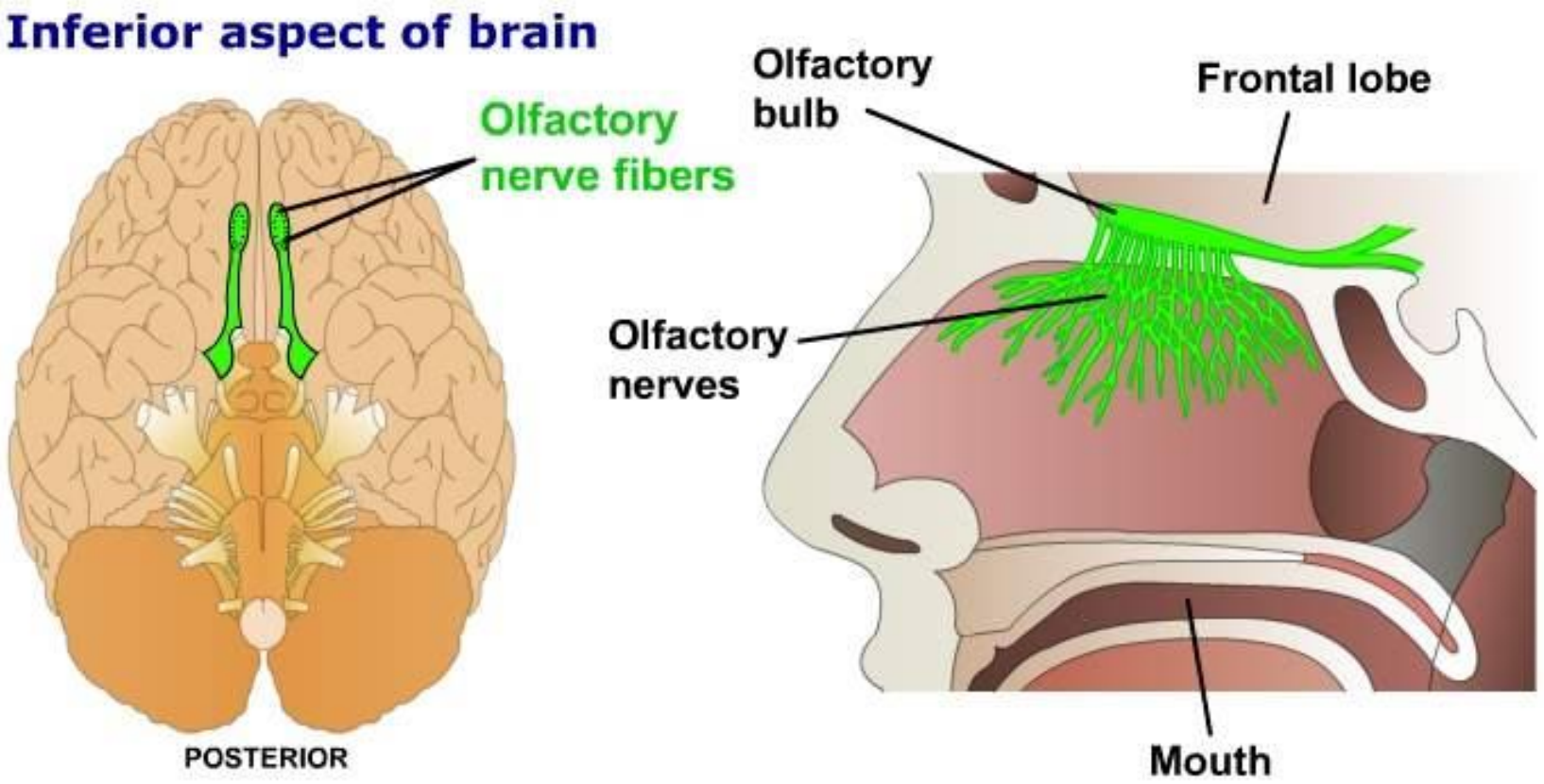
FOREBRAIN — 2
- I Olfactory
- II Optic

MIDBRAIN — 2
- III Occulomotor
- IV Trochlear

PONS — 4
- V Trigeminal
- VI Abducent
- VII Facial
- VIII Vestibulocochlear

MEDULLA OBLONGATA — 4
- IX Glossopharyngeal
- X Vagus
- XI Accessory
- XII Hypoglossal

Olfactory nerve (I)



A The olfactory nerve - key questions

- Partial or total loss of smell?
- Altered sensation of smell?
- Nasal and post-nasal discharge?
  (mucus, serous, purulent, blood)
- Nasal obstruction?
  (polyps, inflammation, masses)
- Pain around the sinuses?
- History of allergies?
- Trauma to frontal lobes?
- Viral infections?
- Parkinson's disease?

A The olfactory nerve - exam procedure

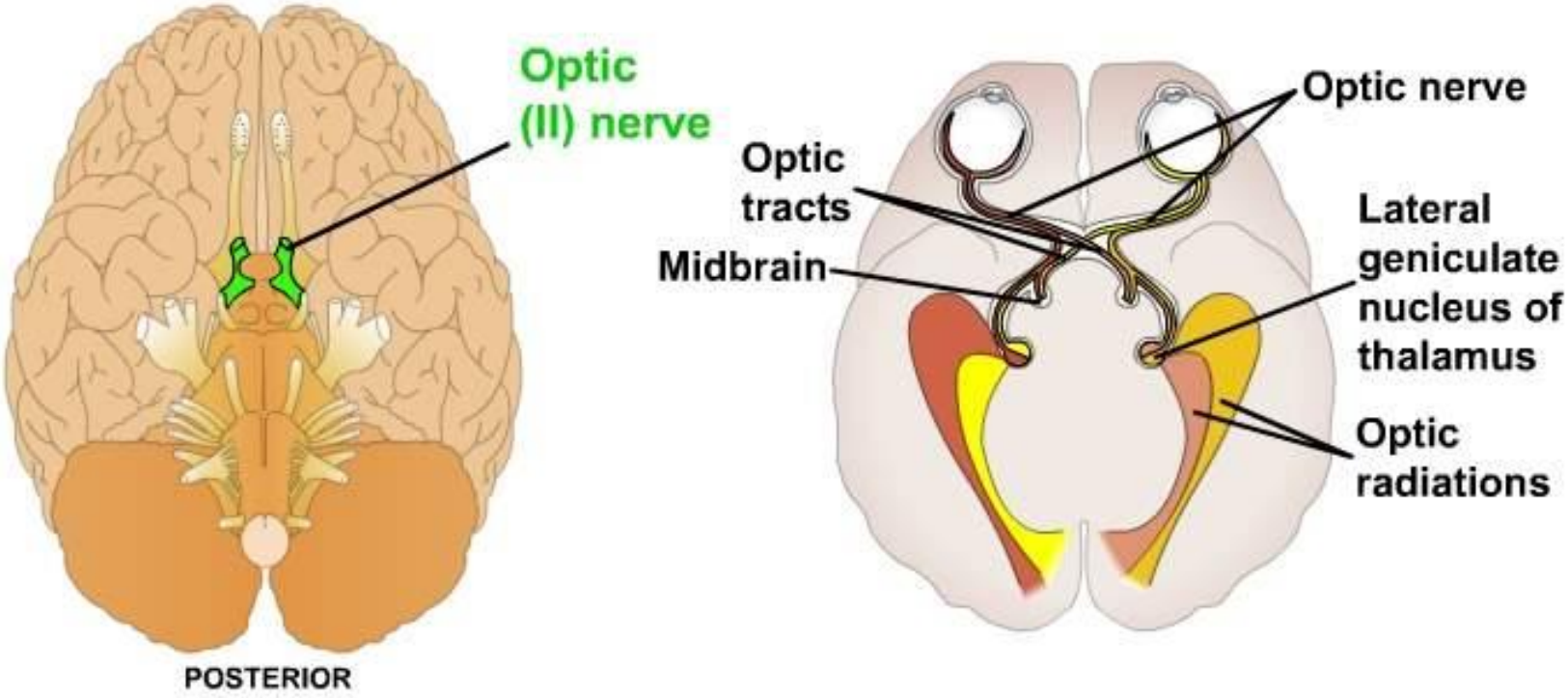
- Test for smell recognition
- Use familiar but gentle substances
- Test each nostril in turn by asking them to block the other nostril
- Place pressure / tap over the sinuses
- Ask them to lean forward for pain or discomfort
- Examine the nasal cavity with a rhinoscope
- Transilluminate the sinuses

The olfactory nerve - pathologies

- Frontal lobes tumours / abscess
- Trauma to the head / frontal
- Sinus problems
- Senile anosmia
- Blocked nostrils
- Nasal polyps or tumours
- Viral infections
- Parkinsons disease

Optic nerve (II)

Inferior aspect of brain



The optic nerve - key questions

- Blurred vision?
- Double vision?
- Sensitivity to light?
- Poor night vision?
- Floaters?
- Vitreous haemorrhages?
- Obstructed visual fields?
- Tunnel vision?
- Poor macular vision?

  unilateral / bilateral /

  symmetrical / non-symmetrical?

- Allergies?
- Sinus problems?
- Painful eyes?
- Transient loss of vision?
- History of hypertension and diabetes?

A The optic nerve - exam procedure

- Visual acuity- Snellen & Jaeger charts
- Confirm with pinhole card
- Red reflex
- Direct and consensual pupillary light reaction (CN: II & III)
- Visual fields
- Blind spot
- Fundoscopy

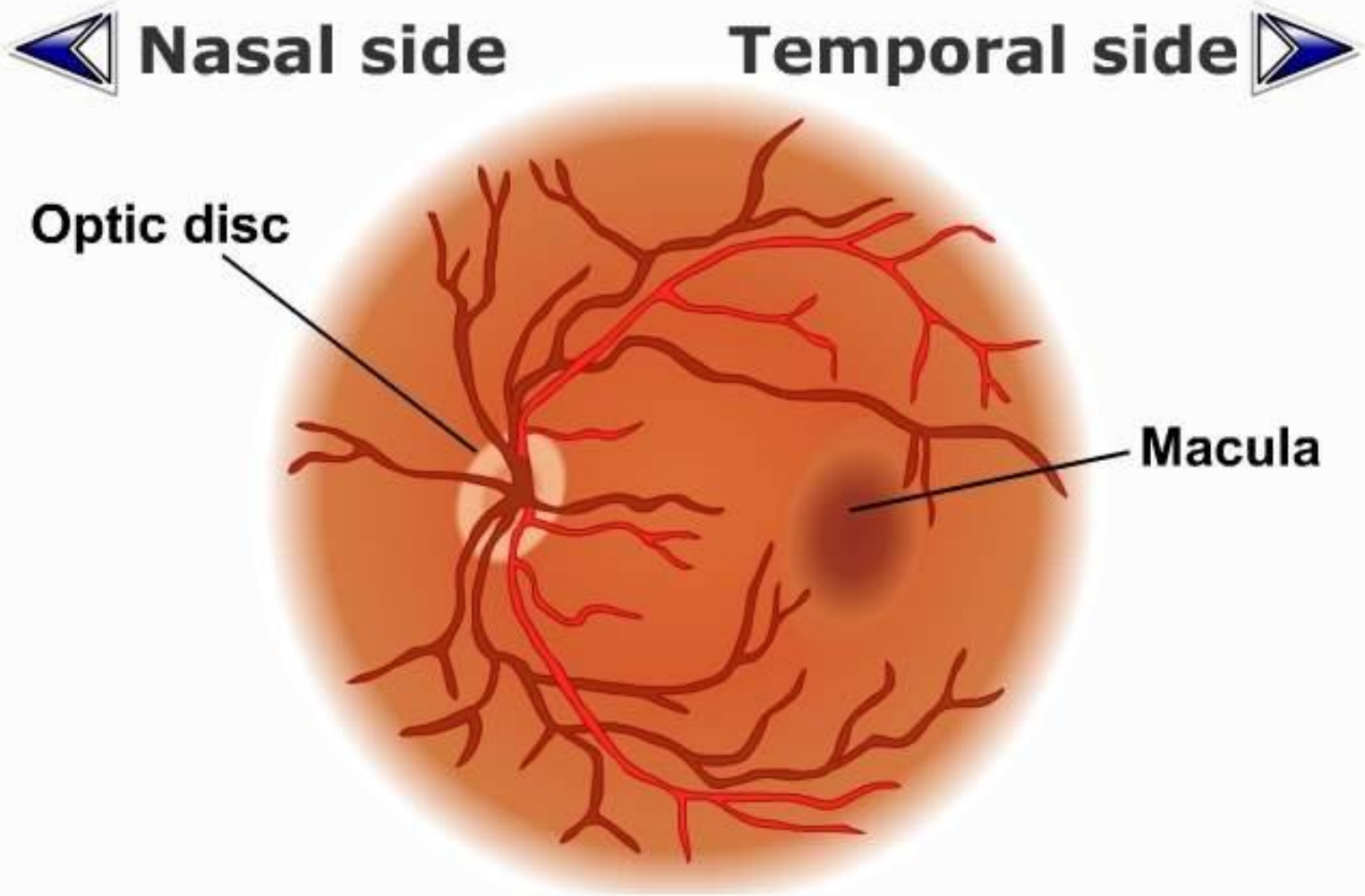
Ophthalmoscope - beams

Normal beam	➢ General examination
Narrow beam	➢ Constricted pupils
Red-free filter(green)	➢ Blood vessels ➢ Haemorrhages
Grid	➢ Mapping out lesions
Slit light	➢ Elevations ➢ Concavities

Fundoscopy (using ophthalmoscope)

- Observe red/pink appearance of fundus
- Set ophthalmoscope at +10 diopters
- Start examining anterior portion of eye
- Gradually reduce to 0 diopters
- Examine integrity of:
  - Retina
  - Vessels
  - Optic disc
  - Fovea

Normal retina (left eye)



Retinal change

'Cotton wool spots' or exudates

- Diabetes
- Hypertension
- Vasculitis
- HIV

Shiny yellow circumscribed patches
'hard exudates of lipids'

- Diabetics

Retinal change

'Larger round blots'

These are haemorrhages deep in the retina

- Diabetes

'Flame shaped' superficial haemorrhages

Along nerve fibres

- Hypertension
- Gross anaemia
- Hyperviscosity
- Bleeding diathesis

Peripheral new vessels

- Ischaemic diabetic retinopathy
- Retinal vein occlusion

Optic disc changes

Pale disk

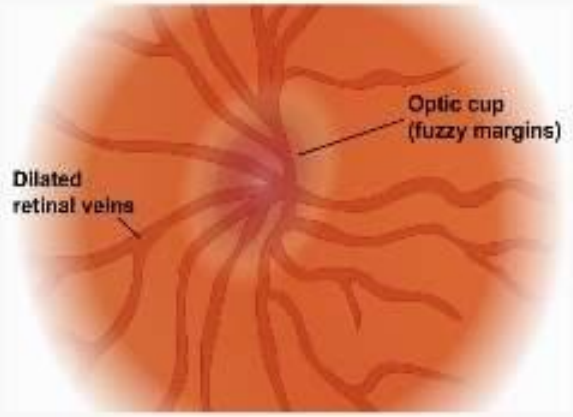
- **Multiple sclerosis**
- **Optic nerve compression**
- **Following optic neuritis**

Enlarged optic cup and rim is diminished

- **Glaucoma**

Causes of papilloedema

- Increased intracranial pressure
- Severe hypertension
- Meningitis
- Trauma
- Subarachnoid haemorrhage
- Acute optic neuritis



The macula

"The area of central vision"

"A slightly darker area, free of vessels"

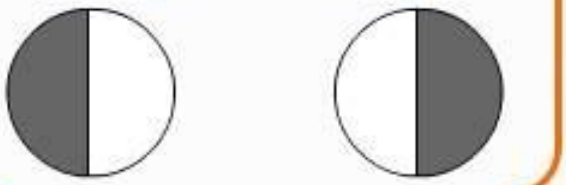
- **Pale macula may signify a pathology**
- **Senile macular degeneration**
- **Macular oedema**

Visual defects
and location of possible lesions

Visual field defects

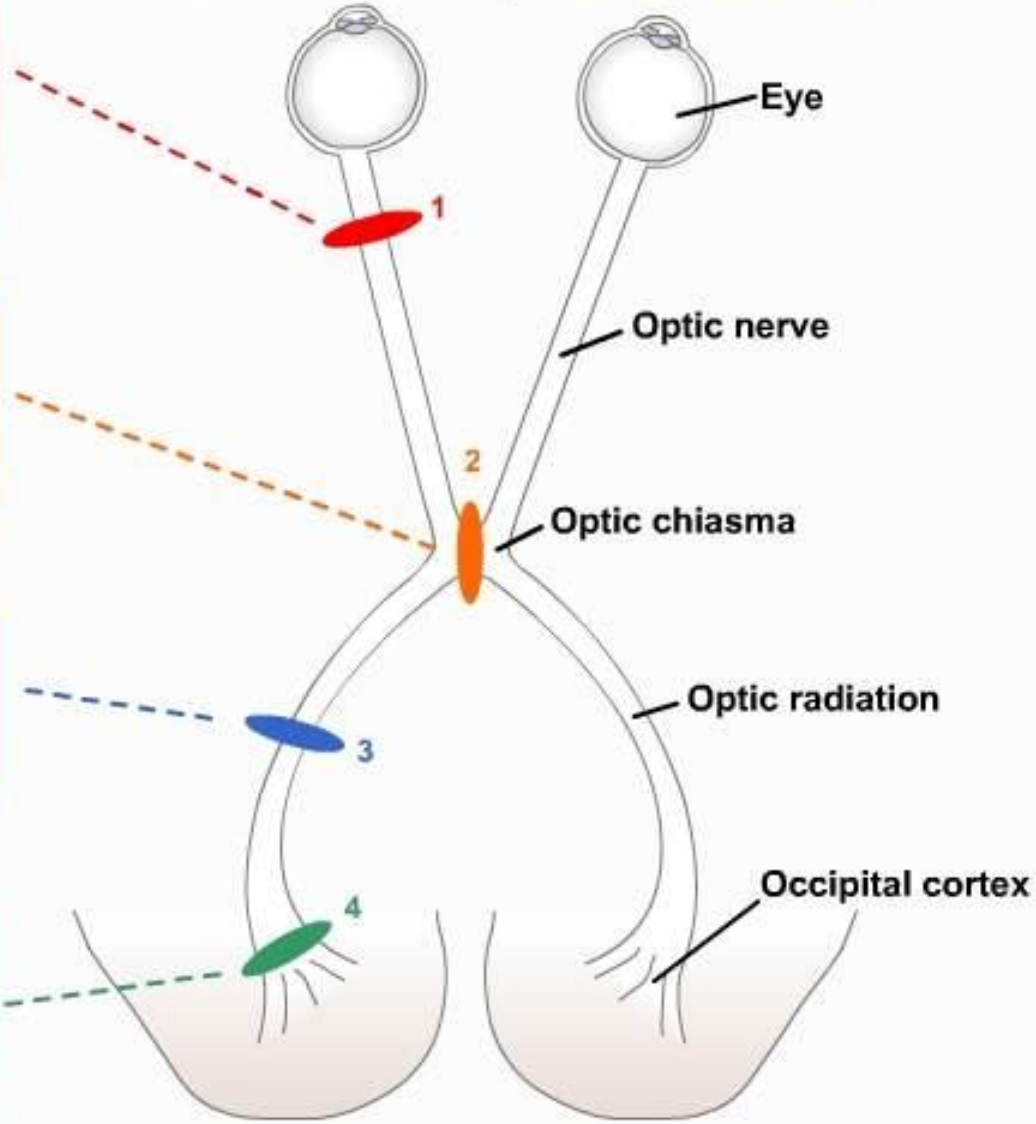
1- Unilateral blindness

2- Bitemporal hemianopia



3- Right homonymous hemianopia

4- Right homonymous hemianopia with macula sparing

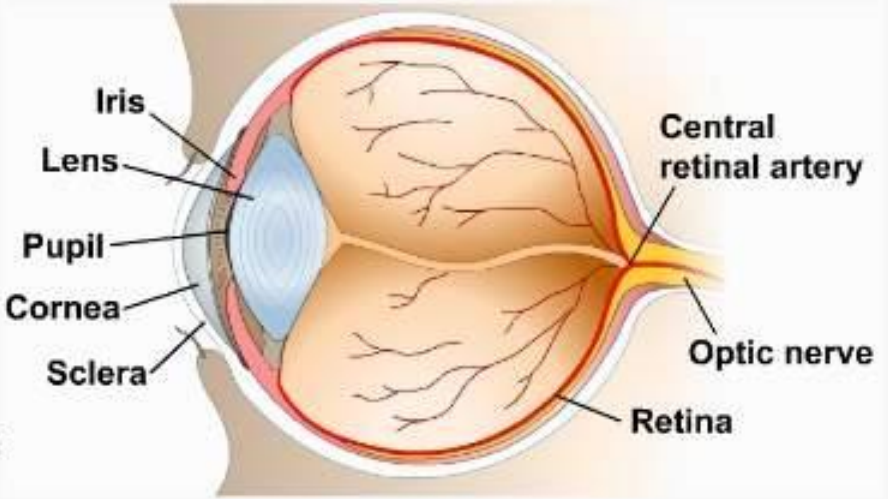


Loss of the red reflex

- Cataract
- Retinal detachment
- Haemorrhage into the vitreous body
- Rarely with
  - Floaters
  - Scars
  - Corneal lesions

Ophthalmoscopy procedure

- External features
- Red reflex
- Anterior structures
- Vitreous body
- Optic disc
- Retina and blood vessels
- Macula



Oculomotor
Trochlear
Abducent

Cranial nerves III, IV, VI

Nerves III, IV, VI - exam procedure

- Observe for diplopia and strabismus
- Observe the pupils and level of eyelids
- Test for direct and consensual pupillary reaction to light
- Test for visual pursuit
- Test for accommodation & convergence

The oculomotor nerve - pathologies

- Basilar skull fractures
- Uncal herniation
  (increased intracranial pressure)
- Lesions in the cavernous sinus
- Syphillis
- Aneurysms
- In diabetes
- Pituitary tumours
- Vascular diseases

The oculomotor nerve - pathologies

Clinical manifestations:

- Ptosis
- Inferolateral displacement of the affected eye
  causing diplopia or strabismus
- Mydriasis (dilated pupil)

A The trochlear nerve - pathologies

- Fracture of the wing of the sphenoid bone
- Intracranial hemorrhage / pressure
- Tumours or aneurysm

Manifestations:

- Extorsion of the affected eye
- Diplopia worsens with downgaze
- Diplopia improves when head is tilted to the contralateral side

The abducent nerve - pathologies

- Lesions of the cavernous sinus
- Aneurysms
- Fractures

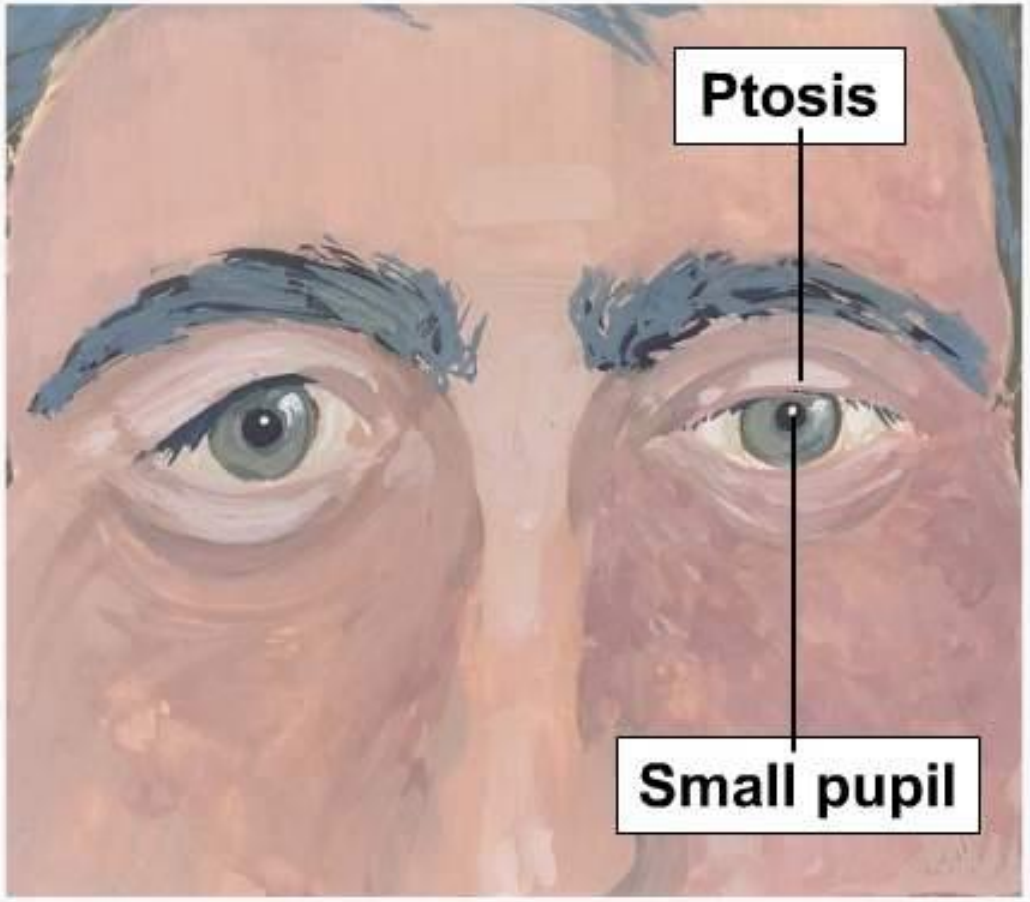
Manifestations:

- Medial deviation of affected eye
  (Diplopia improves when affected eye looks medially or when the contralateral eye is abducted)

Horner's syndrome

Sympathetic lesion emerging from T1

- Miosis
- Enophthalmos
- Anhydrosis
- Ptosis (partial)

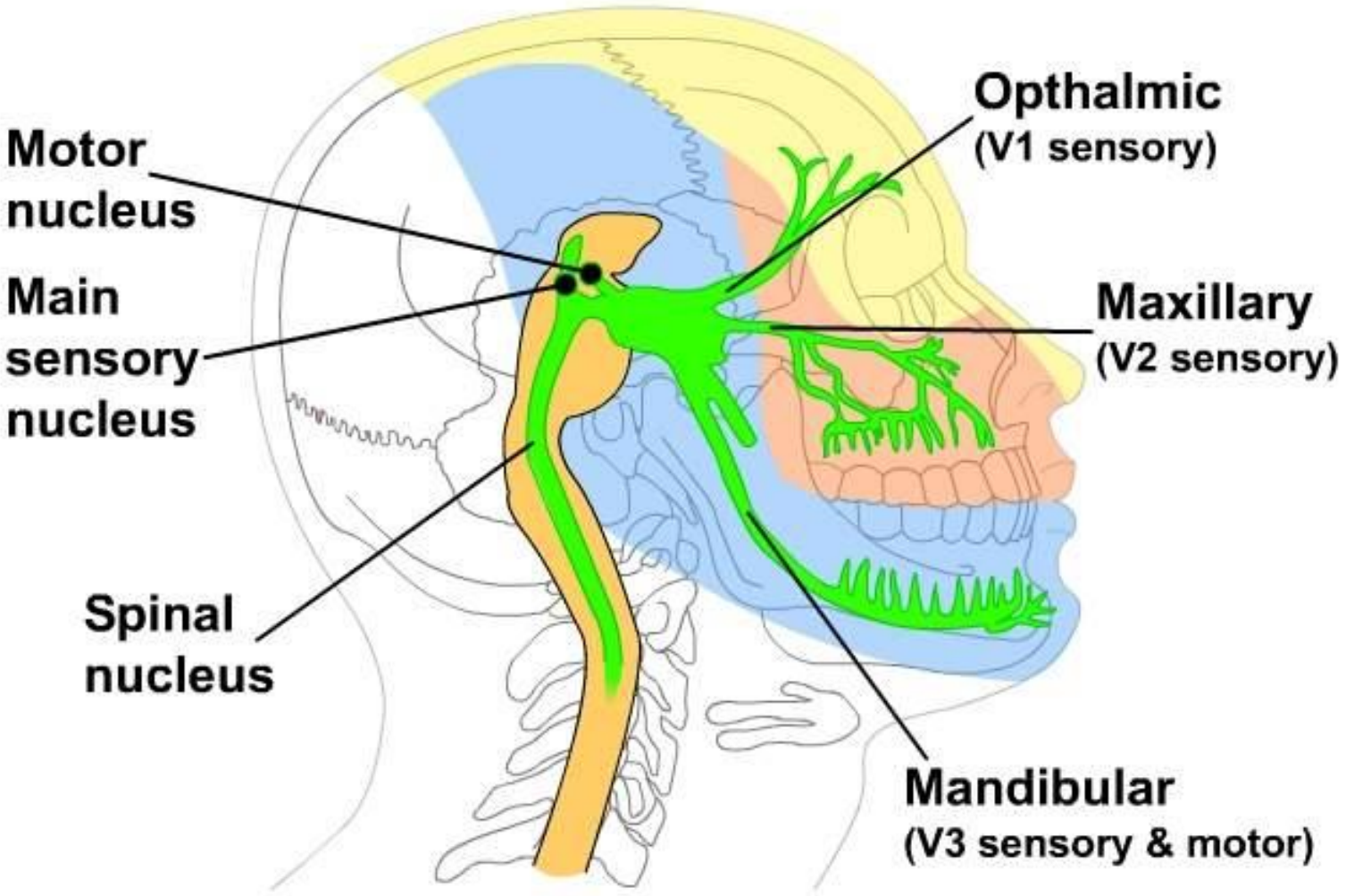


PEAS: Ptosis-Enophthalmos-Anhydrosis-Small pupil

Oculomotor (III)

- **Nucleus:** Mid brain
- **Structures supplied:** Extra and Intra ocular muscles, eyelids
- **Function:** Eye movement, elevation of eyelid, constriction of pupil, parasympathetic component
- **Test:**
  - Light reflex
  - Pursuit of an object
  - Accommodation

Trigeminal nerve (V)



Trigeminal nerve - key questions

- Facial pain (trigeminal neuralgia)?
- Any areas of numbness on the face?
- Any corneal lesions?
- Problems with the jaw?
- Difficulty chewing?

Testing Trigeminal (V)

Motor component:

- Observe facial symmetry & jaw deviation
- Lower & elevate jaw
- Clench teeth and feel for muscle strength

Sensory component:

- Test skin with cotton wool and pin
- Elicit corneal reflex using cotton wool
- Test jaw jerk

Lesions of the trigeminal nerve

- Lesions of the spinal tract and nucleus
  - Pain and temperature

- Lesions of the ophthalmic division
  - Corneal reflex

  (Afferent = trigeminal nerve)

  (Efferent = facial nerve)

The trigeminal nerve - pathologies (A)

- Spinal tract lesions

  Manifestations:

  Reduced skin sensation

- Ophthalmic division lesions

  Manifestations:

  Reduced corneal reflex

- Skull fractures
- Tumours

The trigeminal nerve - pathologies (B)

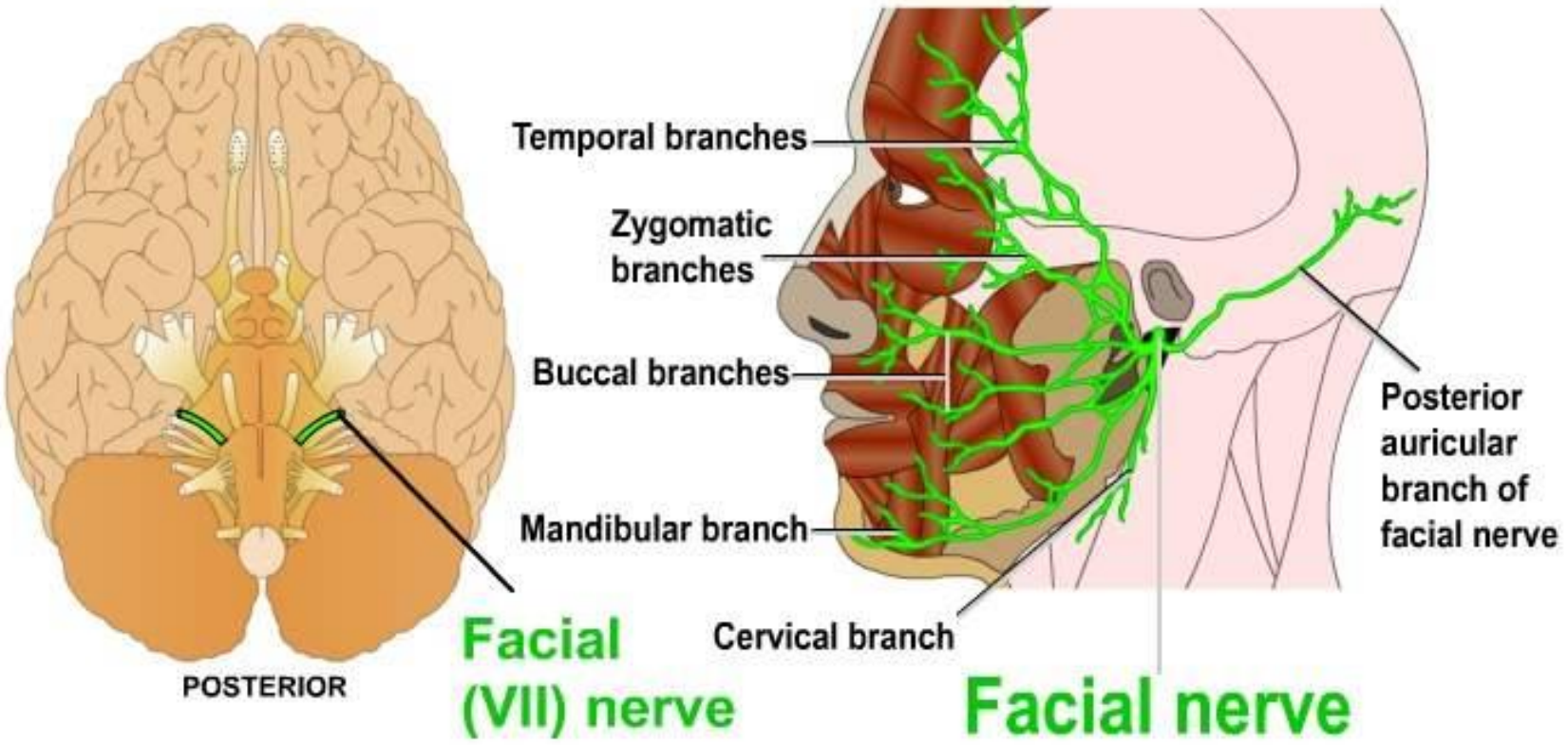
- Facial surgery
- Trigeminal neuralgia (Tic Doloureux)
- Herpes zoster
- Lesions in cavernous sinus

Manifestations:

- Weakness in muscles of mastication
- Jaw asymmetry

Facial nerve (VII)

Inferior aspect of brain



The facial nerve - key questions

- Facial weakness?
- Dribbling?
- Spontaneous movements?
- Inability to frown or whistle?
- Loss or altered taste sensation?
- Altered hearing?
- Endocrine disorders:hyper/hypothyroidism,
- Acromegaly, Paget's disease of bone, Cushing's disease?

A The facial nerve - exam procedure

- Observe the face. Note the symmetry of wrinkles, nasolabial folds drooping of lips at corners of the mouth.
- Check for Bells palsy
- Perform facial expressions: Raise eyebrows, frown, close eyes and lips tightly and attempt to open them, show teeth, whistle, blow out cheeks and feel the resistance.
- Test taste sensation; anterior two thirds of tongue

FACE-EAR-TASTE-TEAR AND SALIVA!

A The facial nerve - pathologies

- **Bell's palsy** (idiopathic, unilateral paralysis of lower motor neurones)
- **Fractures of the petrous bone**
- **Space occupying lesions (tumours or aneurysm)**
- **Peripheral lesions** involves muscles of both the upper and lower face and can affect taste from the anterior 2/3 of the tongue (via the chorda tympani).
  Upper & lower parts of face will be affected
- **Central lesions** (ie tumours or haemorrhage), due to crossed innervation the upper aspect of face and orbicularis occuli will not be affected.
  Only lower parts of face will be affected

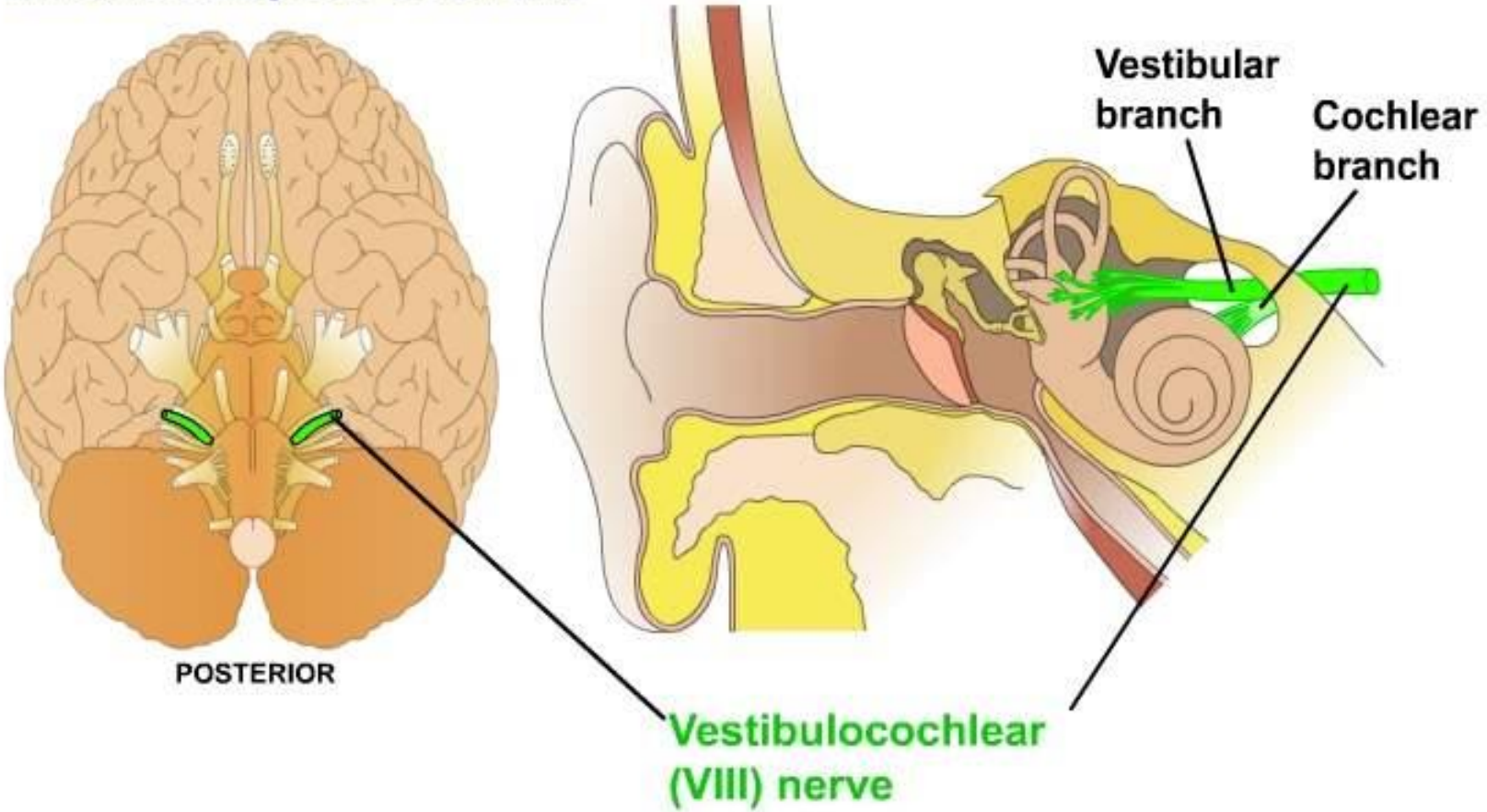
Bell's palsy

A unilateral paralysis of the lower motor neurones

- Facial distortion:
  - Sagging of the mouth
  - Dribbling (or dry mouth)

- Loss of taste
- Inability to frown or close the eyes tightly
- Excessively watery eyes (or dry eyes)
- Hyperacusis (distorted hearing)

Vestibulocochlear nerve (VIII)



A Vestibulocochlear nerve - pathologies

Vestibular division:

- Loss of balance?
- Dizziness / vertigo?
- Nausea?
- Paget's disease?
- Viral / bacterial infections of the ears?
- Meniere's disease?
- Blast injury?

Cochlear division:

- Partial or total loss of hearing?
- Tinnitus?
- History of grommets?

Vestibulocochlear nerve - exam procedure

Balance:

- Positional test: Hallpike's test
- Check for dizziness and nystagmus
- Warm and cold caloric tests

Hearing:

- Whisper a few words from distance
- Rinne's test
- Weber's test
- Otoscopy

Rinne's test

- *Compares air and bone conduction of sound*
- Use tuning fork of 512Hz
- Place vibrating fork firmly on mastoid process
- When patient no longer feels vibration, place tuning fork close to ear, he should still be able to hear it
- Repeat with other ear
- Compare with findings from Weber's test

Rinne's test

Makes a comparison of sound conducted to the ear through bone and air

Air Conduction > **Bone Conduction**

Conductive deafness BC > AC

Causes of conduction deafness

- Ear wax
- Middle ear disease
- Loss of elasticity in the ossicular chain

Weber's test

- Place a vibrating tuning fork (512Hz) firmly on the vertex or the forehead
- Ask the patient if they hear the buzzing equally in both ears / sides
- Compare your findings with Rinne's test

Weber's test

Assesses the transmission of sound through bone to both ears simultaneously

Makes a comparison between the two ears

Affected ear ➢ Sound will be reduced

Normal ear ➢ Sound will be perceived louder

Weber's test findings

- Weak side suffers from sensory-neural deficit
- The stronger side may appear to be so because of blockage in the external auditory meatus, ie ear wax

A Vestibulocochlear nerve - pathologies

- Middle and inner ear infections
- Fractures of the petrous bone
- Acoustic neuroma (may also affect facial nerve)
- Tumours and vascular lesions, esp. at cerebellopontine angle
- Otosclerosis
- Meniere's disease

Examination of the ears

Examine the walls of the external ear canal:

- Walls should be skin coloured
- Some hairs
- Some ear wax

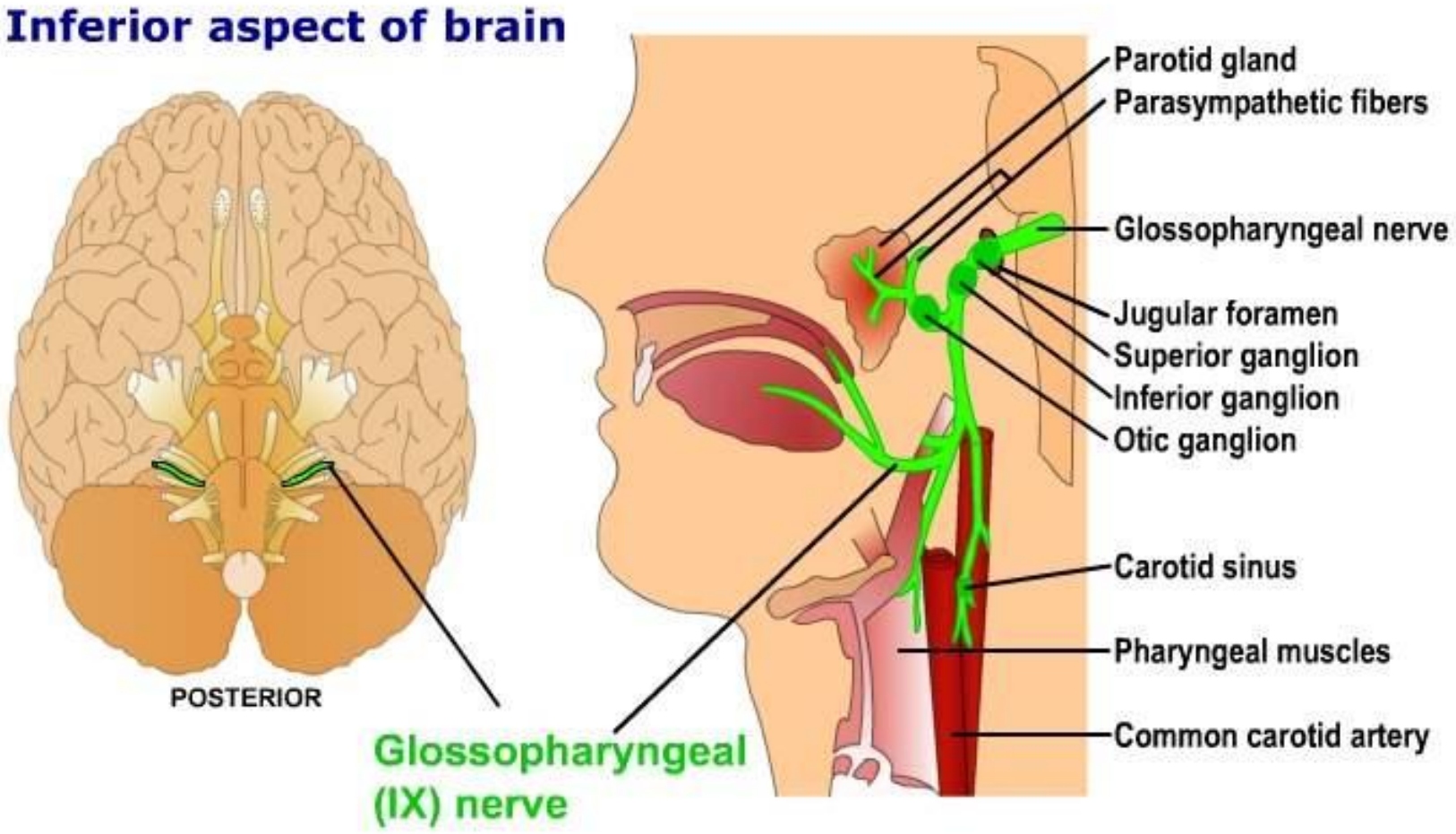
Check for:

- Redness
- Inflammation
- Exudates (serous, pus or blood)
- Excess build up of wax

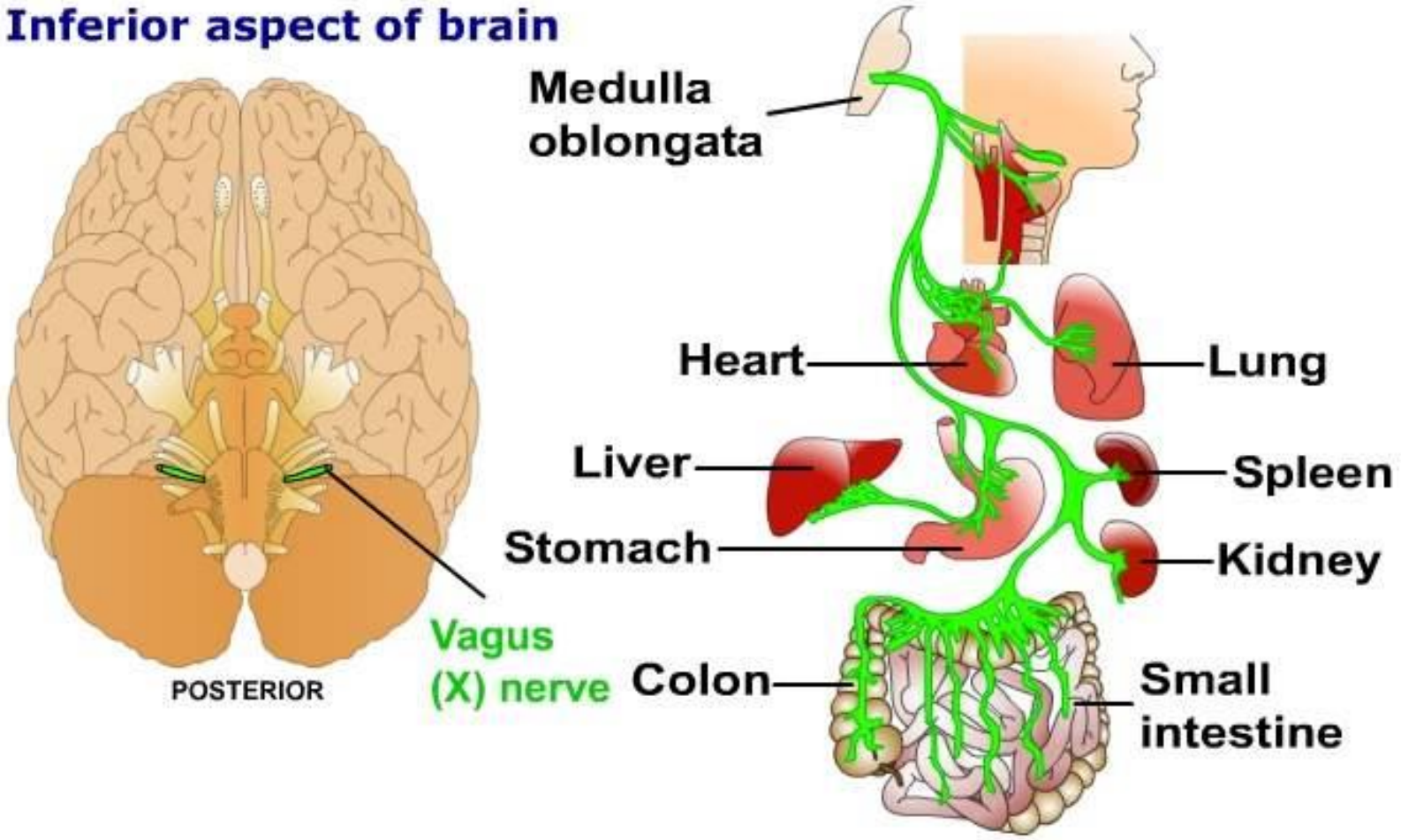
Vestibulocochlear (VIII)

- **Nucleus:** Pons
- **Structures supplied:**
  - Vestibular branch: vestibular apparatus (balance mechanism)
  - Cochlear branch: Cochlea (organ of Corti)
- **Function:** Balance & hearing
- **Tests:**
  - Balance: Posture & balance, nystagmus, Hallpike's manoeuvre, caloric tests
  - Hearing: Rinne's & Weber's tests

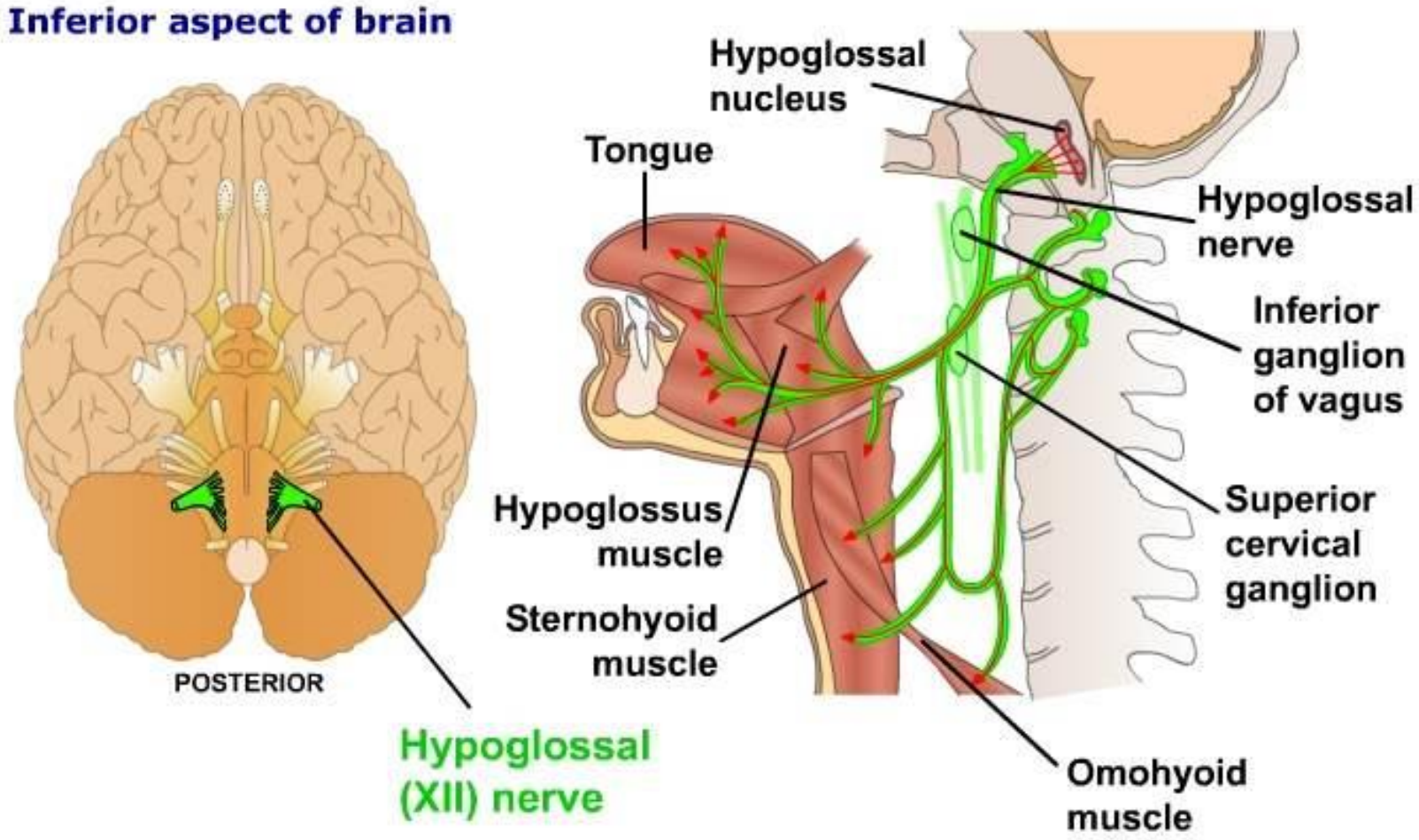
Glossopharyngeal nerve (IX)



Vagus nerve (X)



Hypoglossal nerve (XII)



Testing of Glossopharyngeal & Vagus nerves (IX, X)

- Note voice: hoarse?
- Assess quality of cough: bovine-like?
- Observe uvula and tonsilar arches
- Ask patient to say “Ahhh”: Note symmetry in elevated tonsilar arches
- Test gag reflex: Is it present, is elevation symmetrical

Testing the Hypoglossal (XII)

1. Observe symmetry of tongue in mouth

2. Note any wasting and fasciculations

3. Note size of tongue

4. Ask patient to protrude tongue: is it symmetrical or does it deviate?

5. Assess strength of tongue: feel it being pushed inside his cheek

Note: The tongue deviates toward the weak side

Cranial nerves IX, X, XII - exam procedure

Glossopharyngeal:

- Say 'Ahhh..'
- Gag reflex
- Taste (posterior 1/3 of tongue)

Vagus:

- Note voice production
- Gag reflex and palatal movement of fauces & uvula

Hypoglossal:

- Observe the tongue for fasciculations and atrophy
- Protrusion of tongue – check for deviation
- Assess its strength – pushing against inside of cheeks

Cranial nerve IX - pathologies

- Isolated lesions of the glossopharyngeal nerve are rare
- Tumour or aneurysm of the posterior fossa
- Glossopharyngeal neuralgia (idiopathic)
- If the lesion is near the jugular foramen then:
  - Numbness of ipsilateral pharynx
  - Dysphagia
  - Absent gag reflex

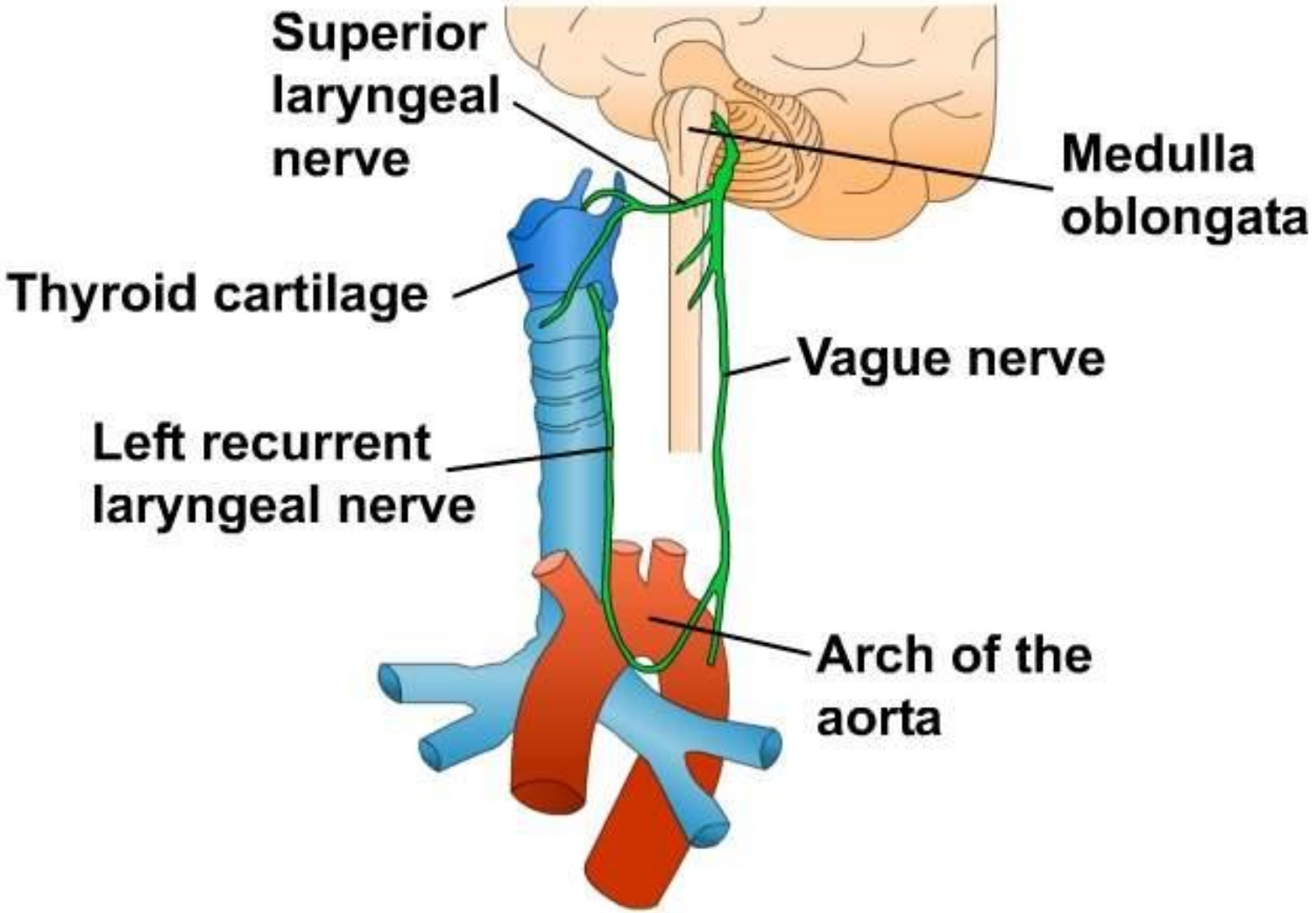
Lesions of the vagus nerve

- Lesions in the brainstem
- Extramedullary lesions
- Jugular foramen lesions
- Bulbar palsy

Cranial nerve X - pathologies

- Isolated lesions of the vagus nerve are rare
- Tumours or aneurysm. This will cause:
- Ipsilateral depression of soft-palate and uvular deviation towards the affected side
- Cardiac and gastrointestinal dysfuction due to its parasympathetic component
- The recurrent laryngeal nerve has a long course, hooked under the arch of the aorta, may be affected by mediastinal / aortic lesions
- This will cause hoarseness, dysphagia, dysphonia reduced gag reflex, bovine cough

Recurrent laryngeal nerve
(vagus nerve)



A Cranial nerves IX, X, XII - pathologies

- Tumours, aneurysms, or other external compressive lesions
- In upper motor neuron lesion the tongue will deviate away from side of lesion
- In a lower motor neuron lesion the deviation will be towards the side of the lesion
- Wasted fasciculating tongue may signify motor neurone disease

Glossopharyngeal (IX)

- **Nucleus:** Medulla oblongata
- **Structures supplied:** Post. 1/3 of tongue, mucous membranes of mouth & tonsillar fossae, parotid glands, carotid sinuses and aortic bodies
- **Function:** Taste post 1/3 tongue, salivation, sensation to oropharynx, baroreception & chemoreception
- **Tests:**
  - Inspection of mouth, phonation taste, gag reflex

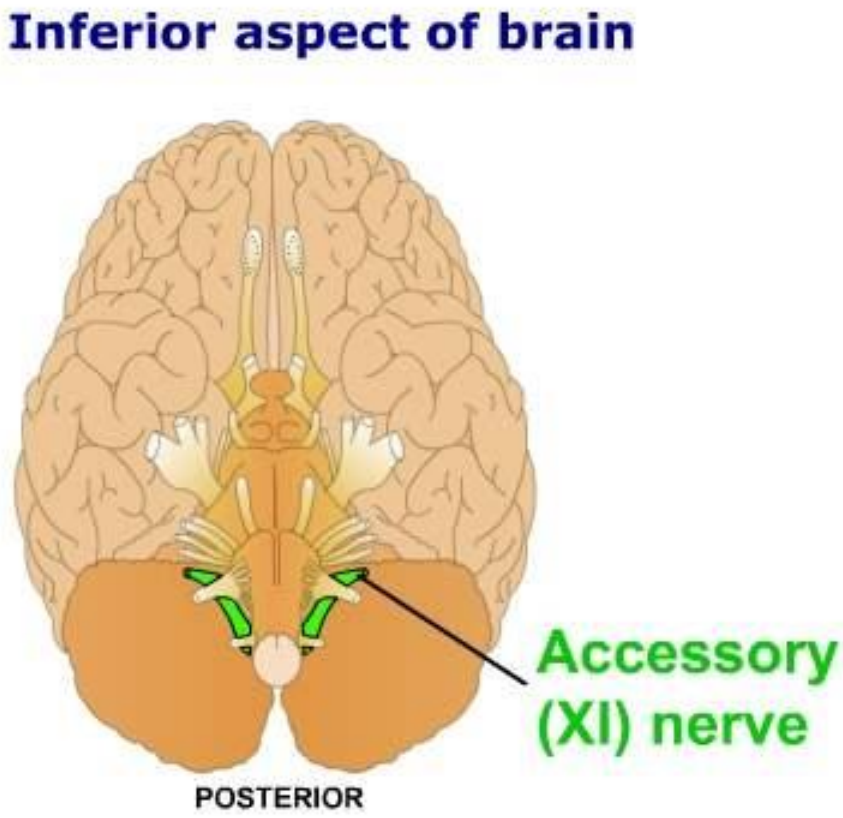
Vagus (X)

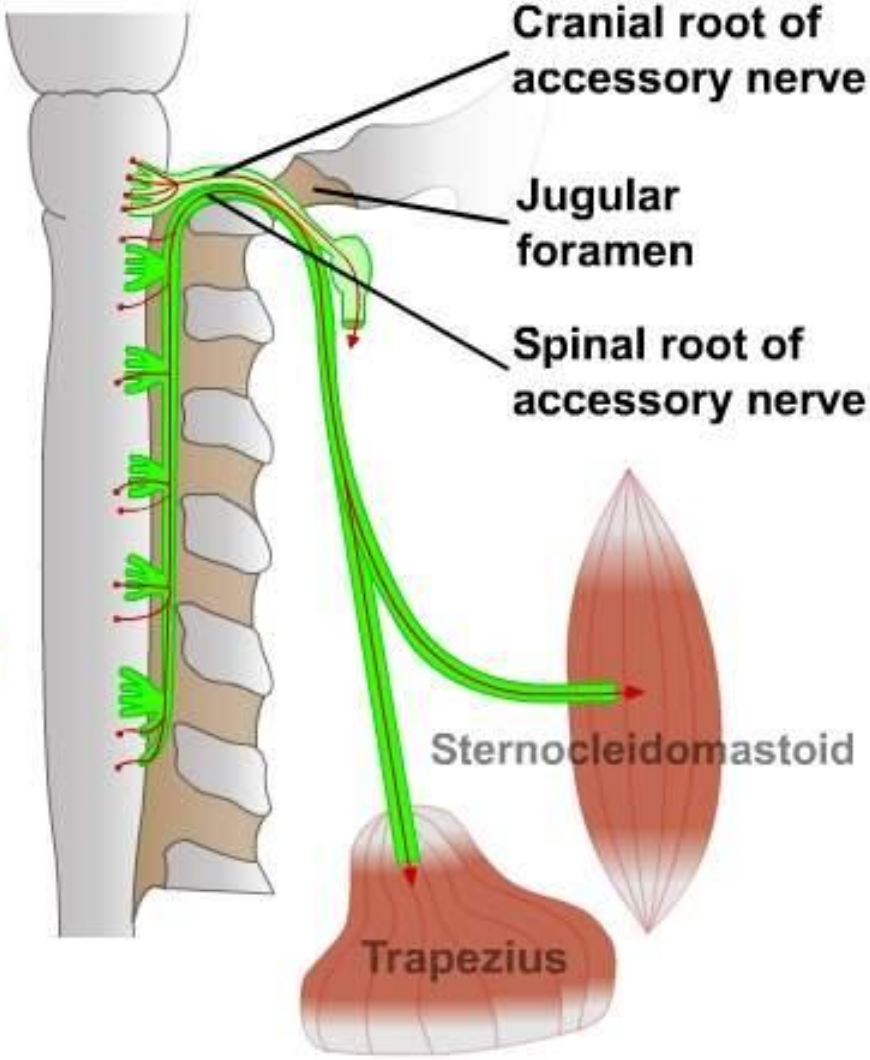
- **Nucleus:** Medulla oblongata
- **Structures supplied:** Baroreceptors, pharynx & larynx, tympanic membrane, ext. auditory canal & ear, parasympathetic to many visceral structures
- **Function:** Blood pressure sensing, phonation, motor factions of oro/laryngopharynx
- **Tests:**
  - Phonation, gag reflex, inspection of mouth & throat

Hypoglossal (XII)

- **Nucleus:** Medulla oblongata
- **Structures supplied:** Intrinsic muscles of the tongue
- **Function:** Movement of the tongue
- **Tests:**
  - Inspection of tongue muscle bulk & fasciculations
  - Protrusion and symmetry of tongue
  - Assess tongue strength pushing inside cheek

Accessory nerve (XI)





Accessory nerve - key questions

- Weakness elevating shoulders?
- Weakness lifting head off the pillow?
- Any evidence of muscle wasting?

Accessory nerve - exam procedure

- Observe shape and symmetry of shoulders and neck
- Trapezius: Resist elevation of shoulders
- Sternocleidomastoids: Resist rotation of neck (testing of contralateral muscle to the direction of rotation)
- Resisting the raising of the head off the pillow

The accessory nerve - pathologies

- Bilateral lesions may suggest a myopathy
- Tumours or aneurysm
- Neck surgery (seek ipsilateral signs)

The 1st CN, the Olfactory Nerve

Supplies:

- The nasal mucosa

Assessments:

- Test with familiar substances
- Examine the nasal passages

The 2nd CN, the Optic nerve

Supplies:

- Supplies the retina with vision

Assessments:

- Evaluate visual acuity
- Test the visual fields
- Check for light reflex
- Perform fundoscopy

The 3rd, 4th, and 6th CNs
Oculomotor, Trochlear and Abducent

Supplies:

- The muscles that move the eyes, eyelids and pupils

Assessments:

- Observe the eyelids and pupils
- Test for pursuit (eye movements) and check for diplopia
- Check convergence & accommodation
- Test the pupillary reaction

The 5th CN, the Trigeminal Nerve

Supplies:

- Muscles of mastication
- Skin of the face

Assessments:

- Test sensation over the skin of the face
- Check for corneal reflex
- Assess the muscles of mastication for symmetry
- Test the strength of the muscles of mastication
- Test the jaw reflex

The 7th CN, the Facial Nerve

Supplies:

- Muscles of facial expression
- The tongue (taste)
  (also eardrum, tear, saliva)

Assessments:

- Check the symmetry of facial lines
- Perform active facial expressions
- Evaluate taste sensation
- Check for lacrimation and saliva production

The 8th CN, the Vestibulocochlear Nerve

Supplies:

- The acoustic and vestibular apparatus

Assessments:

- Assess balance
- Perform Hallpike's test
- Observe for nystagmus
- Assess hearing
- Perform Rinne's and Weber's tests

The 9th and 10th CNs
The Glossopharyngeal and Vagus Nerves

Supplies:

- The larynx & pharynx
- Parasympathetic supply to viscera

Assessments:

- Inspect the pharynx
- Check voice production (Ahh)
- Perform the gag reflex

The 11th CN – The Accessory Nerve

Supplies:

- The sternocleidomastoids muscles
- Trapezius muscles

Assessments:

- Observe symmetry of neck and shoulders
- Test the strength of the sterno-cleidomastoids and trapezius muscles

The 12th CN – The Hypoglossal Nerve

Supplies:

- The tongue

Assessments:

- Examine the shape of the tongue, size, and look for fasciculations
- Evaluate the strength of the tongue

END