

Localization of Neurological Lesions

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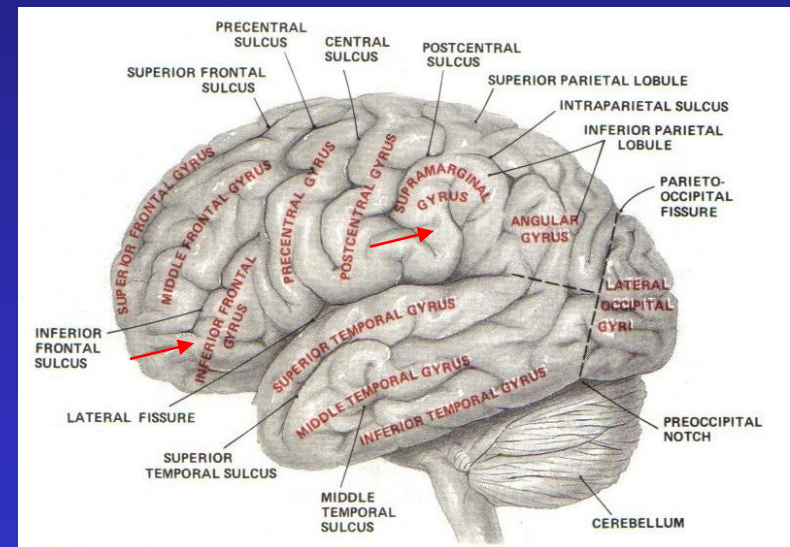
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Brain Lesions Suggested by Abnormal Mental Status and Speech

- Mental status: cortex dysfunction - confusion, lethargy/coma
- Speech:
 - Aphasia:
 - Broca's (motor) aphasia: preserved comprehension, non-fluent speech. Lesion to the dominant (left) hemisphere: **inferior frontal gyrus** of the frontal lobe.
 - Wernicke's aphasia (sensory): poor comprehension, fluent but often meaningless speech. Lesion to the **supramarginal gyrus** of the parietal lobe and upper part of temporal lobe.



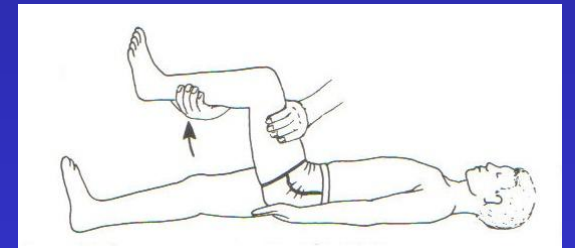
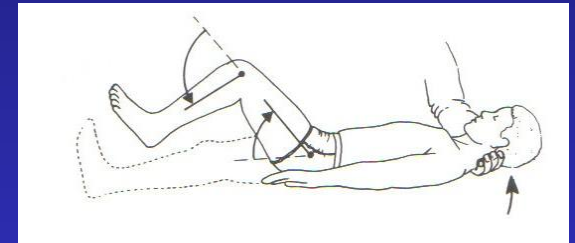
Other Speech Problems

- Speech:
 - Dysphonia: unable to produce normal volume of sound or speaks in a whisper. Lesion of vocal cord, laryngeal problem, myasthenia gravis
 - Dysarthria: slurred speech, lesion in cerebellum, upper and lower motor neuron disease, parkinsonism



Brain Lesions Suggested by the Abnormal Signs

- Meningeal irritation:
 - Neck stiffness
 - Brudzinski sign: lift the head and look for hip and knee flexion.
 - Positive: hip and knee flexion
 - Kernig's sign: flex the leg at the hip with the knee flexed, and try to extend the knee.
 - Positive: resistance to knee straightening

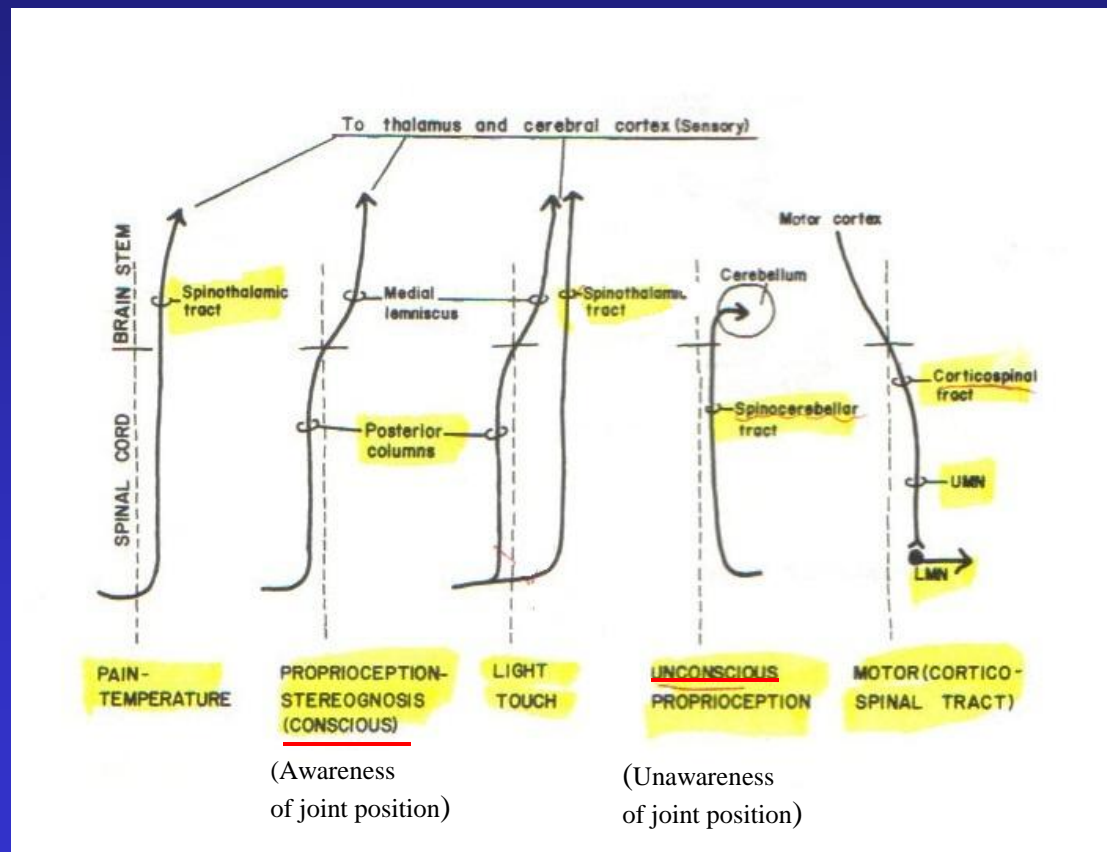


Lesions Suggested by Abnormal Cranial Nerve Function

- CN 1: loss of smelling
- CN 2: loss of visual acuity
- CN 3,4,6: loss of extraocular eye movement
- CN 5: abnormal facial sensation, loss of corneal reflex and symmetrical jaw movement
- CN 7: ipsilateral facial weakness
- CN 8: hearing loss
- CN 9, 10: loss of palate elevation and gag reflex
- CN 11: loss of shoulder shrugging function
- CN 12: tongue deviation to the weak side

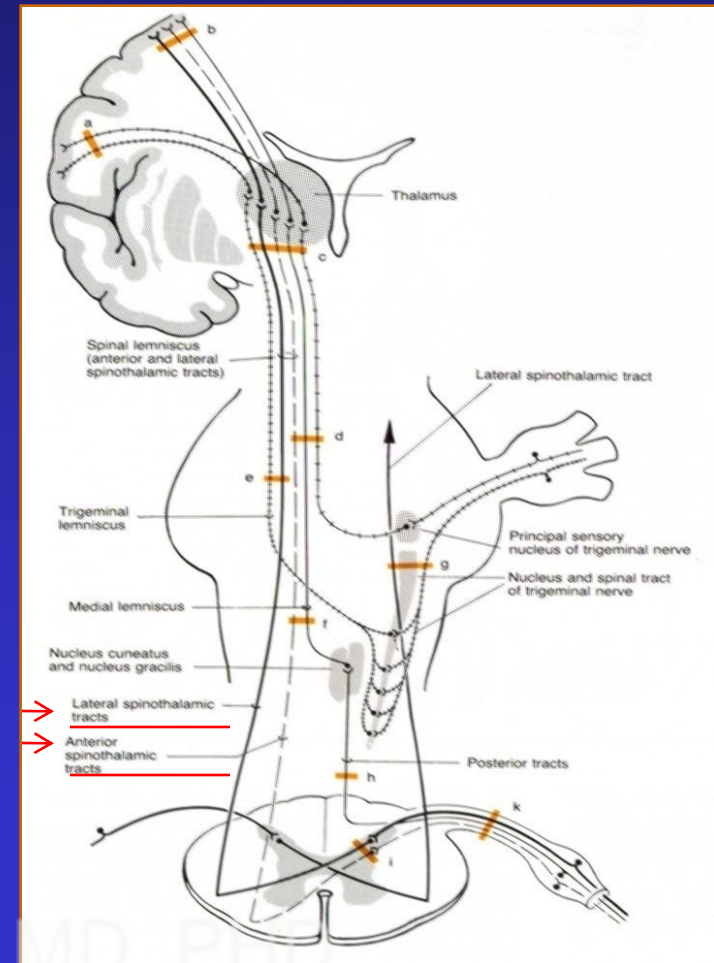


Lesions of Motor, Coordination, and Sensory Pathways (Overview)



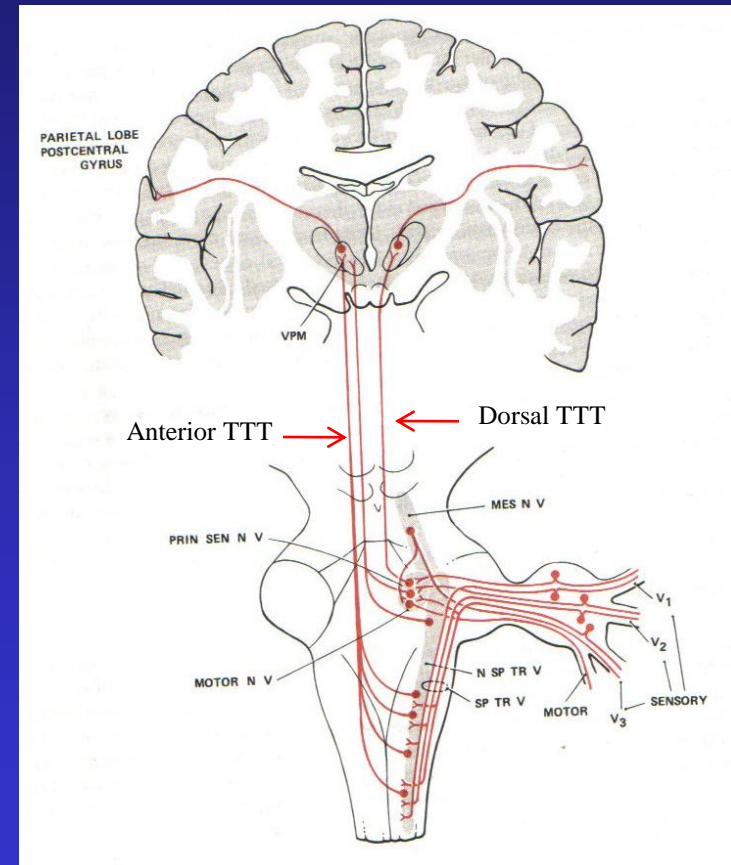
Lesions of the Sensory Pathway – The Spinothalamic Tract

- Loss of pain and temperature on the contralateral side, beginning 1-2 level below to the lesion (decussation at the anterior white commissure usually occurs 1-2 spinal nerve segments above the point of entry)
- Lateral STT (pain and temperature)
- Anterior (ventral) STT (pressure and crude touch)



Lesions of the Sensory Pathway – The Trigeminothalamic Tract (1)

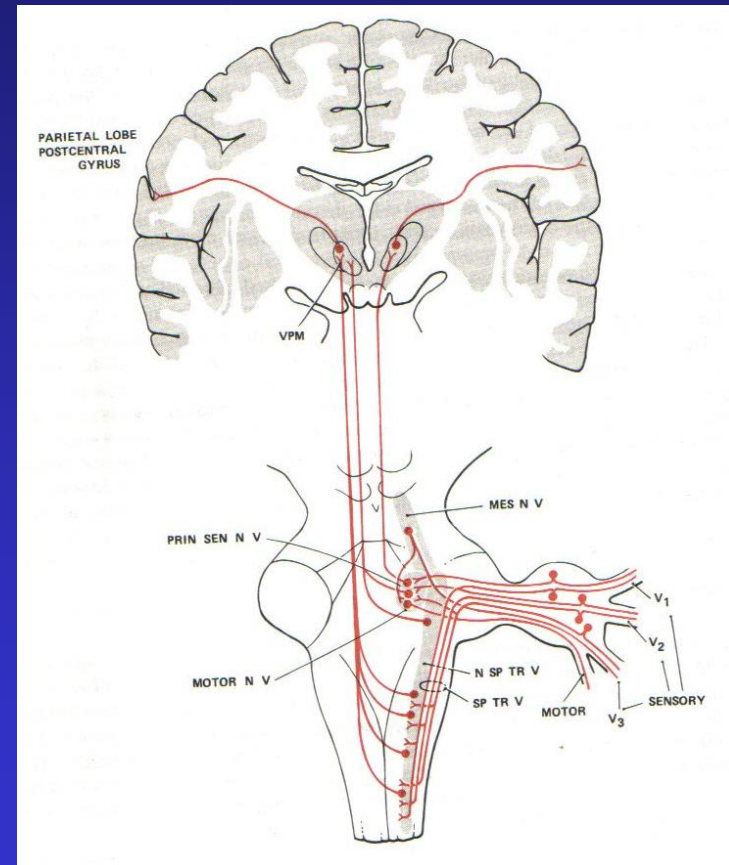
- Trigeminal nucleus: three sensory and one motor:
 - Mesencephalic nucleus : proprioception of periodontium and the muscle of mastication
 - Project to the trigeminal motor neuron mediating the monosynaptic jaw jerk reflex
 - Principle (chief) sensory nucleus: mediating facial touch, conscious proprioception of the jaw
 - Project to contralateral ventral posteromedial (VPM) of the thalamus via **anterior** trigeminothalamic tract
 - Oral cavity information travels to the ipsilateral VPM via **dorsal** trigeminothalamic tract
 - Spinal trigeminal nucleus: touch, pain, temperature of ipsilateral face
 - Subnucleus oralis: discriminative fine tactile sense
 - Subnucleus interpolaris: tactile sense and dental pain
 - Subnucleus caudalis: head pain and temperature
 - Project to contralateral VPM via **anterior** trigeminothalamic tract



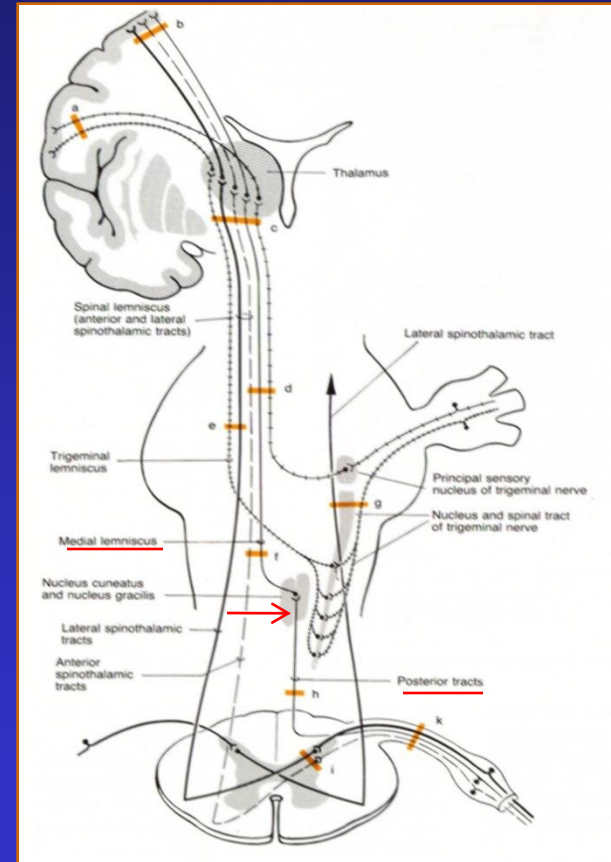
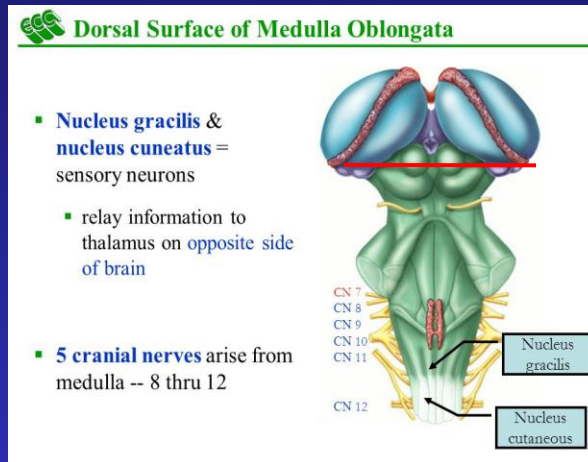
Trigeminal motor nucleus: innervates the muscle of mastication

Lesions of the Sensory Pathway – The Trigeminothalamic Tract (2)

- Lesion of the Trigeminothalamic tract:
 - Anterior tract: loss of head, face, oral cavity - pain, temperature, discriminative fine touch and crude touch, conscious proprioception on the contralateral side
 - Dorsal tract: ipsilateral oral cavity touch



Lesions of Sensory Pathway – The Dorsal Column - Medial Lemniscus Pathway

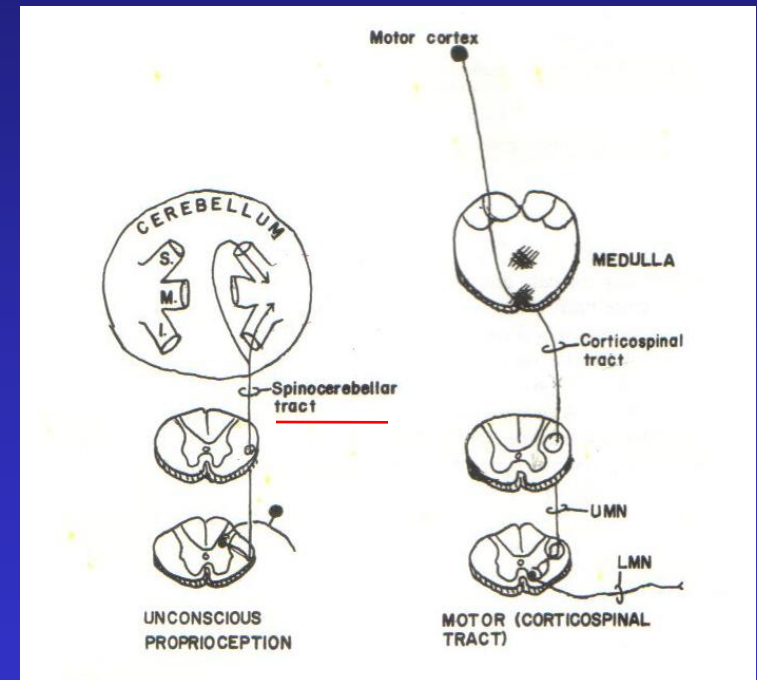


- Dorsal column (in spinal cord, synapse in nu. cuneatus and nu. gracilis before decussation) - medial lemniscus (in brainstem) tract
 - **Conscious** proprioception (able to sense and describe the position of the limb), & stereognosis (identify the object by touch)
 - **Below** the sensory decussation in the medulla (lesion of the dorsal column): loss of light touch, 2-point discrimination, vibration, and proprioception/joint positional sense to the **ipsilateral** side, and below the level of the lesion
 - **Above** the decussation (lesion of the medial lemniscus): sensory loss **contralateral** to the lesion



Lesions of the Coordination Pathway – The Spinocerebellar Tract

- **Unconscious** proprioception: able to walk or perform other complex acts without having to think about which joint to flex or extend
- Transmitted from the spinal cord to the same side of the cerebellum.
- Ataxia to the same side of the lesion in the coordination test.



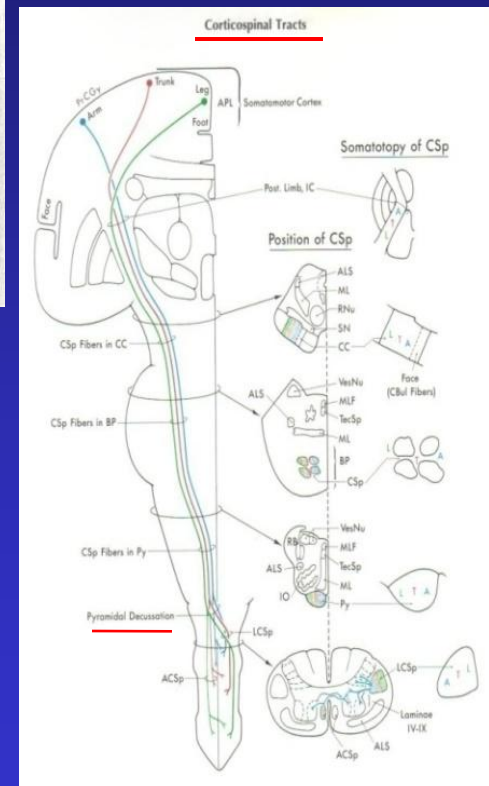
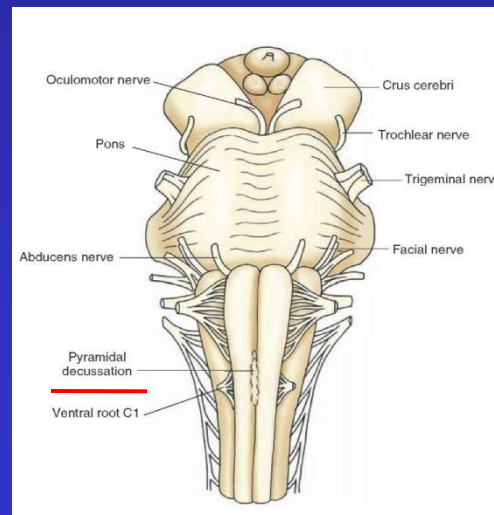
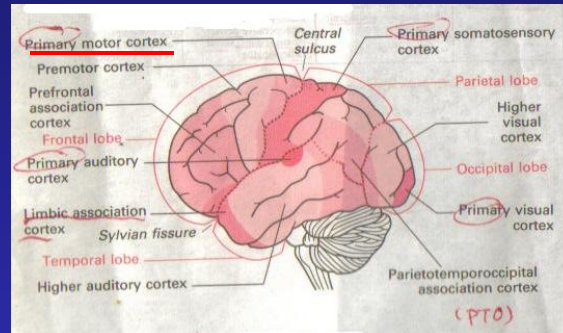
Lesions of Motor Pathway – The Descending Corticospinal Tract

Lesion above the medulla pyramidal decussation:

- E.g. motor cortex (frontal lobe), internal capsule, midbrain, pon, medulla, etc
- Muscle weakness contralateral to the side of lesion
- Babinski's sign: positive, contralateral to the side of lesion

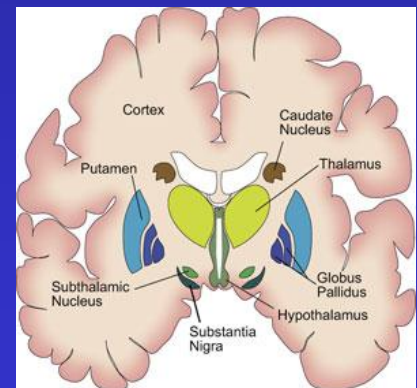
Lesion below the decussation:

- E.g. cervical cord
- Muscle weakness ipsilateral to the side of lesion
- Babinski's sign: positive, ipsilateral to the side of lesion



Lesions Suggested by the Abnormal Gait

- Stroke or lesion to the frontal **motor cortex**: hemiplegic gait contralateral to the lesion
- **Cerebellar** ataxia: deviate to the ipsilateral side of the lesion
- Loss of **posterior column** function: sensory ataxia, loss of proprioception/joint positional sense in Romberg's test
 - Above the sensory decussation in Medulla: contralateral to lesion
 - Below: ipsilateral
- **Basal ganglion**
 - components: dorsal striatum (caudate nucleus & putamen), ventral striatum (nucleus accumbens and olfactory tubercle), globus pallidus, ventral pallidum, substantia nigra, subthalamic nucleus
 - dysfunction: shuffle gait in Parkinson's disease.



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

