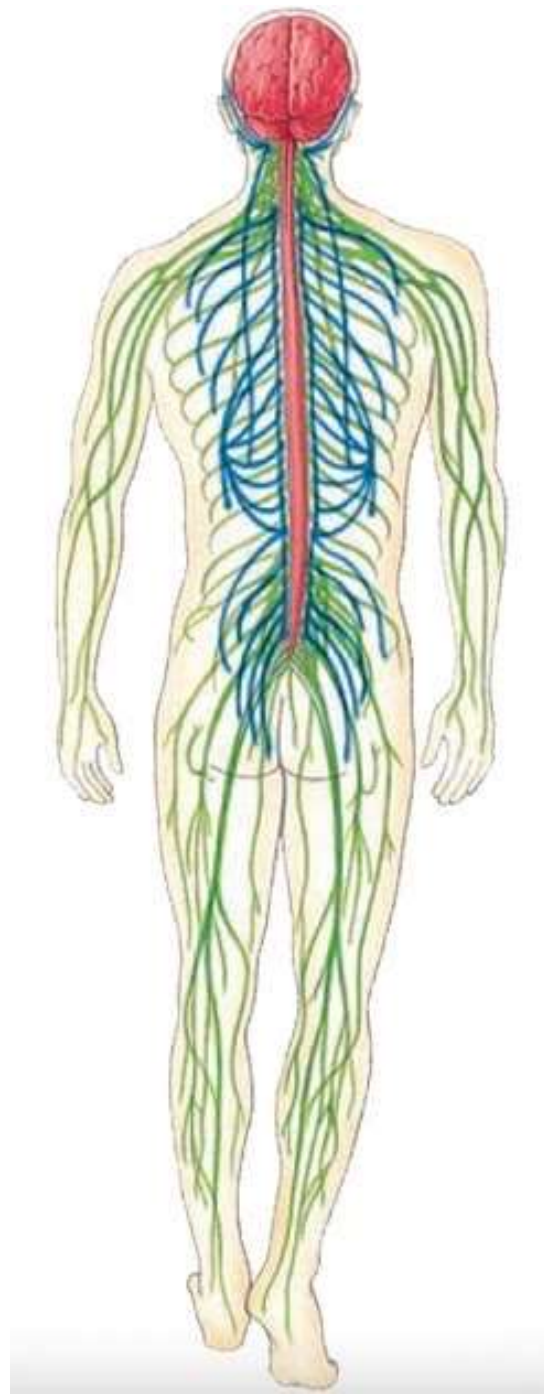


Neurophysiology

Sensation 1

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Functions of the nervous system

- **Sensory function:** sensory receptors detect internal or external stimuli. The sensory information is carried to the CNS through cranial and spinal nerves.
- **Integrative function:** processes sensory information by analyzing it and making decision for appropriate responses.
- **Motor function:** changes the activity of the effectors (muscles and glands) through cranial and spinal nerves.

Sensation

- **Sensation** is the conscious or subconscious awareness of changes in the external or internal environment.

The process of sensation

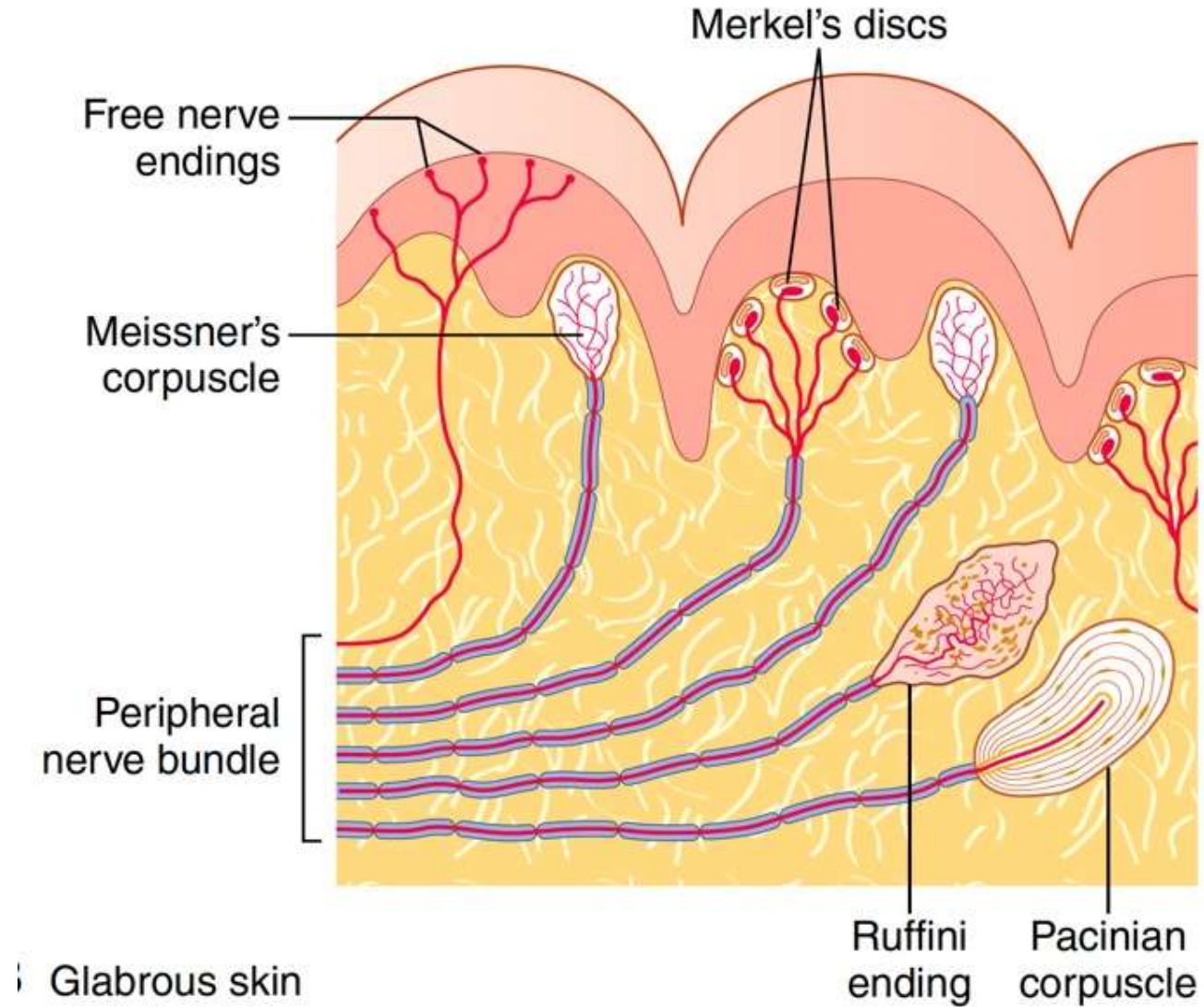
1. Stimulation of the sensory receptor.

A receptor may be either (1) a specialized ending of the afferent neuron (encapsulated or free) or (2) a separate receptor cell closely associated with the peripheral ending of the neuron.

Sensory receptors

- **Location:** interoceptors vs exteroceptors
- **Type of stimulus:** mechanical (tactile, proprioception, hearing, balance,...), thermal, chemical (smell, taste,...), visual,

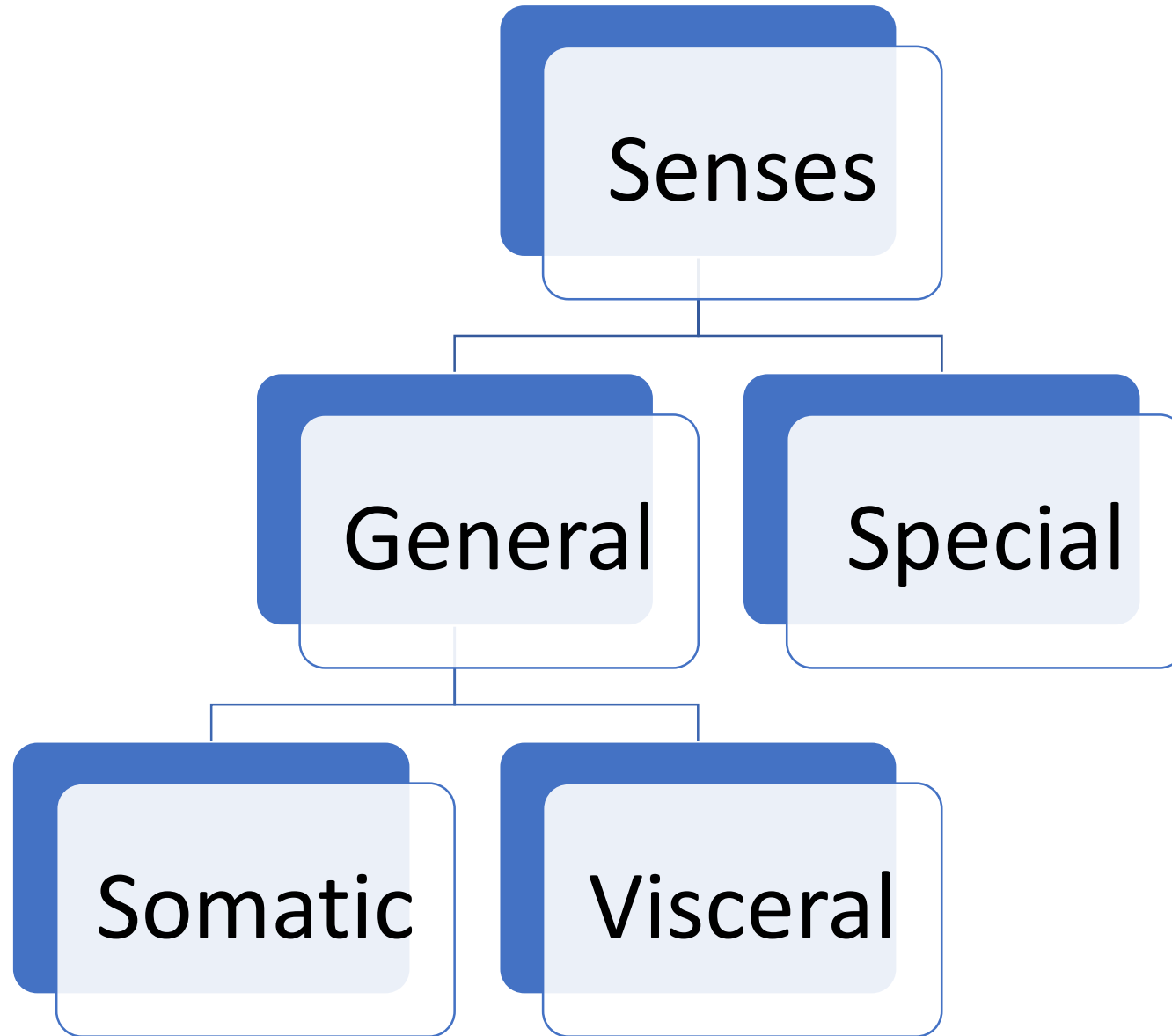
Tactile receptors



Characteristics of sensory receptors

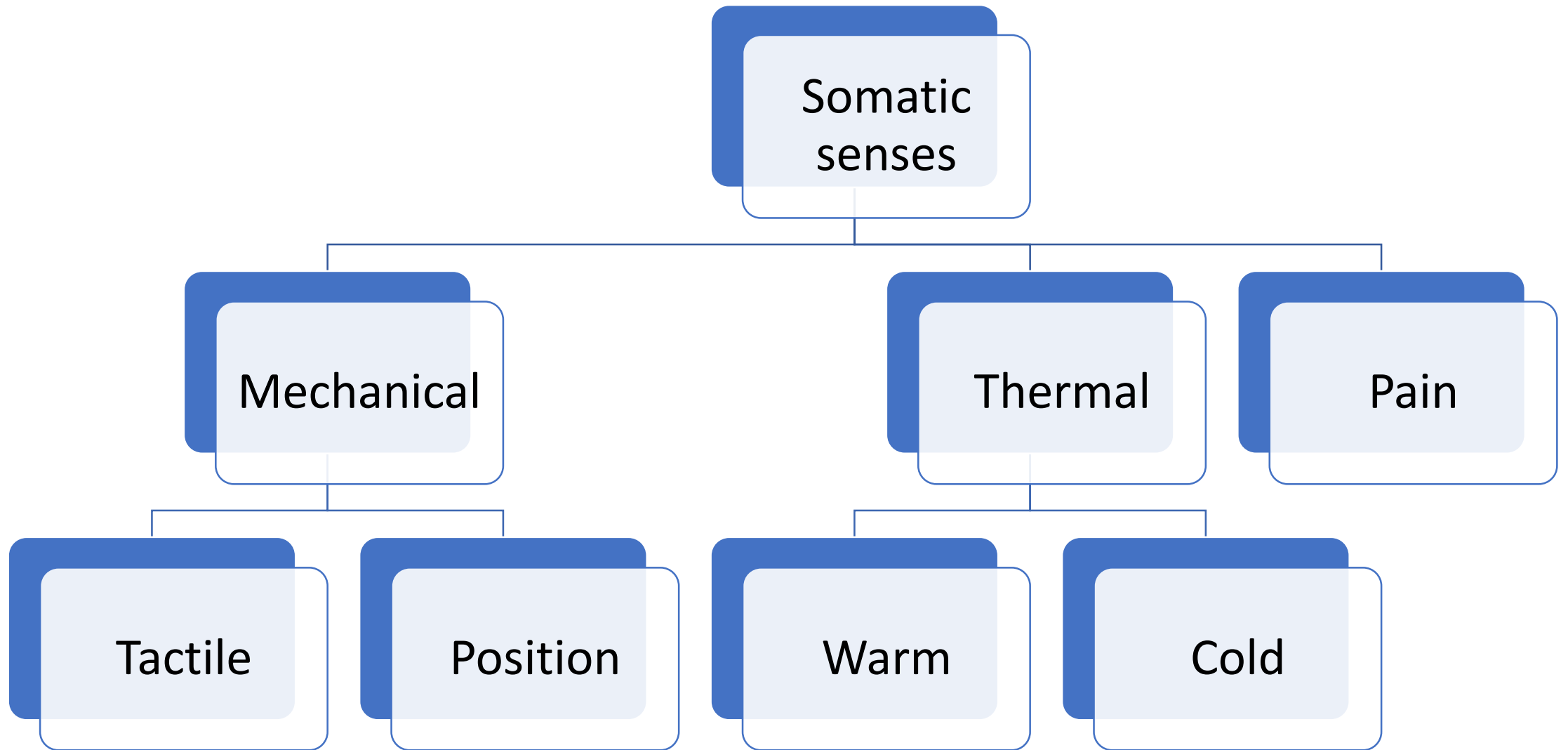
- **Differential sensitivity**

Each type of receptor is specialized to respond to one type of stimulus.



Somatic sensory receptors

- Somatic sensations arise from stimulation of sensory **receptors embedded in** the:
 - Skin
 - Subcutaneous layer
 - Mucous membranes
 - Skeletal muscles
 - Tendons
 - Joints.



Tactile senses

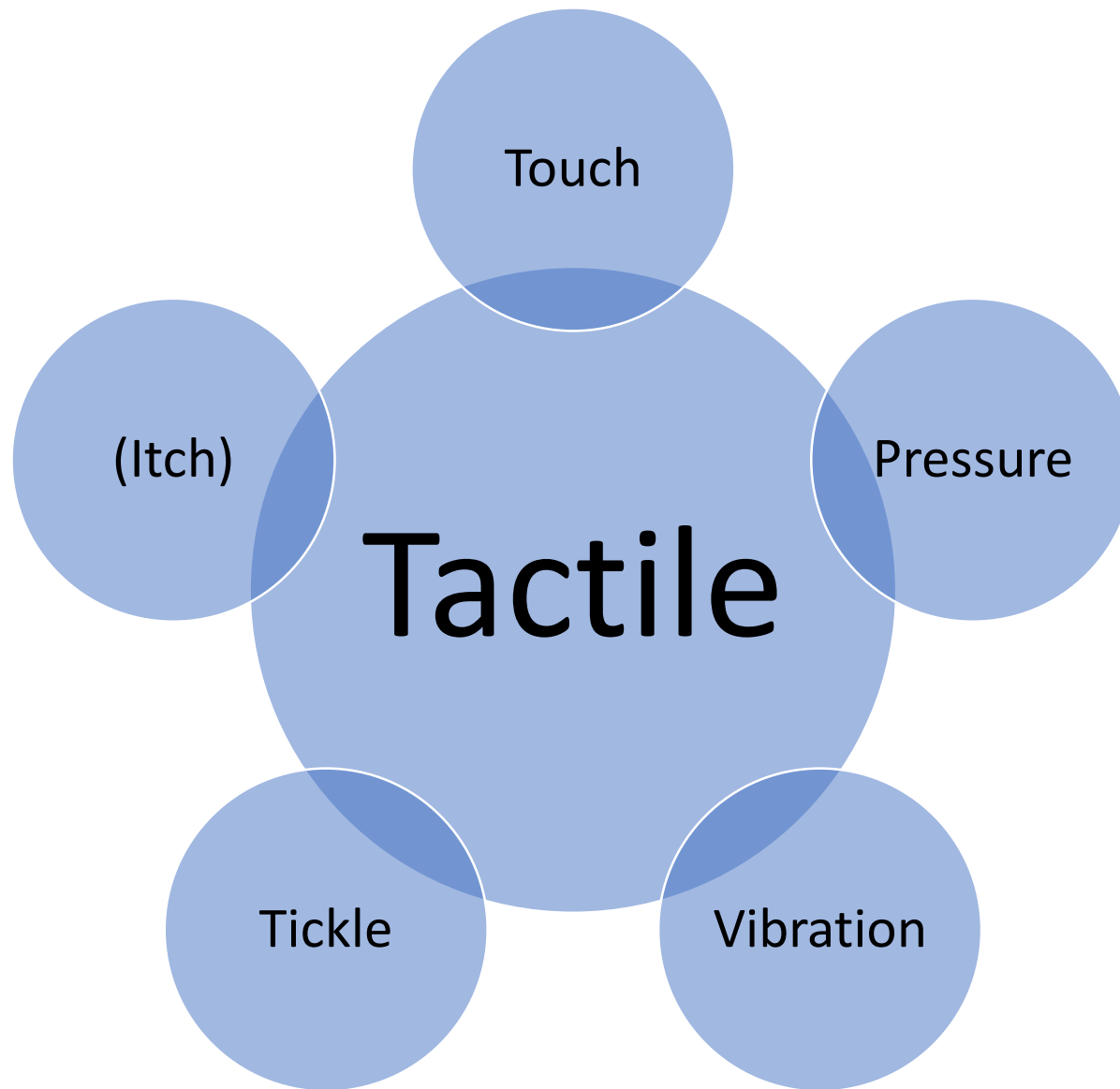
- **Touch:** generally results from stimulation of tactile receptors in the skin or in tissues immediately beneath the skin.
- **Pressure:** usually results from deformation of deeper tissues.
- **Vibration:** results from rapidly repetitive sensory signals.

Tactile senses

- **Tickle:** Typically arises only when someone else touches you, not when you touch yourself.
- The reason could be due to the impulses to and from the cerebellum when you are moving your fingers and touching yourself that don't occur when someone else is tickling you.

Itch

- The purpose of the itch sensation is presumably to call attention to mild surface stimuli such as a flea crawling on the skin.
- The signals elicited then activate the scratch reflex or other maneuvers that rid the host of the irritant.
- Itch can be relieved by **scratching** if this action removes the irritant or if the scratch is strong enough to elicit pain.
- The pain signals are believed to suppress the itch signals in the cord by lateral inhibition.



Touch

Pressure

Tactile

Vibration

Tickle

(Itch)

Position receptors (proprioceptors)

- Allow us to know where our body parts are located and how they are moving even if we are not looking at them, so that we can walk, type, or dress without using our eyes.
- Proprioceptors also allow weight discrimination, the ability to assess the weight of an object. This type of information helps to determine the muscular effort necessary to perform a task.

Position receptors (proprioceptors)

- Knowledge of position, both static and dynamic, depends on knowing the degrees of angulation of all joints in all planes and their rates of change.
- Therefore, multiple different types of receptors help to determine joint angulation and are used together for position sense. Both skin tactile receptors and deep receptors near the joints are used.

Position senses

- They are divided into two subtypes:
- (1) static position sense, which means conscious perception of the orientation of the different parts of the body with respect to one another.
- (2) rate of movement sense, also called kinesthesia or dynamic proprioception.

Static

Position

Dynamic or
Rate of
movement

The process of sensation

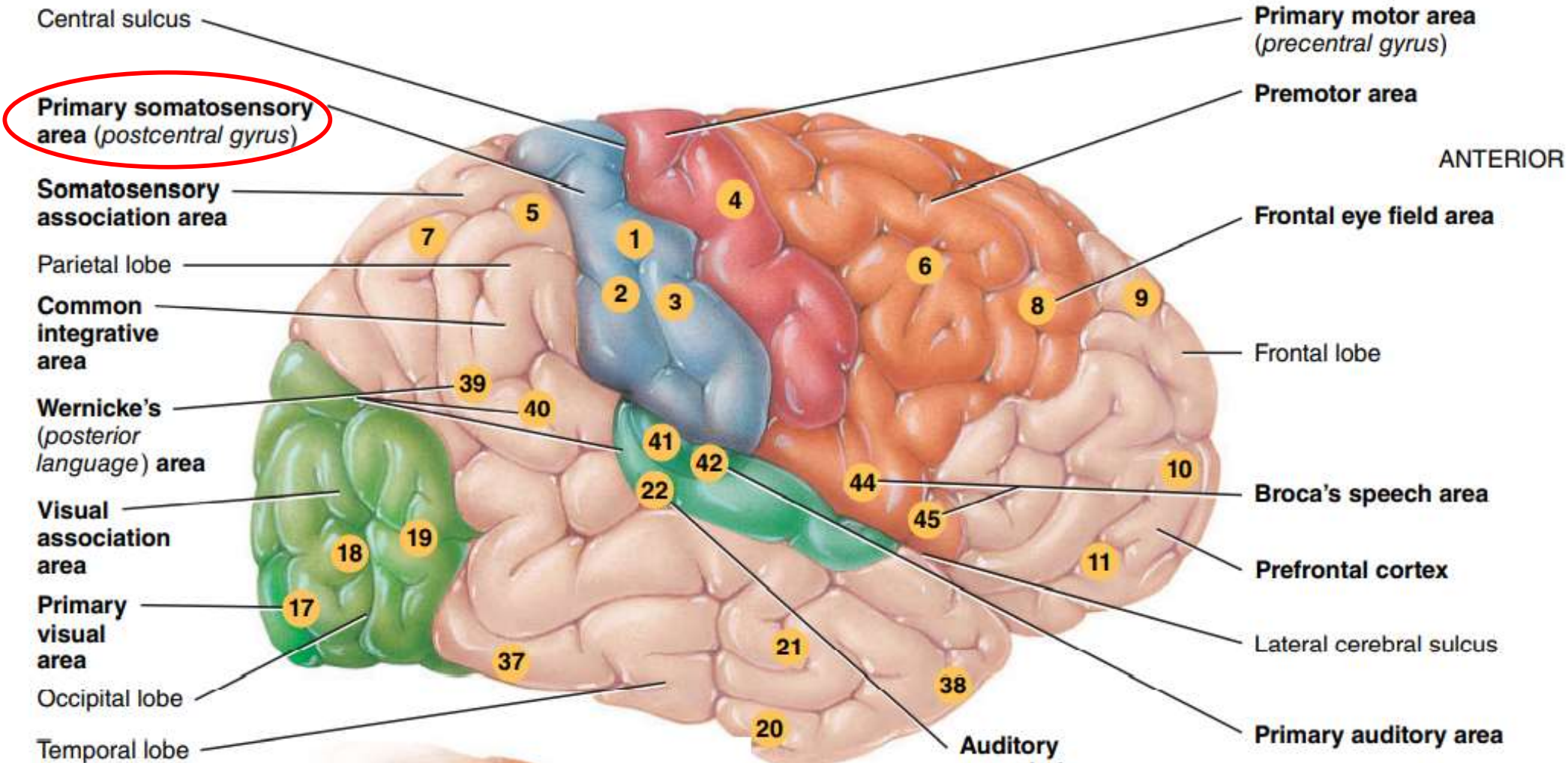
- 1. **Stimulation of the sensory receptor.**
- 2. **Transduction of the stimulus.** A sensory receptor converts the energy in the stimulus into a graded (receptor) potential.

Graded potential vs Action potential

The process of sensation

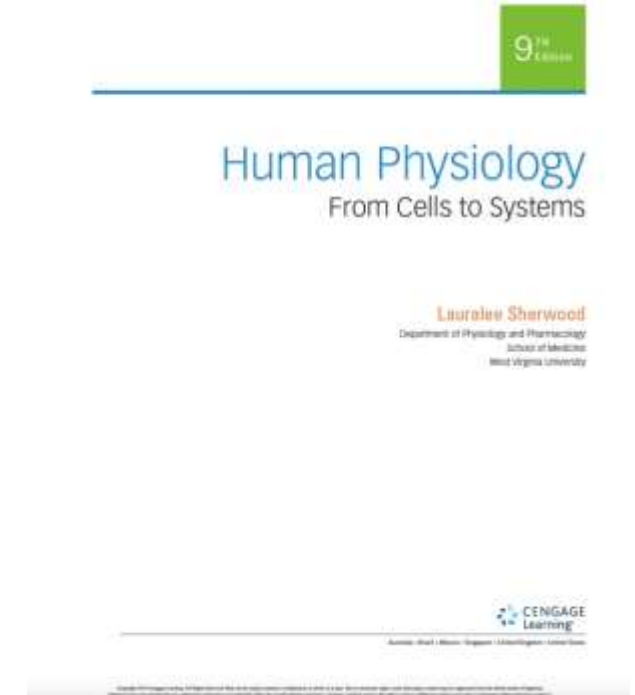
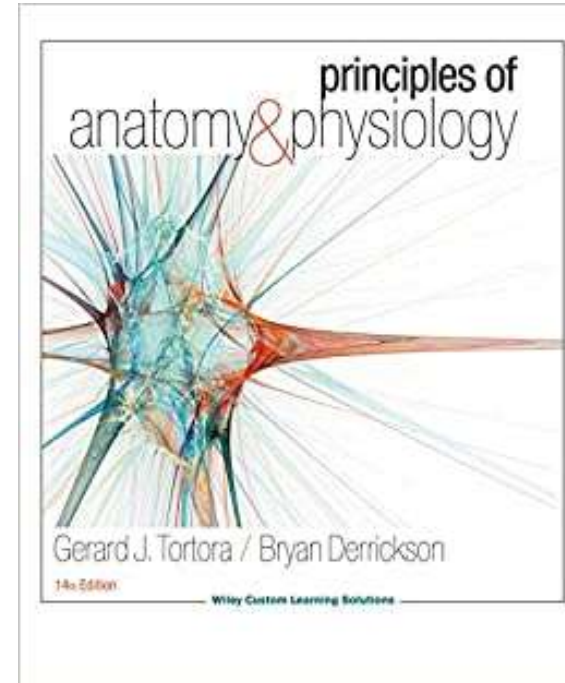
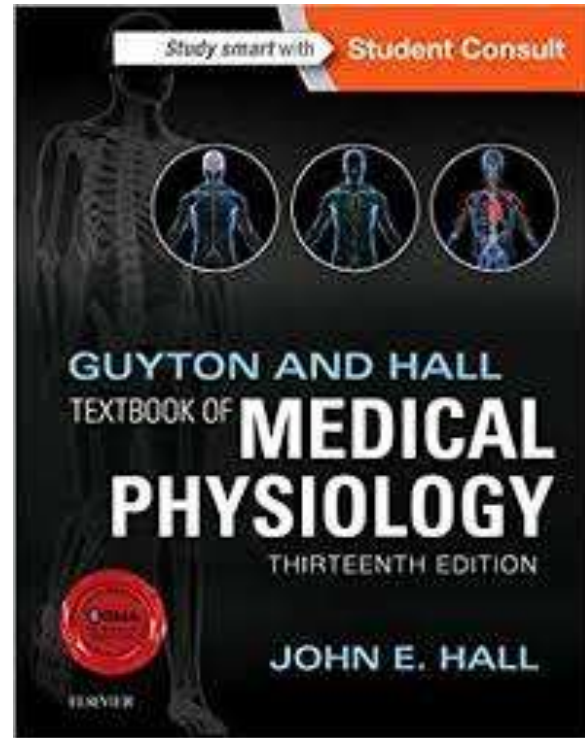
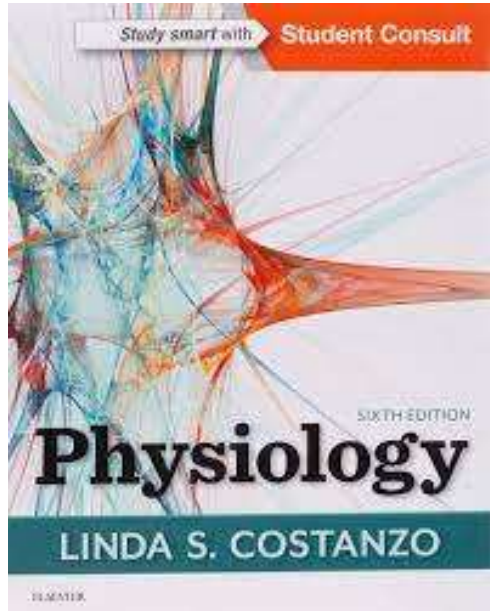
- **3. Generation of nerve impulses.** When a graded potential in a sensory neuron reaches threshold, it triggers one or more nerve impulses, which then propagate toward the CNS.
- **4. Integration of sensory input.** A particular region of the CNS receives and processes the sensory nerve impulses.

Cerebral cortex



- **Perception** is the conscious interpretation of sensations and is primarily a function of the cerebral cortex.

References



Thank you