XXX. Vertigo and nystagmus

Practicals

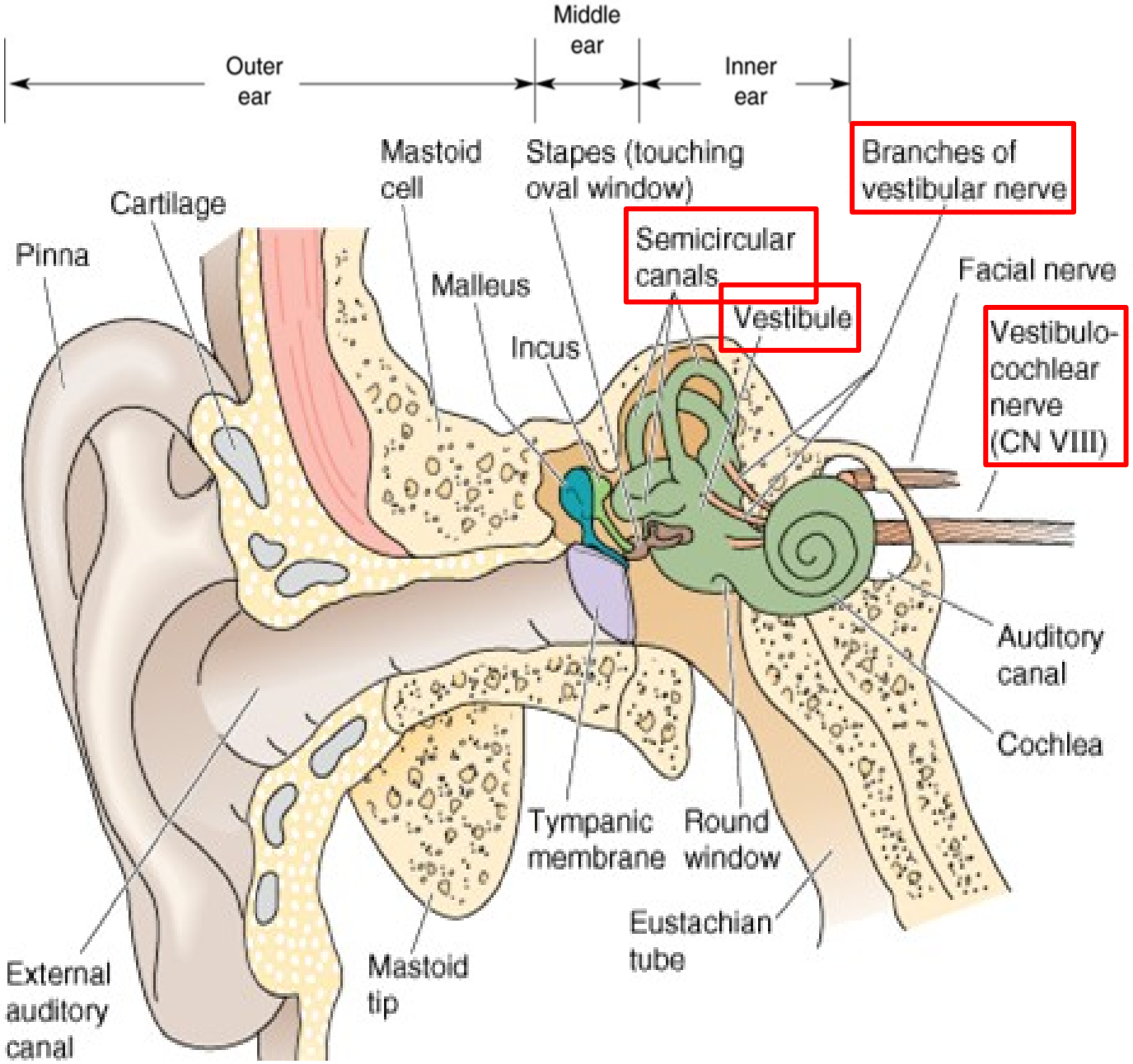
Department of Physiology LF MU

Nystagmus

- rhythmic eye-bulb movements, 2 components: slow deviation to one side and fast twitch to the opposite side (slow is vestibular, fast from brainstem structures)
- Nystagmus at rest (unprovoked) – vestibular system, neural pathways or cerebellum is affected by some pathological process
- Direction of the nystagmus is determined according to the fast twitch

The Vestibular System

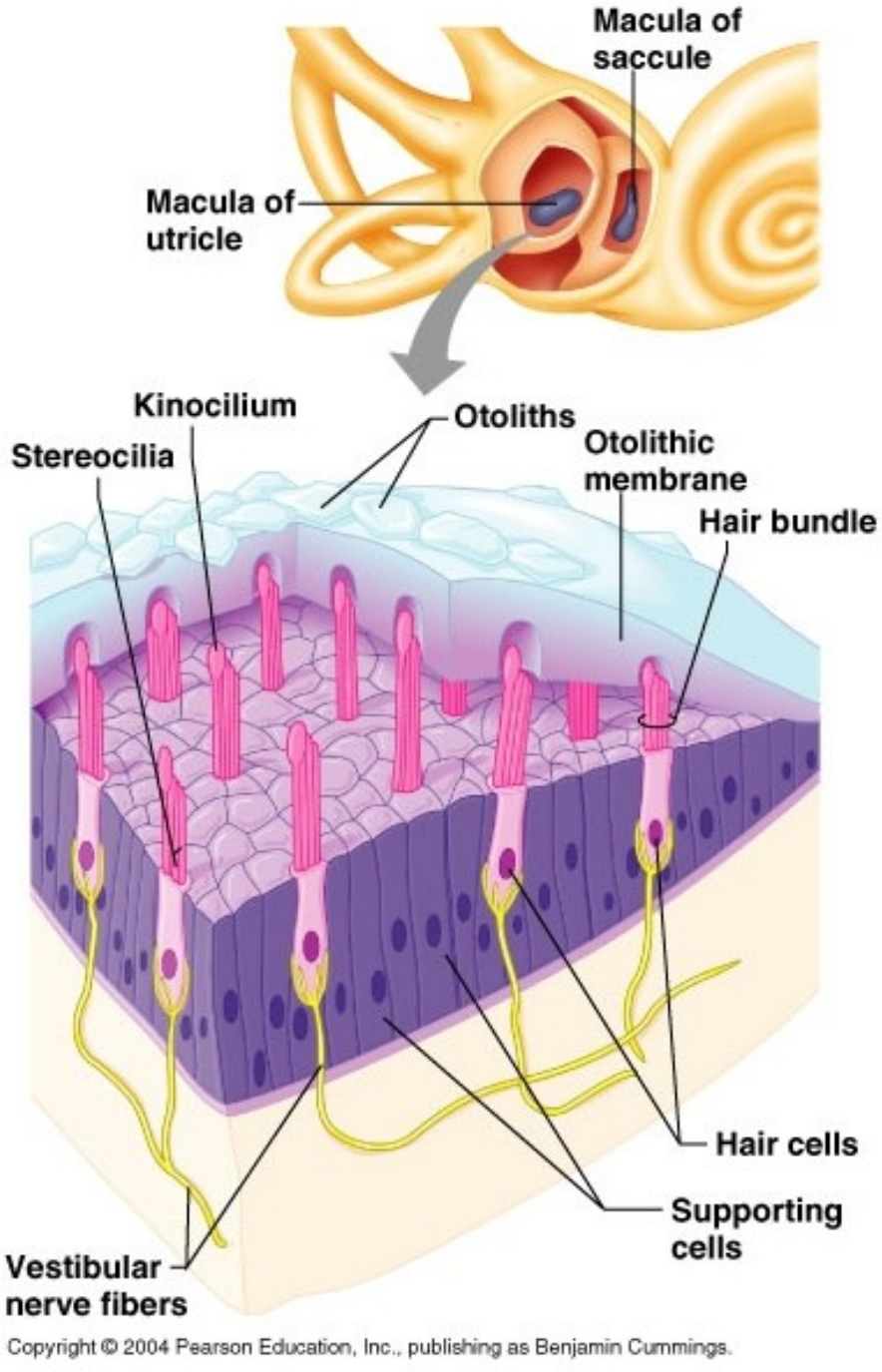
structure



The Vestibular System

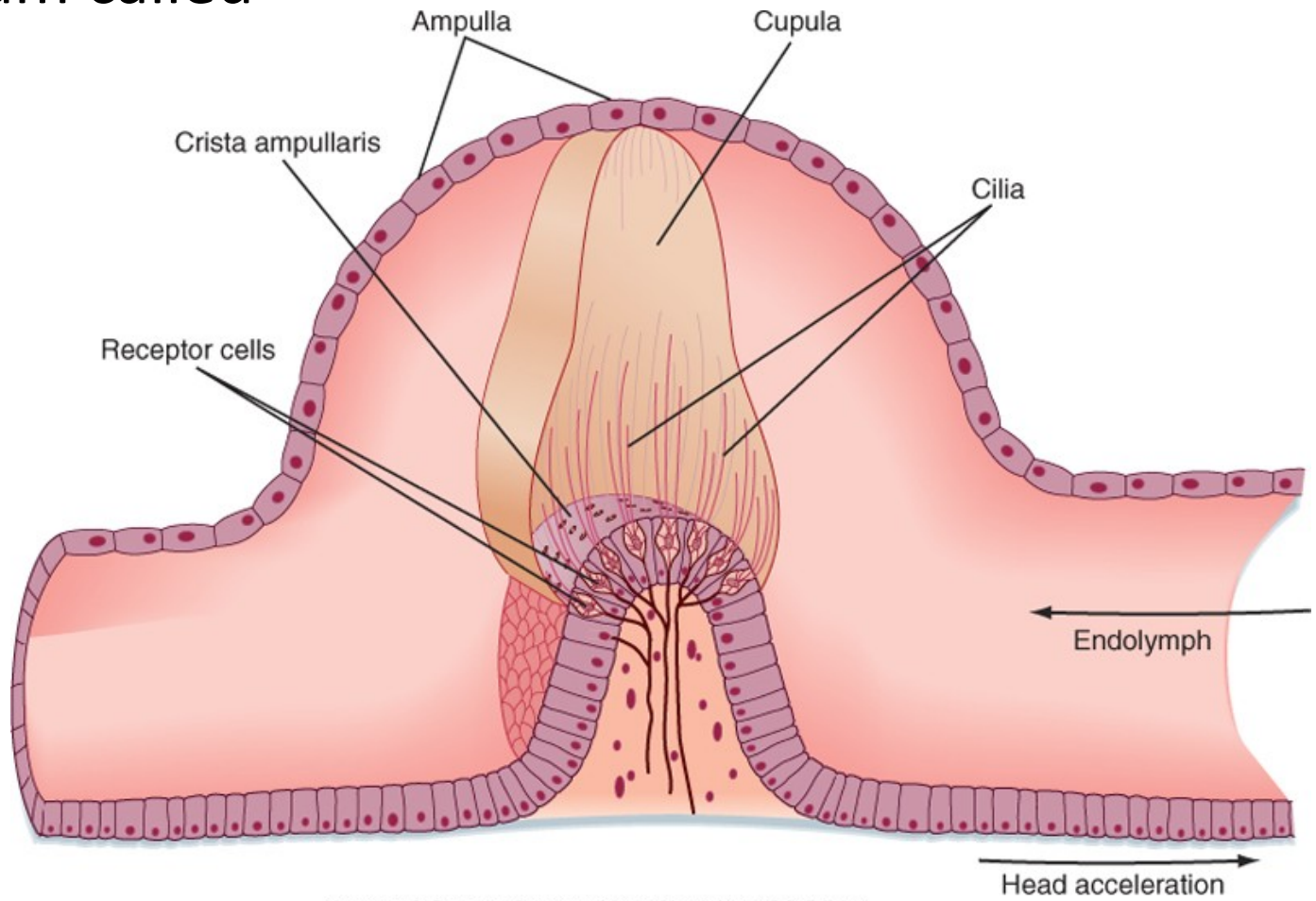
- The **vestibulo-ocular reflex** (VOR) stabilizes retinal images during head motion by counter-rotating the eyes at the same speed as the head but in the opposite direction

- **Semicircular canals** (kinetic sensor)
  - cristae ampullares, specialized for respondir to rotational acceleration of the head
- **Utriculus, sacculus** - maculae staticae (static sensor)
  - linear acceleration, head position in the gravitational field



The Vestibular System – Semicircular canals

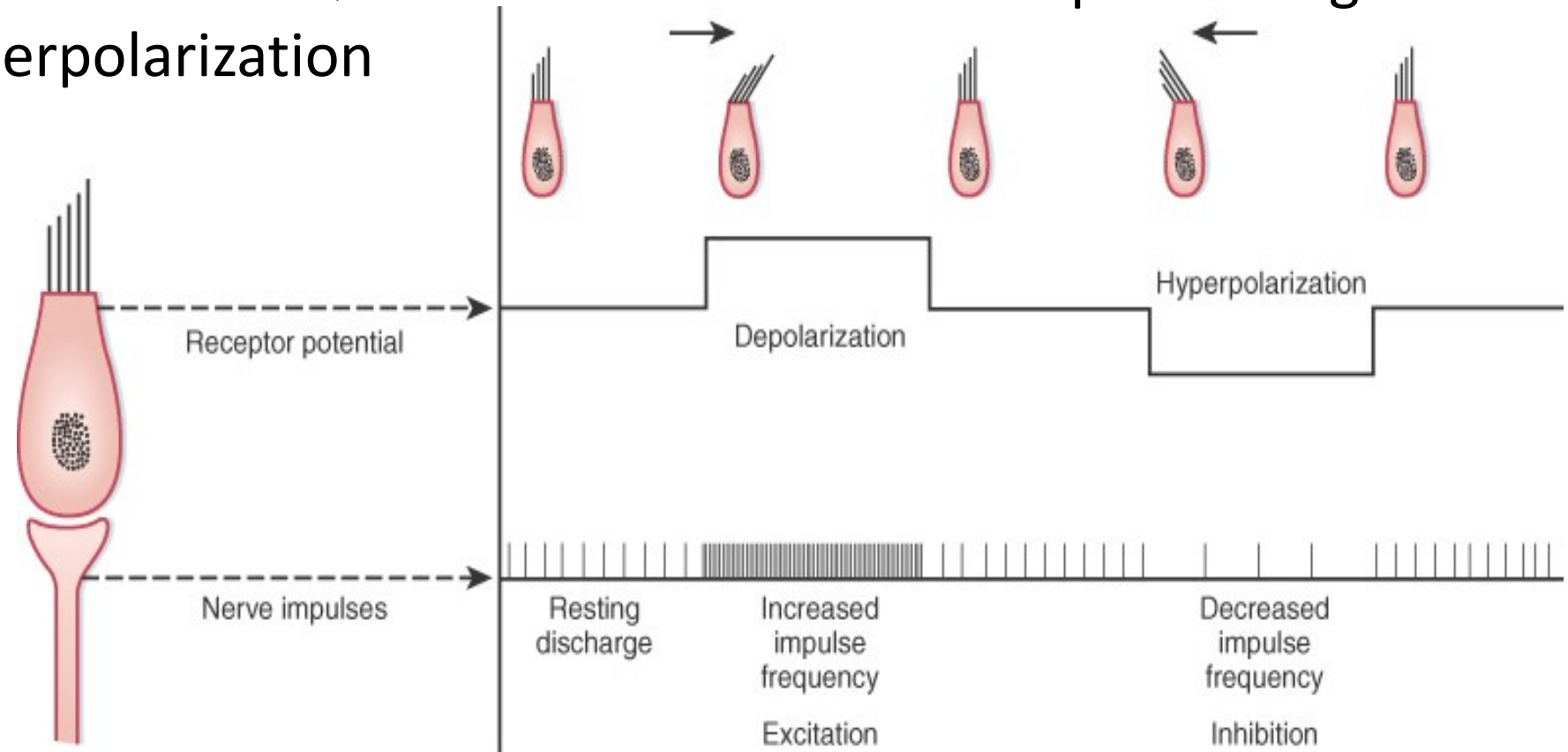
- Each semicircular canal contains an ampulla containing hair cells embedded in sensory epithelium called crista ampullaris
- Cilia of hair cells project into gelatinous cap called cupula
- Head rotation results in inertial movement of endolymph in opposite direction, which inflects cilia



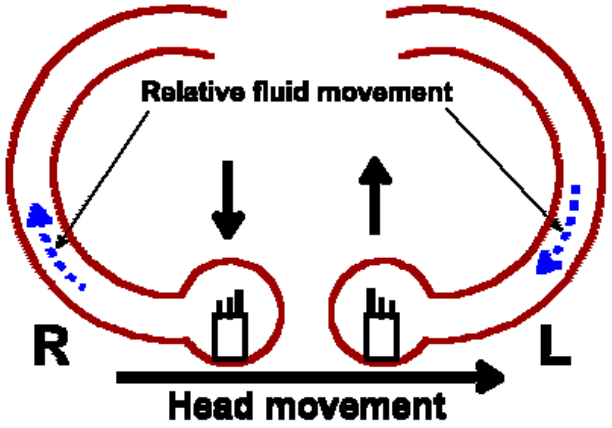
http://users.atw.hu/blp6/BLP6/HTML/C0089780323045827.htm

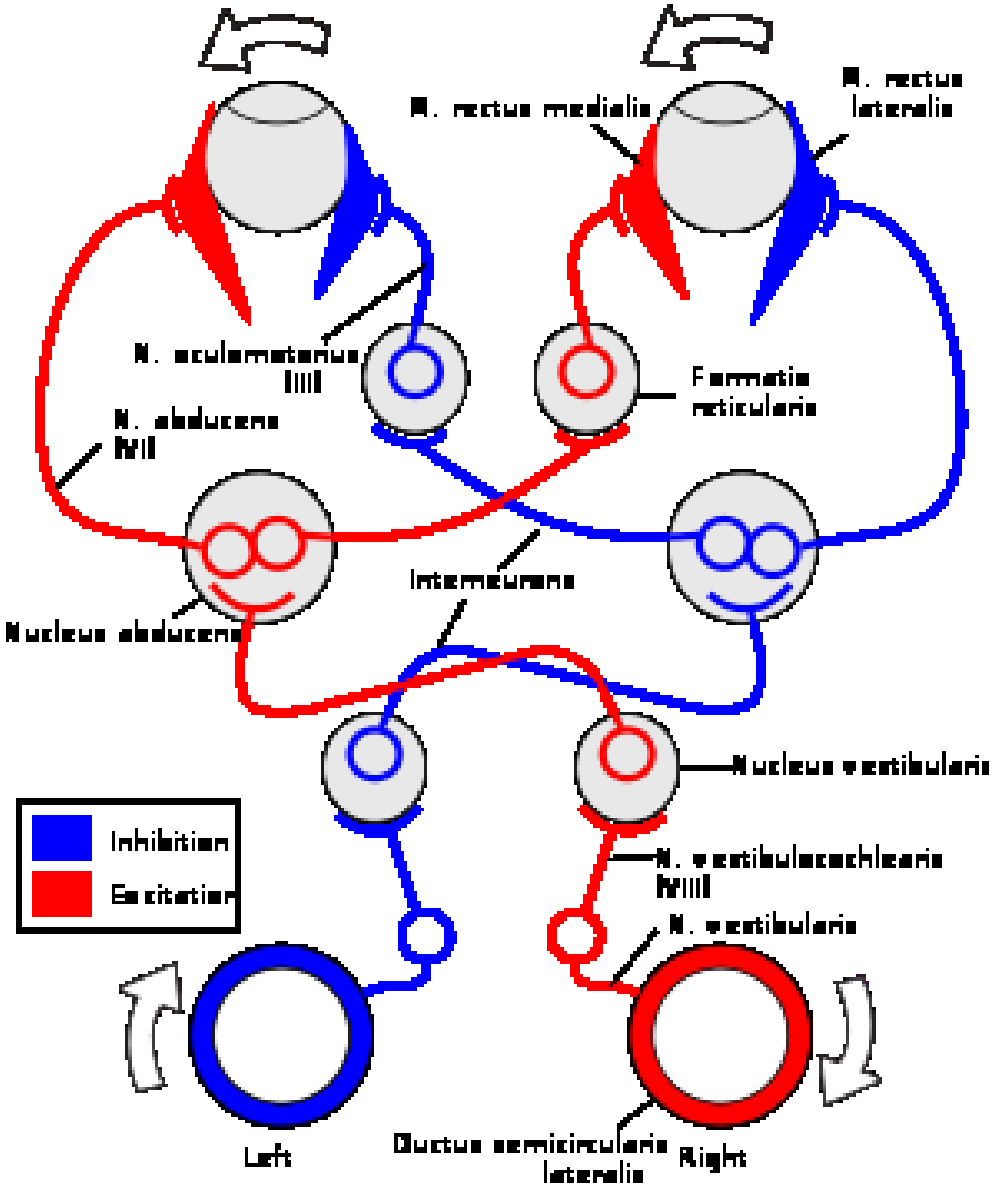
Semicircular canals: sensory transduction

- Steriocilia maintain directionality on both sides of the head
- Bending towards kinocilium → opens mechanically gated cation channels → K+ influx → depolarization
- Bending away from kinocilium → closes channels that are open during resting state → hyperpolarization



- Head rotation results in inertial movement of endolymph in opposite direction
- With turning of the head, hair cells on one side of the body send excitatory signals to the brain while hair cells on the opposite side are inhibited
- Each channel is associated with a pair of peculiar muscles that moves the eye in its plane





Tests for provocation of nystagmus

- semicircular canals are stimulated by:
  - post-rotational
  - Caloric (application of external auditorial tube either with cold=27 C or warm=47 C water)
  - Galvanic (stimulation with electric current)

Post-rotational nystagmus

- Examined subject with eyes closed and head inclined frontally by about 30 degrees is sitting in the swivel chair – lateral channel is in horizontal plane
- Rotate the chair 10 times during 10 s and than suddenly stop chair
- The rotation is suddenly stopped and movements of subject's eyes are observed
- Observe post-rotational nystagmus
  - Slow eye movement – initiated from vestibular system, in direction of endolymphe flow
  - Fast eye movement – initiated from brain stem, returns the bulb to the starting position (direction of nystagmus)

- Various head inclinations stimulate different channels – influence on plane and direction of nystagmus

Evaluation of the post-rotational nystagmus in practicals

- In practical: direction (horizontal, vertical, diagonal, rotational) – according to the fast eye movement
- Other possible parameters
  - amplitude (in degrees)
  - frequency (Hz)
  - duration (s, min)

head inclination	**direction of rotation**	**plane of nystagm**	**direction of nystagmus**
frontally by about 30°			
on the left by 90°			
on the right by 90°			
maximally back			
maximally frontally			

Vertigo

- Vertigo (dizziness)– subjective loss of stability in space, rotation of surrounding space or rotation of body in space
- connected with objective symptoms – disturbances of equilibrium and nystagmus – by stimulation of the labyrinths

- Hautant test (differential diagnosis of vestibular, cervicogenic, and ischemic dysfunction)
  - subject closes eyes and stretch arms forwards
  - tonic deviations of the arms are associated with deviation of the body in the same direction
  - deviations of the arms are in direction of impaired labyrinth (according to the slow part of nystagmus)
  - In practical: Hautant test after rotation – observe the direction of the arms deflection in the relation to the direction of rotation