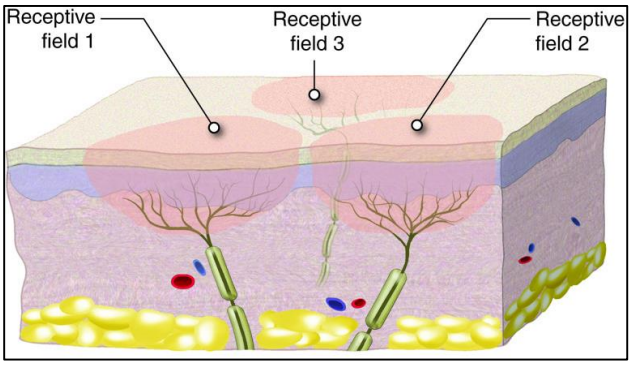
Somatic sensations-I

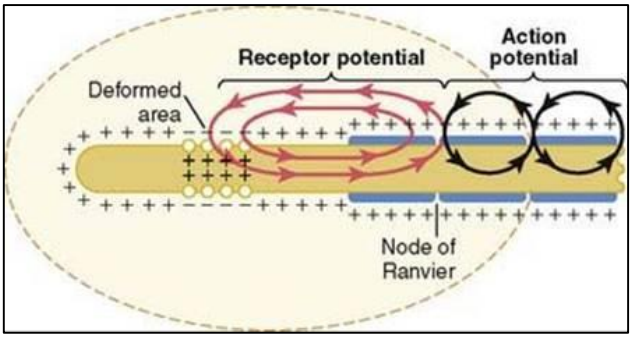
Sensation

- **Sensation** is the conscious or subconscious awareness of changes in the external or internal environment.
- **Perception** is the conscious interpretation of sensations and is primarily a function of the cerebral cortex.

The process of sensation



1. **Stimulation of the sensory receptor**. An appropriate stimulus must occur within the sensory receptor's receptive field, that is, the body region where stimulation activates the receptor and produces a response.
2. **Transduction of the stimulus**. A sensory receptor converts the energy in the stimulus into a graded potential.



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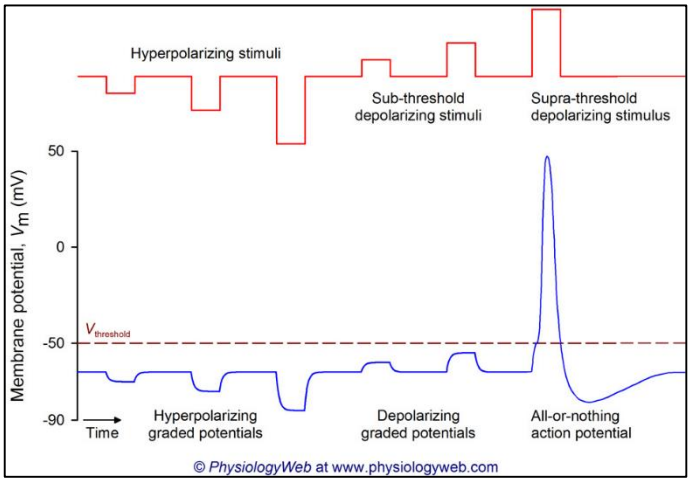


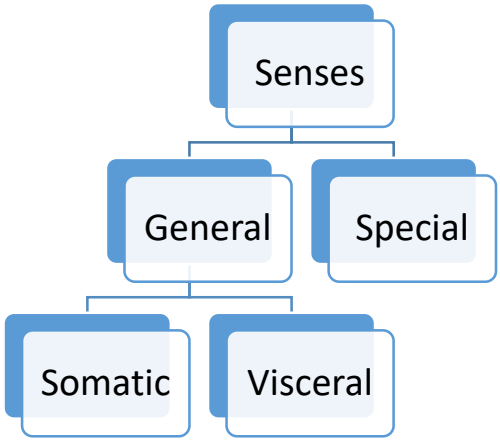
3. **Generation of nerve impulses**. When a graded potential in a sensory neuron reaches threshold, it triggers one or more nerve impulses, which then propagate toward the CNS.
4. **Integration of sensory input**. A particular region of the CNS receives and processes the sensory nerve impulses.

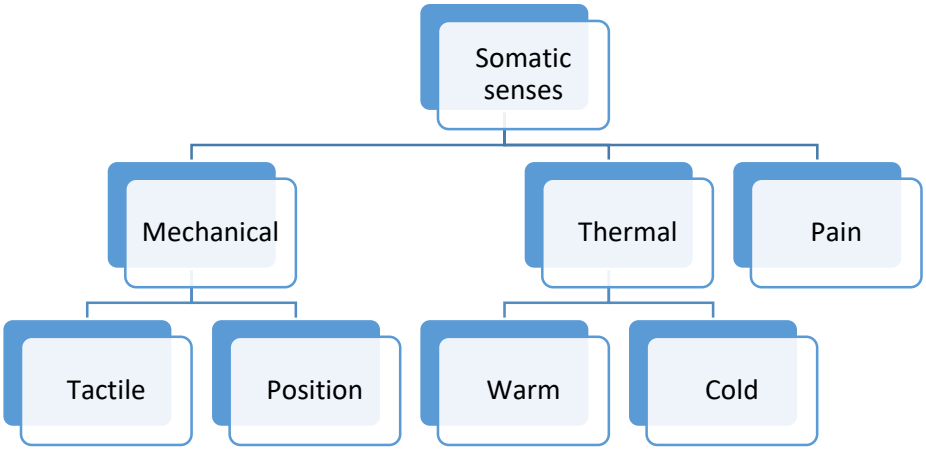
Somatic sensations

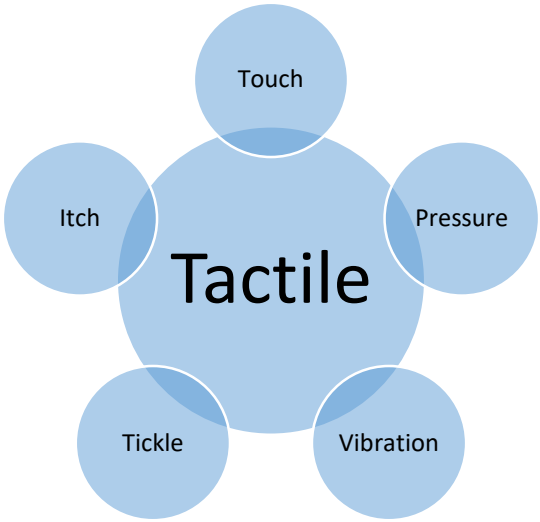
- Receptors are **distributed unevenly**.
- The areas with the highest density of somatic sensory receptors are the tip of the tongue, the lips, and the fingertips.

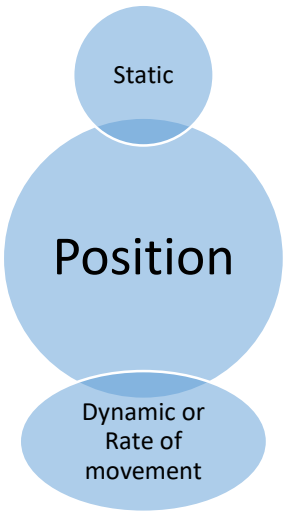
Adaptation in sensory receptors

- A characteristic of most sensory receptors is **adaptation**, in which the receptor potential decreases in amplitude during a maintained, constant stimulus.
- Because of adaptation, the perception of a sensation may fade or disappear even though the stimulus persists.









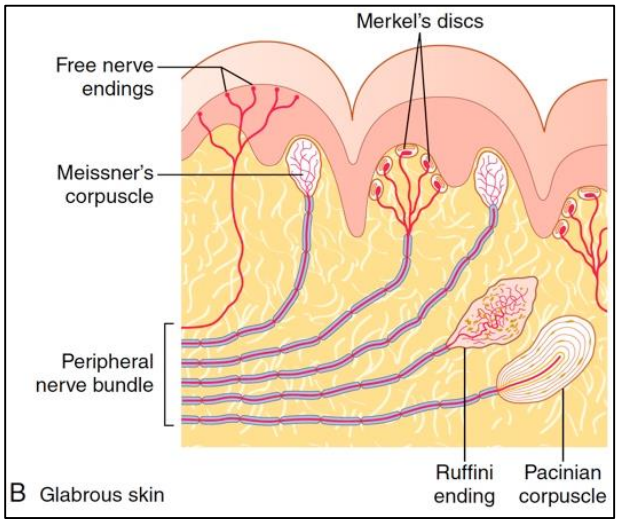
	location	function	characteristics
Free nerve endings	skin and other tissues	Detects touch and pressure	
Meissner's corpuscle (encapsulated nerve ending)	In the dermis of nonhairy skin: lips and fingertips (locations where tactile discrimination is especially good).	Sensitive to moving objects on skin and low-frequency vibrations.	Rapidly adapting Small receptive field
Merkel's discs (Expanded tip tactile receptors)	Fingertips and hairy skin	determine continuous touch of objects against the skin.	Grouped in touch domes. Slowly adapting Small receptive field.
Ruffini ending (multibranched encapsulated nerve endings)	In the dermis of hairy and nonhairy skin and joint capsules.	Detects heavy prolonged touch and pressure signals, stretch and joint rotation (for signaling continuous states of deformation of the tissues)	Slowly adapting Large receptive field
Pacinian corpuscle	In the dermis, subcutaneous layers of hairy, nonhairy skin and muscles	Detects tissue vibration or other rapid changes in the mechanical state of the tissues (velocity).	The most rapidly adapting of tactile receptors
Hair end organ		Detects velocity and direction of movement across the skin (Detects movement of objects on the surface of the body or initial contact with the body)	Adapt quickly

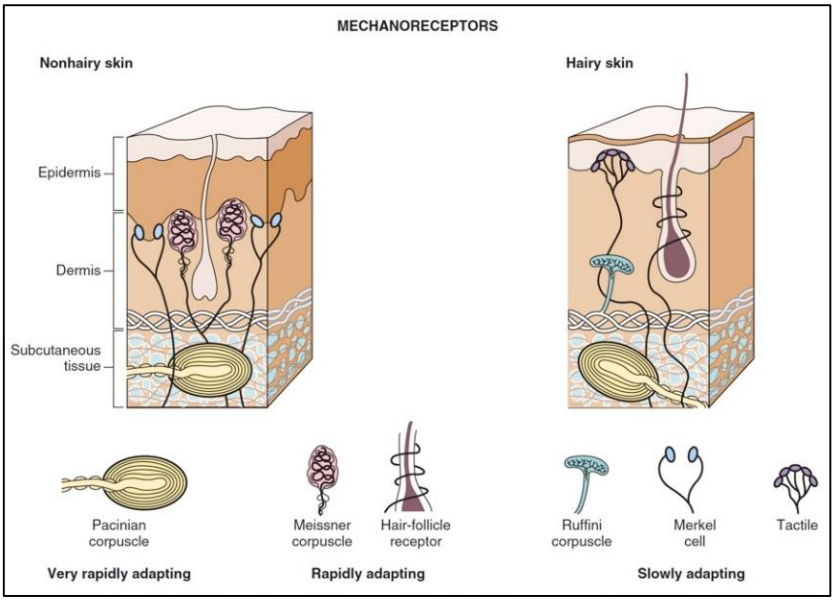
Meissner's corpuscles have

- small receptive fields and can be used for two-point discrimination
- rapidly adapting receptors that encode point discrimination, precise location, tapping, and flutter.
- areas of the skin where a person's ability to discern spatial locations of touch sensations is highly developed.

Merkel discs and Meissner's corpuscles

- play extremely important roles in localizing touch sensations to specific surface areas of the body and in determining the texture of what is felt
- responsible for giving out steady-state signals





Conduction velocity of tactile signals

- Almost all specialized sensory receptors transmit their signals in type Aβ nerve fibers (30 to 70 m/sec).
- Free nerve ending tactile receptors transmit signals mainly via type Aδ myelinated fibers (5 to 30 m/sec).
- Some tactile free nerve endings transmit via type C unmyelinated fibers at velocities from a fraction of a meter up to 2 m/sec, such as tickle sensory fibers.