## Somatosensory Receptors

<table>
<thead>
<tr>
<th>Receptor Type</th>
<th>Response Type</th>
<th>Depth</th>
<th>Response Field</th>
<th>Sensitivity</th>
<th>Best Stimulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacinian Corpuscle</td>
<td>Rapid Adapting</td>
<td>Deep</td>
<td>Very Large</td>
<td>10nm</td>
<td>High Frequency</td>
</tr>
<tr>
<td>Hair Receptor</td>
<td>Rapid Adapting</td>
<td>Deep</td>
<td>10mm</td>
<td>1um</td>
<td>Hair Displacement</td>
</tr>
<tr>
<td>Meissner’s Corpuscle</td>
<td>Rapid Adapting</td>
<td>Shallow</td>
<td>3-5mm</td>
<td></td>
<td>Low Frequency</td>
</tr>
<tr>
<td>Merkel Disk Receptor</td>
<td>Slow Adapting</td>
<td>Shallow</td>
<td>Spotty 2-3mm</td>
<td>Broad</td>
<td>Texture</td>
</tr>
</tbody>
</table>

## Proprioceptive Receptors

<table>
<thead>
<tr>
<th>Receptor Type</th>
<th>Response Type</th>
<th>Responds to Muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle Spindle Afferent</td>
<td>Rapid Adapting</td>
<td>Elongation</td>
</tr>
<tr>
<td>Golgi Tendon Organ</td>
<td>Slow Adapting</td>
<td>Contraction</td>
</tr>
</tbody>
</table>

## Vestibular Organs

<table>
<thead>
<tr>
<th>Organs</th>
<th>Response Type</th>
<th>Responds to Muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semicircular Canals</td>
<td>Rapid Adapting</td>
<td>Head Rotation</td>
</tr>
<tr>
<td>Otolith Organs</td>
<td>Slow Adapting</td>
<td>Linear Translation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Utricle - Horizontal Motion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Saccule - Vertical Motion</td>
</tr>
</tbody>
</table>

## Retinal Ganglion Cells

<table>
<thead>
<tr>
<th>Cell Type</th>
<th>Response Type</th>
<th>% of Cells</th>
<th>Response Field Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnocellular (Y)</td>
<td>Rapid Adapting</td>
<td>80</td>
<td>Large</td>
</tr>
<tr>
<td>Parvocellular (X)</td>
<td>Slow Adapting</td>
<td>10</td>
<td>Small</td>
</tr>
<tr>
<td>Koniocellular</td>
<td>??</td>
<td>10</td>
<td>??</td>
</tr>
</tbody>
</table>

## Cochlear Nucleus Neurons

<table>
<thead>
<tr>
<th>Neurons</th>
<th>Response Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octopus Cell</td>
<td>Rapid Adapting</td>
</tr>
<tr>
<td>Spherical Bushy Cell</td>
<td>Slow Adapting</td>
</tr>
</tbody>
</table>

## Sound Wave Characterizations:
- Amplitude (Loudness)
- Frequency (Pitch)
- Complexity (Timbre)

## Functions of the Proprioceptive System:
- Joint protecting Reflexes (e.g. knee jerk)
- Adjusted of muscle contraction / recruitment
- Detection of body position and movement
- Coordination of motor commands
- Sense of self?

## Inner Ear Bones:
- Incus
- Malleus
- Stapes

## Functions of the Vestibular System:
- Postural Reflexes
- Gaze Adjustment
- Assessment of self-motion
- A reason not to drink too heavily?

## Egocentric Maps:
1. Retinotopic
2. Ocular Dominance
3. Orientation Tuning
4. Color

## Properties of Ion Channels:
- Kinetics
- Distribution
- Ion Selectivity
- Gating
- State
Neuron Doctrine — A theory, akin to cell theory in biology, that neurons are individual and distinct units of the brain.

Law of Dynamic Polarization — Signal propagation along an axon is unidirectional (dendrite -> soma -> axon).


Synaptic Potential — The electrical potential evoked at a synapse (typically via communication from a presynaptic neuron).

Action Potential — All or nothing response initiated through a cascade of voltage gated sodium channels.

Equilibrium Potential — The potential at which forces causing ions to flow down a concentration gradient is balanced by forces repelling similarly charged ions away from each other. Calculated by Nernst Equation.

Temporal Summation — Potentials that summate by being in close temporal proximity to each other.

Spatial Summation — Potentials that summate by being in close spatial proximity to each other.

Response Fields — The particular conditions under which a neuron will preferentially fire.

Topographic Representation — A mapping of sensory receptors onto distinct brain regions that maintain spatial resolution such that adjacent signals will activate adjacent neurons.

Alpha Motor Fiber — Motor fiber that innervates extrafusal muscle fibers.

Gamma Motor Fiber — Motor fiber that innervates intrafusal muscle fibers.

Kinesthesia — The perception of the body's position and movement.

Posterior Parietal Cortex — Integrates vestibular, proprioceptive, and visual information with motor actions.

Anterior Intraparietal — Region of the posterior parietal cortex that encodes grip position.

Pincocchio Effect — Illusory effect in which a person's nose "feels" to be growing due to conflicting somatosensory and proprioceptive signals.

Effector Dependence — Dependence on a particular effector (e.g. for proper proprioception, need some sort of feedback).

Hemineglect — Disorder caused typically by parietal lesions that causes the patient to ignore sensory stimulus when it occurs in regions of the environment defined by the patient’s trunk.

Dorsal Tegmental Nucleus — Integrates vestibular information and contains cells that respond to the angular velocity of head motion: a key component that interfaces with head direction cells.

Head Direction Cell — Specialized cell that increases in firing rate with respect to head direction in allocentric space.

Angular Velocity Cell — Specialized cell that increases in firing rate with respect to angular head velocity.

Rods — A photoreceptor that responds preferentially to low light conditions.

Cones — A photoreceptor that has three different types which is responsible for color vision.

Foveation — The relative amount of photoreceptors present in the fovea compared to the rest of the retina.

“On” Bipolar Cells — Bipolar cells that hyperpolarize in response to glutamate.

“Off” Bipolar Cells — Bipolar cells that depolarize in response to glutamate.

Cytochrome Oxidase — An enzyme typically targeted with staining techniques to indicate areas of the brain that are consuming relatively higher amounts of energy.

Blobs — Areas in the primary visual cortex in which koniocellular projections are most dense.

“What” Pathway — Projection from the primary visual cortex along the temporal pathway that integrates context useful for object identification.

“Where” Pathway — Projection from the primary visual cortex along the parietal pathway that integrates vestibular and proprioceptive information useful for performing motor tasks.

Pinna — The outer ear, responsible for reflecting sound from different sources that is critical for height source localization.

Fourier Transform — A transformation of time series data into frequency components.

Tonotopy — Topographic organization of sound in a frequency dependent manner.

Interaural Time Difference — Used in source localization by sensing the time difference between left and right ear picking up the sound. Less effective with persistent high frequency sounds.

Interaural Level Difference — Used in source localization by sensing the amplitude difference between left and right ear due to sound attenuation by the head. Less effective for low frequency sounds.

Medial Superior Olivary — Region responsible for assessing interaural level differences.

Lateral Superior Olivary — Region responsible for assessing interaural time differences.

Medial Nucleus Trapezoid Body — Region that projects inhibitory neurons into the lateral superior olivary.

Motiility — The ability of movement of the hair cells.

Heschl's Gyrus — Gyrus containing the primary auditory cortex.

Doppler Effect — Distortion of sound waves caused by a moving object's sound emission. The direction of movement will hear an increase in frequency while opposite the direction of motion will hear a decrease in frequency.

Active Sensing — The control of sensory systems to focus attention towards picking up a particular stimulus.

Echolocation — Method through which the location of a target can be discerned via the time delay between when the sound is released and when it is reflected back to the source of the sound.

Robert Galambos — One of three founders of neurobiology program at UCSD, famous for discovering echolocation.