

XXX. Vertigo and nystagmus
XLI. Estimation of Reaction Time Using
Computer

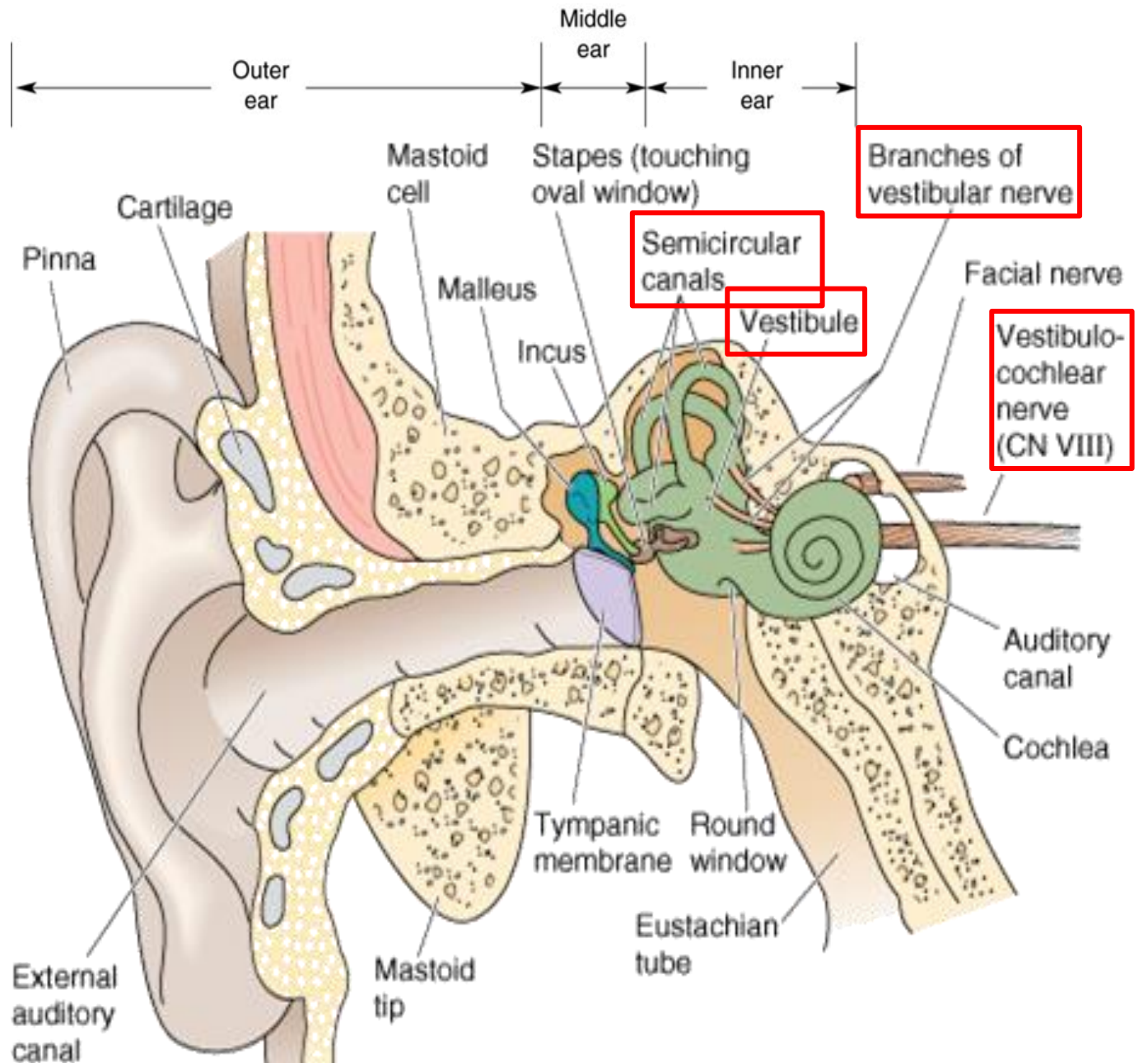
Practicals
(1. – 3. week)

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

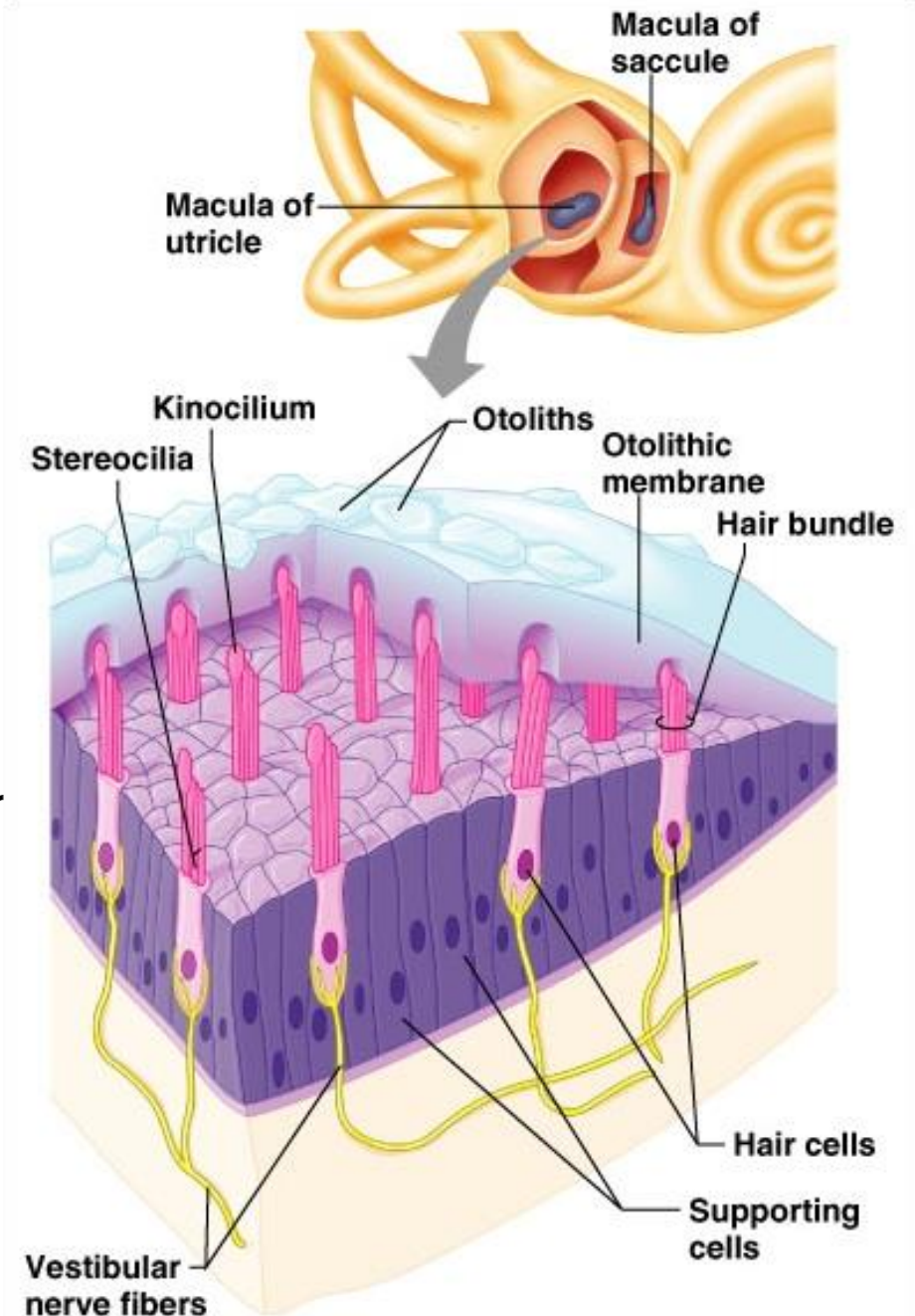


The Vestibular System structure



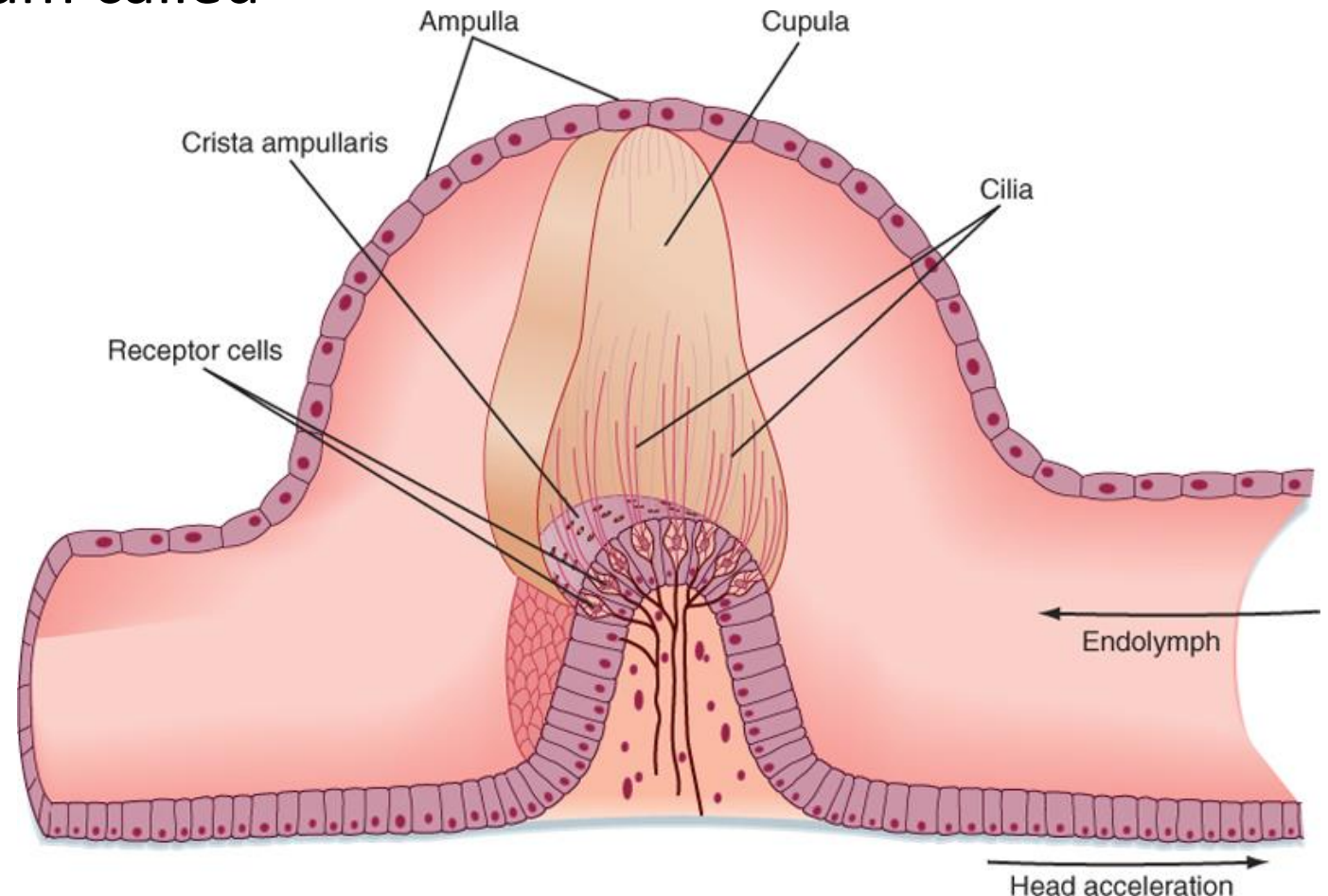
The Vestibular System

- 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 responding to rotational acceleration of the head
- **Utriculus, sacculus** - maculae staticae (static sensor)
 - linear acceleration, head position in the gravitational field



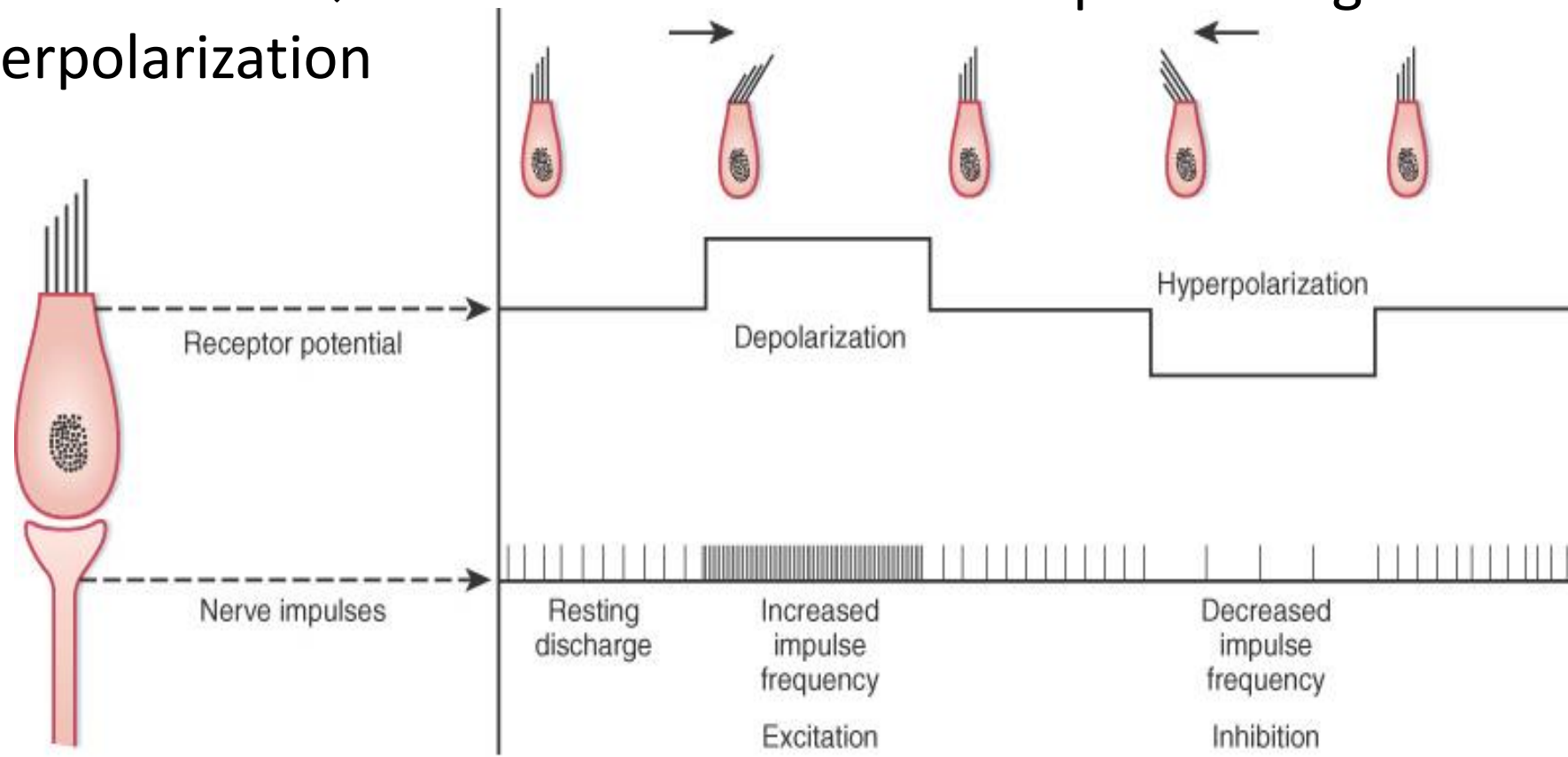
The Vestibular System – Semicircular canals

- 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

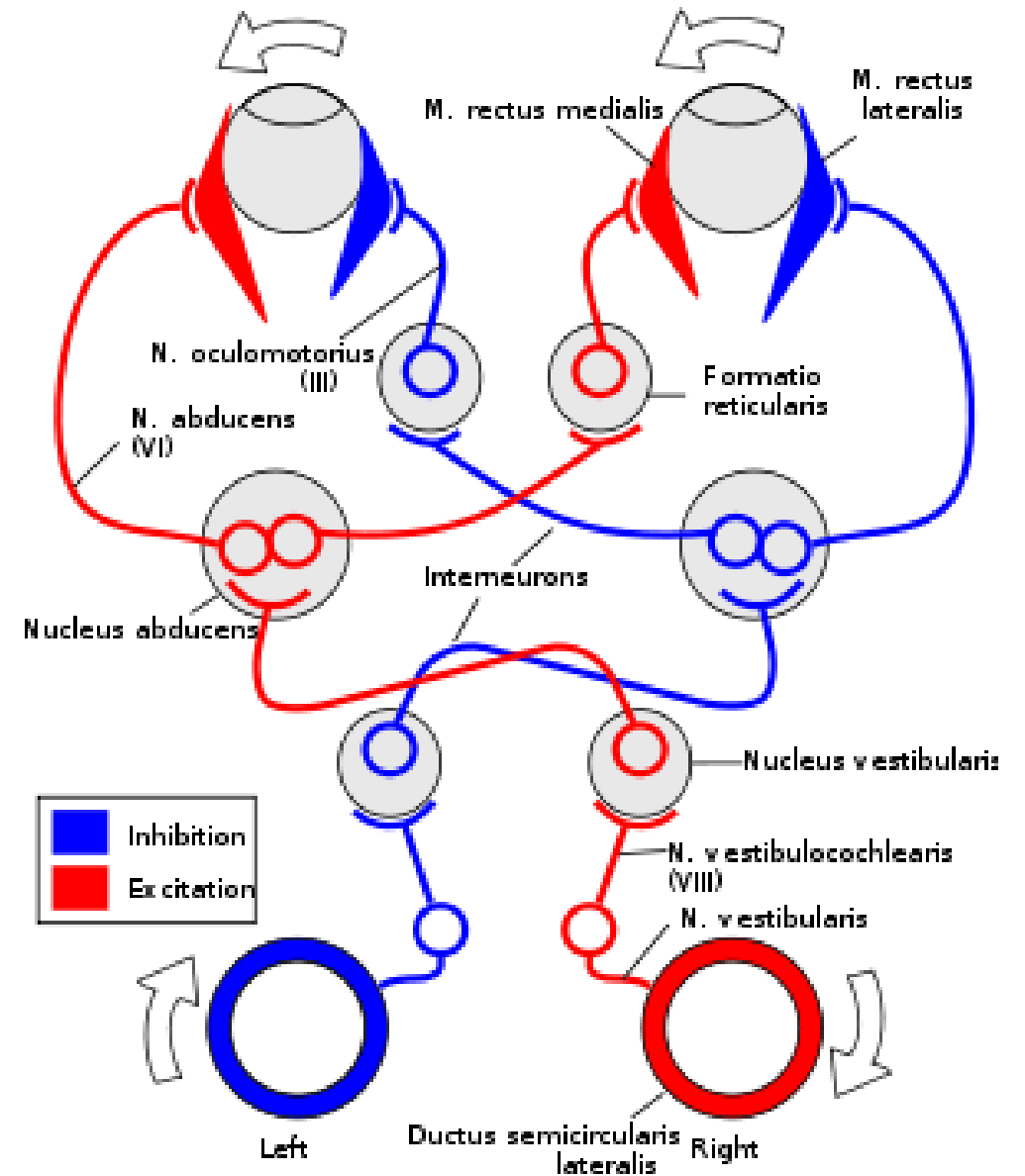
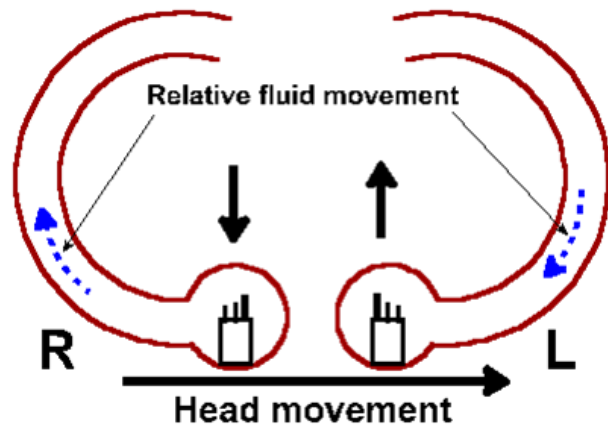


Semicircular canals: sensory transduction

- 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 then 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 endolymph 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			

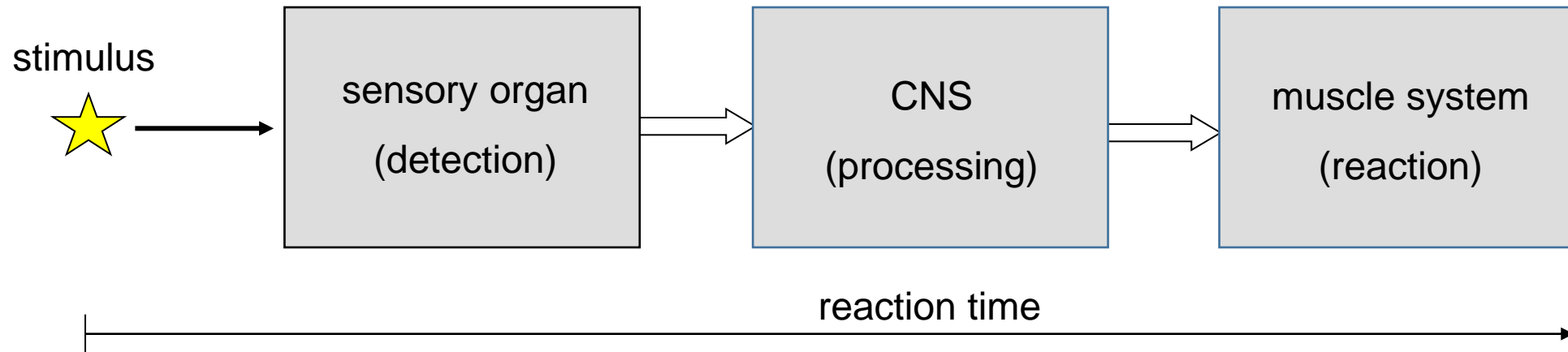
Vertigo

- 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

XLI. Estimation of Reaction Time Using Computer

Reaction time

- time from application of stimulus (light, acoustic, touch, etc.) till the moment of reaction of experimental subject.



- Reaction time depends on:
 - modality and intensity of the stimulus,
 - complexity of task (different reaction on different stimulus),
 - motivation, attention, fatigue and experience of the subject

Tests or reaction time

- Visual and acoustic stimuli:** The test consists of repeated random presentation of visual (asterisk in the centre of the screen) and acoustic (simple sound of 1 kHz) stimuli. The examined person responds to every stimulus by pressing ENTER on the keyboard.
- Visual stimuli:** The reaction to repeated random presentation of visual stimuli
- Acoustic stimuli:** The reaction to repeated random presentation of acoustic stimuli.
- Go/NoGo centre:** The test consists of repeated random presentation of two different visual stimuli (asterisk and symbol of dollar). Every stimulus is presented in the centre of the screen. The examined person responds to every asterisk by pressing ENTER on the keyboard. The symbol of dollar should be ignored.
- Go/NoGo periphery:** The test consists of repeated random presentation of two different visual stimuli (asterisk and symbol of dollar). Each stimulus is presented anywhere on the screen. The examined person responds to every asterisk by pressing ENTER on the keyboard. The symbol of dollar should be ignored.

Tests or reaction time

test		average	standard deviation	number of mistakes
visual and acoustic stimuli	visual			
	acoustic			
Visual stimuli				
Acoustic stimuli				
Go/NoGo centre				
Go/NoGo periphery				

References

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