

# The sensory axis

By Gustav Emil Dietrichson

# Things I'm going to cover and you're going to understand

- The basics
- Cutaneous receptors
- Dorsal column-medial lemniscus
- Spinothalamic tract
- The thalamus and the cortex
- Pain
- Questions

# Receptors

- Stimulus → Conduction change → Generator potential
- Intereceptors, exteroceptors, proprioceptors, teleceptors

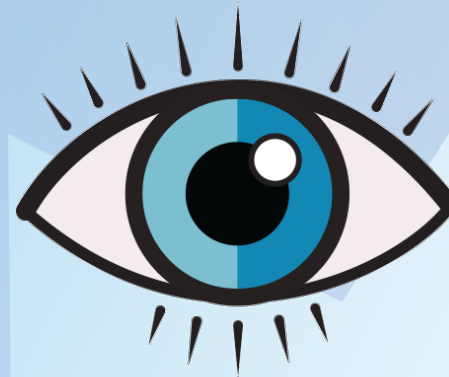
Thermoreceptors



Chemoreceptors



Photoreceptors



Mechanoreceptors



# Nerve fibers

- A

- A $\alpha$  – Proprioception

- 70-120m/s

- A $\beta$  – Touch

- 5-12m/s

- A $\gamma$  – Motor

- 3-6m/s

- A $\delta$  – Pain, temp

- 12-30m/s

FAST

- B – Preganglionic  
autonomic ggl

- 3-12m/s

- C – Pain, temp

- 0,5-2m/s

- C<sub>ggl</sub> – Postsynaptic  
sympathetic ggl

- 0,7-2,3m/s

SLOW

A fibers = Thickest  
C fibers = Thinnest

# Cutaneous receptors

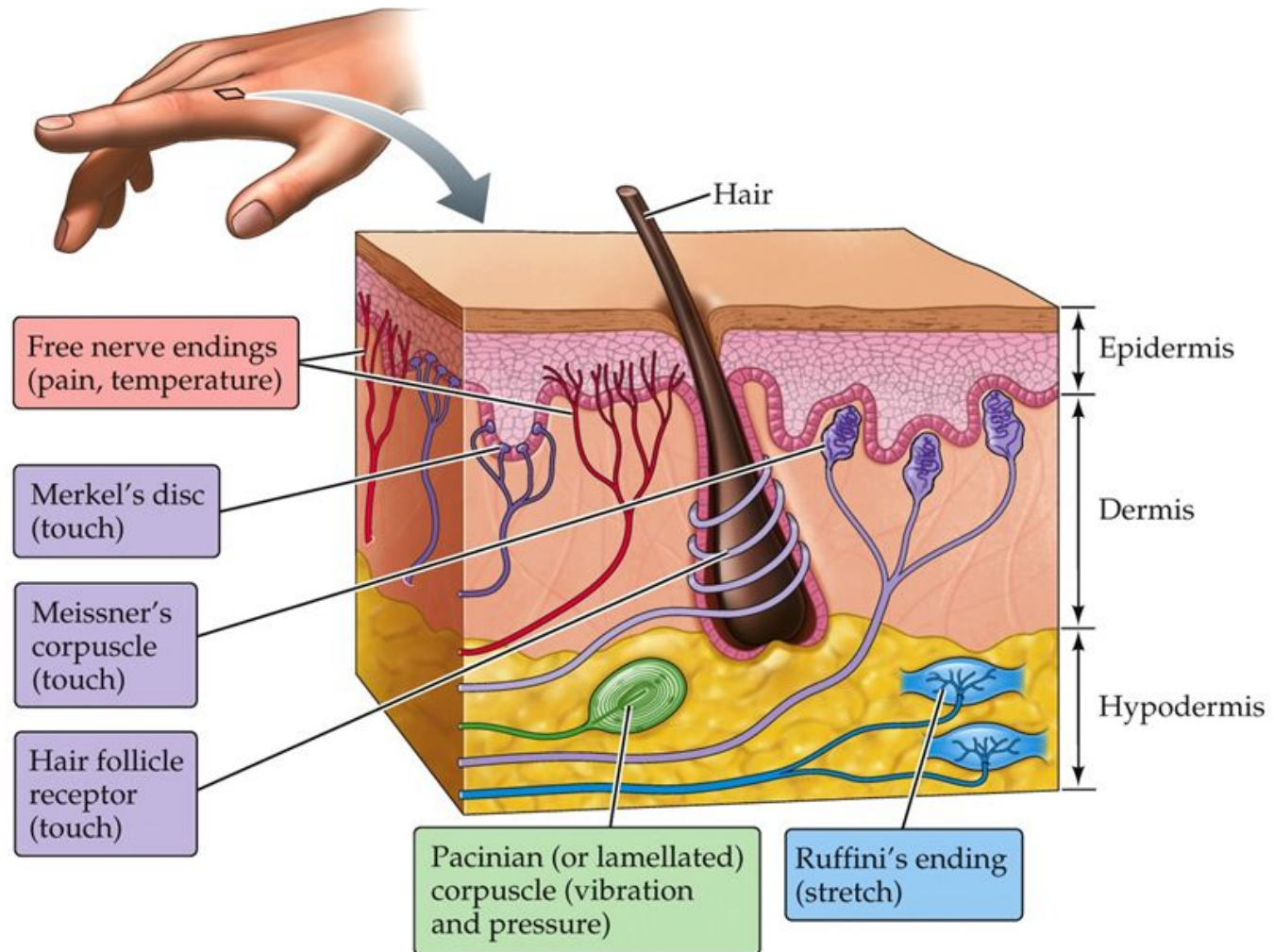
- Merkel discs
  - Fine touch
  - Discriminative touch
- Meissner corpuscles
  - Texture change
  - Slow vibrations
- Ruffini endings
  - Skin stretch
  - Sustained pressure
- Pacinian corpuscles
  - Deep touch
  - Fast vibrations

Apical

Basal

- Both "Corpuscles" are PHASIC receptors, while the other two are TONIC receptors
- \*ALL USE A $\beta$  FIBERS

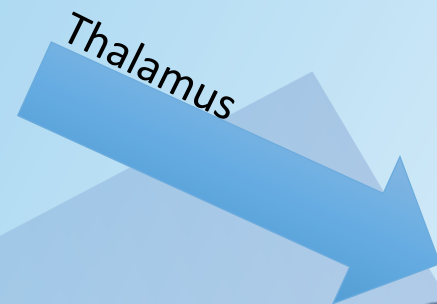
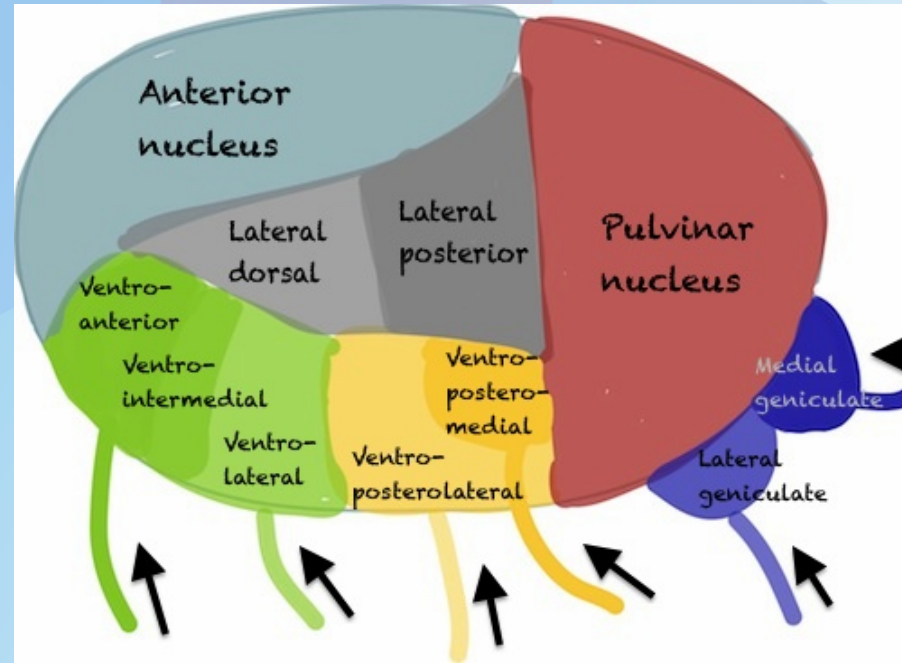
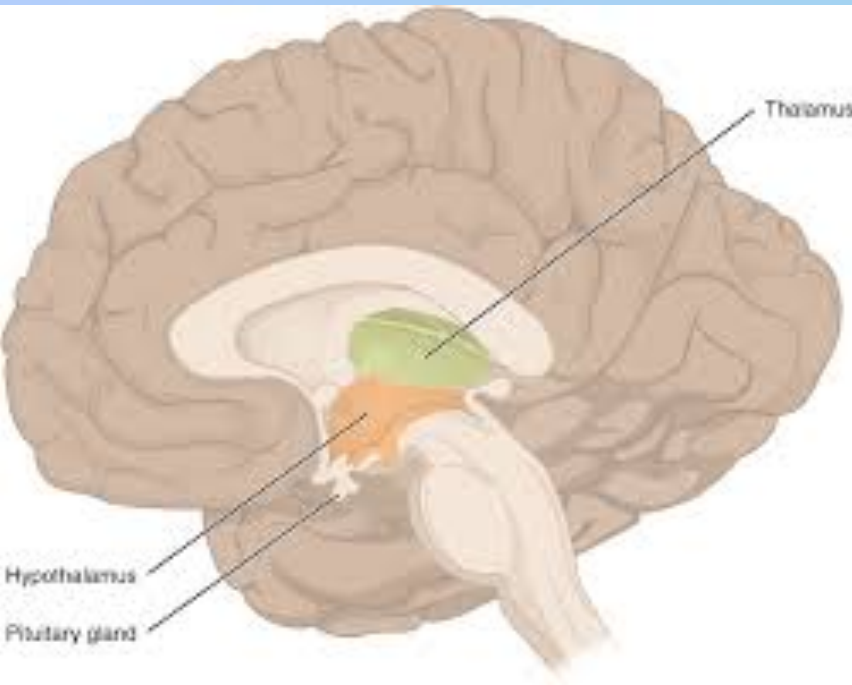
## Receptors in Skin



**BIOLOGICAL PSYCHOLOGY 7e, Figure 8.4**  
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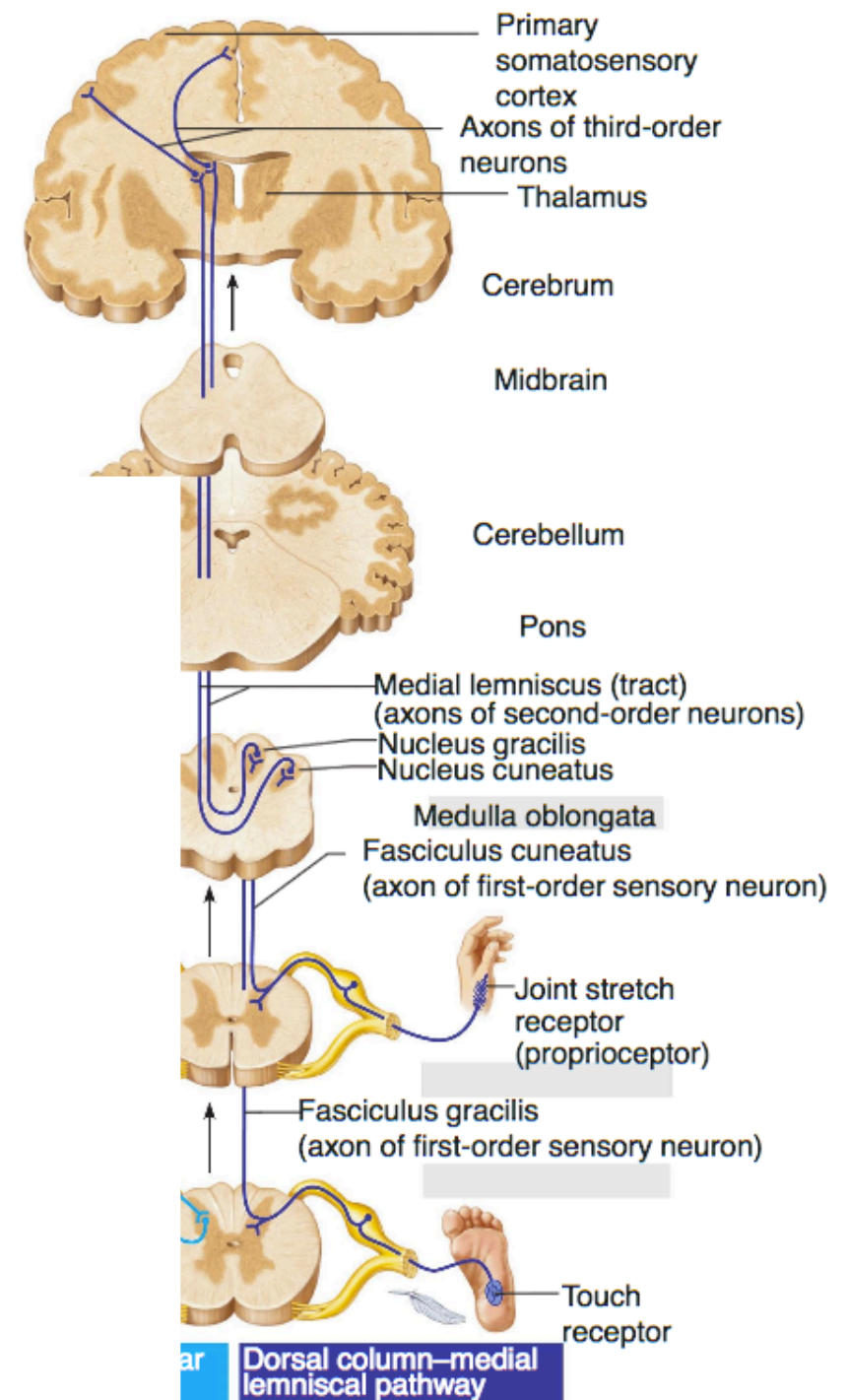
# Thalamus

- What is the Thalamus?
- Ventroposterolateral nucleus → Brodmann area 3,1,2



# Dorsal column-medial lemniscus

- Receives all information from
  - Merkel discs, Meissner corpuscles, Pacinian corpuscles, Ruffini endings
  - Muscles spindles and Golgi tendon organs
- Proprioception
- Fine touch
- Vibration (Low and high)
- Pressure (deep and superficial)
- Two touch discrimination
- **DRAW!**





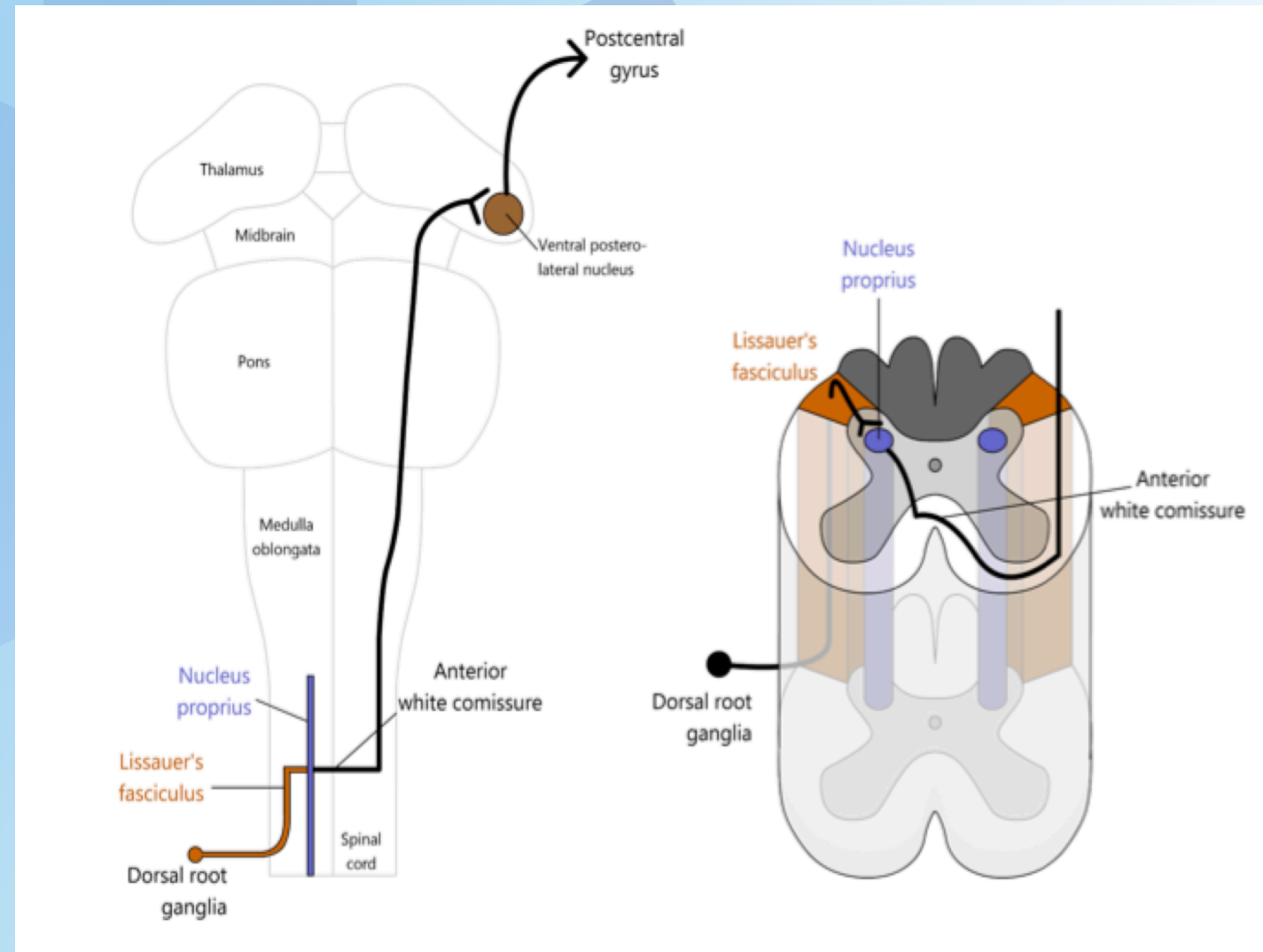
# Spinothalamic tract

- Anterior spinothalamic
  - Crude touch
- Lateral spinothalamic
  - Temperature
  - Pain
  - Itching
  - Sexual arousal

*Everything annoying*

• **DRAW!**

## Lateral spinothalamic tract



# Fast and slow pain

Fast pain	Slow pain
A $\delta$ fibers	C fibers
Myelinated	Unmyelinated
Glutamate	Substance P
Sharp, specific	Not sharp, dull, intense and diffuse
Terminates in VPL nucleus of Thalamus	75-90% terminates in the reticular formation

VR-1/TRPV-1	VRL-1
High temperatures (above 43C)	High temperatures (above 43C)
H <sup>+</sup> change	H <sup>+</sup> change
Capsaicins	

\*Nociceptors called free nerve endings

# Interpretation of pain

## Reticular formation

- Responsible for alertness in CNS
- Sorts stimuli and chooses most important one
- During sleep it ignores non-crucial stimuli

Reticular formation

Brodmann area 3,1,2

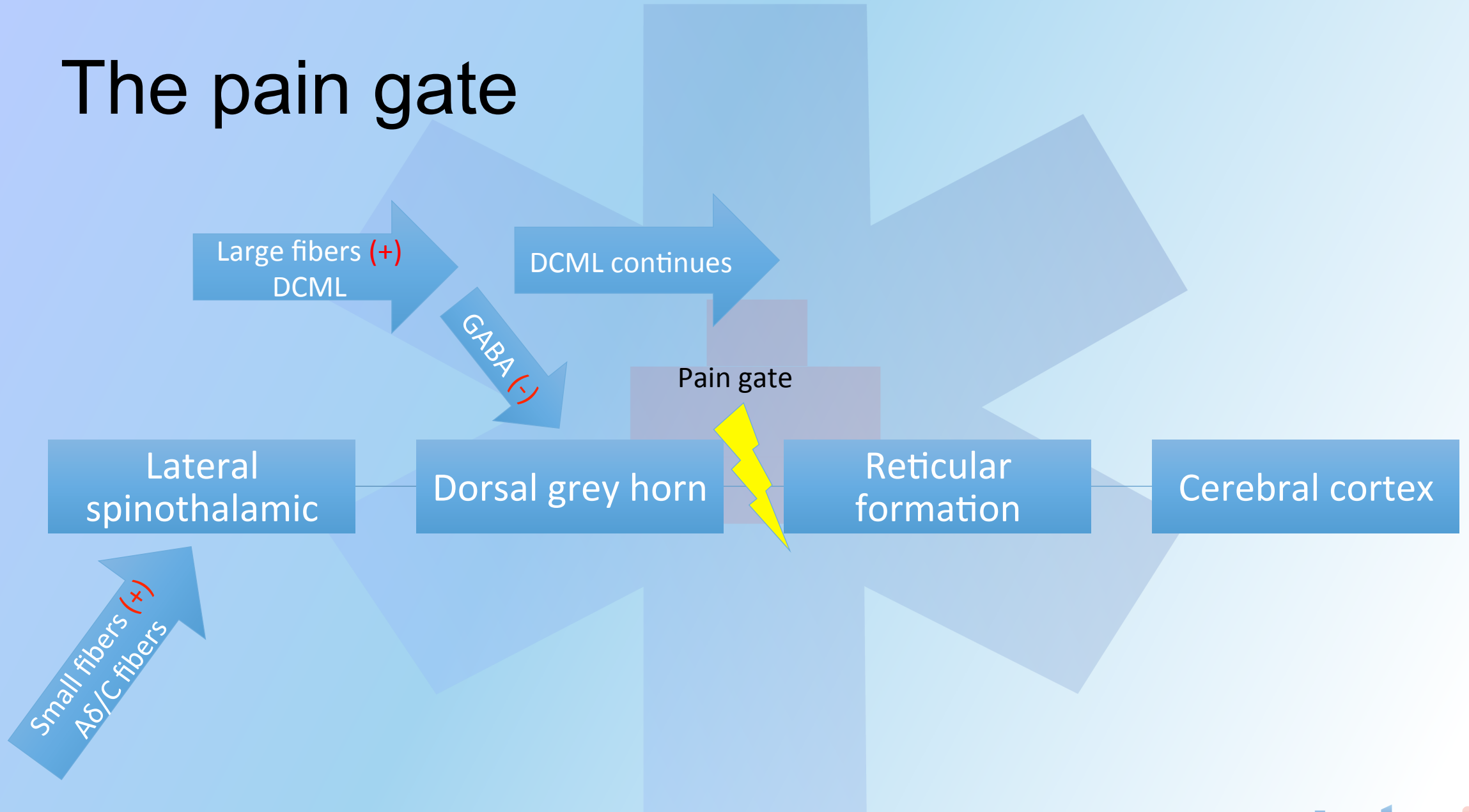
Painful stimuli

VPL nucleus of Thalamus

Cingulate gyrus

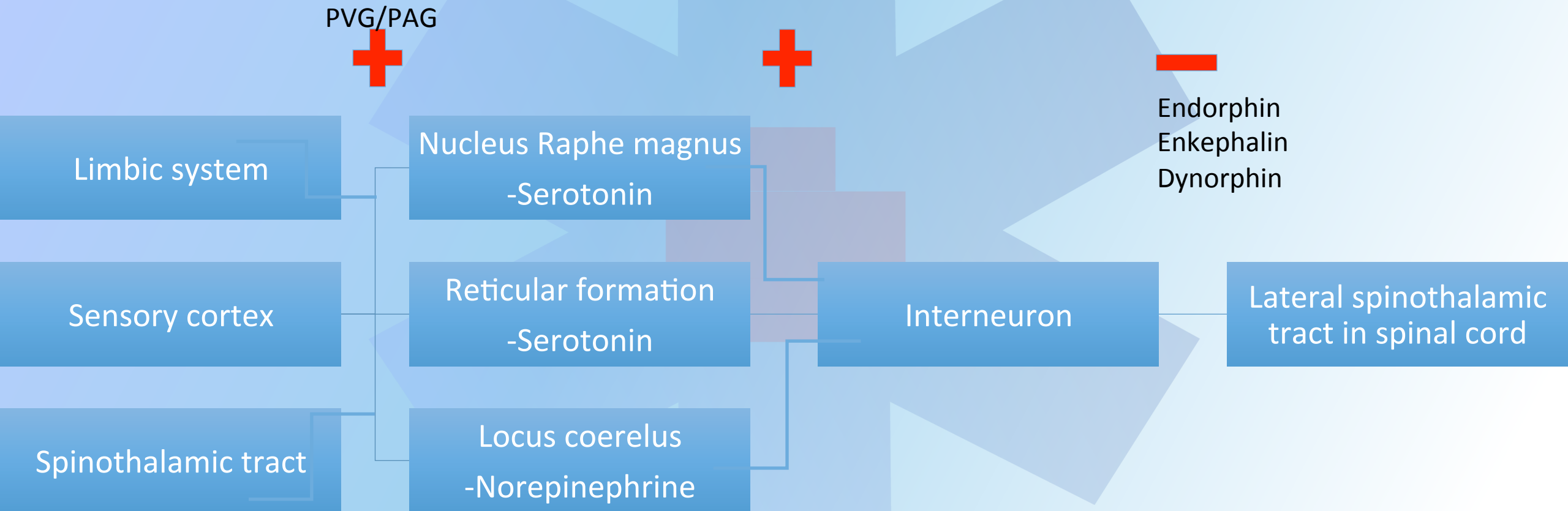
Insular cortex

# The pain gate



# Descending analgesic system

=Pain relieving



PVG = Periventricular gray matter  
PAG = Periaqueductal gray matter

# What types of sensation does the pacinian corpuscles convey?

- a) Fine touch and discriminative touch
- ➔ • b) Deep touch and fast vibration
- c) Skin stretch and slow vibration
- d) Heat and pain
- e) Skin stretch and sustained pressure

# Where does the DCML decussate?


- a) Pons
- b) Midbrain
- c) Spinal cord above T6
- • d) Medulla
- e) Spinal cord below T6

# Where do most of the fibers from the lateral spinothalamic tract end up?

- a) Ventroposterolateral nucleus
- b) Postcentral gyrus
- • c) Reticular formation
- d) The aqueduct of the brain
- e) Superior colliculus



# What types of substances inhibit the lateral spinothalamic tract at the level of spinal cord to numb pain?

- 
- a) Opioids
  - b) Substance P
  - c) Glutamate
  - d) Prostaglandins
  - e) Acetylcholine

Thank you for me

