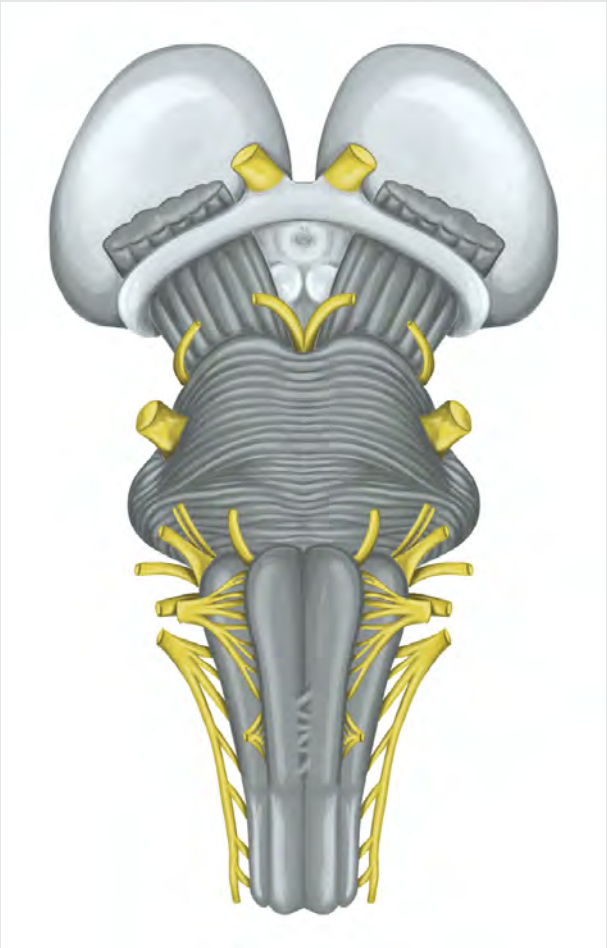
Cranial Nerve Disorders And The Scientific Osteopathic Approach



Luc Peeters, MSc.Ost.

The same author also published books on:

- Cranial Nerve Disorders and the Scientific Osteopathic Approach
- Fascial Chains
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- Posturology and its Scientific Osteopathic Approach
- Scientific Osteopathic Approach to Patients with Abdominal Complaints
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- Principles of Modern Osteopathy – Integration of Osteopathy into General Healthcare
- Evidence Based Practice
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Cranial Nerve Disorders And The Scientific Osteopathic Approach

1. Introduction

1.1. Organization and General Approach

The human nervous system is organized into:

- **The central nervous system (CNS):**
  - Brain.
  - Spinal cord.
- **The peripheral nervous system (PNS)** (outside of the brain & spinal cord):
  - **Somatic nervous system (SNS)** (**cranial nerves**, spinal nerves, ganglia):
    - Sensory.
    - Motor.
  - **Autonomic nervous system (ANS)** (cardiac muscles, smooth muscles, exo- and endocrine glands):
    - Parasympathetic.
    - Sympathetic.
    - Intrinsic.

This book concerns the cranial nerves and their pathology.

12 pairs of cranial nerves

There are 12 pairs of cranial nerves:

- Olfactory n. I
- Optic n. II
- Oculomotor n. III
- Trochlear n. IV
- Trigeminal n. V
- Abducens n. VI
- Facial n. VII
- Vestibulocochlear n. VIII
- Glossopharyngeal n. IX
- Vagus n. X
- Accessory n. XI
- Hypoglossal n. XII

2 of the cranial nerves, the olfactory and optic nerves come from the forebrain. They can be seen as continuations of the brain.

The other 10 nerves emerge from the brainstem.

These 10 cranial nerves have as well motor (efferent) as sensory (afferent) fibers between brain and structures of head, neck and a part of the visceral system.

These 10 cranial nerves have 1 or more nuclei in the brainstem.

The cranial nerves are coated in a derivate of the cranial meninges.

The cranial nerves function in a similar way as the peripheric nerves (they can be seen as modified peripheral nerves):

- Somato-motor.
- Somato-sensory.
- Viscero-motor.
- Viscero-sensory.

as well as with special senses (smell, sight, taste, balance and hearing).

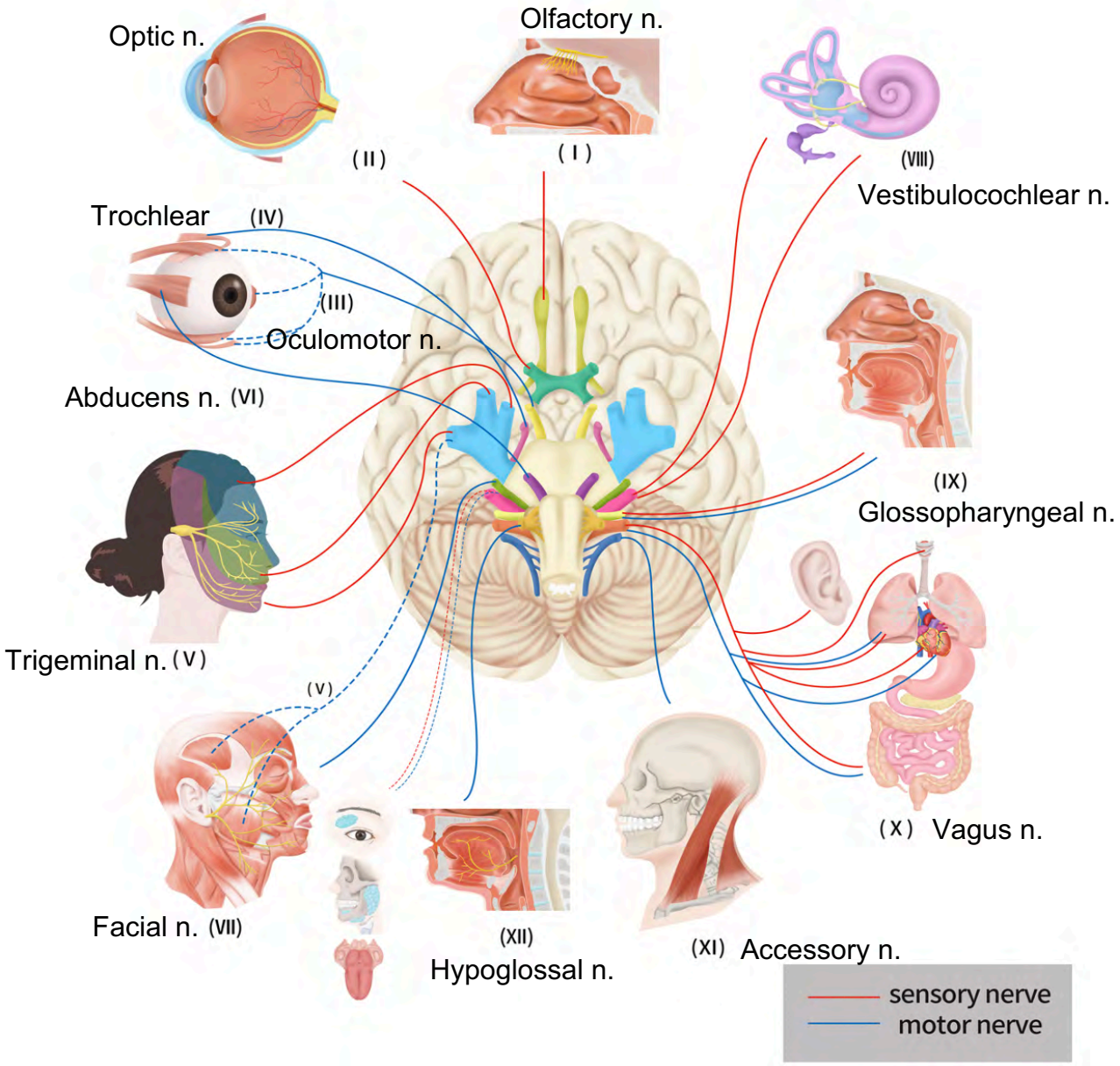


Figure 1 - The cranial nerves

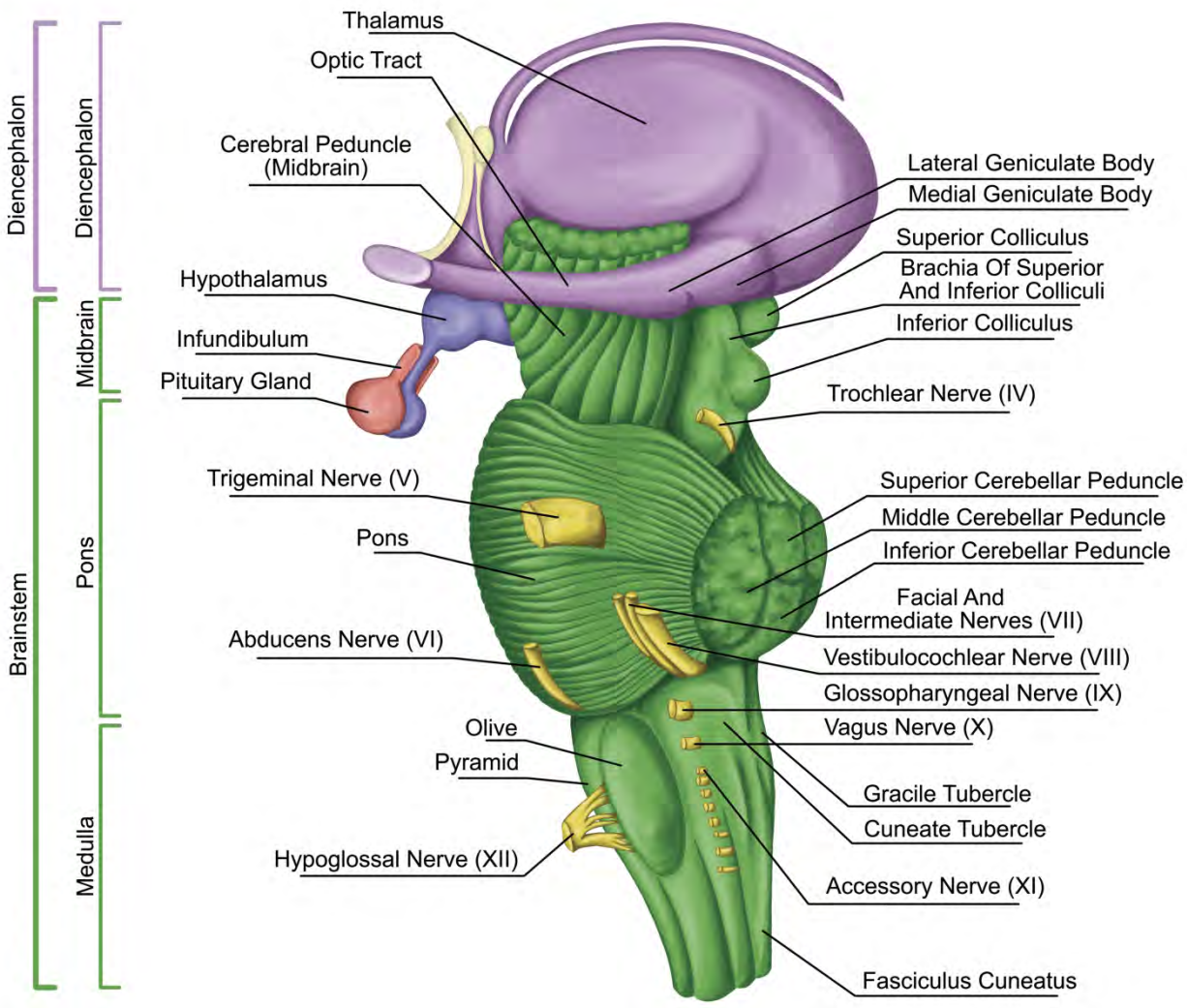


Figure 3 - Brainstem – lateral view

Osteopathy

The osteopathic influence on the quality and functioning of the brainstem is limited to:

- Improving local arterial flow.
- Improving the 'oxygen' quality of the blood.
- Improving the venous drainage of the brainstem and high cervical region.
- Reducing the eventual tension of the surrounding dura.

Olfactory therapy or smell training

16 weeks short term exposure to specific odors may increase olfactory sensitivity in patients with post-infectious and post-traumatic olfactory dysfunction.

To begin smell training, you will need a kit of jars. The original smell training essential oils were rose, lemon, clove and eucalyptus. These remain the standard fragrances for smell training kits.

Open a jar and hold it close to your nose. Take some gentle sniffs for 20 seconds. During this time, concentrate on what you are doing. Keep your mind on lemon for instance, or one of the other smell training smells. Try to block out any intrusive thoughts. Be as attentive as you can and try to recall what your experience of lemon was.

Close the jar after 20 seconds and take a few breaths. Then go on to the next jar.

Even if you can't smell anything today, start training and give it a shot. A damaged olfactory nerve has a good chance to repair itself, and smell training is the way you can help that happen faster.

2.4.3. Nasal and Sinus Disease

Post-viral upper respiratory tract infections can cause hyposmia and anosmia.

This is also the case for sinusitis.

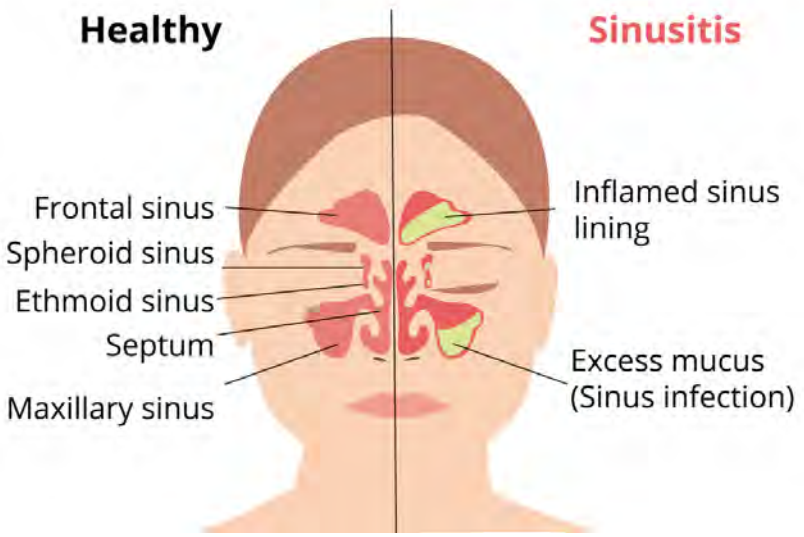


Figure 16 - Sinusitis

Possible other local causes:

- Bacterial rhinosinusitis.
- Allergic rhinitis.
- Vasomotor rhinitis.
- Fungal rhinitis.
- Chronic rhinitis.
- Atrophic rhinitis.
- Nasal polyps.
- Local trauma.
- Nasal septum deviation.
- Cysts.
- Mucosal edema.
- Foreign bodies in nose or sinuses.
- Sinus tumors.
- Covid-19 infection.

2.4.4. Influence of Toxic Fumes, Physical Injury or Nasal Sprays

Several substances can damage the regeneration process of the olfactory cells. The olfactory epithelium regenerates normally every 2-4 weeks. When this regeneration process is damaged, the smell gets lost.

Some examples:

- Ammonia (stimulates also the trigeminal nerve).
- Cocaine.
- Paint solvents.
- Formaldehyde.
- Benzene.
- Heavy metals.
- Ethyl acetate.
- Radiation.

2.4.5. Neurological Causes of Anosmia

- Lesions of the orbital surface of the brain (inferior part frontal lobe).
- Sphenoid ridge/ olfactory groove meningiomas (tumor of meninges). This can come with headache and dizziness.
- Frontal lobe gliomas.

Osteopathy

Depending on the cause of the olfactory dysfunction, osteopathy cannot cure all these diseases.
Osteopathy however doesn't cure patients.

The aim of an osteopathic treatment is to improve the mechanical, vascular, neurological and metabolic conditions of the complaint structure.

This will help/stimulate the recovery or healing process.

Concerning the olfactory nerve there are the following treatment goals:

- **General:**
  - **Improving local arterial flow:**
    - When we find somatic dysfunctions in the upper thoracic region ($T_{1\text{-}5}$), we mobilize or manipulate this region. This influences the orthosympathetic innervation of the arterial system of the head.
    - We mobilize all soft tissues in the throat region because this could possibly influence the function of the cervical sympathetic ganglia.

  - **Improving oxygen supply of the arterial system:**
    - We treat the lung/heart function to obtain:
      - Bigger exchange surface of the lungs.
      - Better blood flow through better heart function.

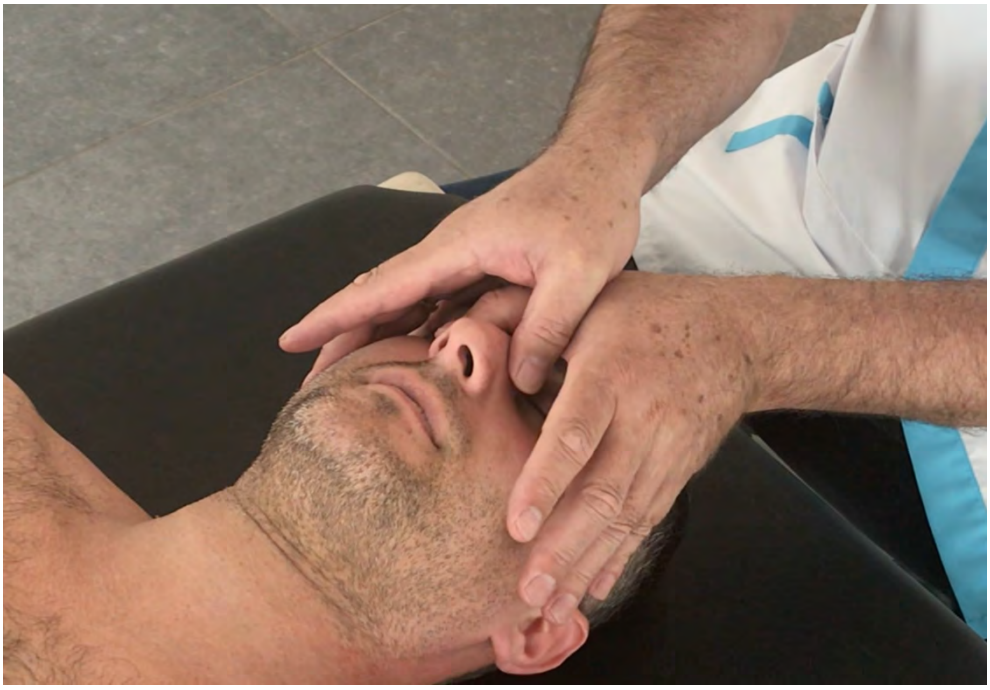
  - **Improving the venous drainage of the brainstem:**
    - By harmonizing the cranial membranous system.
    - By mobilizing the upper cervical region.
    - By mobilizing the thoracic outlet.
    - Treating the lung/heart function.
    - Stretch of the cranial membranous system:
      - This is also important because most of the cranial nerves are surrounded by a dural sheet that can be stretched.

- **Specific:**
  - Mobilization of the nasal bone.

The nasal bones articulate with the frontal bones, and they articulate with the sphenoid and ethmoid bones.

Given this relationship, articulation of the nasal bones indirectly affects the ethmoid and sphenoid sinuses.

By introducing motion to the nasal bones, the ethmoid and sphenoid bones also move. Improving the motion of the sphenoid and ethmoid bones helps with decongestion of the sphenoid and ethmoid sinuses.



Video 15 - Nasal bone mobilization

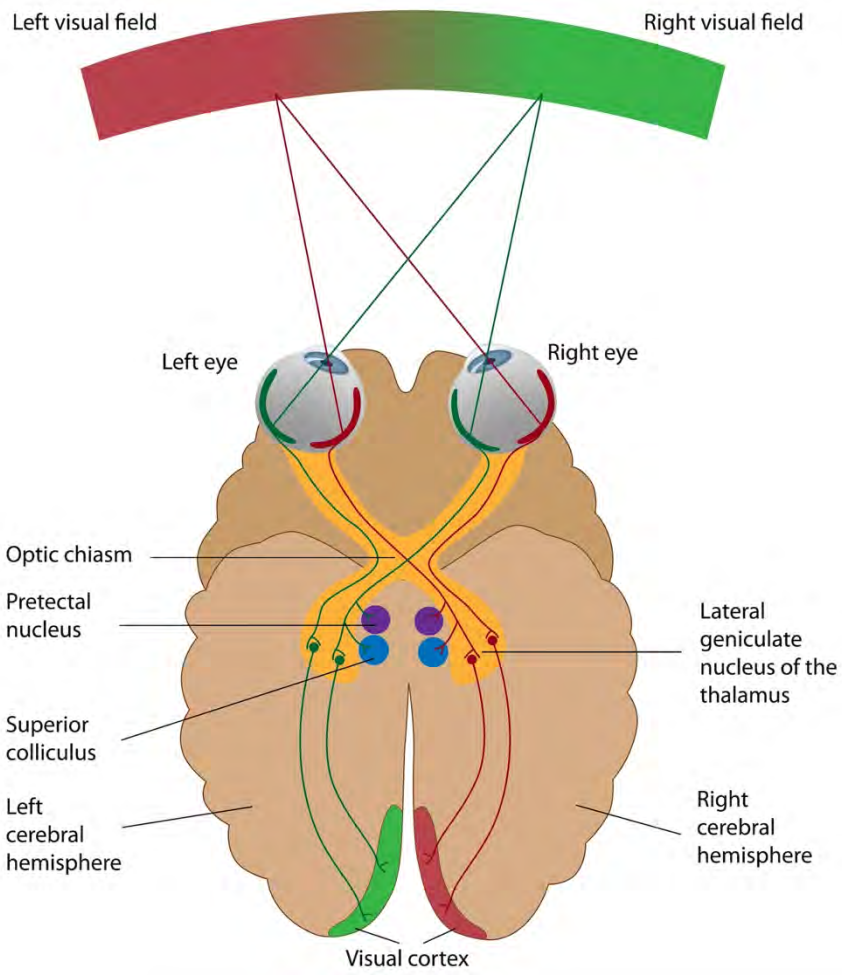


Figure 23 - Visual projection

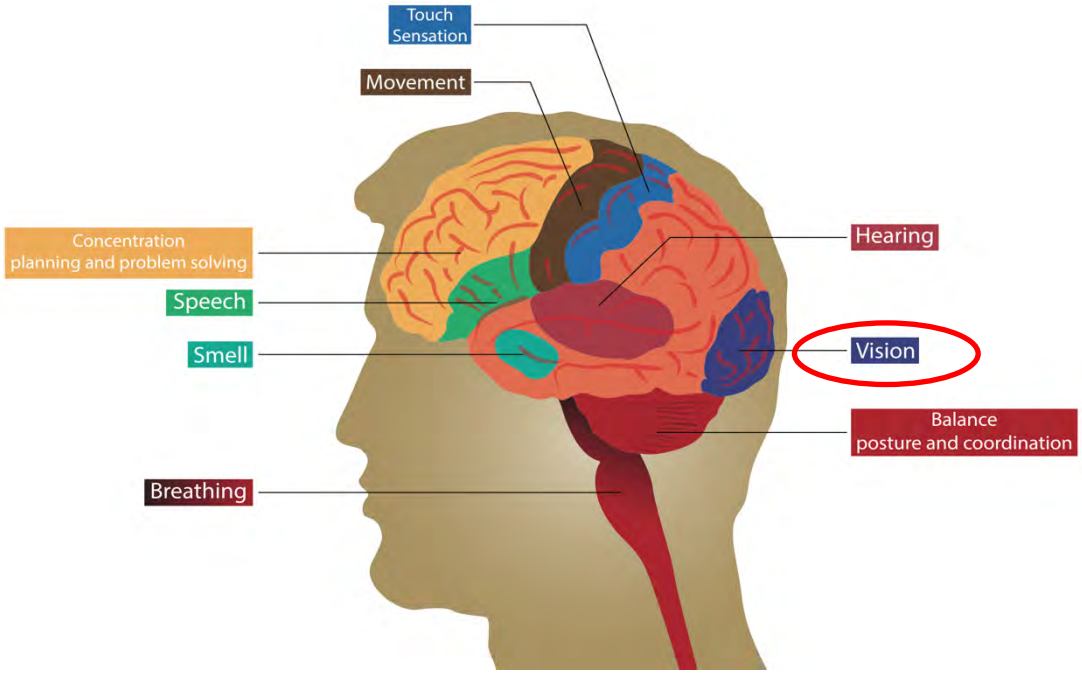


Figure 24 - Visual cortex

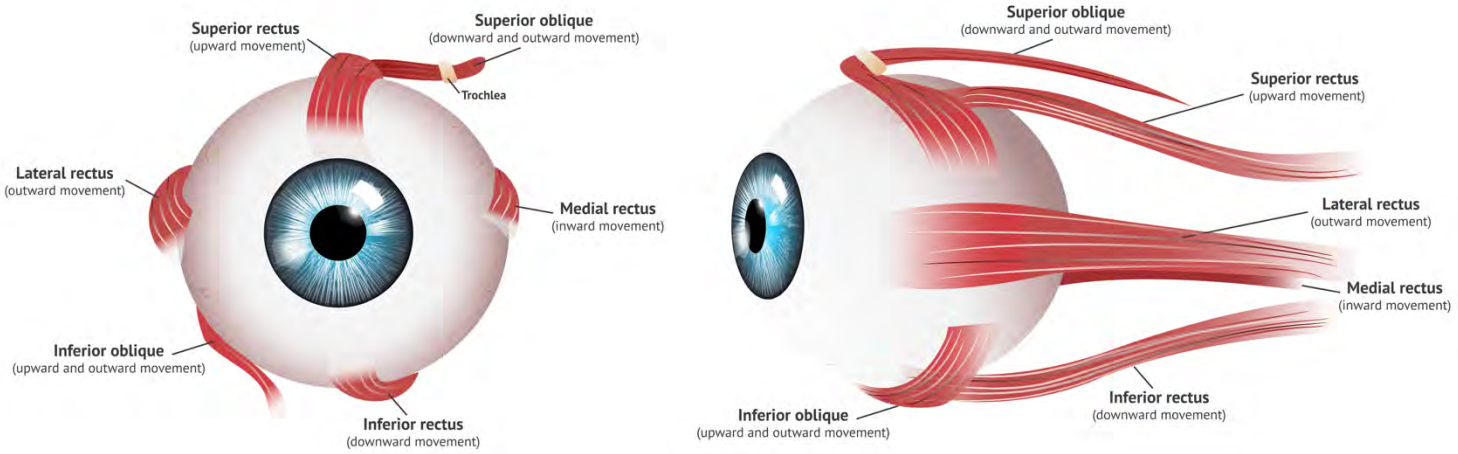


Figure 25 - Eye muscles

The optic nerve arises from the retina.

Primary neurons

The primary neurons are the rods and the cones located in the retina. They have the quality of transforming light into electric potential.

At the fovea, the density of cones (color vision) is high.

In the periphery of the retina the rods are more dense (black and white vision).

In the dark the pupil widens so as to allow as much light as possible into the eye.

At night-time the peripheral part of the retina is predominantly active and so everything seems black and white.

When looking at the stars, a better image is gained by looking next to the star.

Secondary neurons

They are short bipolar cells located in the retina.

They link the primary neurons with the optic nerve.

They also interconnect the rods and cones to form receptive fields.

The neurons are small around the fovea and larger in the periphery.

Tertiary neurons

These are large ganglion cells and they form:

- The optic nerve.
- The optic chiasm.
- The optic tract.

They end in the lateral geniculate body.

The optic nerve exits the eye at the blind spot and runs posterior/ medial in the orbit through the common tendinous ring.

This annulus is a common insertion point for the right, external eye musculature. The optic nerve runs together with the ophthalmic artery and other structures.

Some of the neurons don't run into the lateral geniculate body but continue medial into the pretectal region. It is here that junctions are made for the visual reflexes.

The lateral geniculate body is a part of the thalamus.

The fibers coming from the nasal field of vision do not cross in the optic chiasm and remain ipsilateral.

The neurons coming from the nasal field of vision cross to the contralateral side in the chiasm. The neurons coming from the temporal region do not.

The chiasm lies on the floor of the third ventricle, 5-10 mm above the diaphragm sella.

It is 12 mm wide, 4 m thick.

The medial parts of the optic tracts communicate between the optical system and the oculomotor nuclei.

The optic nerve can be divided in 3 parts:

- **Intraocular portion:**
  - 1 mm in length.
  - 1.5 mm in diameter……to 3-4 mm behind sclera.
- **Intraorbital portion:**
  - Surrounded by the annulus of Zinn (= common tendinous ring).
  - Blood supply = ophthalmic a. with meningeal branches.
  - 30 mm.

The bony orbit (orbital cavity)

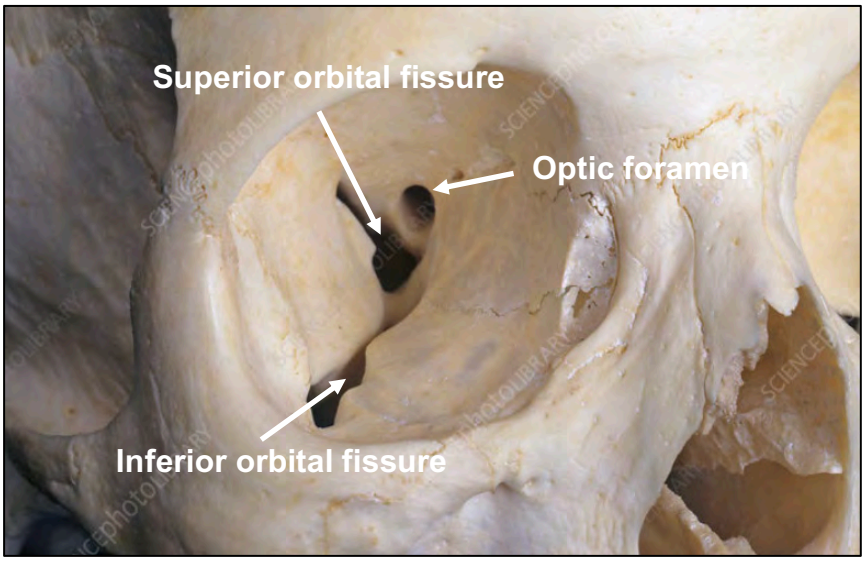


Figure 26 - Orbital cavity

Consists out of:

- Frontal bone.
- Ethmoid bone.
- Lacrimal bone.
- Maxillary bone.
- Zygomatic bone.
- Sphenoid bone.
- Palatine bone.

In this orbital cavity there are openings:

- Superior orbital fissure.
- Inferior orbital fissure.
- Optic foramen.

The direction of the optic canal is:

- Medially.
- Posteriorly.
- Cranially.
- Upwards in a 45° angle.

Both optic nerves join in the optic chiasma, just above the sella tursica. Pituitary tumors can cause interruption of the nerve conduction which leads to bitemporal hemianopia.

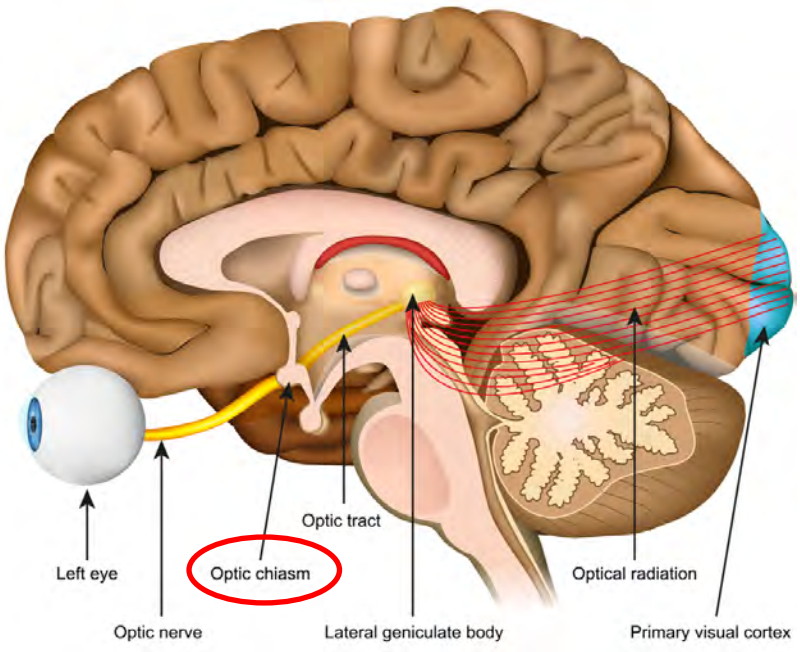


Figure 29 - Optic chiasma

The optic radiation has 3 groups:

- Inferior portion (serves the superior vision).
- Superior portion (serves the inferior vision).
- Central portion (macula fibers).

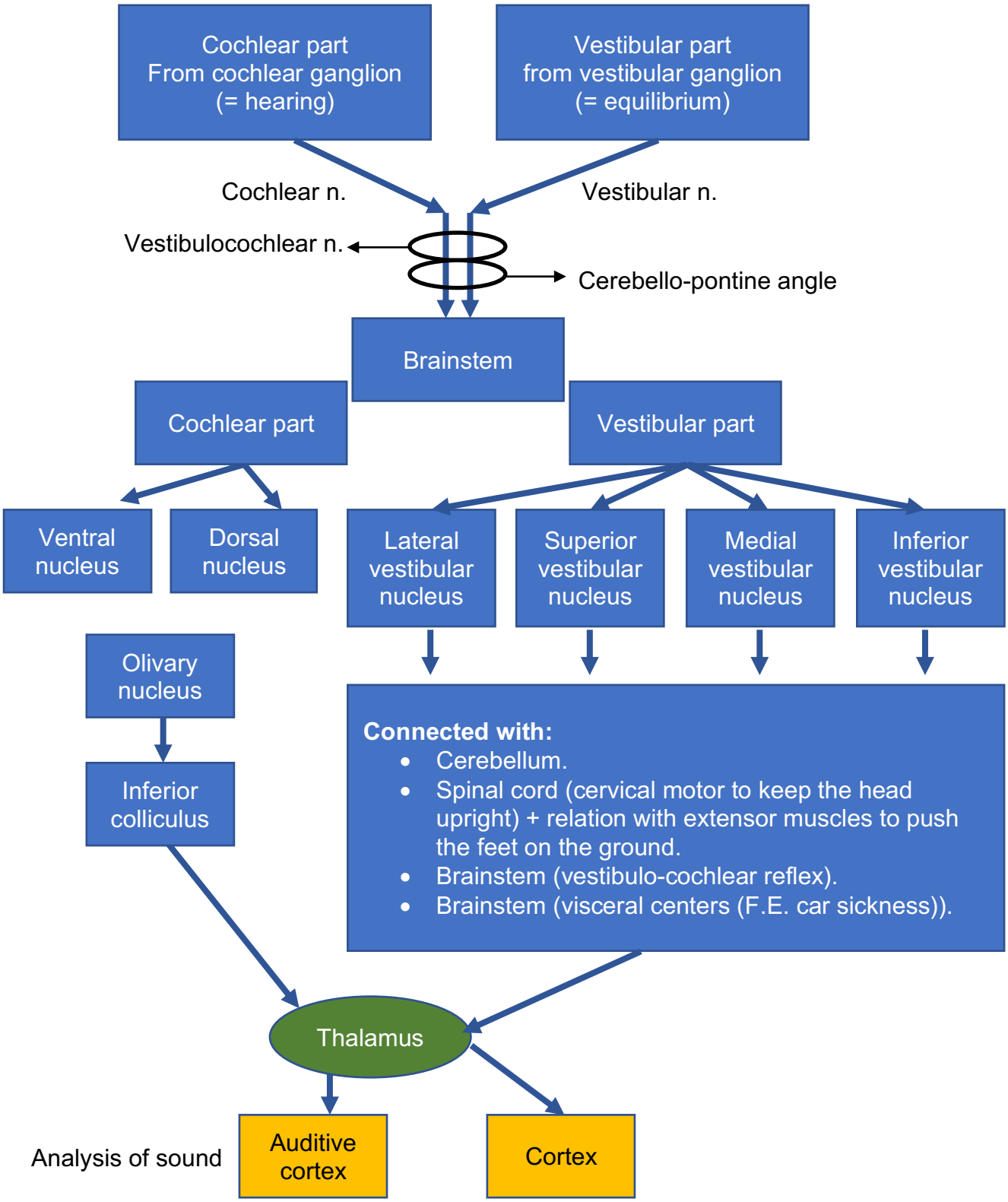
Blood supply of the optic radiation = anterior choroidal a. and posterior cerebral a.

The visual cortex

- 20-45 cm2.
- Thinnest portion of the cerebral cortex.
- Occupies 3-5 % of the brain.

9. Vestibulocochlear Nerve (VIII)

91. Course and Anatomy



The cochlear nerve

- Receives information from the tonotopically organized cochlea, the organ of hearing (Corti organ).
- Is formed by central processes of bipolar cells of the cochlear ganglion in the central modiolus of the cochlea.
- The cochlear nerve detects sound waves that vibrate the ear drum (tympanic membrane).
- The cochlea is on the bottom of the inner ear and it houses the hearing organ, the organ of Corti.

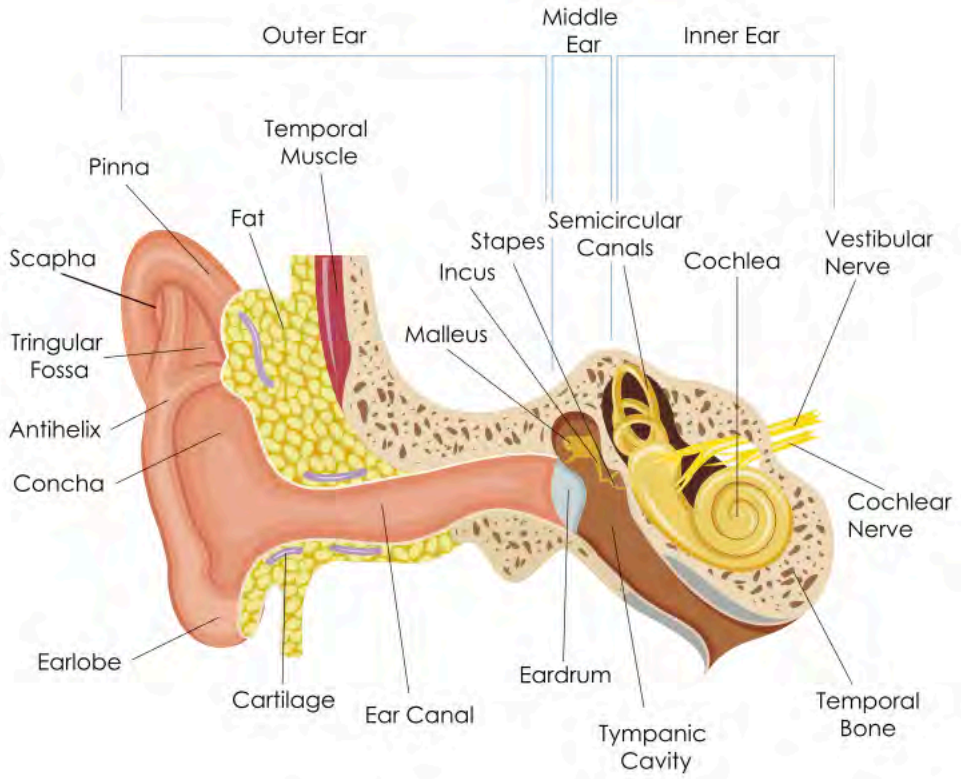


Figure 111 - The ear

- The cochlea is a spiral, fluid-filled cavity in the bony auditory labyrinth that contains the Organ of Corti, along its basilar membrane.
- The bipolar neurons making up the spiral (cochlear) ganglion create the link between the central nervous system (CNS) and the Organ of Corti.

- Visceral centers in the brainstem (for example car sickness).
- The cortex through the thalamus.

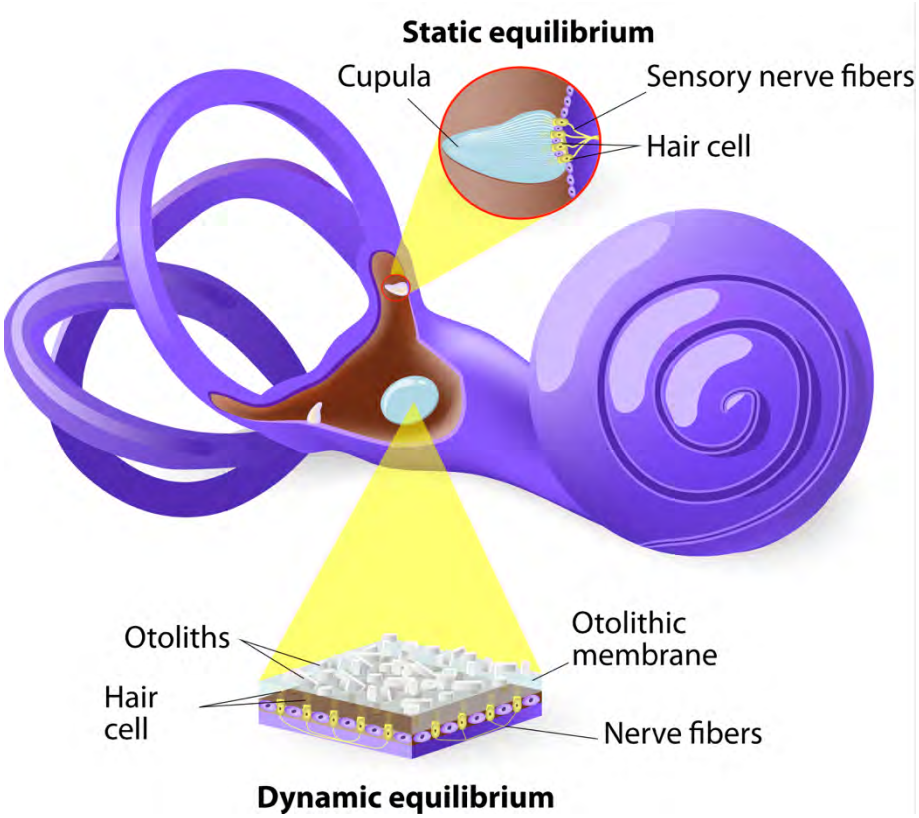


Figure 113 - Vestibular system

9.2. Function

9.2.1. Special Senses

- Cochlear part: Hearing.
- Vestibular part: Equilibrium.

The vestibular nerve relays information related to motion and position.

The vestibular system involves coordinated communication between the vestibular apparatus (semicircular canals, saccule, and utricle), ocular muscles, postural muscles, brainstem, and cerebral cortex.

Vestibular fibers also innervate the motoneurons of the extraocular muscles to mediate the vesiculo-ocular reflex.

Additionally, vestibular fibers innervate postural, spinal muscles to mediate the vestibulospinal reflex, via the lateral and medial vestibular spinal tracts.

Vestibular reflexes

- **Vestibulo-ocular reflex:** keep the eyes still in space when the head moves.
- **Vestibulo-colic reflex:** keeps the head still in space – or on a level plane when you walk.
- **Vestibular-spinal reflex:** adjusts posture for rapid changes in position.

9.3. Tests

9.3.1. Cochlear Part

9.3.1.1. Indications for Testing

- Reduction of hearing.
- Patients speaking with loud voice.
- Patients that turn the head with the better ear towards the examiner.

9.3.1.2. Hearing Test with Whispering Voice

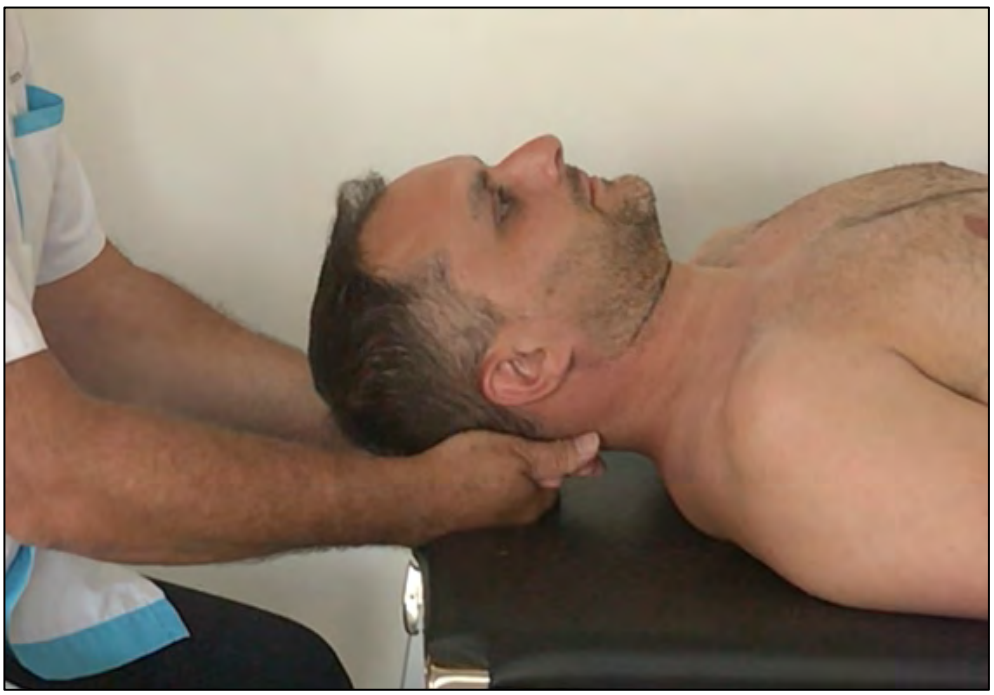
The examiner whispers a series of numbers. The patient had to point out the number with the fingers.

The test is done on both sides.

children such as sleep, calmness, well-feeling, digestion, heart functions, respiration…

Beside the posterior high cervical techniques, osteopaths should not forget to also treat the ventral soft tissues of the upper neck.

More techniques can be found in my book ‘Scientific Osteopathic Approach to Patients with Cervical Complaints and Headache’.



Video 62 - Compression of the 4th ventricle

Note:

If the environment is perceived as safe, the activity of the myelinated vagus increases. Via this part of the vagus the heartbeat slows down, the fight/flight reaction reduces, the stress response of the HPA axis reduces and inflammatory reactions reduce.

This promotes a climate of recovery, growth and positive social interaction. Through the vagus there is also a reciprocal link between involved social behavior and the physical condition.

The unmyelinated vagus is more primitive and older. This part of the vagus nerve stands for immobilization or a ‘freeze’ reaction (sometimes faint) when there is a thread (polyvagal theory).

Myelinated:	surrounded by a sheet of protein and fat that conduct impulses faster.
n.:	nerve.
Neuralgia:	a stabbing, burning, and often severe pain due to an irritated or damaged nerve.
Neurons:	are the fundamental units of the brain and nervous system, the cells responsible for receiving sensory input from the external world, for sending motor commands to our muscles, and for transforming and relaying the electrical signals at every step in between.
Opacity:	the quality of lacking transparency or translucence.
Osteopathic lesion:	loss of mobility.
Pacemaker:	pulse generator.
Palsy:	various types of paralysis, often accompanied by weakness and the loss of feeling and uncontrolled body movements such as shaking.
Paralysis:	the loss of the ability to move some or all of the body.
Paresis:	a condition in which muscle movement has become weakened or impaired.
Perilymph:	extracellular fluid located within the inner ear.
Plexus:	Nerve plexuses are composed of afferent and efferent fibers that arise from the merging of the anterior rami of spinal nerves and blood vessels.
Pons:	a major division of the brainstem.
Pontis:	at the level of the pons.
Postdrome:	after the syndrome.
Pretectal area:	a midbrain structure composed of seven nuclei and comprises part of the subcortical visual system.
Prodrome:	before the syndrome.
Proprioception:	also referred to as kinesthesia (or kinesthesia), is the sense of self-movement and body position. It is sometimes described as the ‘sixth sense’.
r.:	ramus.
RA:	Rheumatic Arthritis
Reflex:	or reflex action, is an involuntary and nearly instantaneous movement in response to a stimulus
Striated cortex:	the part of the visual cortex that is involved in processing visual information. The striate cortex is the first cortical visual area that receives input from the lateral geniculate nucleus in the thalamus.
Syndrome:	a group of symptoms which consistently occur together, or a condition characterized by a set of associated symptoms.
T.:	thoracic.

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Luc Peeters is an osteopath since 1985. He was the Joint-Principal of the largest Academy of Osteopathy in Europe from 1987 till 2020. He provided curricula, syllabuses and academic recognition from several universities.

This book gives a practical overview of the cranial nerves, their functions and possible disorders. The book also explains how osteopaths deal with cranial nerve disorders.

The theory and procedures in this book are checked on their scientific background and esotericism is avoided.

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