THE SKIN SENSES

The cutaneous sensations are served by the somatosensory system

It also includes proprioception and kinesthesia

We'll focus on the sense of touch here, but don't forget these other two

1) The Skin and Receptors
   a) Skin
      i) Largest, heaviest organ

      ii) Role in thermoregulation

      iii) Keeps some things in, some things out

      iv) Two primary layers

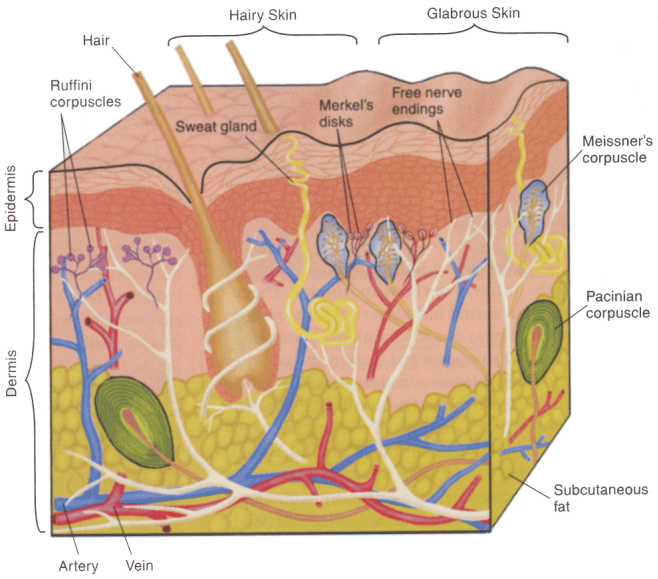
         (1) Epidermis

         (2) Dermis

      v) In these layers, there are sensors

         (1) Mechanoreceptors

         (2) Thermoreceptors



b) Mechanoreceptors

i) Merkel receptor/disk

ii) Meissner corpuscle

iii) Ruffini corpuscle

iv) Pacinian corpuscle

v) Respond to different frequencies

vi) Some are temperature-sensitive as well, or their frequency dependence is moderated by temperature

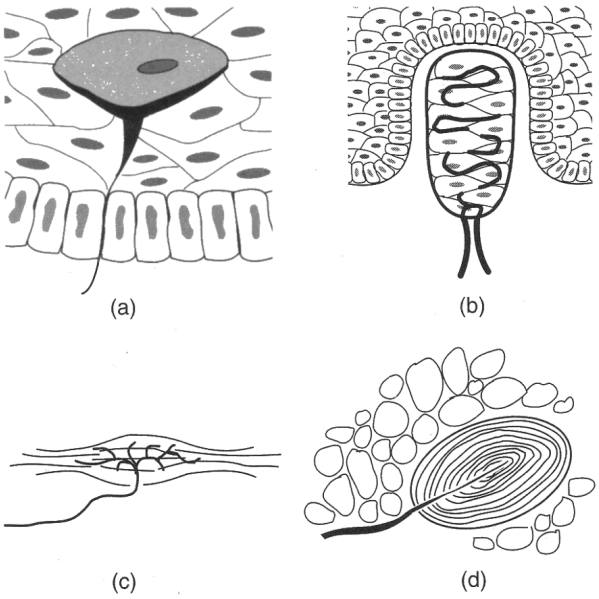


Figure 13.3
The four major receptors for tactile perception: (a) Merkel receptor; (b) Meissner corpuscle; (c) Ruffini cylinder; and (d) Pacinian corpuscle.

Table 13.1
Properties of mechanoreceptors

Receptors	Frequency Range	Perception
Merkel	0.3–3 Hz (slow pushing)	Pressure
Meissner	3–40 Hz	Flutter
Ruffini	15–400 Hz	Stretching
Pacinian	10–500 Hz (very rapid vibration at the upper range)	Vibration

c) Fibers from receptors – Adapting Rate

i) SA – slow adapting fibers

ii) RA – rapidly adapting fibers

d) Receptive field size

i) SA1 & RA1

(1) Near skin surface; Merkel & Meissner

(2) Small receptive fields

(3) Responsible for "acuity" or perception of detail

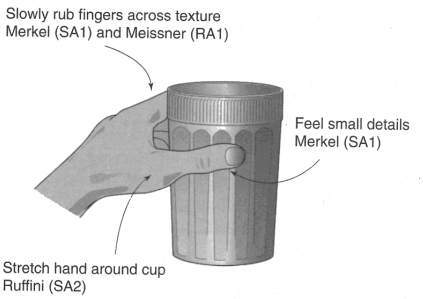


Figure 13.11
Grasping a cup activates a number of different types of mechanoreceptors. Each one creates a particular perception, and, in addition, the overall perception may be determined by a blending of the activity of all of the receptors that are stimulated.

ii) SA2 & RA2

(1) Deeper in skin; Ruffini & Pacinian

(2) Larger receptive fields

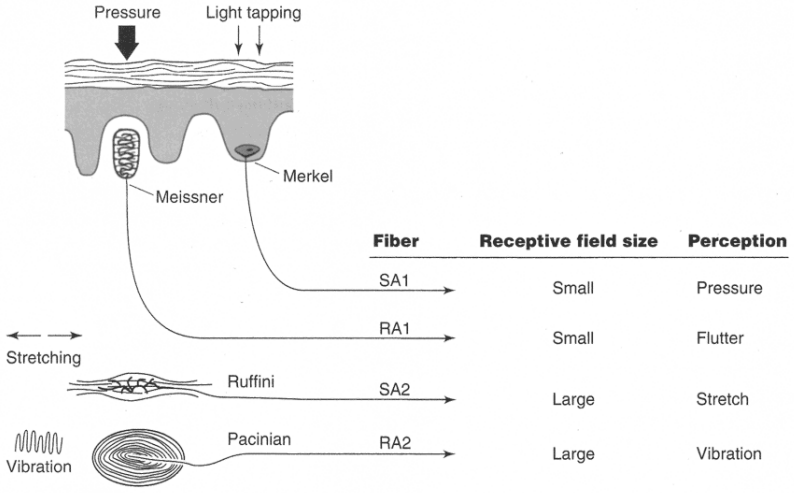


Figure 13.6
The four mechanoreceptors, indicating the fiber type, receptive field size, and perception associated with each one. The best stimulus for activating the receptor is indicated near the receptor.

e) Thermoreceptors

i) Not clear which receptors are responsible

ii) Separate hot and cold receptors

iii) At different levels/depths in skin and work independently (Bazett et al, 1932)

iv) "Paradoxical heat"

2) Neural pathways for touch

   a) Starts at receptors

   b) Goes through 4 types of fibers

   c) Two separate pathways up spinal cord

      i) Medial lemniscal pathway

      ii) Spinothalamic pathway

   d) Fibers cross over to contralateral side of the brain

   e) Synapse in the thalamus

   f) Somatosensory cortex (S1) and then S2

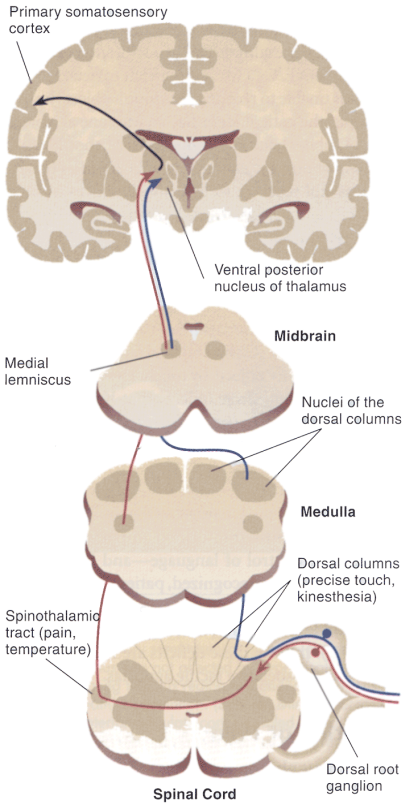


Figure 7.24
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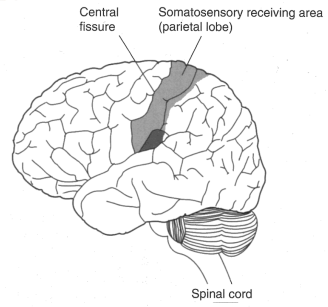
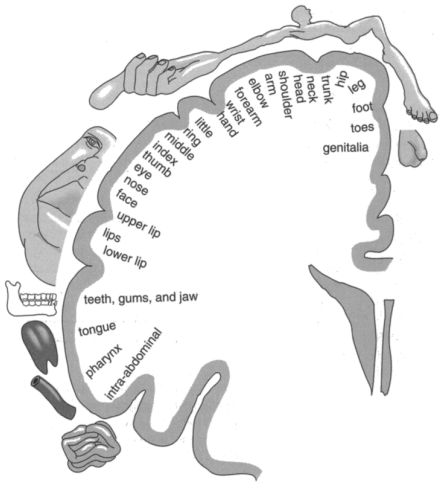


Figure 13.19
The somatosensory cortex in the parietal lobe. The somatosensory system, like the visual and auditory systems, has a number of different areas. The primary somatosensory area, S1 (light shading), receives inputs from the ventral lateral posterior nucleus of the thalamus. The secondary somatosensory area, S2 (dark shading), is partially hidden behind the temporal lobe.

g) Disproportionate topographical map

h) Homunculus



3) Tactile feature detectors

a) Thalamic nuclei

b) Cortical neurons

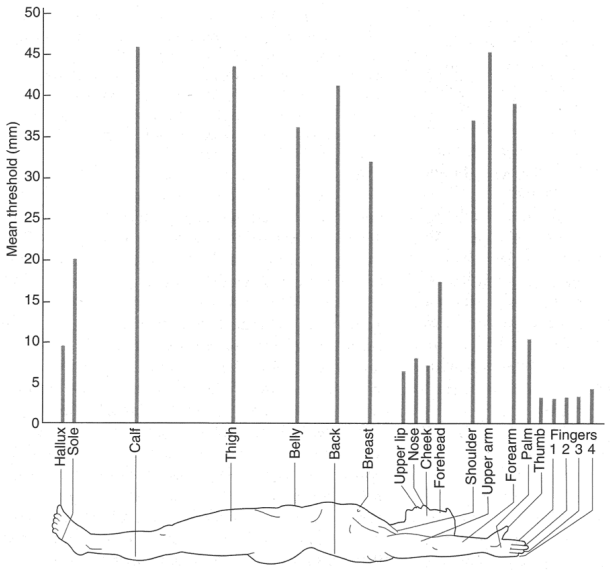


Figure 13.15
Two-point thresholds for males. Two-point thresholds for females follow the same pattern. (From Weinstein, 1968.)

c) Separation thresholds for detectors

4) Tactile object recognition

a) Passive vs. active touch

b) Haptic perception

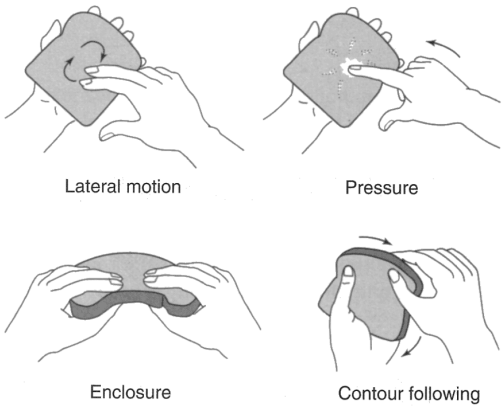


Figure 13.26
Some of the exploratory procedures (EPs) observed by Lederman and Klatzky as subjects identified objects. (From Lederman & Klatzky, 1987.)

c) Notes: