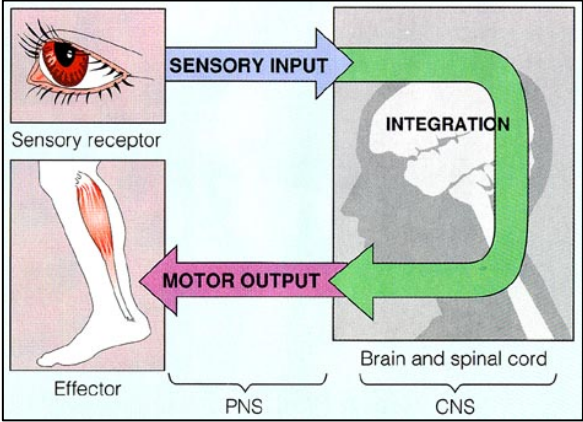
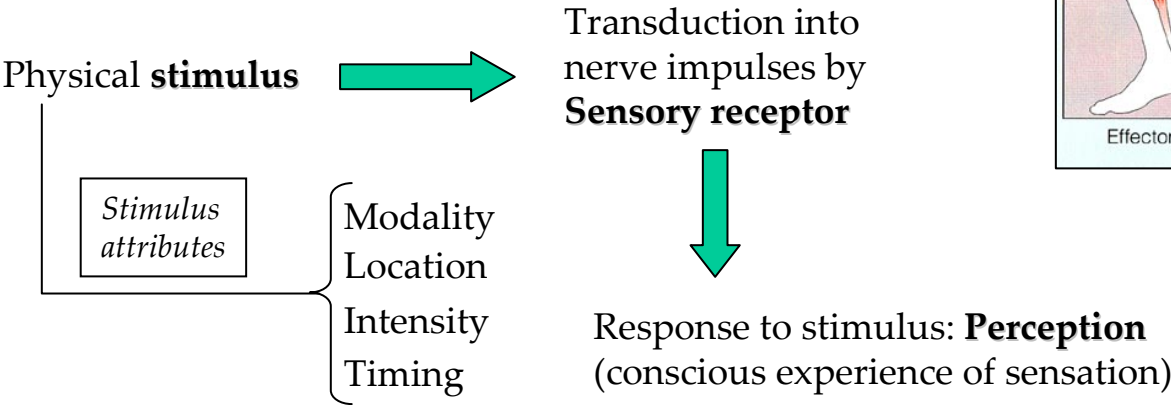


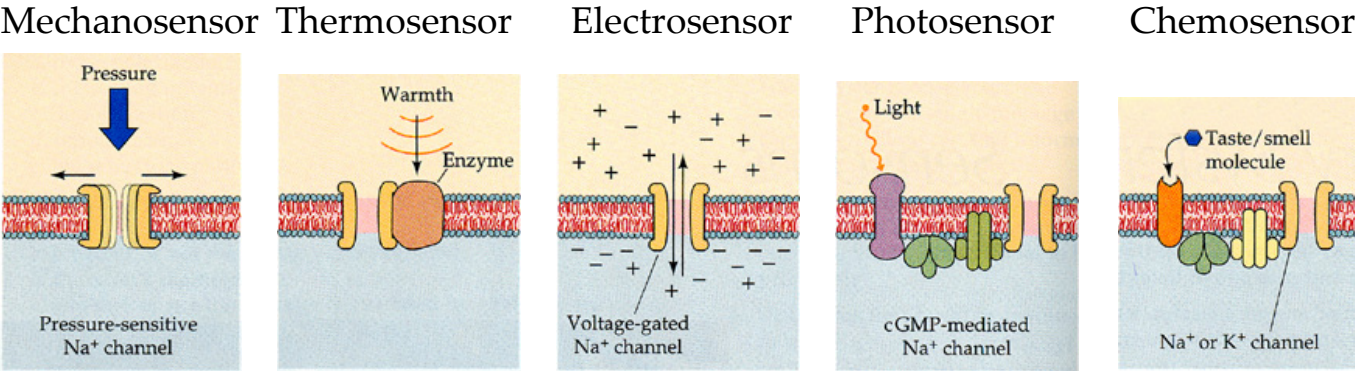
Sensory system physiology

Common aspects of sensory systems



Morphological substrate: Molecular sensors

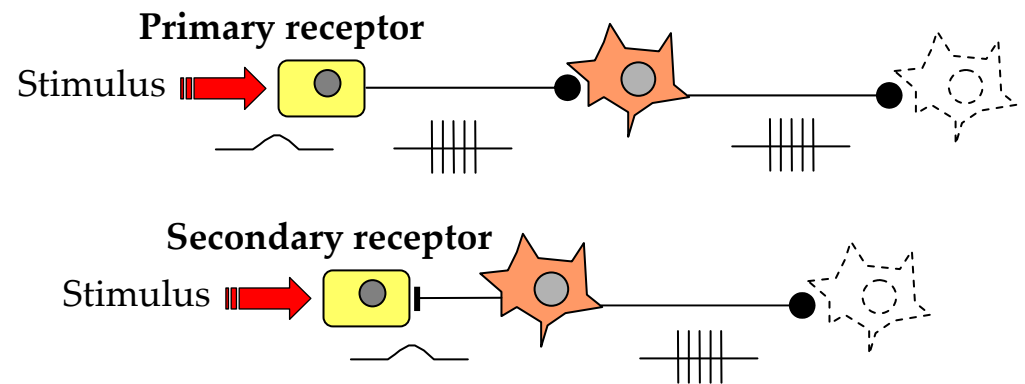
Each receptor molecule transduces a specific type of energy into electrical signals.



Sensory receptor cell

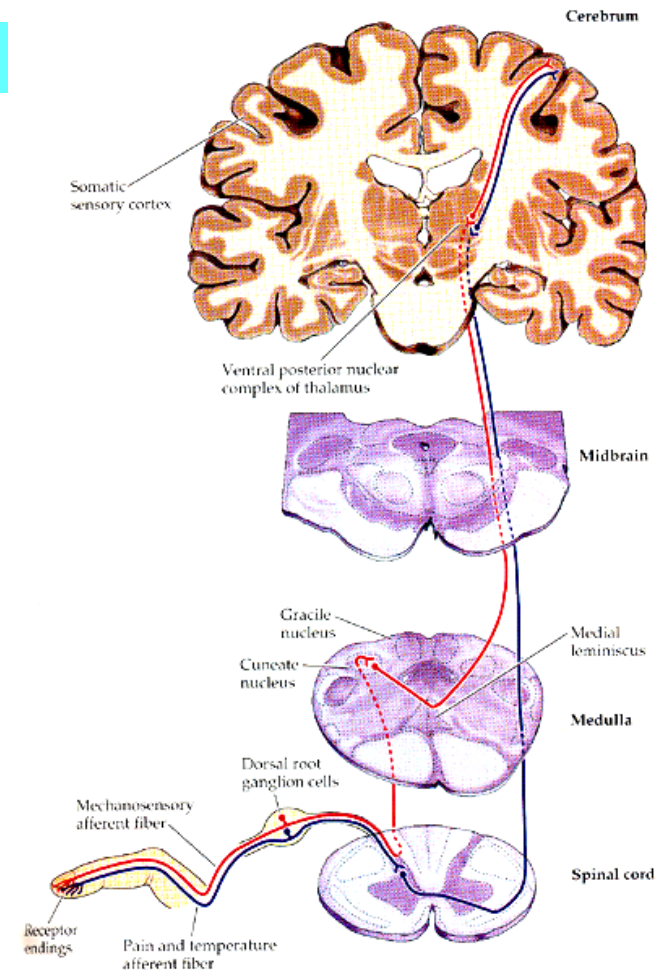
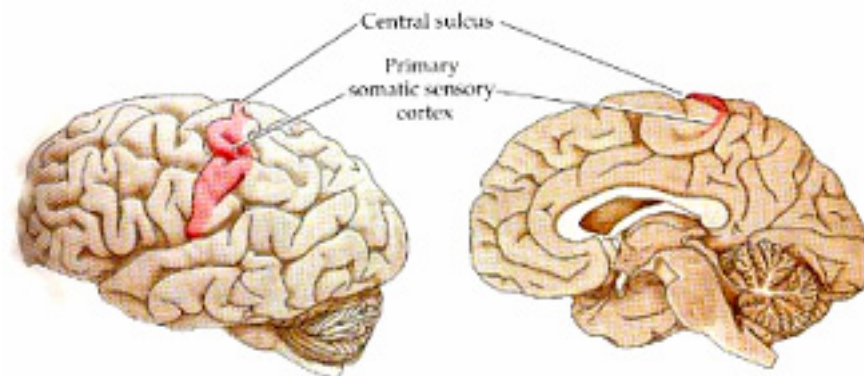
Types of sensory receptor

Concept and characteristics of the receptor potential



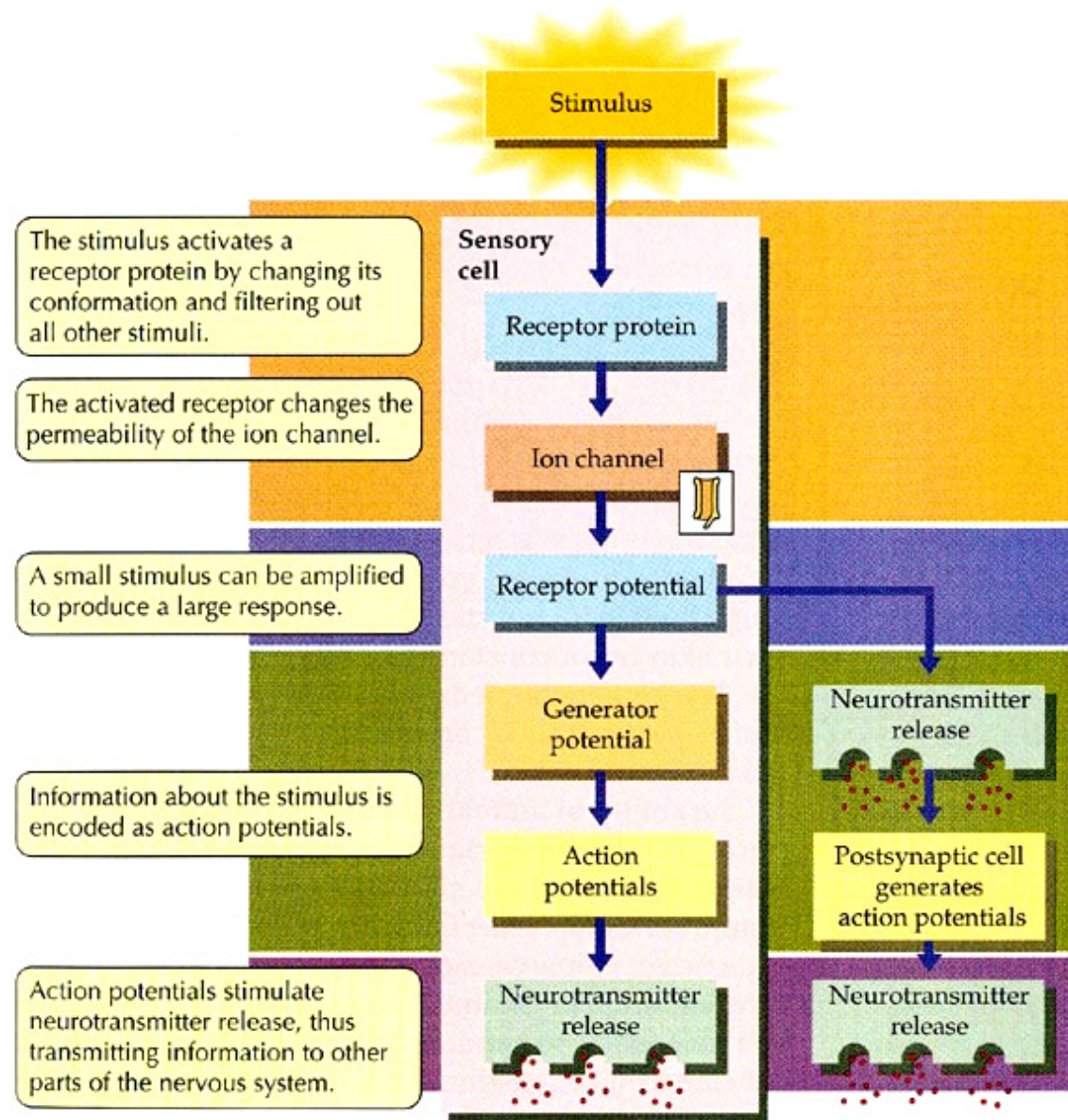
Organization of sensory pathways

1. Serial processing
2. Parallel processing
3. Sensory maps



Stimulus transduction

How does a sensory cell transduce stimulus energy into action potentials?



Coding of sensory information

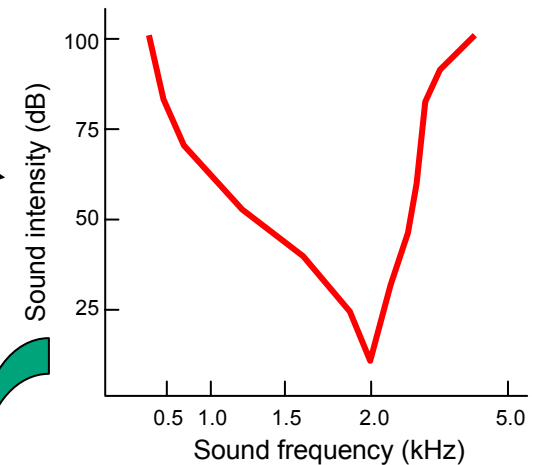
Modality

Type of energy. Specialized receptor tuned to 'adequate' stimulus.



Sensory system	Modality	Stimulus energy	Receptor class
Visual	Vision	Light	Photoreceptor
Auditory	Hearing	Sound	Mechanoreceptor
Vestibular	Balance	Gravity	Mechanoreceptor
Somatosensory	Somatic senses:		
	Touch	Pressure	Mechanoreceptor
	Proprioception	Displacement	Mechanoreceptor
	Temperature sense	Thermal	Thermoreceptor
	Pain	Chemical, thermal, or mechanical	Chemoreceptor, thermoreceptor, or mechanoreceptor
	Itch	Chemical	Chemoreceptor
Gustatory	Taste	Chemical	Chemoreceptor
Olfactory	Smell	Chemical	Chemoreceptor

Modality is encoded by a
Labeled line code

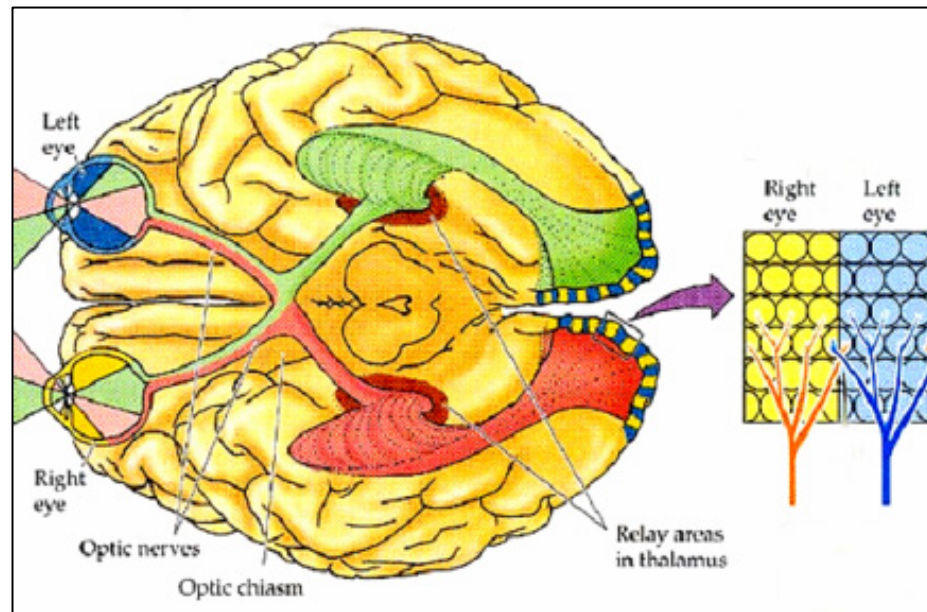
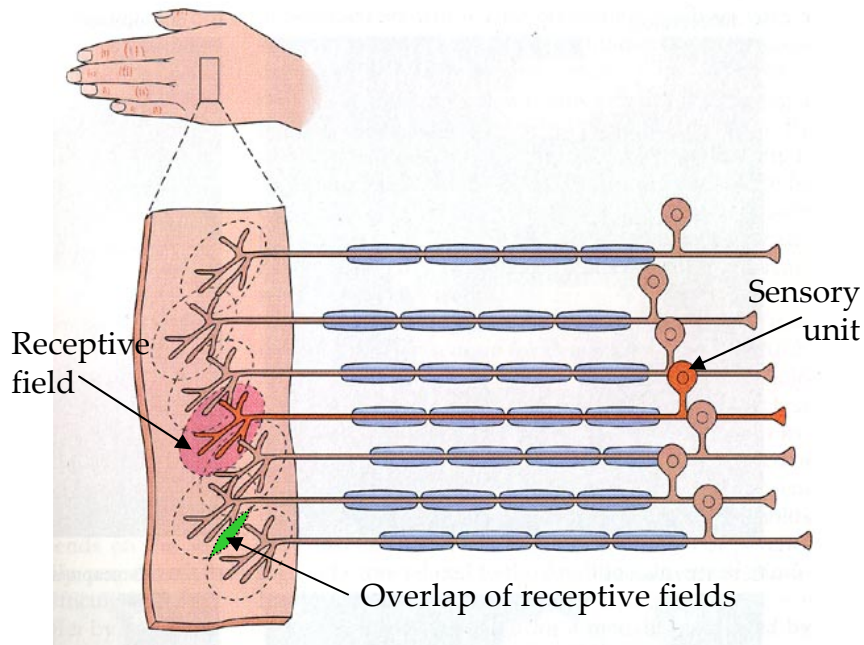


Each modality has
submodalities

Location

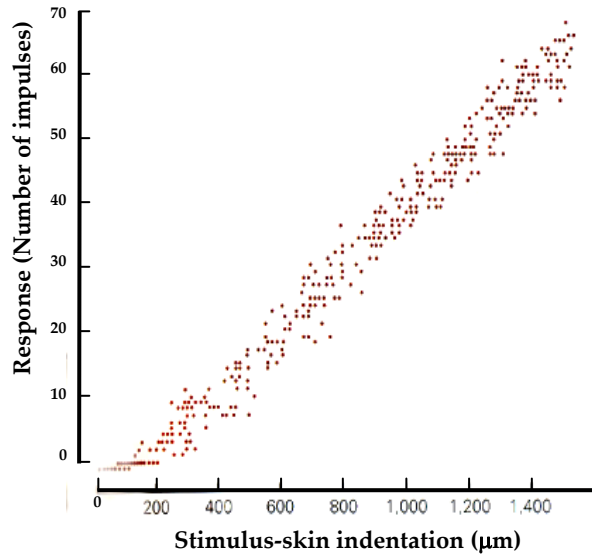
Spatial distribution of activated receptors.
Concepts of receptive field and sensory unit.

Receptor projections and their relay neurons organize in a topographic map.



Intensity

Stimulus intensity is encoded by action potential firing frequency

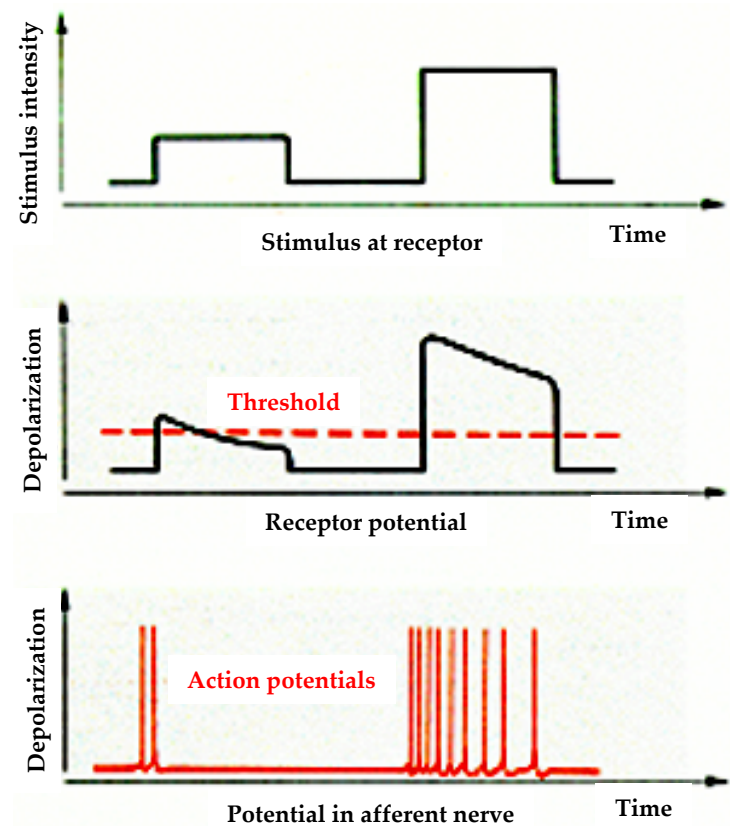


Sensory threshold

1. Absolute threshold
2. Differential threshold

Weber's Law

$$\frac{\Delta S}{S} = k$$



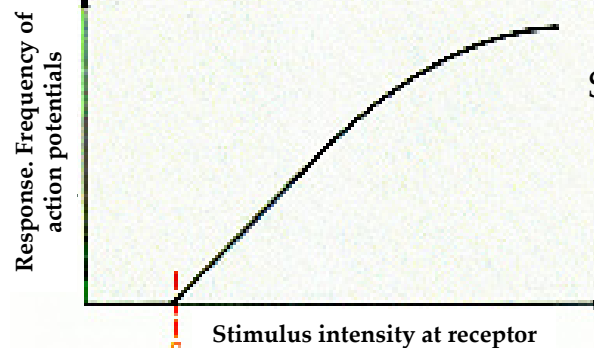
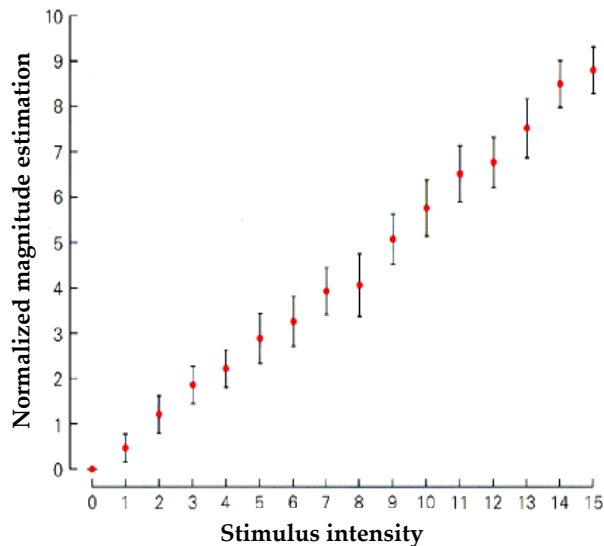
Intensity / sensation relationship

Stevens's Law

$$I_{sens} = k (S - S_0)^n$$

$$\log I = \log k + n \log (S - S_0)$$

The stimulus intensity is faithfully coded into sensation



Firing frequency has an upper limit

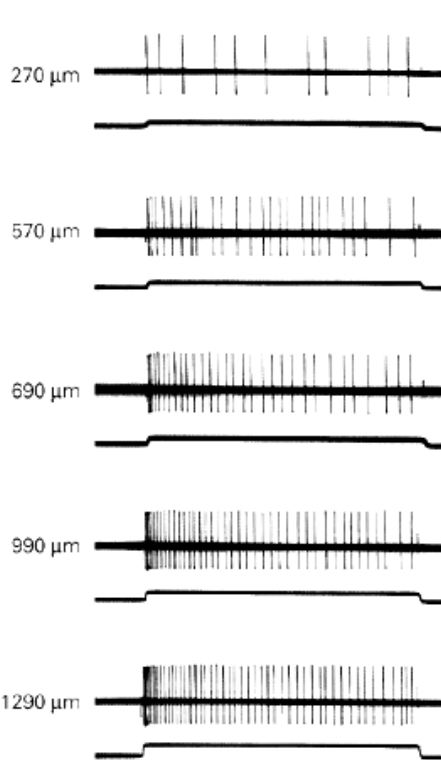
Stimulus intensity is also encoded by the size of the responding receptor population

Recruitment of sensory units

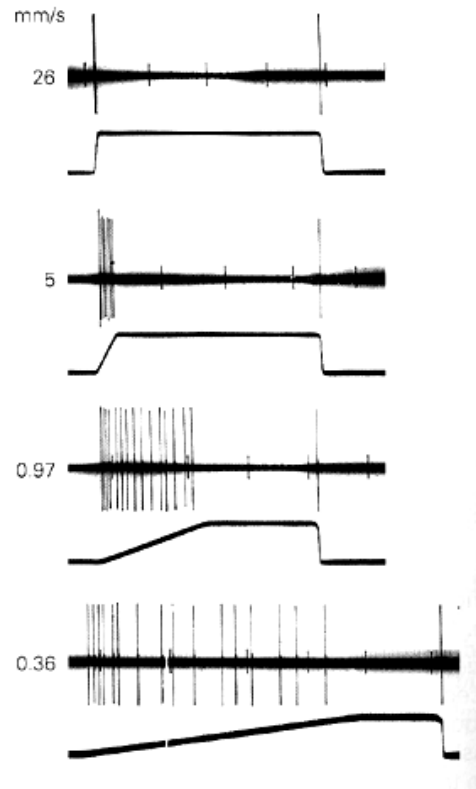
Duration

Adaptation of sensory receptors

A Slowly adapting receptor



B Rapidly adapting receptor

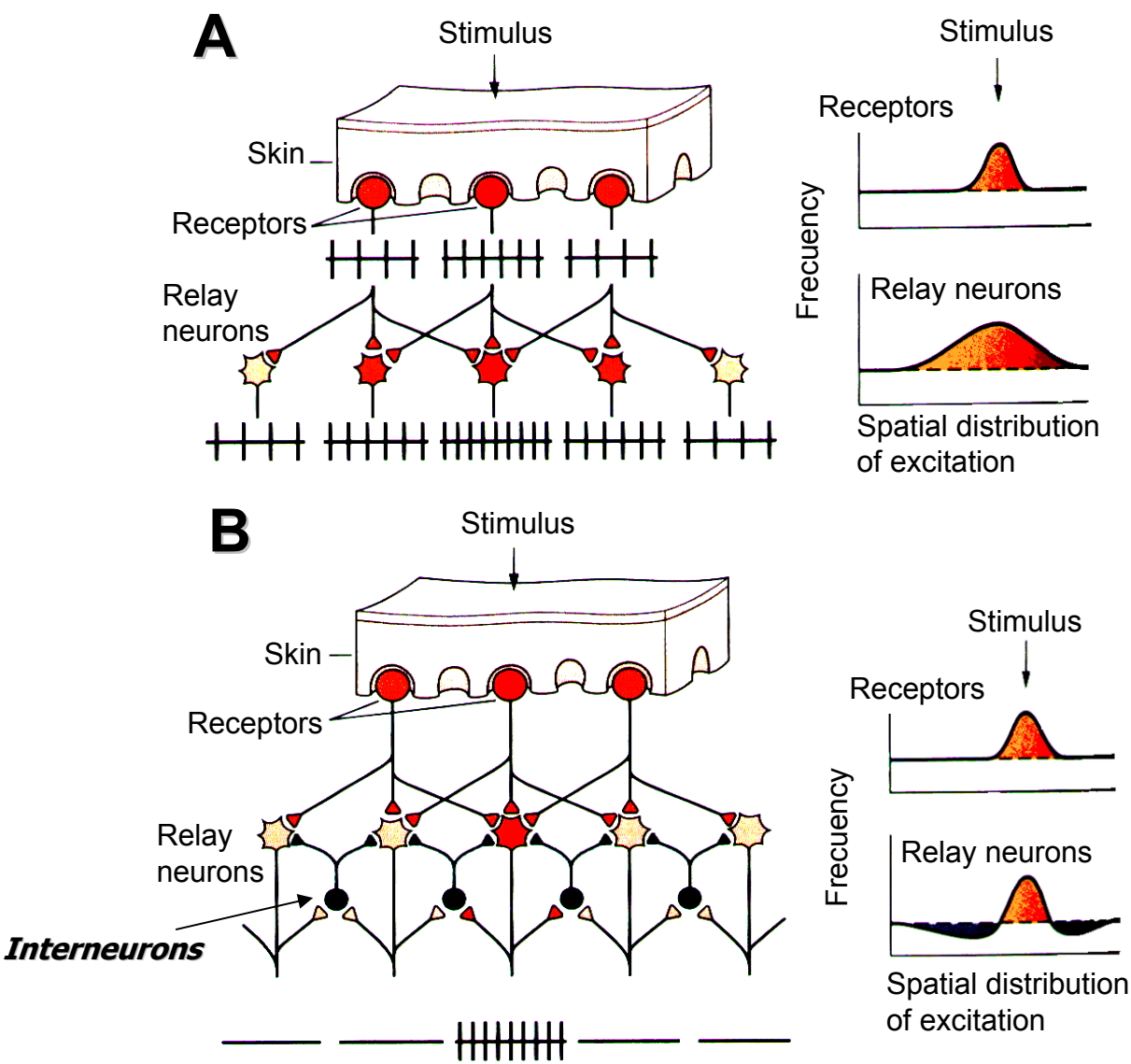


Duration can be coded by the adaptation of receptors

Concept and molecular basis of adaptation

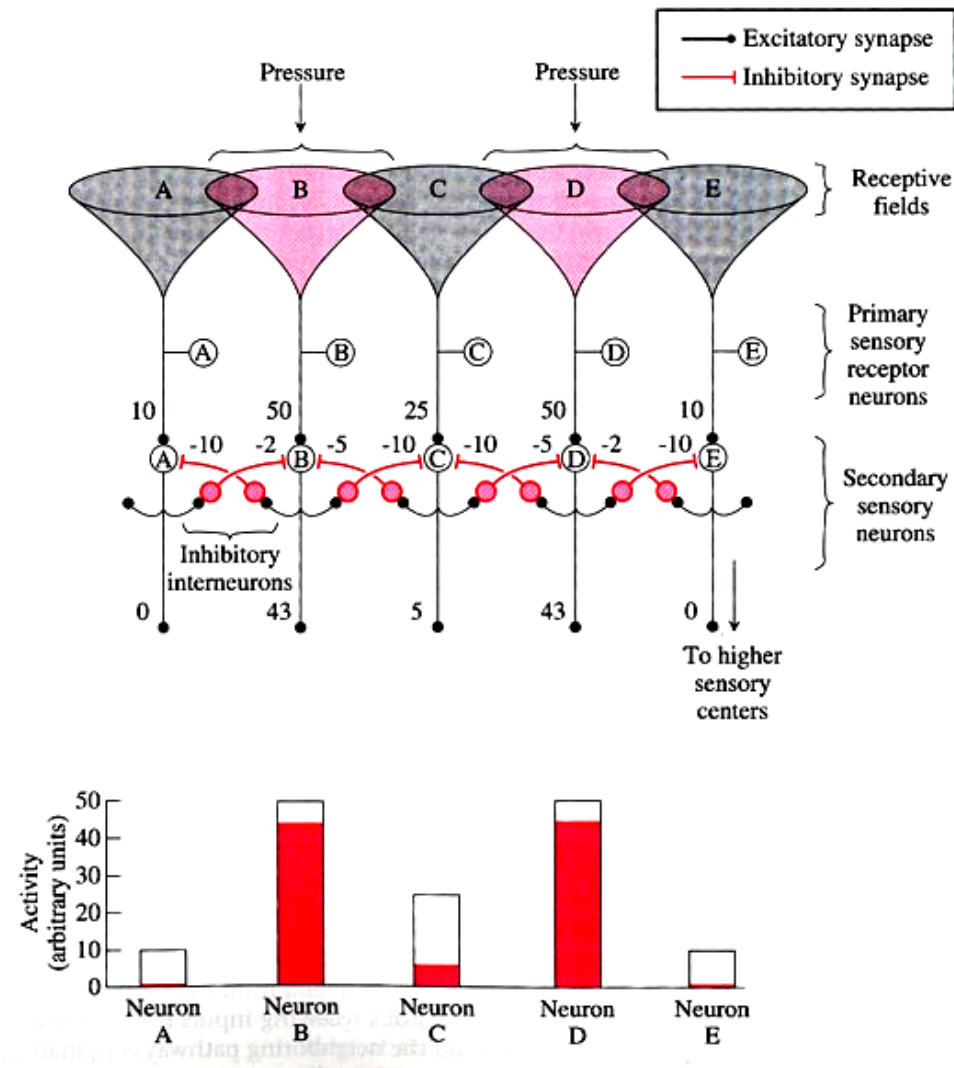
1. Changes in receptor protein
2. Changes in amplification step
3. Changes in ionic channels and neural excitability

Lateral inhibition



Homework

Lateral inhibition: a different view



Types of inhibitory mechanisms acting upon sensory relay nucleus

