20180116 COGS 107b Lecture Notes

Cabinet COGS107b Lecture Notes

20180116 COGS 107b Lecture Notes
Proprioception
Sensory Organ Receptors
The knee-jerk reflex
The muscle spindle
Contractile vs. Non-Contractile
Golgi Tendon Organ
Functions of proprioception:
Dorsal Root ganglion pathways to the brain
Using proprioceptive information
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Proprioception

Sensory Organ Receptors

Across different sensory modalities, anatomical features of sensory organ receptors determine the dynamics of their electrical activity and, within a modality, the type of sensory information they convey.

- Vestibular and auditory systems → cillia
- Taste → tastebuds in the tongue
    - Transform the chemicals of the world into taste
- Smell → olfactory bulb
- Sight → photoreceptor cells

The knee-jerk reflex

1. Stimulus to the patella

2. Quadricep muscle lengthens
3. Muscle spindle afferent is distorted
4. Generator potential is fired
5. Dorsal Root Ganglion carries signal to Ventral horn of spinal cord
6. Sensory neuron inhibits interneuron at the same time it innervates an alpha motor neuron.
7. The two counterbalance to help prevent perpetual reaction.
8. Motor neuron causes contraction of the muscle (kick the foot)

This prevents excessive flexation.

The muscle spindle

Activation by muscle elongation /stretch is modulated by contraction state of the muscle

Intrafusal Fibers: detect the state of the muscle. Innervated by sensory fiber (Dorsal Root Ganglion cells).

If the Intrafusal fiber is disrupted, an action potential is generated.

Transient (Rapidly adapting): Stretching of the I.F. fiber (i.e. elongating the arm) is temporary. Detection of **elongating** not **elongated**.

Contractile vs. Non-Contractile

Non-contractile = sensory part of the I.F. fiber. Dendritic ending

Contractile = Recieves input from gamma motor neuron and innervates I.F. fiber.

This allows the muscle to adapt to the current state of elongation.

Golgi Tendon Organ

Registering Tendon stretch (muscle contraction)

Persistent (Slow adapting): Responds to contraction, not contracting, of the muscle.

Dorsal Root Ganglion innervates tendon organ and branches into muscle.

Functions of proprioception:

- Joint-protecting reflexes
- Adjustment of muscle contraction / recruitment
- Kinesthesia: detection of body position and movement

- Coordination of motor commands
- Sense of self
    - Consistent, continuous signal of the state of the body

Dorsal Root ganglion pathways to the brain

1. Dorsal horn of the spinal cord
2. Graciel/Cuneate nuclei (Segregated signal)
3. Transfers contralaterrally
4. Ventral posterolateral nucleus
5. Posterior parietal cortex

Using proprioceptive information

Encoding of grasp postures in sub-region AIP of the posterior parietal cortex

AIP

Sub-region for the registration of grasping postures.

In the experiment, there are certain objects that cause neurons to fire more frequently during the “Cue” and “Hold” phase.

This implies the holding of the posture can be an abstract in the brain in the absence of the posture.

The Pinnochio effect

Given a device that vibrates at a certain frequency placed on a particular muscle, the muscle will be fooled into “thinking” it is elongating.

So pinch your nose (merkel disks constantly firing), close your eyes, buzz the muscle spindle afferent in the bicep = you’ll experience your nose growing.