Sensory Coding
L5

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Objectives

1. what is sensory coding
2. laws of sensory coding

- Each of the principal types of sensation that we can experience—pain, touch, sight, sound, and so forth

  Is called a **modality of sensation**

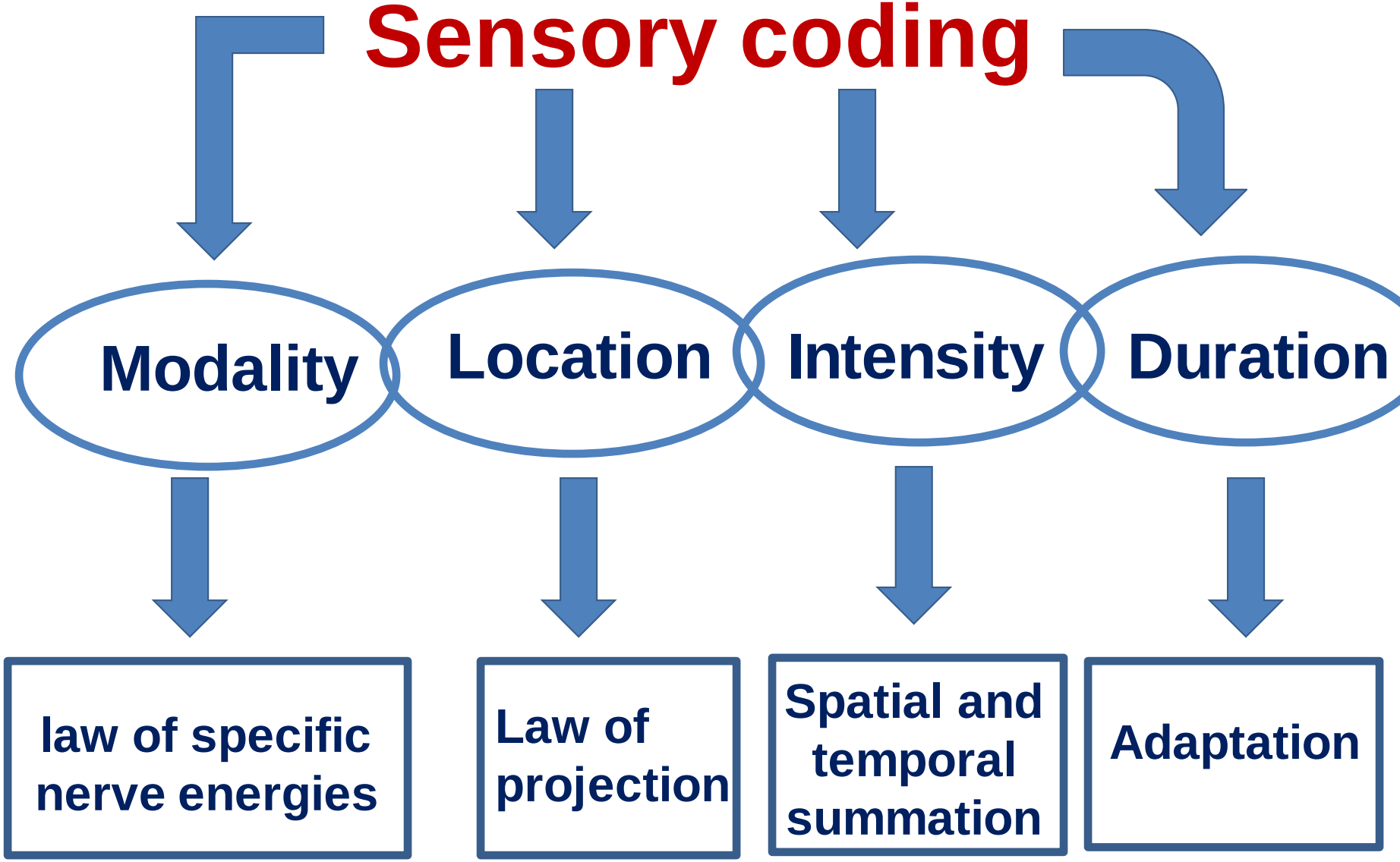
  However….

- nerve fibers transmit only impulses. Therefore,

- How do different nerve fibers transmit different modalities of sensation?

- each nerve tract terminates at a specific point in the central nervous system.

Sensory coding



Modality

is the type of energy transmitted by the stimulus

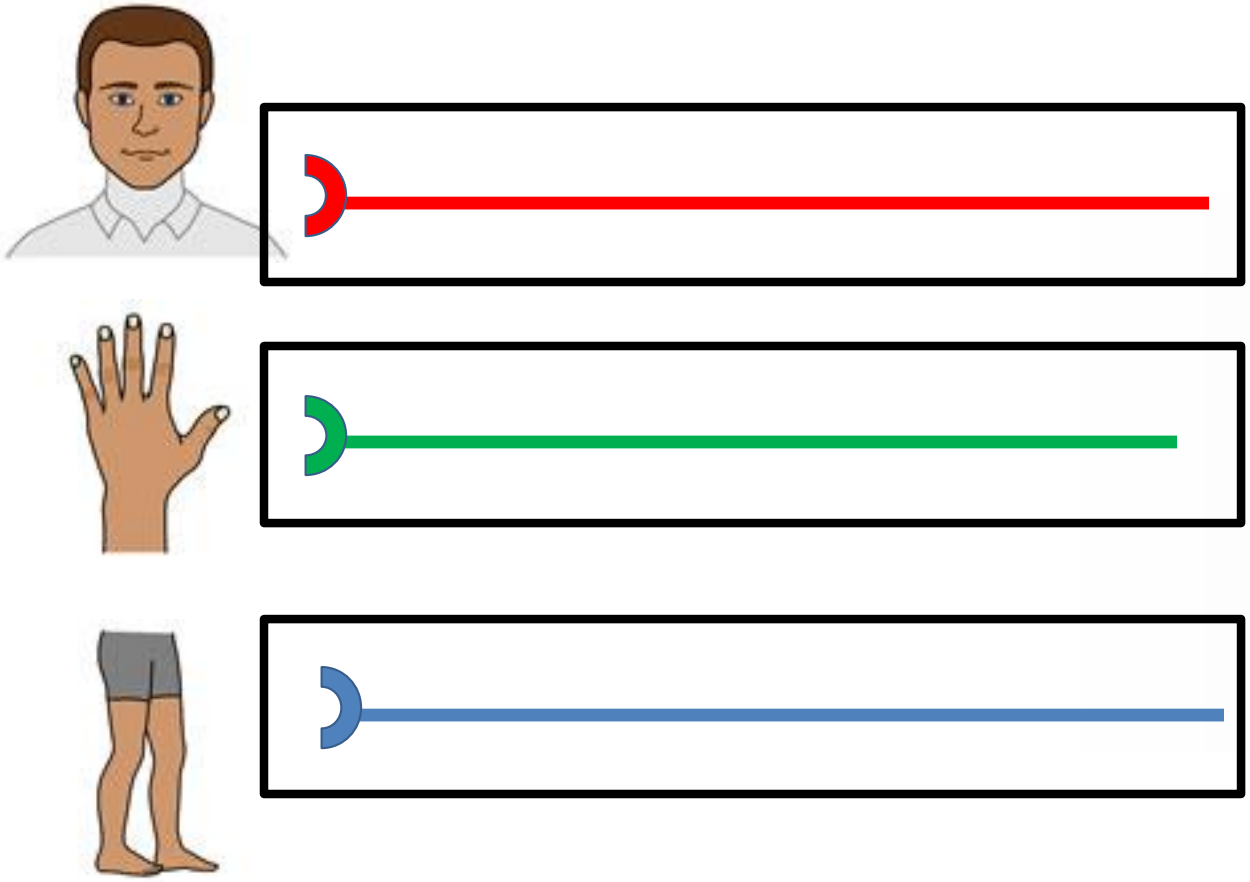
conscious senses

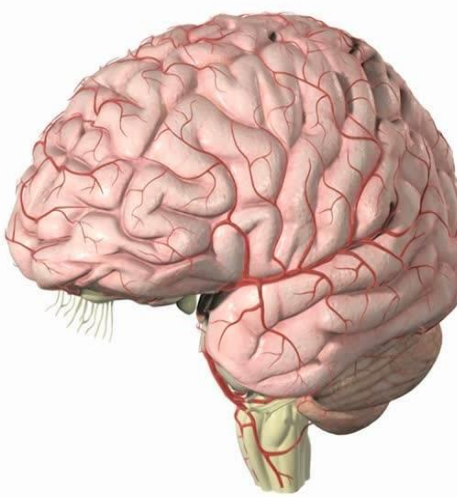
- vision
- Hearing
- Smell
- touch
- Pressure
- pain

not reach consciousness

- muscle length
- arterial blood pressure
- arterial Po2

Labeled line principle





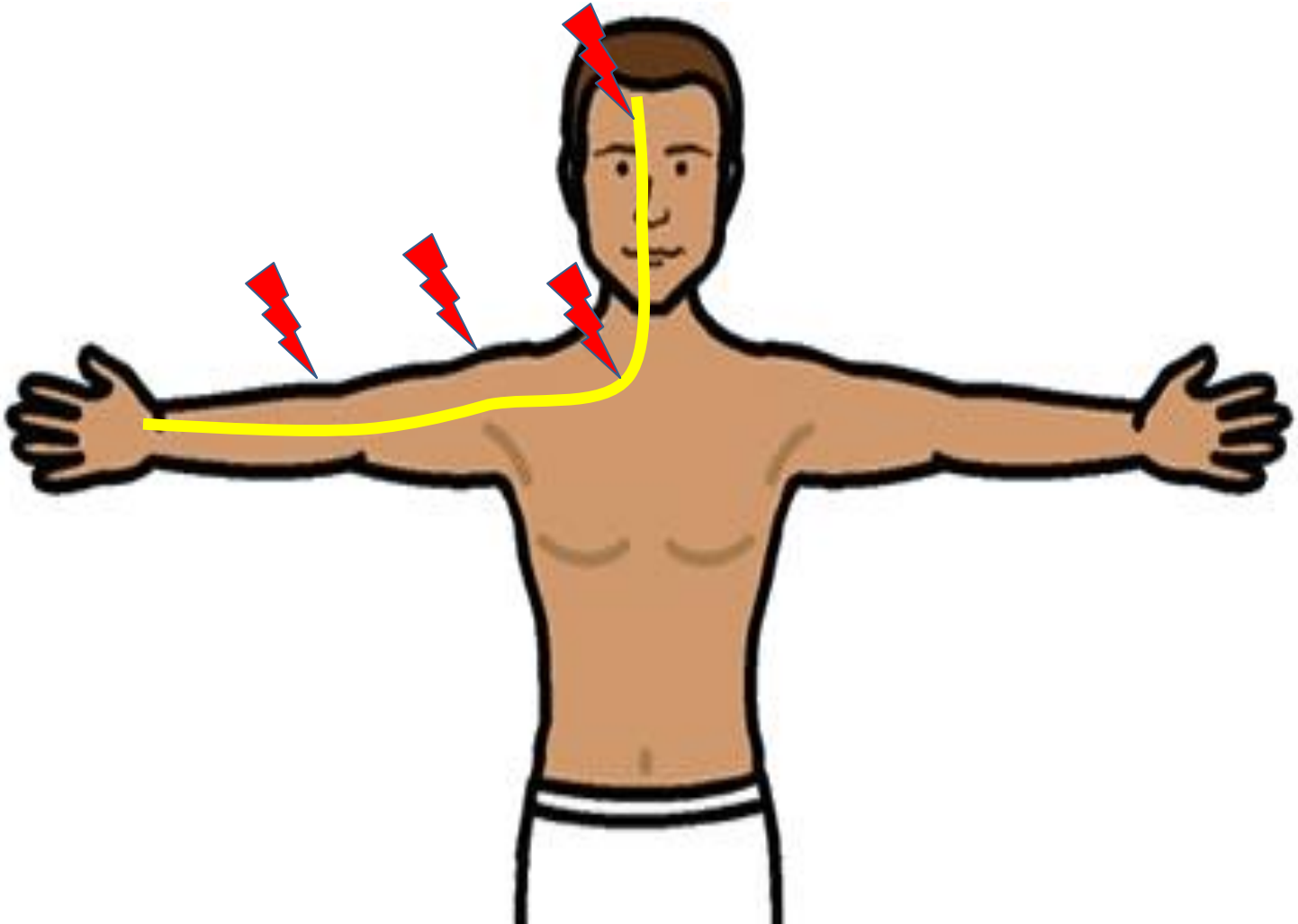
Labeled line principle

- The specificity of nerve fibers for transmitting only one modality of sensation.

law of specific nerve energies

- when the nerve pathways from a particular sense organ are stimulated, the sensation evoked is that for which the receptor is specialized no matter how or where along the pathway the activity is initiated

example, if the sensory nerve from a Pacinian corpuscle in the hand is stimulated by electrodes at the elbow, the brachial plexus, the dorsal columns of the spinal cord, the thalamus, or the postcentral gyrus of the cerebral cortex, the sensation produced by stimulation would be touch.



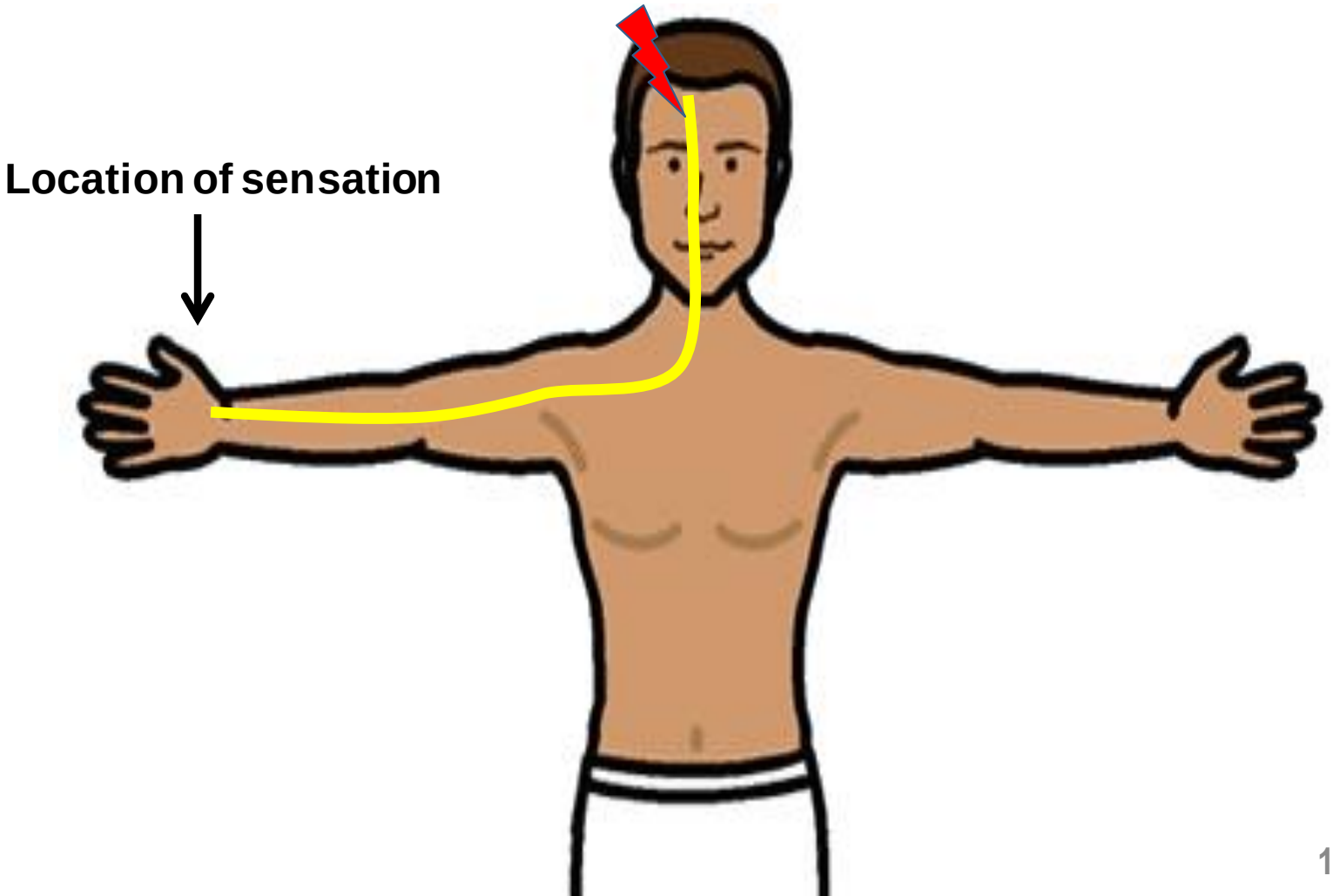
Location

is the site on the body or space where the stimulus originated

Law of projection

No matter where a particular sensory pathway is stimulated along its course to the cortex, the conscious sensation produced is referred to the location of the receptor.

For example: when the cortical receiving area for impulses from the right hand is stimulated, the patient reports sensation in the left hand, not in the head.

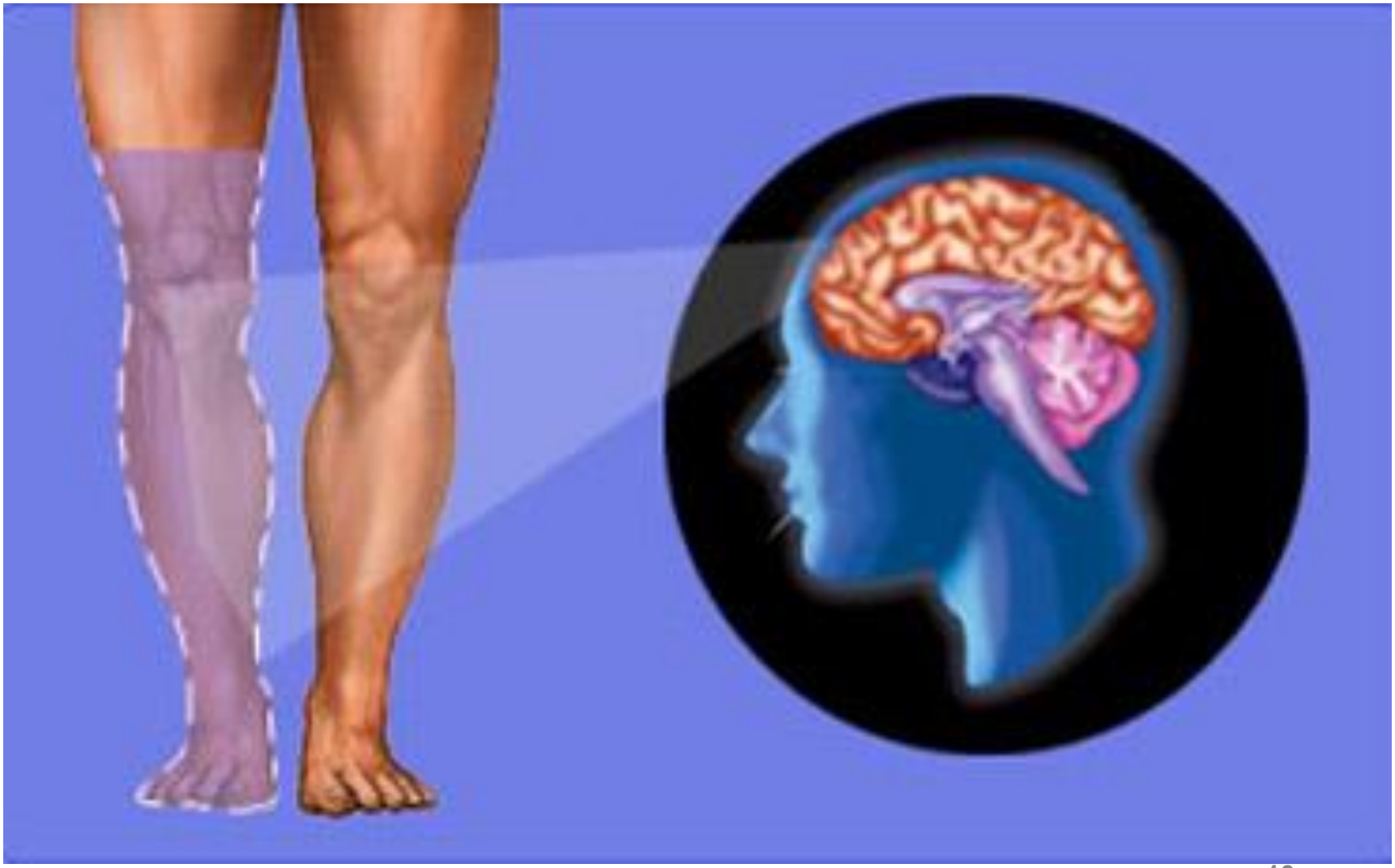


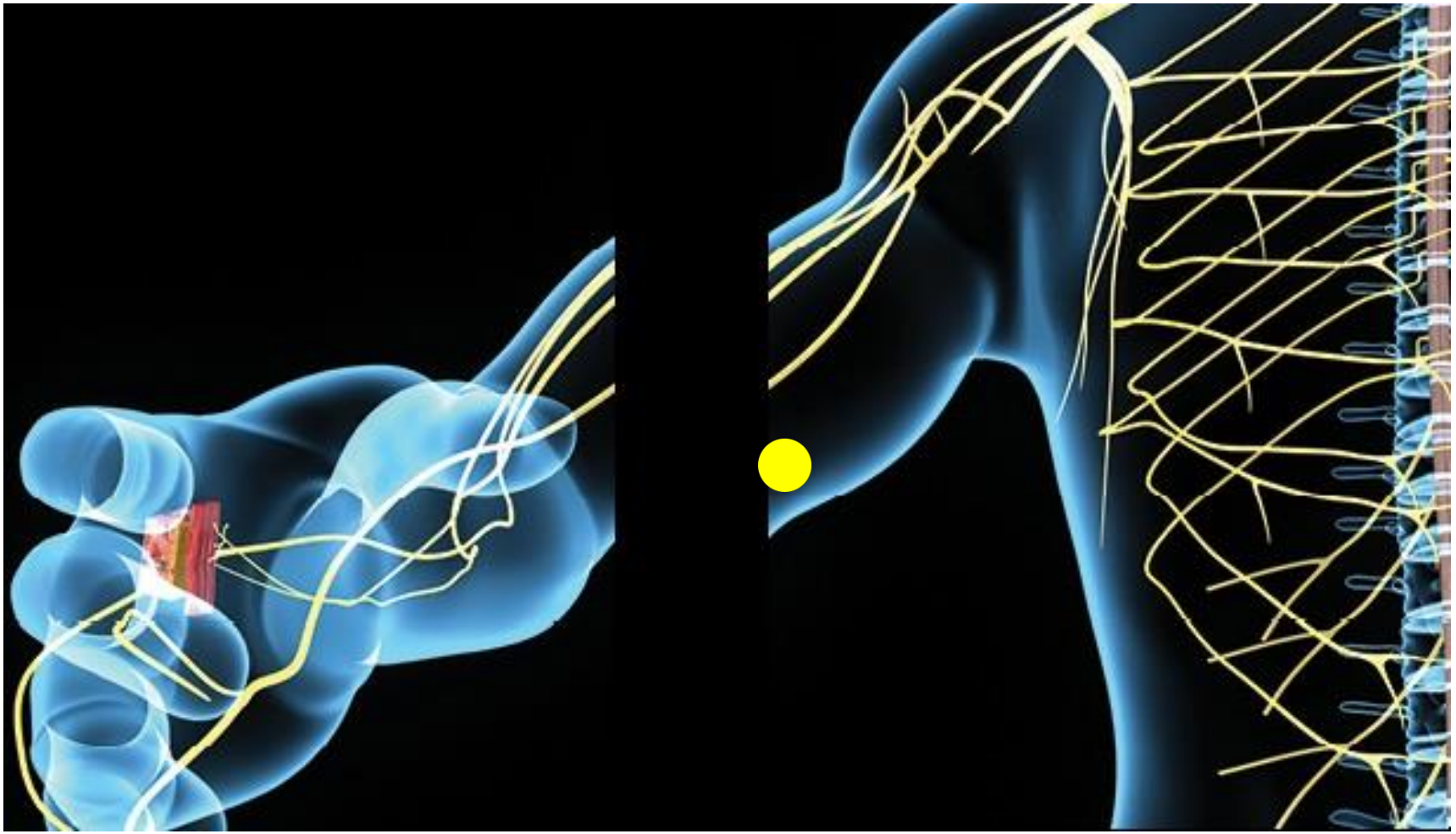
Phantom Limb Pain

In 1551, a military surgeon, Ambroise Pare, wrote :

"…the patients, long after the amputation is made, say they still feel pain in the amputated part. Of this they complain strongly, a thing worthy of wonder and almost incredible to people who have not experienced this

Between 50 and 80% of amputees experience phantom sensations

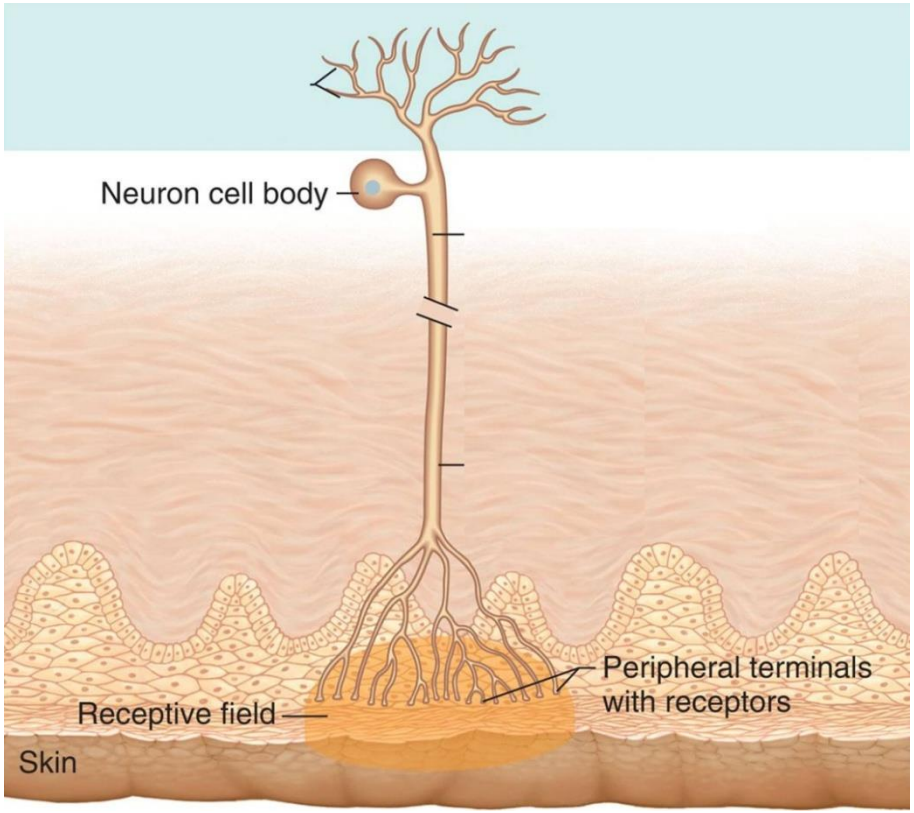




The ends of the nerve cut at the time of amputation often form nerve tangles called neuromas. These may discharge spontaneously or when pressure is put on them. The impulses that are generated are in nerve fibers that are previously come from sense organs in the amputated limb, and the sensation evoked are projected to where the receptors used to be.

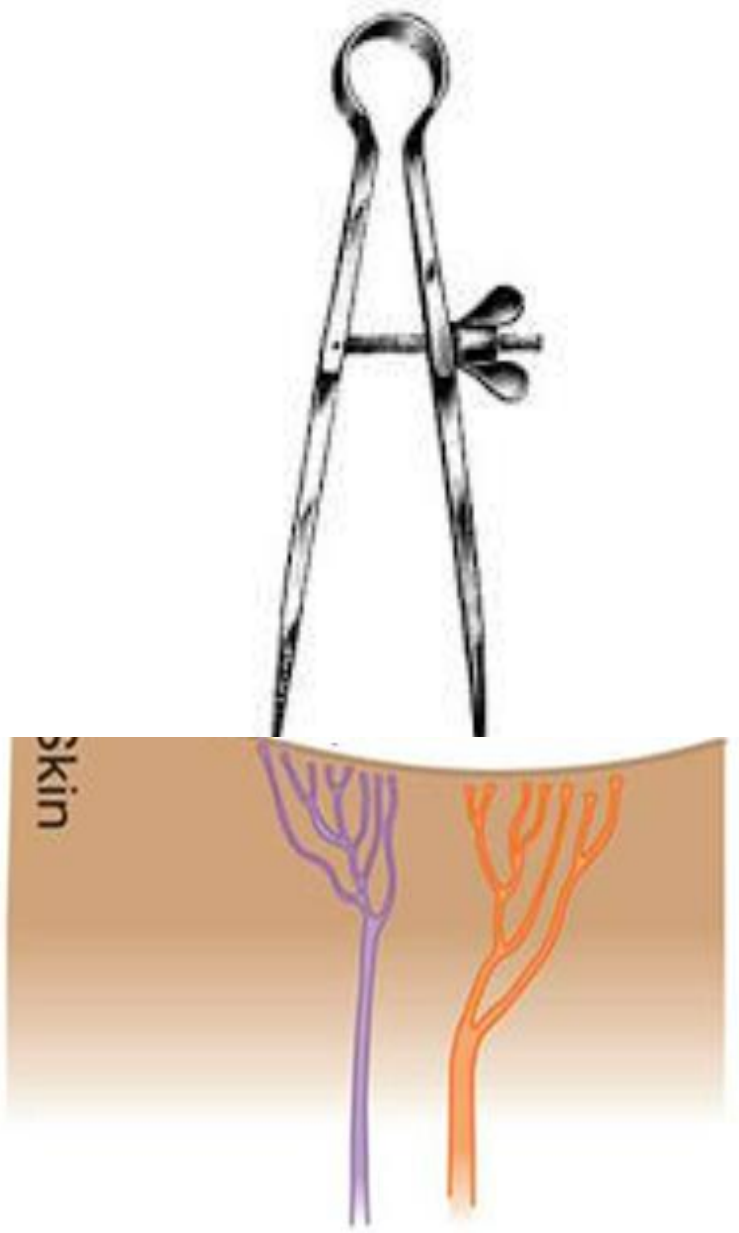
❑**sensory unit** refer to single sensory axon and all its peripheral branches.

❑**Receptive field** of a sensory unit is the spatial distribution from which a stimulus produces a response in that unit

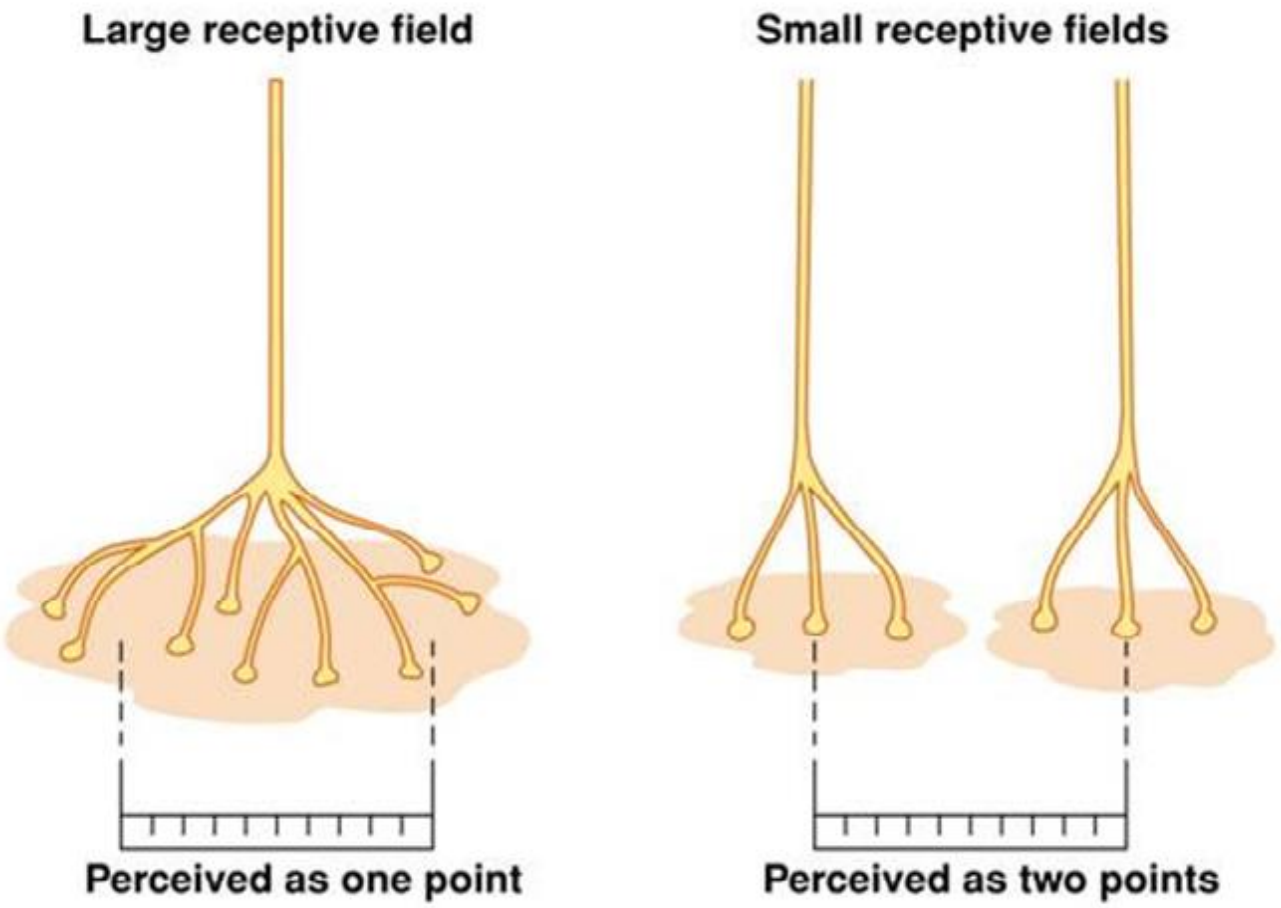


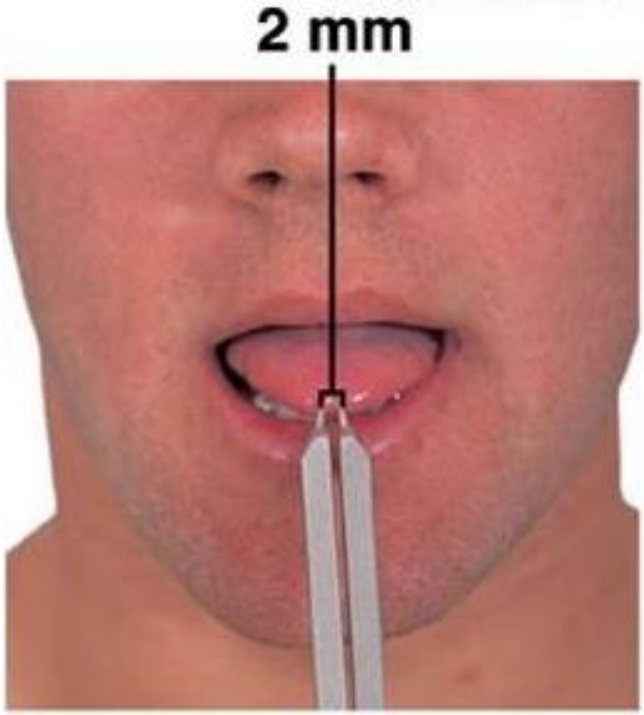
Two-Point Discrimination.

In this procedure, the two points on a pair of calipers are simultaneously positioned on the skin and one determines the minimum distance between the two caliper points that can be perceived as separate points of stimulation. This is called the two-point discrimination.



- Two-point discrimination is used to test the integrity of the **dorsal column (medial lemniscus) system,** the central pathway for touch and proprioception.

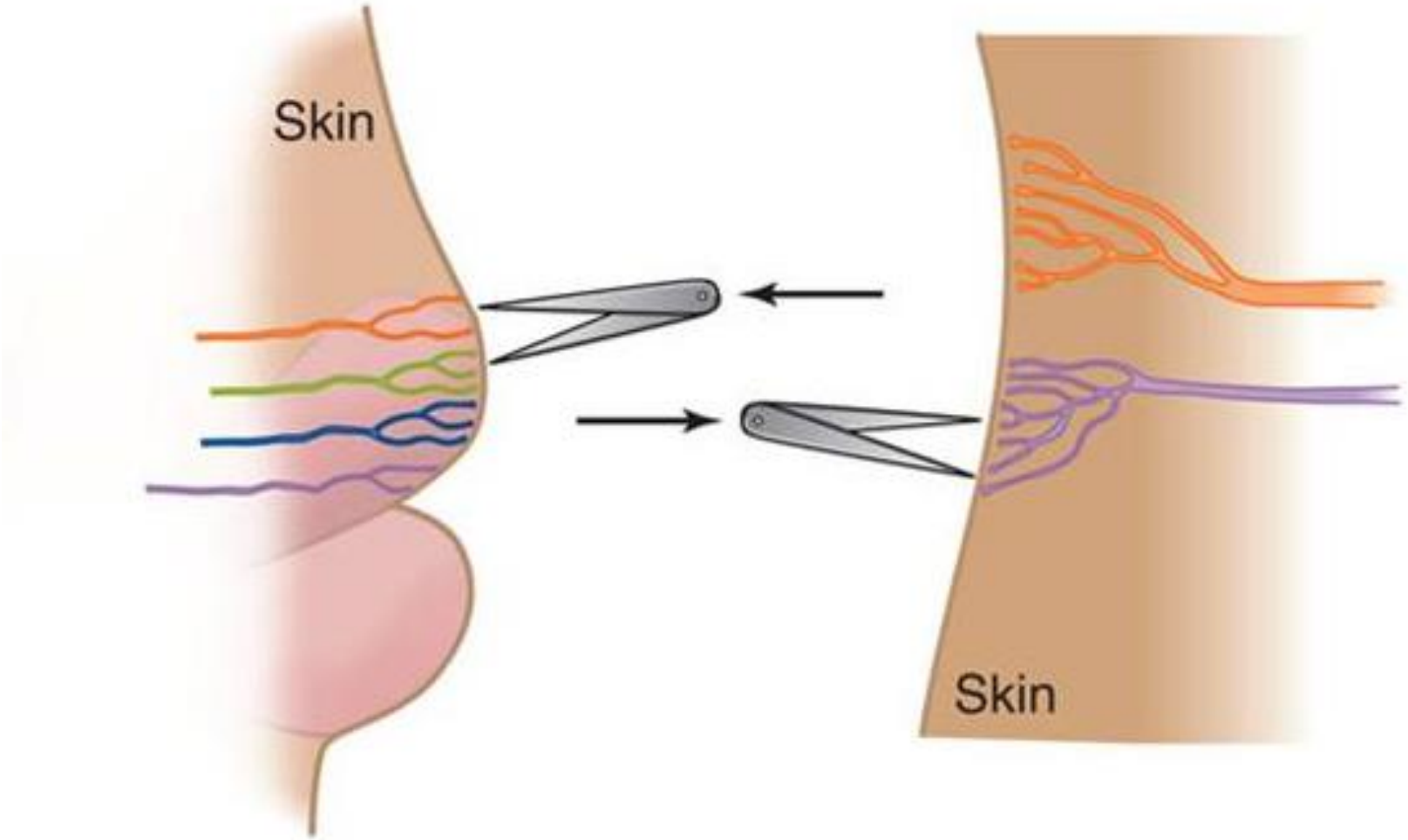




The threshold varies from place to place on the body and is smallest where touch receptors are most abundant.
The back separated by at least 65 mm before they can be distinguished as separate.
On the fingertips two stimuli are recognized if they are separated by as little as 2 mm.

Lips: Two distinct points are felt

Back: Only one point is felt



Intensity

determined by the amplitude of the stimulus applied to the receptor.

↑ pressure applied to the skin

↑ receptor potential in the mechanoreceptor

↑ the frequency of the action potentials

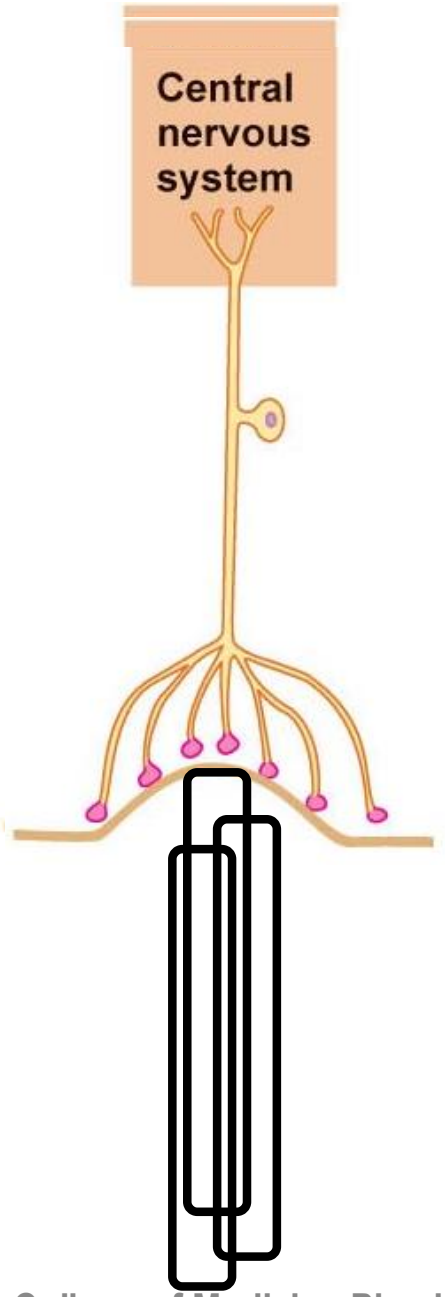
Activate more receptors into the receptive field

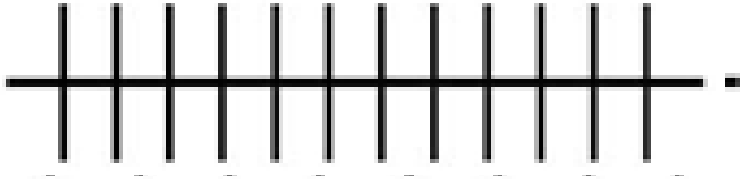
So stimulus intensity coded by:

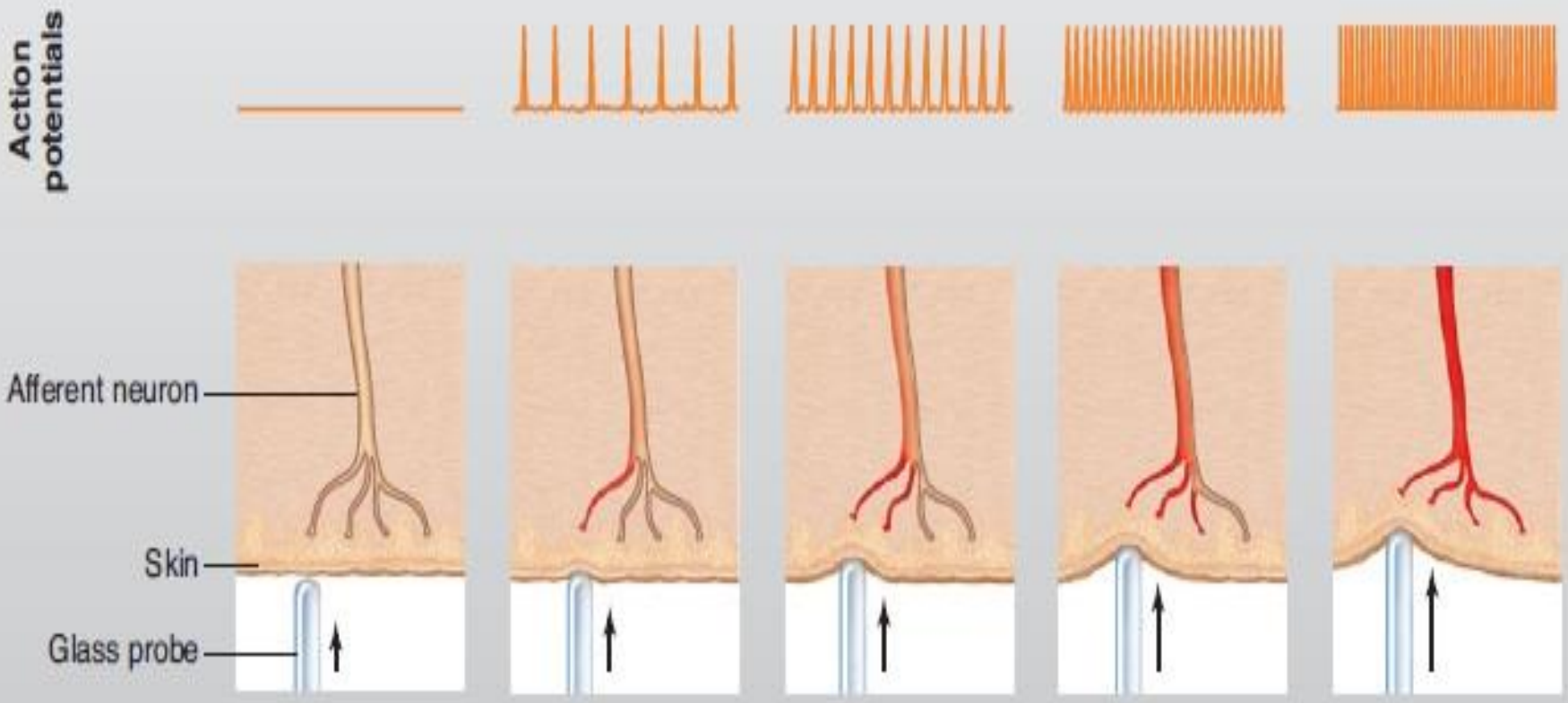
(1) the number of receptors activated (spatial summation)

(2) the frequency of action potentials

(temporal summation)


Central
nervous
system




Action potentials
Afferent neuron
Skin
Glass probe


Pressure (mmHg)
180
120
60

Duration

refers to the time from start to end of a response in the receptor

Adaptation of receptors

rapidly adapting (phasic) receptors

•Meissner and Pacinian corpuscles

slowly adapting (tonic) receptors

•Merkel cells and Ruffini endings
•muscle spindles
• nociceptors
• baroreceptors of the arterial tree
•chemoreceptors of the carotid and aortic bodies.

Thank You