

# 260-2017-11-01-somatosensation

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2017-10-31 12:58:15

# Prelude

MC Hammer - U Can't Touch This



# Today's Topics

- Wrap up on [sensory systems](#)
- Somatosensation
- Blog #2 deadline Friday

# Types of somatosensation

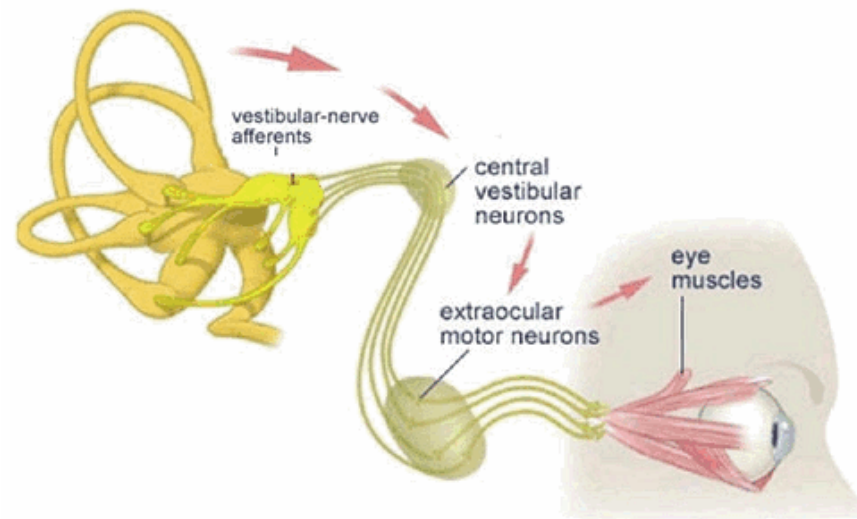
- Internal (interoceptive)
  - Where am I? How do I feel?
  - Proprioception
- External (exteroceptive)
  - What's in the world?
  - Where is it?

# Internal senses

- Vestibular sense
  - Head position (relative to gravity)
  - Head movement (rotation, translation)

Vestibulo-ocular reflex 13/25





# Internal senses

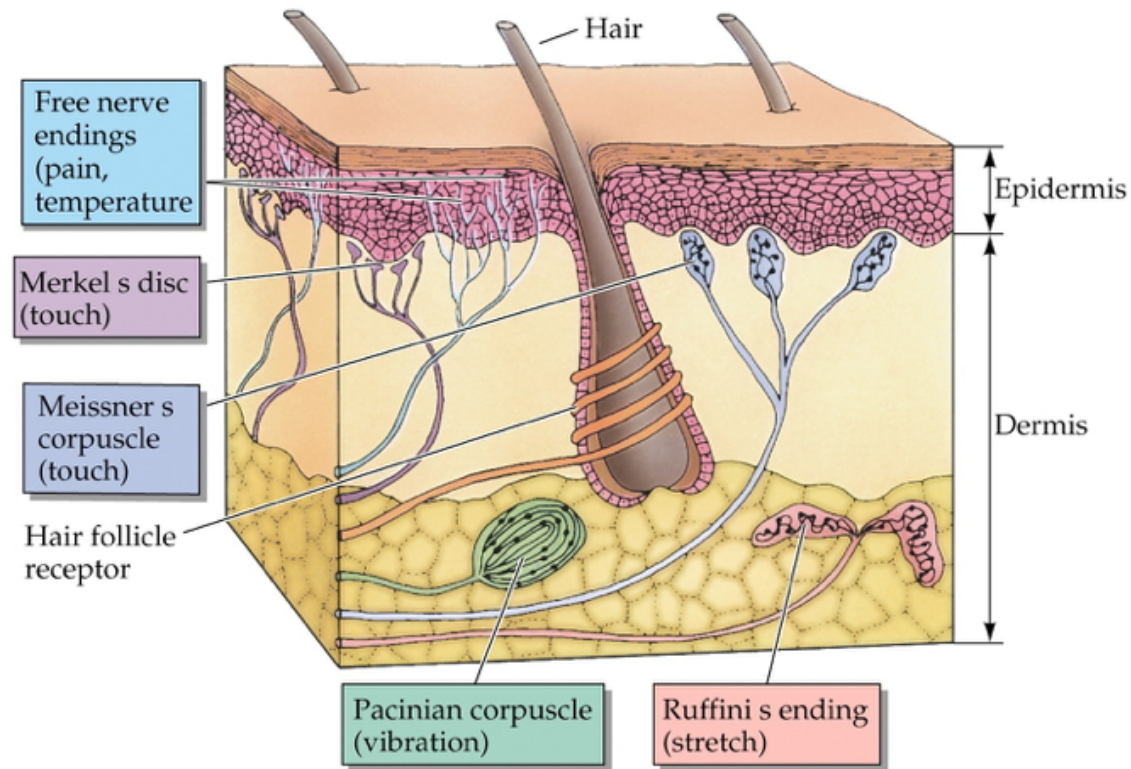
- Kinesthesia
  - Body position
  - Movement
- Pain



# External senses

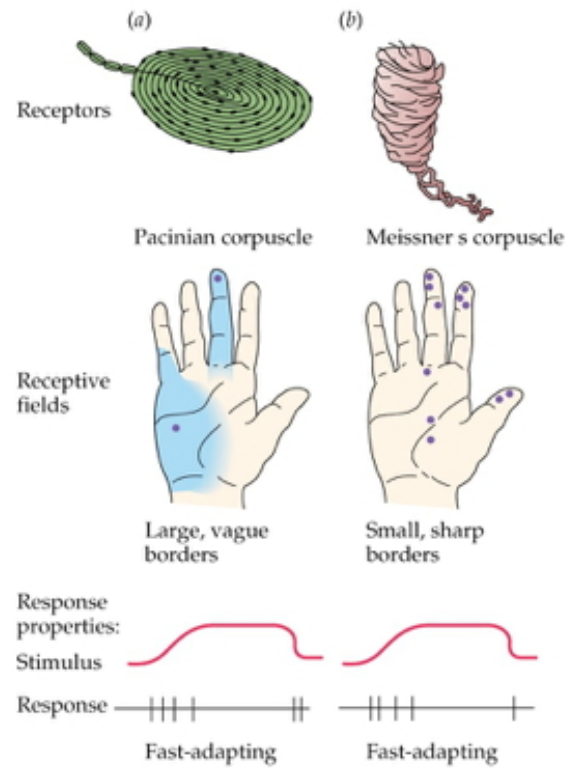
- Cutaneous senses (touch)
  - Hot, cold
  - Pressure
  - Vibration
  - Damage (pain)
- Plus kinesthesia (why?)

# Cutaneous receptors

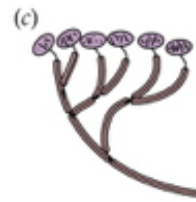


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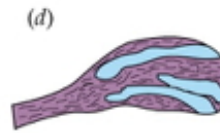
# Receptors specialize



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Merkel's discs



Ruffini's ending



Small, sharp borders



Large, vague borders



Slow-adapting



Slow-adapting

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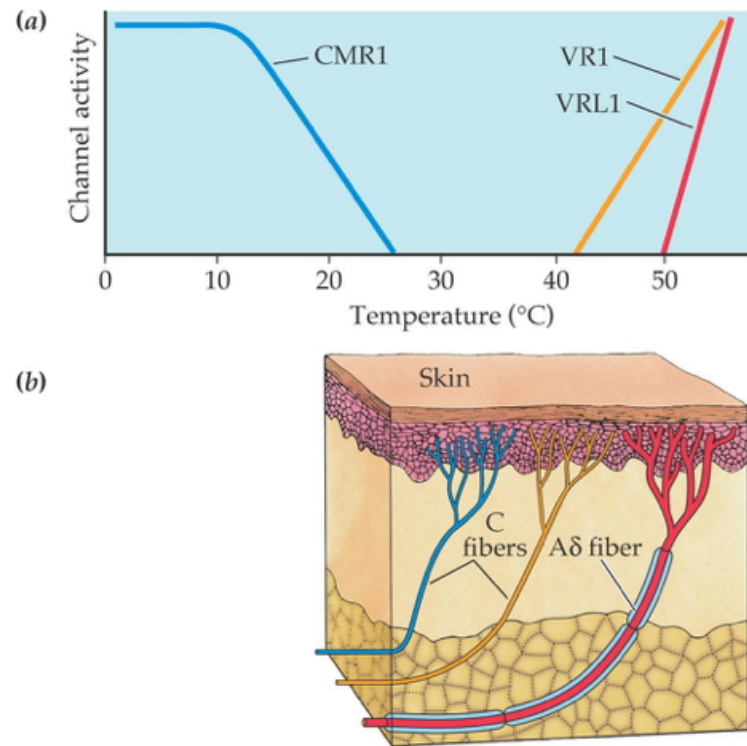
# Combined thermo and chemo receptors

- Why are spicy foods hot?
- Why are minty foods cool?

# Combined thermo and chemo receptors

- Menthol/mint receptor (CMR1)
  - Also signals "cool"
- Vanilloid Receptors (VR1, VRL1)
  - Also signal "hot"
  - Capsaicin

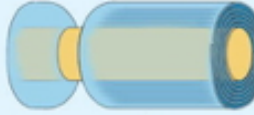
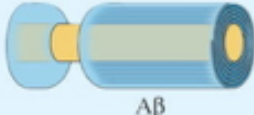
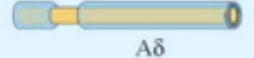
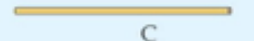
# Menthol & vanilloid receptors



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# Size/speed trade-off

**TABLE 8.2** *Fibers That Link Receptors to the CNS*

Sensory function(s)	Receptor type(s)	Axon type	Diameter (μm)	Conduction speed (m/s)
Proprioception (see Chapter 11)	Muscle spindle	 Aα	13–20	80–120
Touch (see Figures 8.12 and 8.13)	Pacinian corpuscle, Ruffini's ending, Merkel's disc, Meissner's corpuscle	 Aβ	6–12	35–75
Pain, temperature	Free nerve endings; VRL1	 Aδ	1–5	5–30
Temperature, pain, itch	Free nerve endings; VR1, CMR1	 C	0.02–1.5	0.5–2

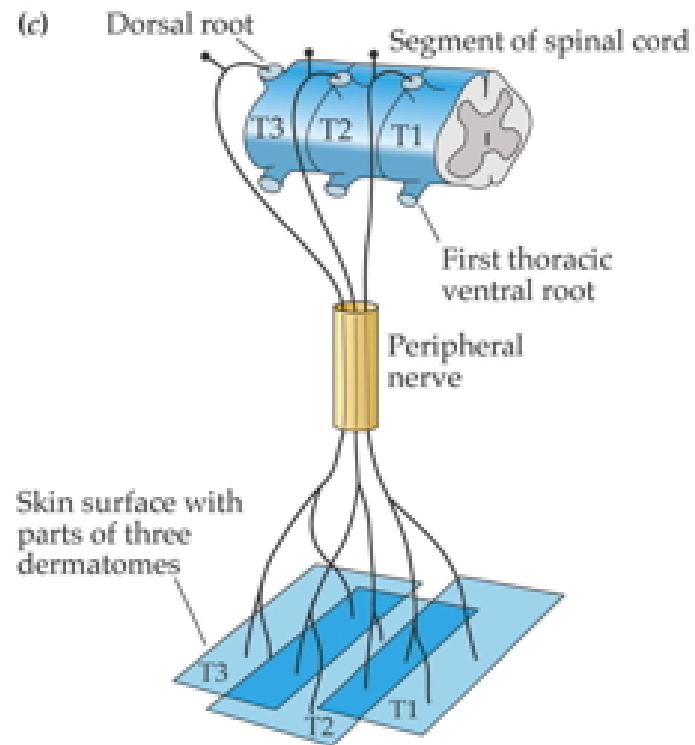
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# From skin to brain

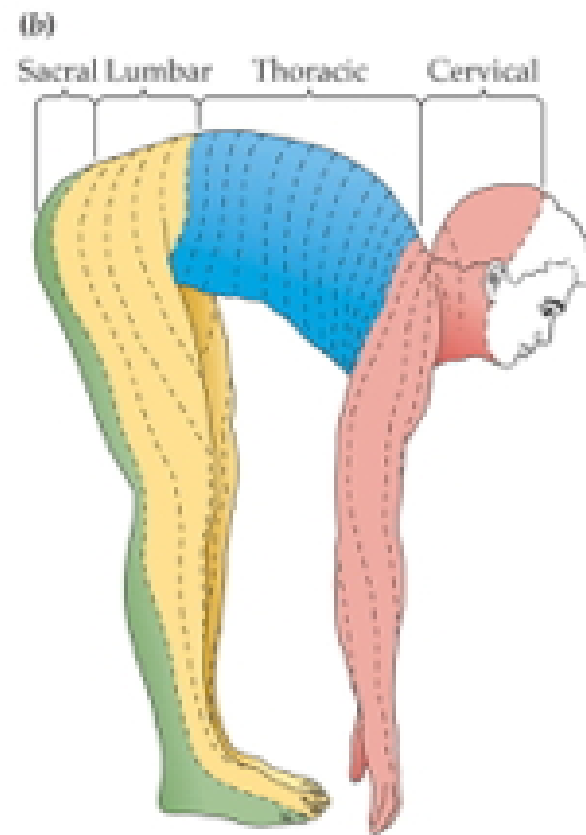
- Cutaneous receptors
- Dorsal root ganglion
- Ventral posterior lateral thalamus
- Primary somatosensory cortex (S1)
  - Parietal lobe

# Dermatomes



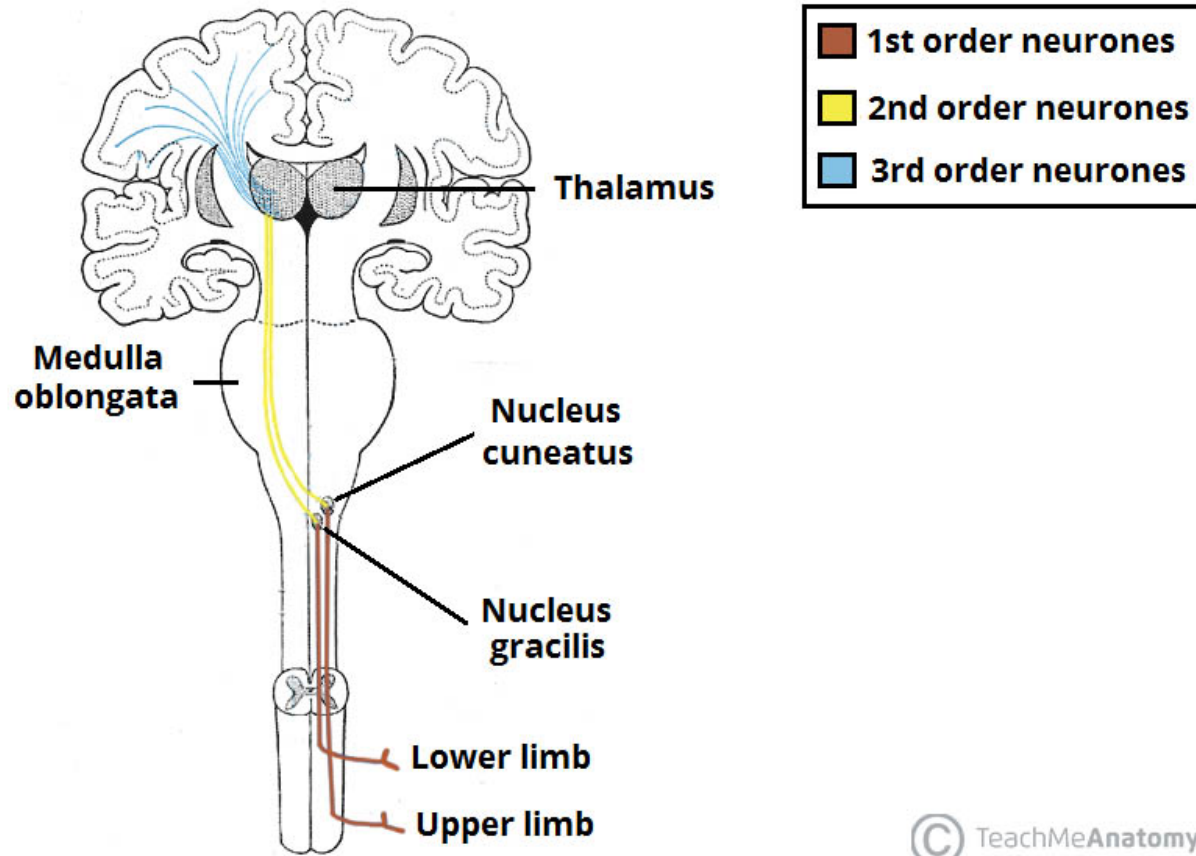
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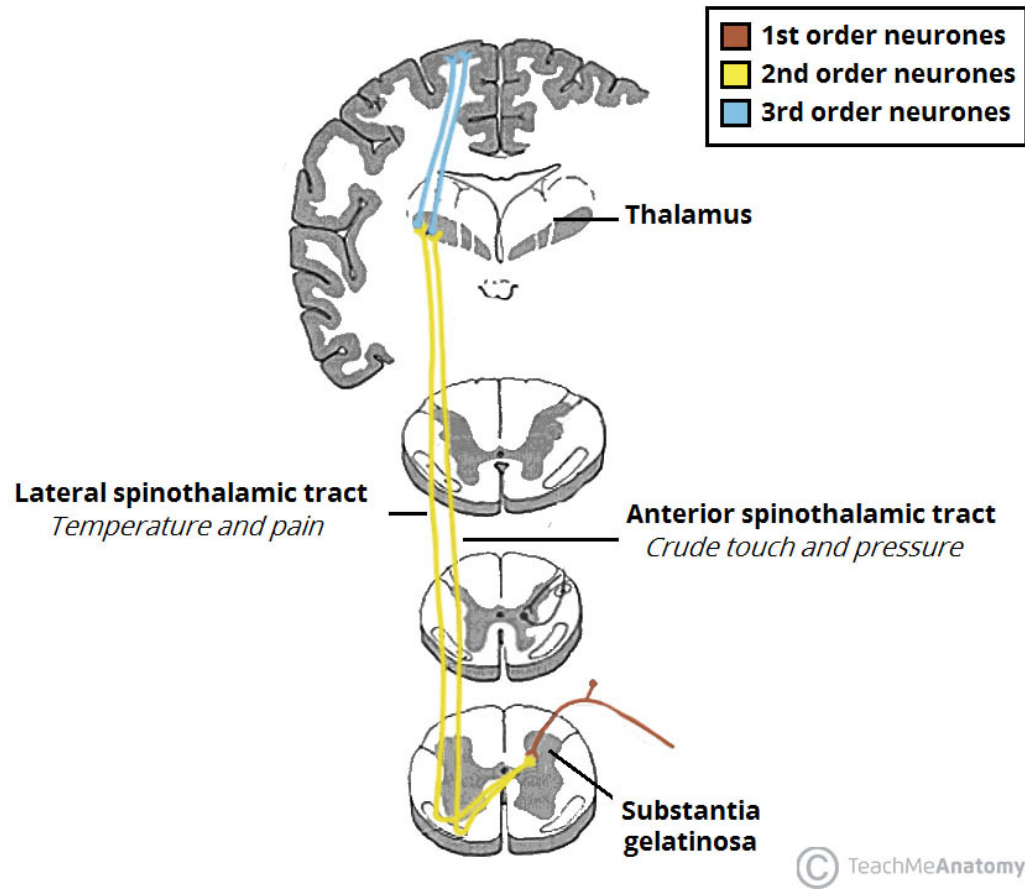
# Dermatomes



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# Functional segregation



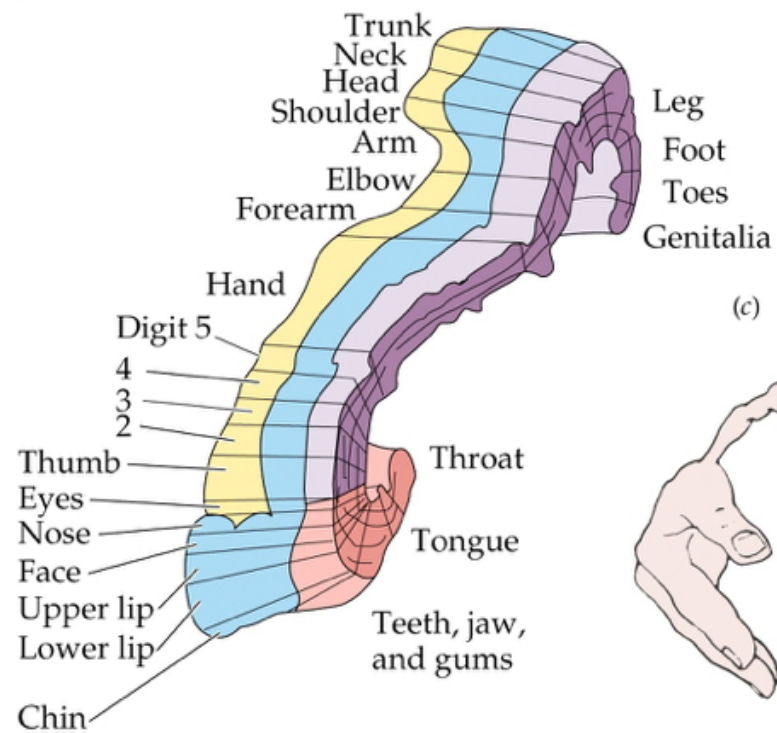


# Functional segregation

- Dorsal column/medial lemniscal pathway
  - Touch, proprioception
- Spinothalamic tract
  - Pain, temperature

# Somatotopic maps

(b)



(c)



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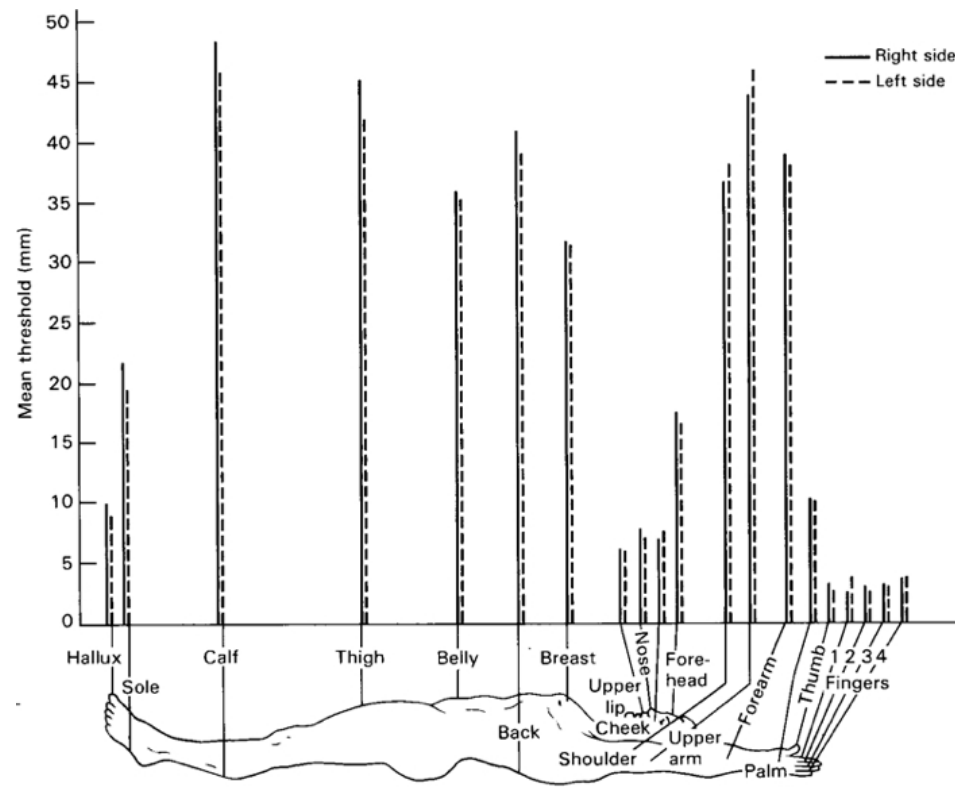
# Non-uniform mapping of skin surface



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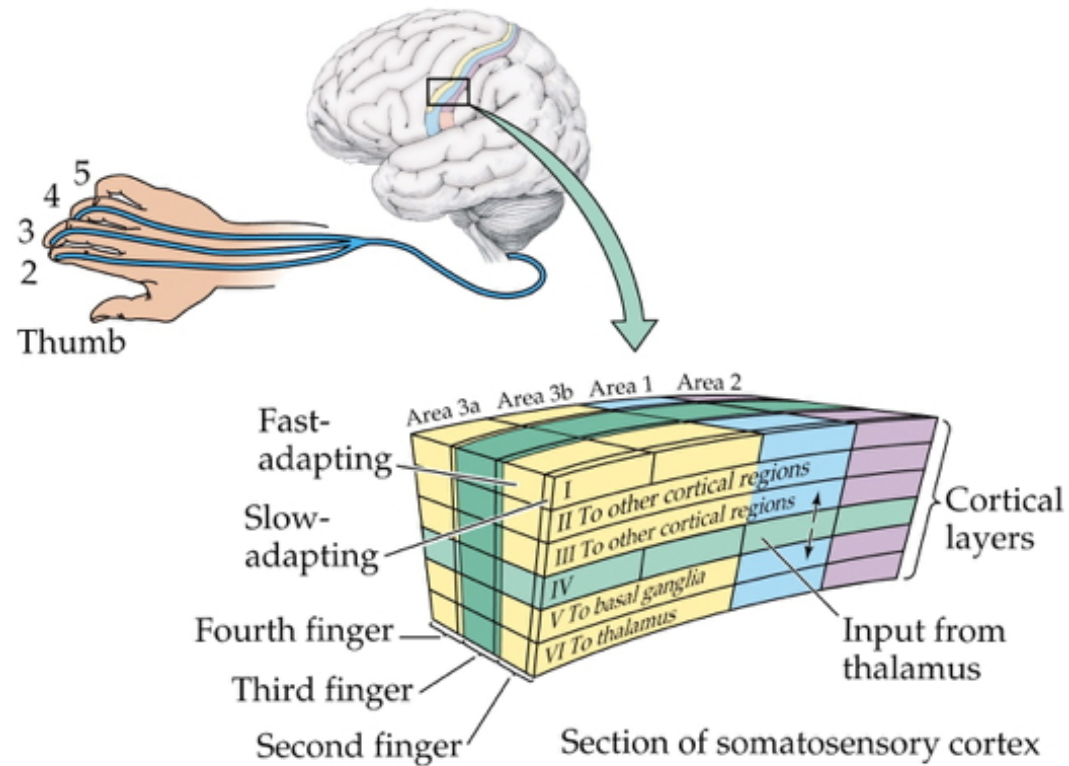


# Non-uniform mapping of skin surface



<http://jov.arvojournals.org/data/Journals/JOV/933499/jov-3-10-1-fig001.jpeg>

# Columnar organization/functional segregation



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# Phantom Limbs

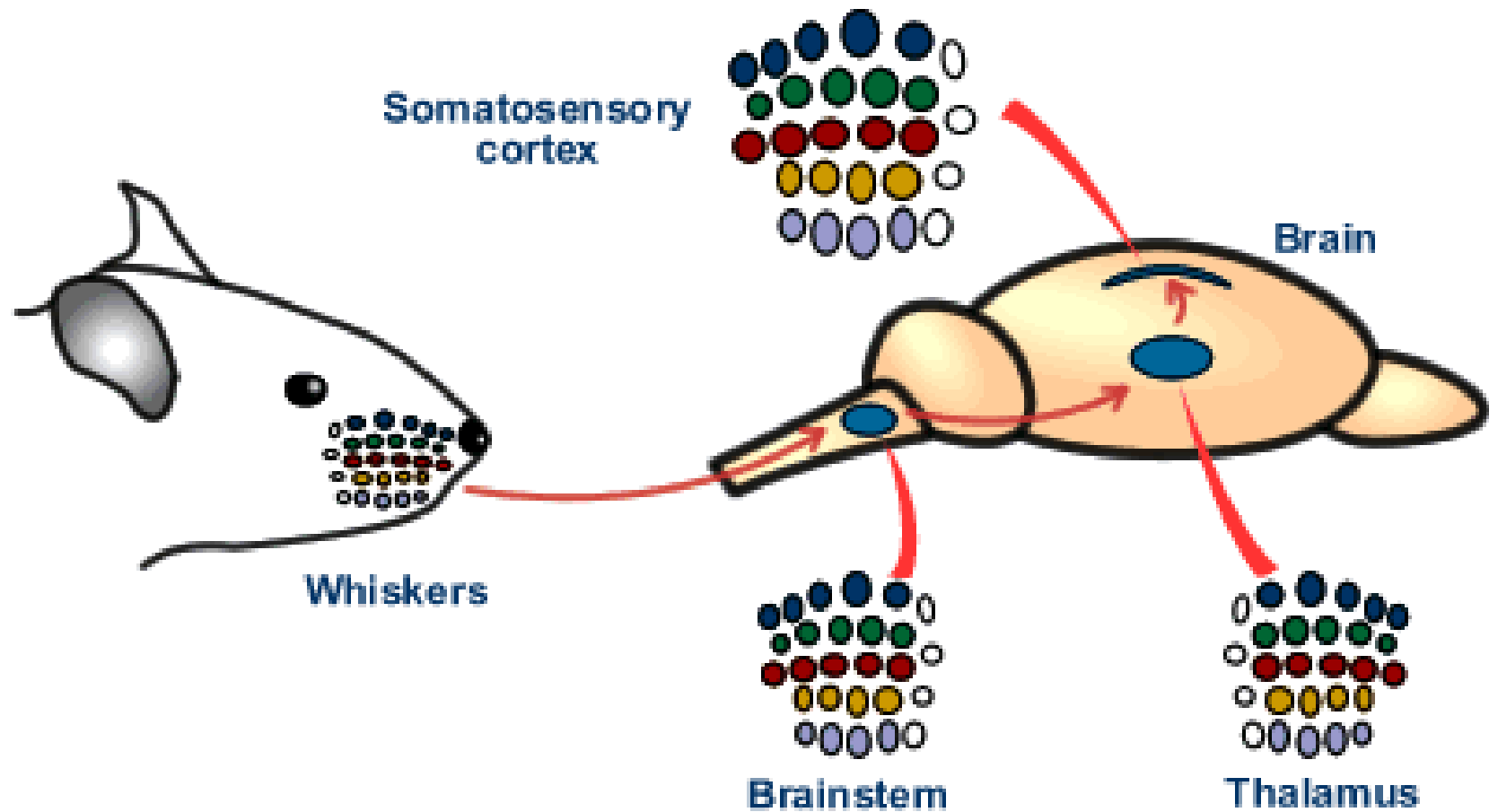
Phantom Limb Video



# What/where

- Perceiving Where
  - Somatotopic maps – where on skin
  - Kinesthesia – configuration of limbs
- Perceiving What
  - Patterns of smoothness, roughness, shape, temperature

# Somatosensation in other animals



# Next time...

- Pain