

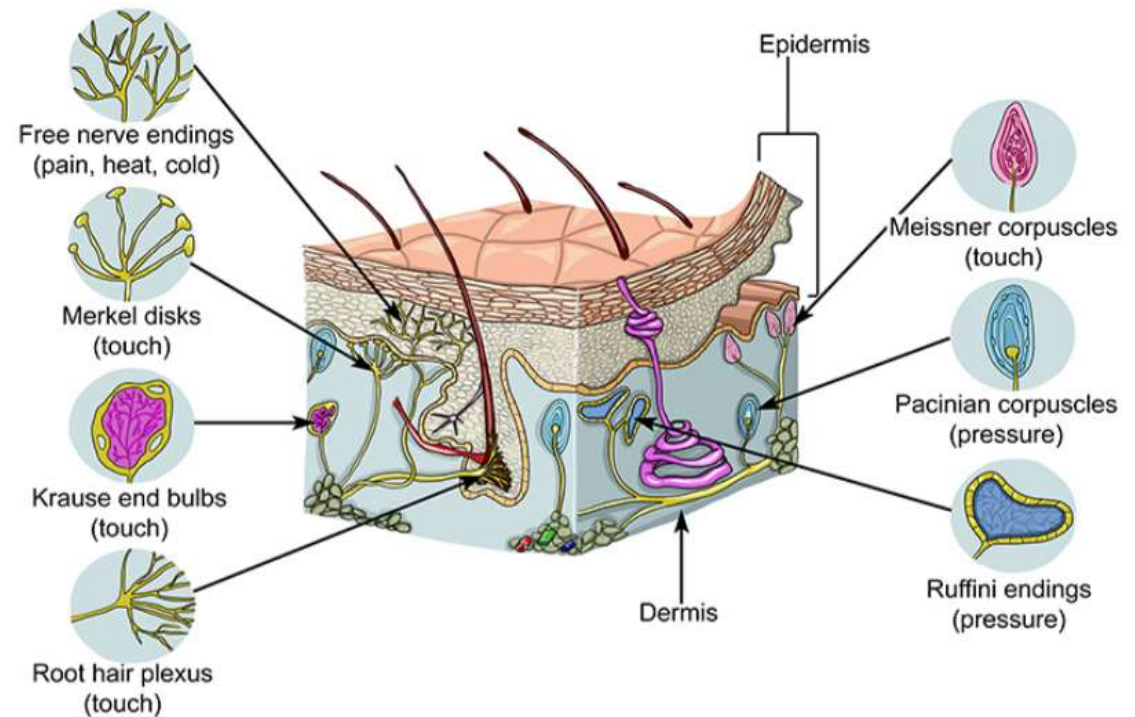


Somatic senses and equilibrium

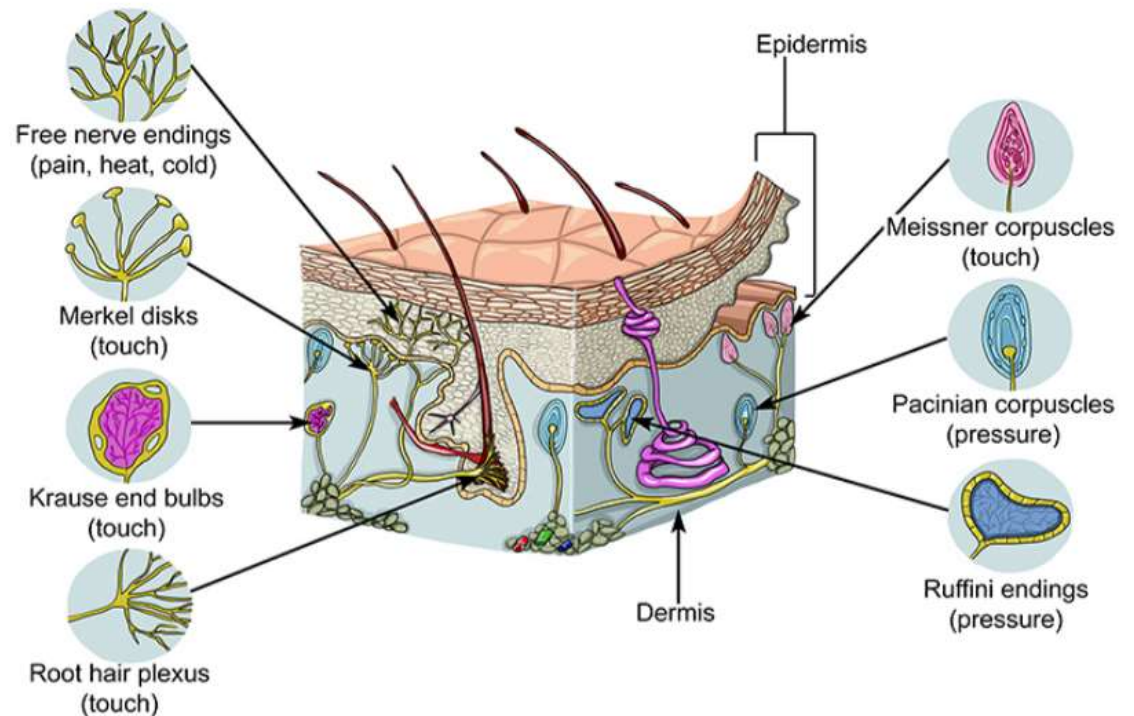
12.3.2024

Cutaneous sensations

- Tactile (touch, pressure), thermal (cold, warm), pain
- Several types of receptors: free nerve endings and specialized receptors
- Lots of receptors in hands, feet, face

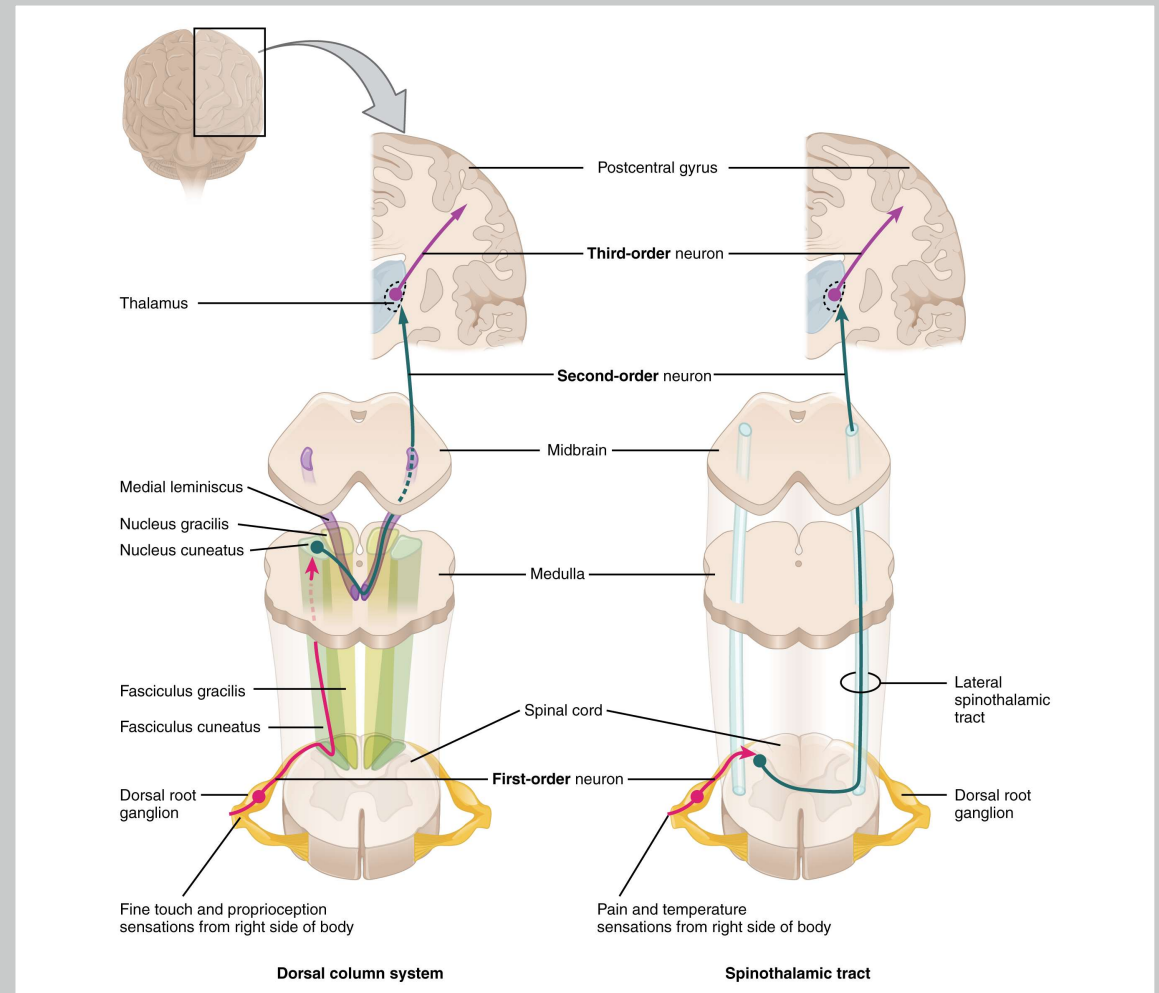


- Cold and warm receptors have their preferred temperatures:
cold receptors 15-35 °C,
warm receptors 35-45 °C
- Sensing of heat (> 45 °C) is mediated mainly by pain receptors, but partly also by cold receptors

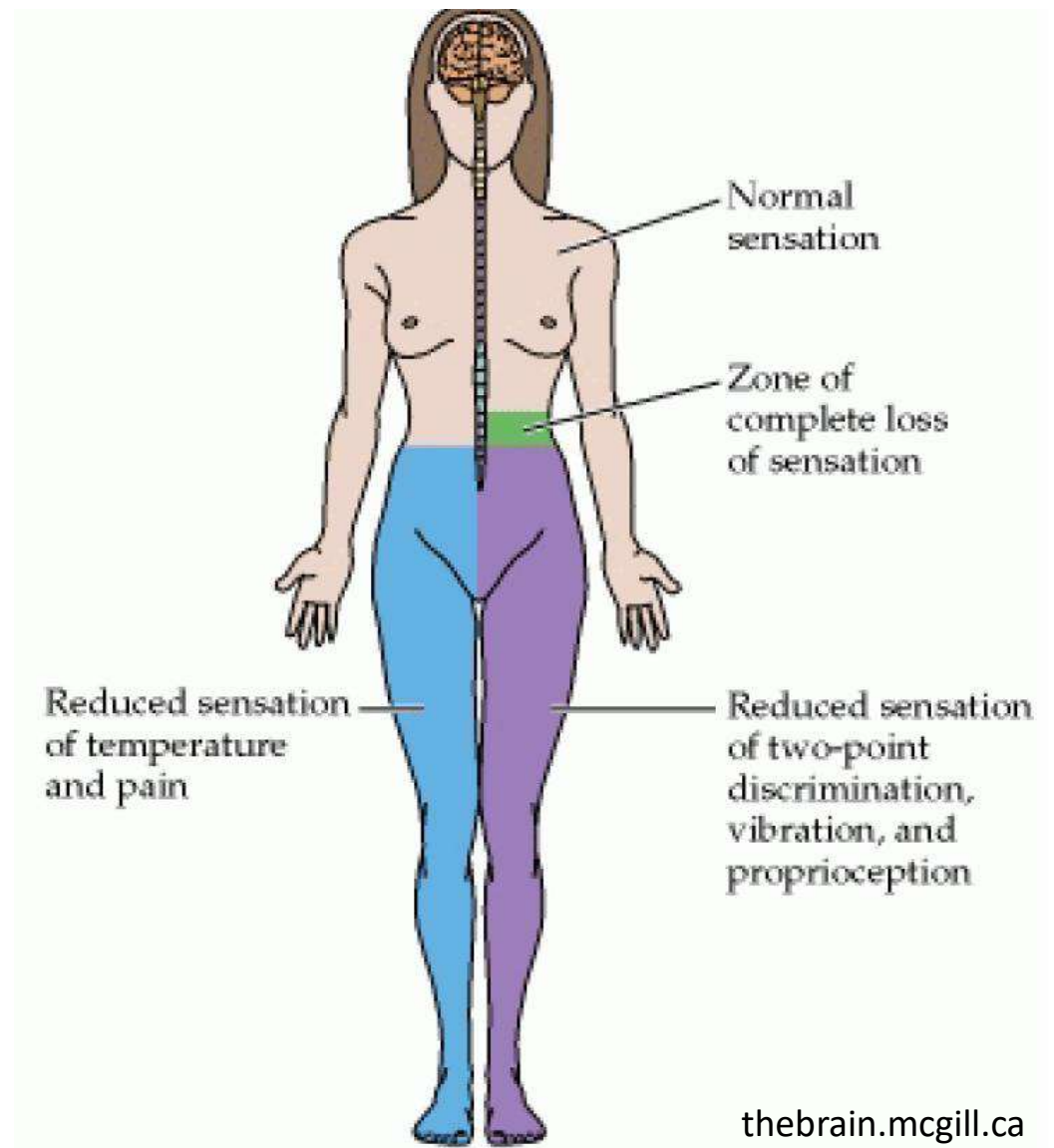


Two somatic sensory pathways to the cortex

- Dorsal/posterior column system: touch, pressure, vibration, proprioception
 - ✓ Thick, fast fibers
- Anterolateral/spinothalamic tract: pain, temperature
 - ✓ Part of the sensation occurs already during the course of the tract



Dissociated
sensory loss
possible

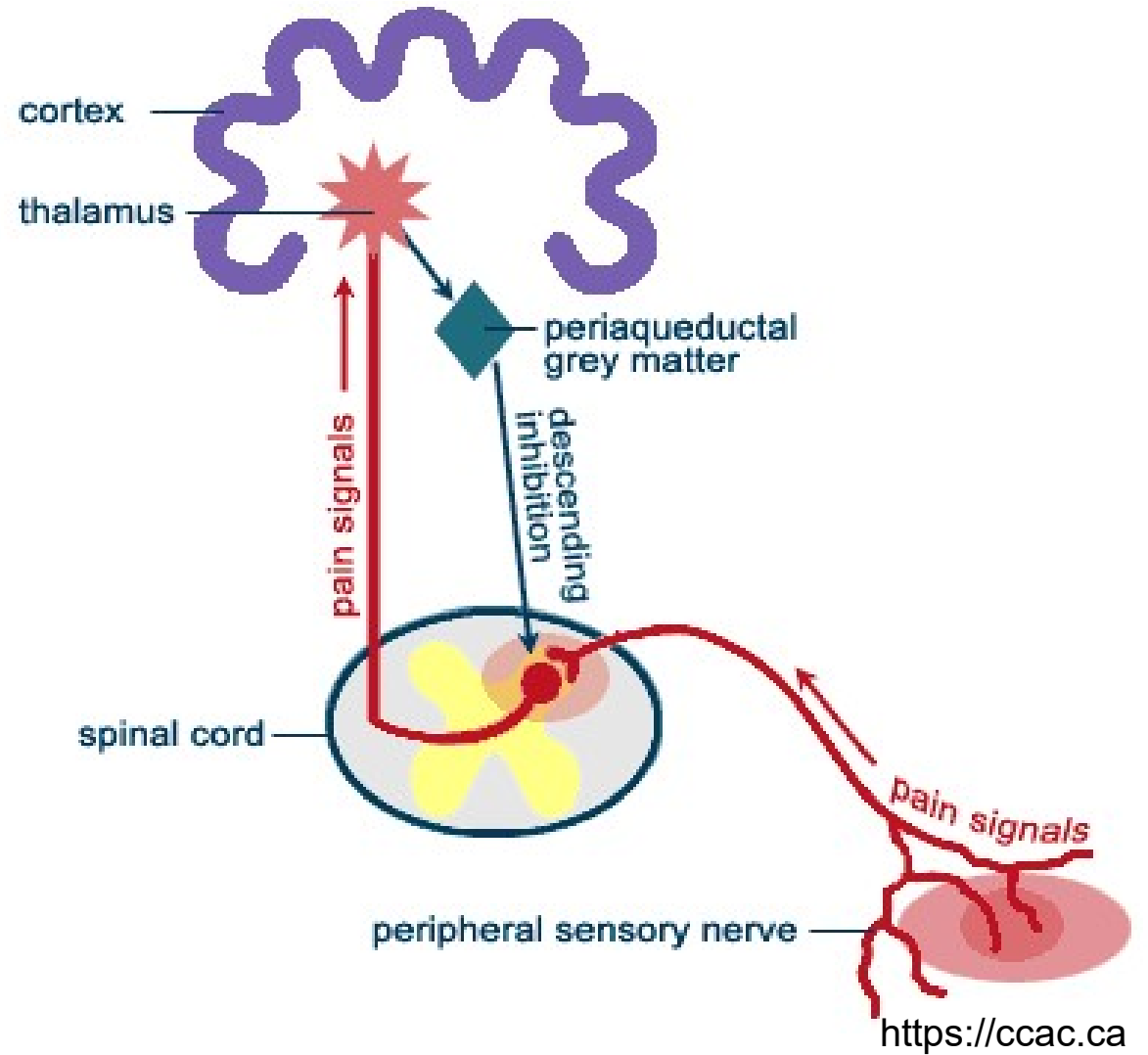


Pain

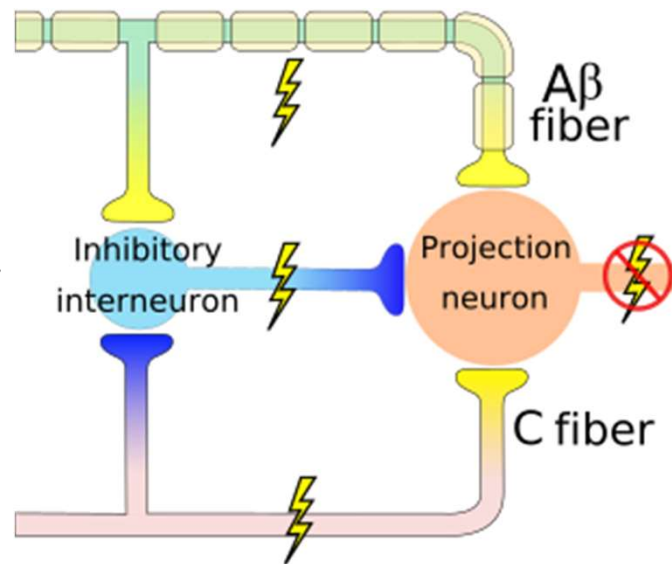
- Receptors are free nerve-endings
 - ✓ React to substances released from the injured cells, exceptional temperatures, hypoxia
 - ✓ Prominent on skin, vascular walls, intestines; only little in brain and internal organs
- Projection pain, referred pain
- *Itch* also results from stimulation of free nerve endings

SUPERFICIAL SOMATIC PAIN	Skin, superficial tissues Often prickling or burning
DEEP SOMATIC PAIN	Muscles, joints, bone, tendons Often throbbing or aching
VISCERAL PAIN	Inner organs, visceral walls Often throbbing or wave-like Can be referred

Intrinsic analgesia system: Tracts that inhibit the sense of pain



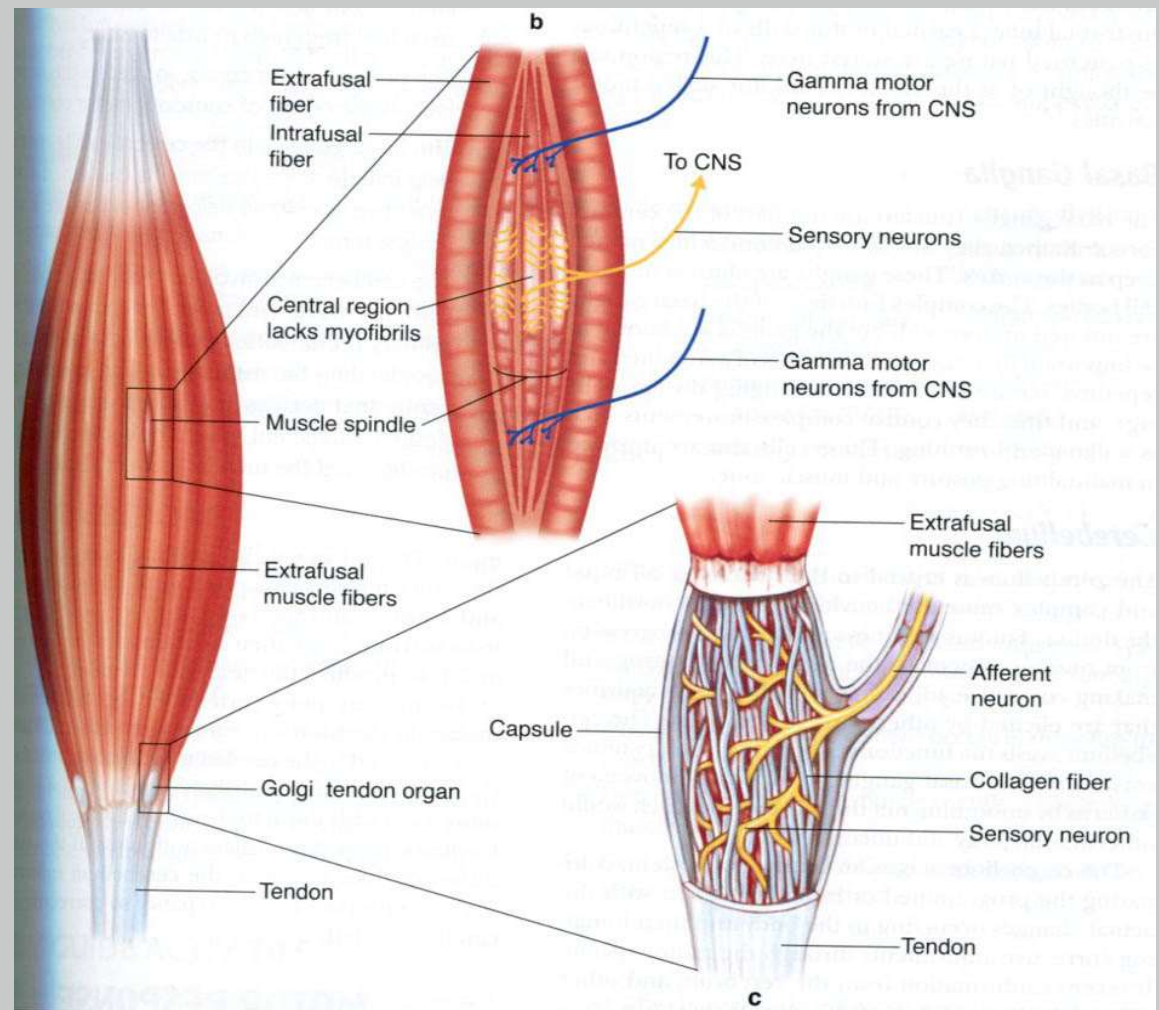
Activation of the competing sensory tract: transcutaneous nerve stimulation, acupuncture



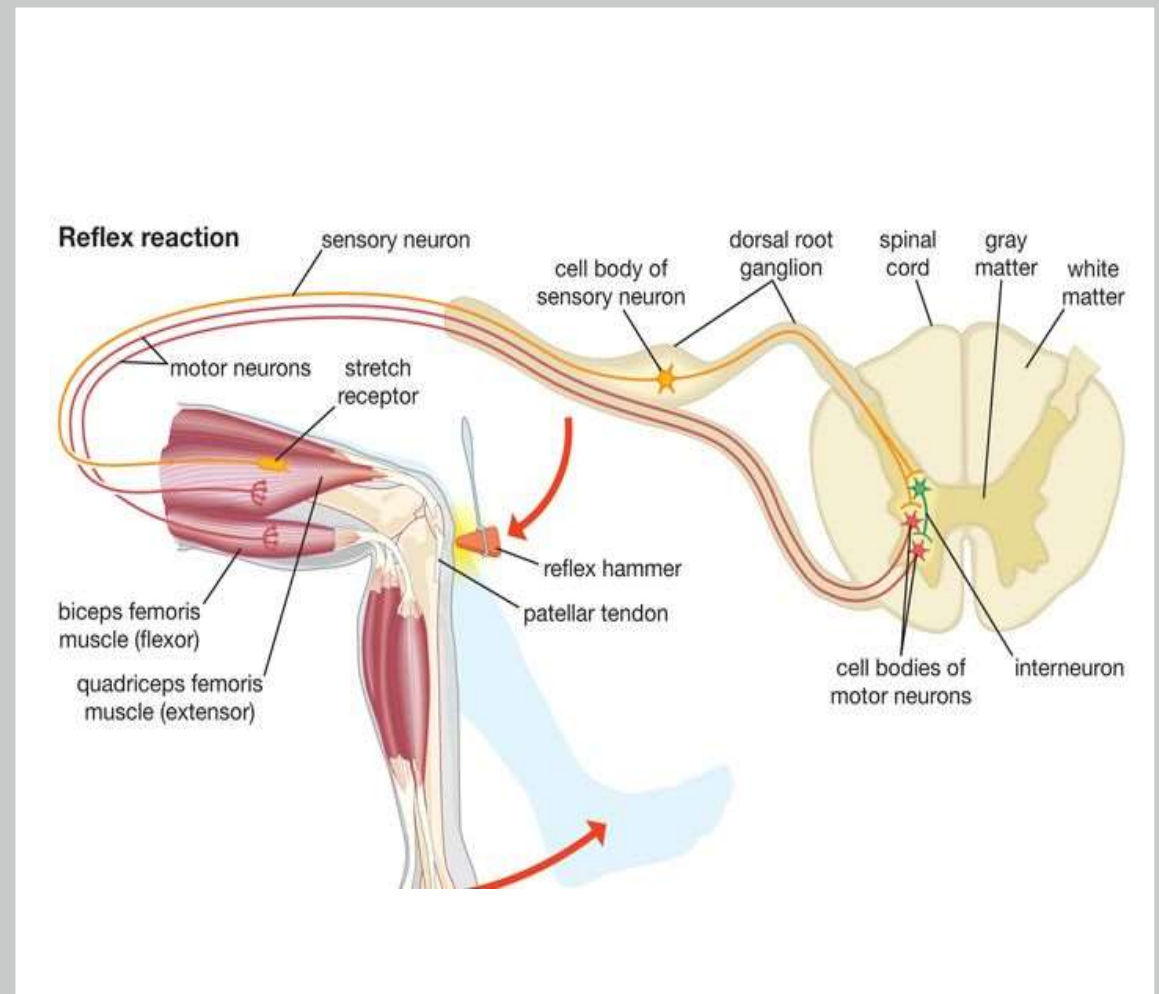
Wikipedia, physio-pedia.com

Proprioception

- Sense of position and equilibrium depend on receptors in muscles, tendons, joints, skin, as well as of vision and vestibular organ in the inner ear
- *Proprioceptors* in muscles, tendons and joints
- Muscle spindles, and Golgi tendon organs



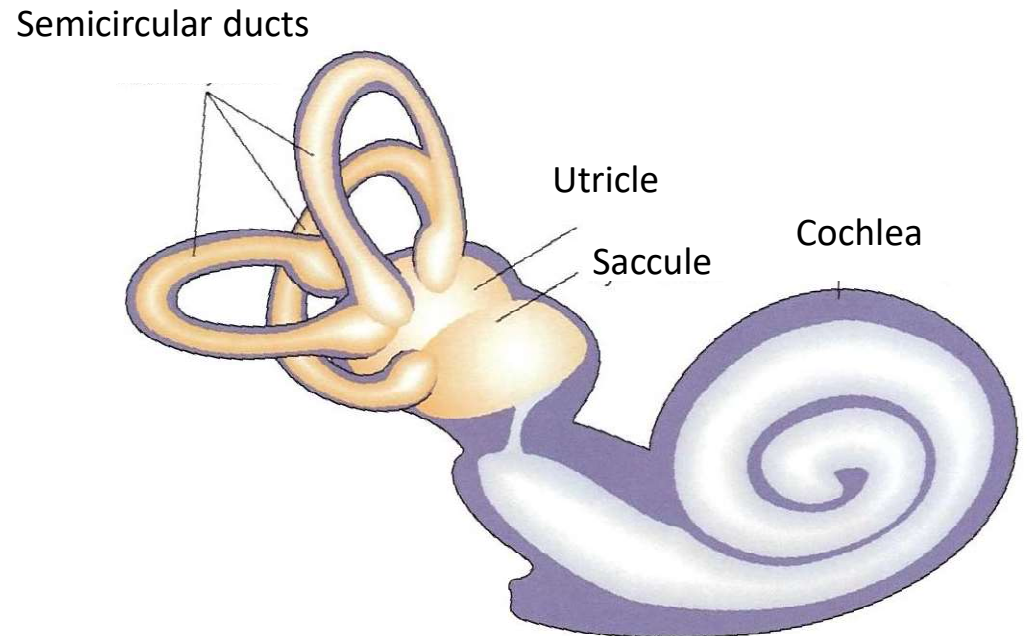
- Muscle spindles: Monitor muscle length and its change
gammamotoneurons increase the sensitivity to the length changes
- Golgi tendon receptors: Information about changes in muscle tension
- Inhibit harmful, too strong movements
- Receptors in joints sense changes in joint angle



<https://www.britannica.com/science/reflex-physiology>

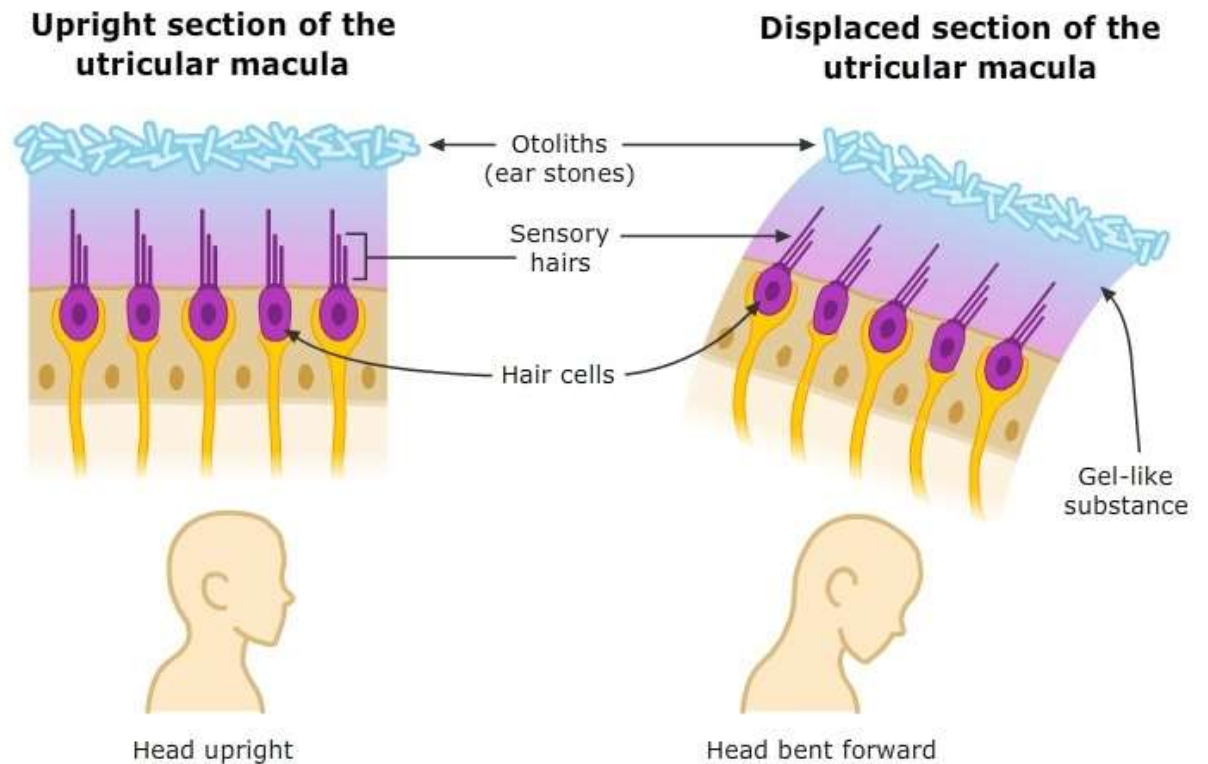
Sense of equilibrium

- Inner ear contains sensory organs that detect the head tilt and its acceleration
- Utricle and saccule (head position) and three direction-sensitive semicircular tracts (angular acceleration)



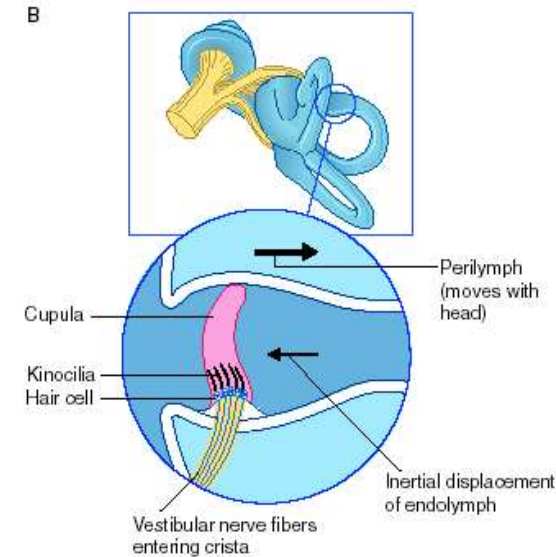
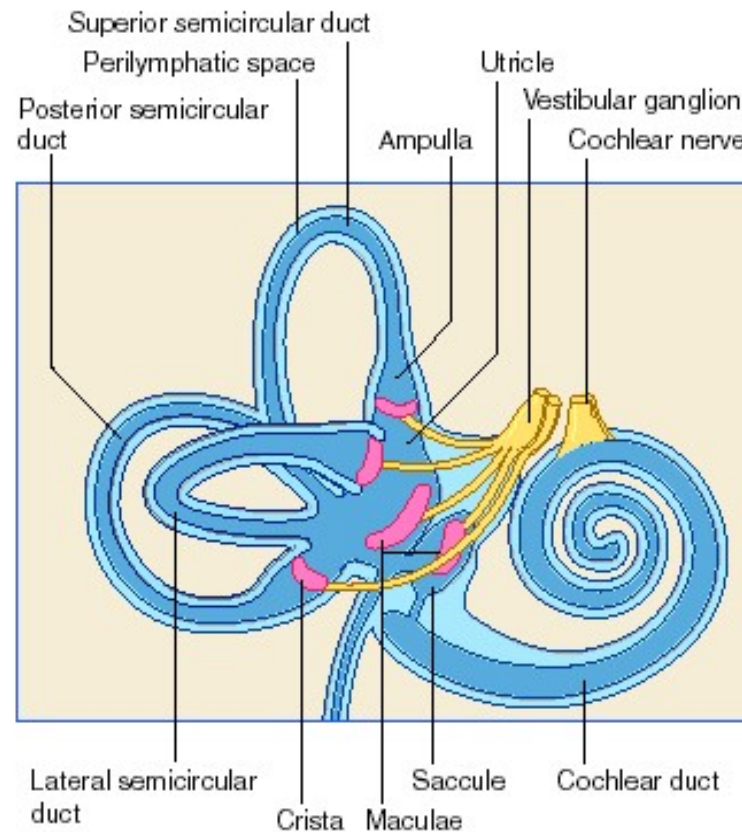
The receptors in the inner ear react to changes in head position

- Utricle and saccule have hair cells which are covered by viscous fluid and small stones (otoliths)
- Head movements activate hair cells → nerve impulses are conducted together with cranial nerve VIII to the brainstem nuclei and to the cortex

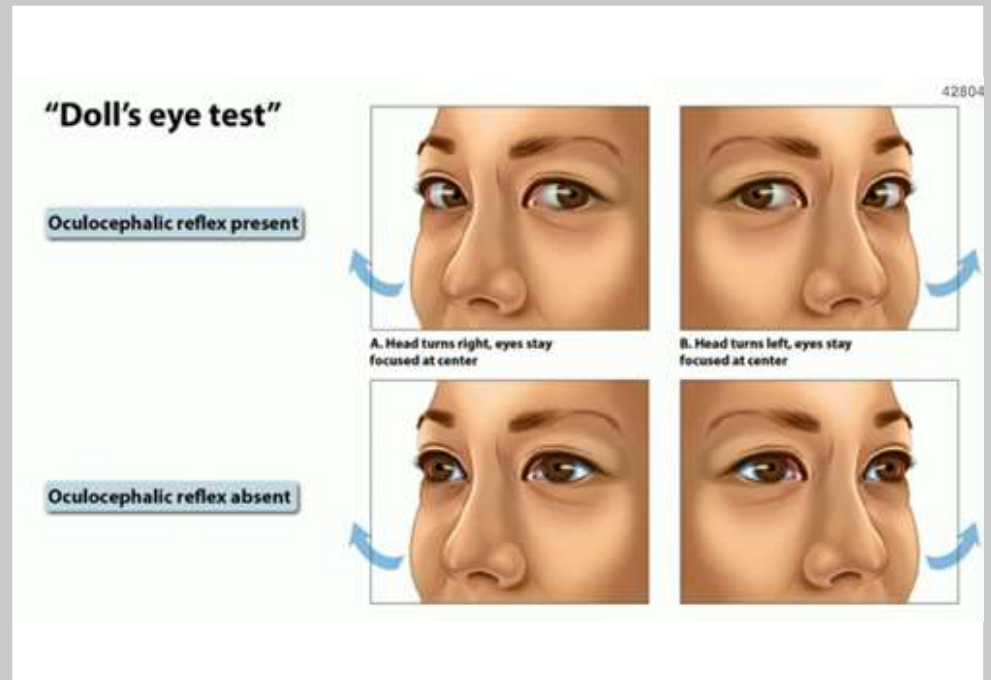
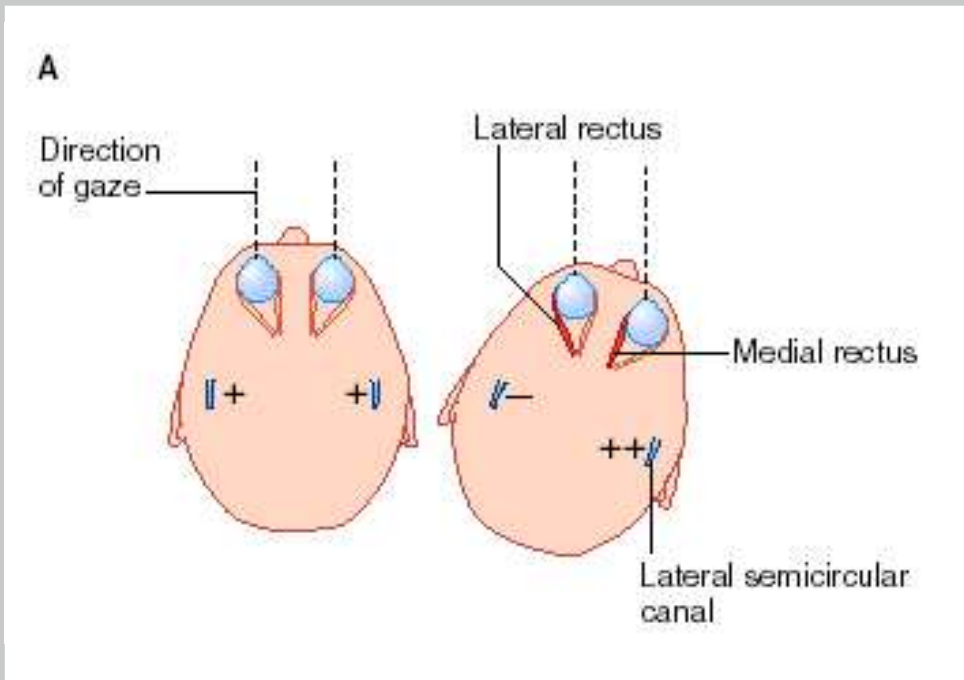


Semicircular ducts react to changes in angular acceleration

- 3 semicircular ducts in 90° angle to each other
- Head's angular acceleration or deacceleration → hair cells are activated → VIII cranial nerve



Signals from semicircular canals help to keep the gaze direction steady



<http://www.fleshandbones.com/readingroom/pdf/289.pdf>,

<https://quizlet.com/546233604/neuro-1-2-neuro-exam-viral-clostridial-diseases-flash-cards/>