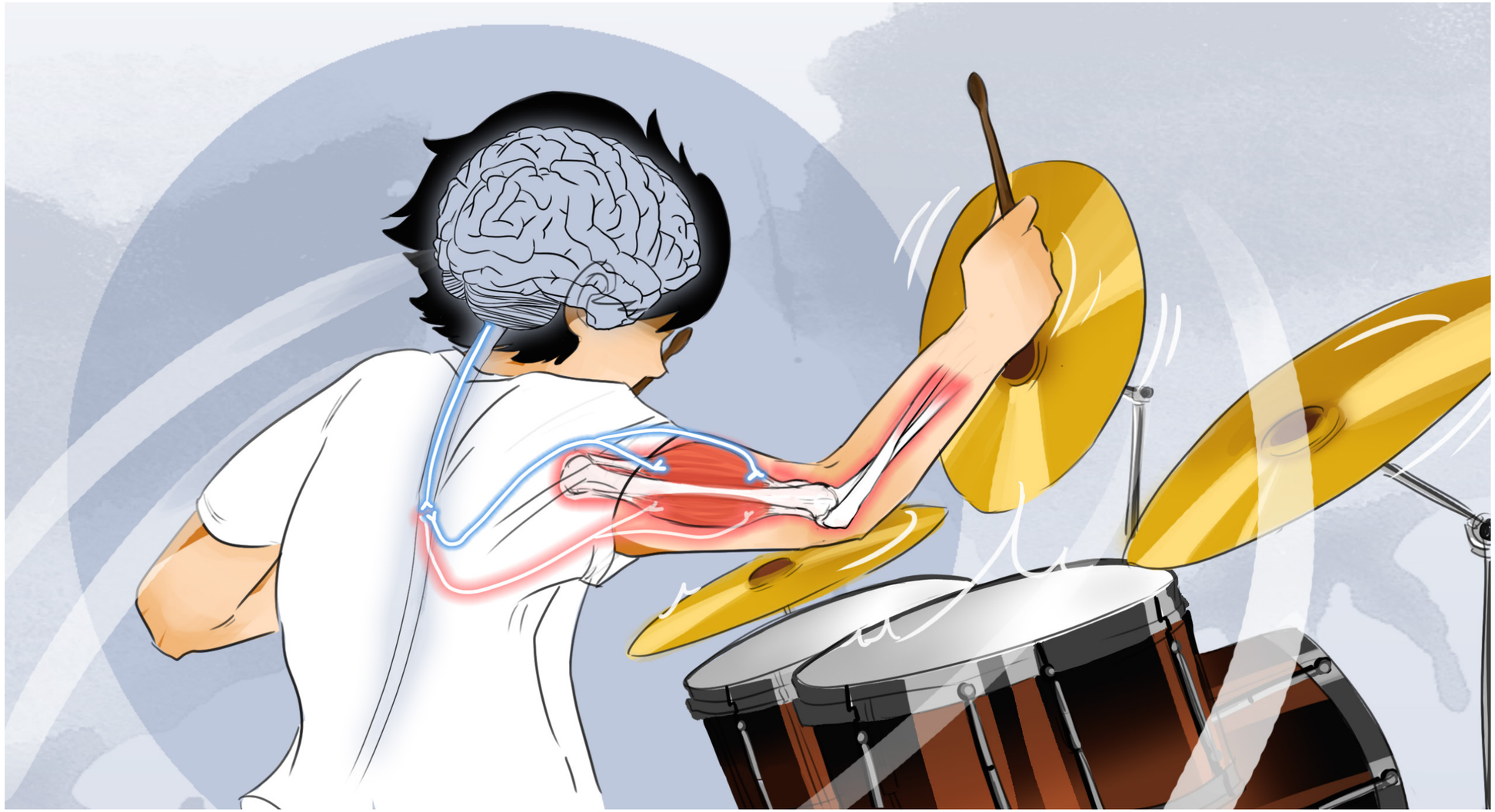
Somatosensory System



steven j. barnes

- Know the various categories of cutaneous receptors and the sensations they mediate.
- Understand the complexity of pain as a sensation.
- Explain what the ‘somatosensory homunculus’ is.

Learning Goals

Receptor Types Vary Across Sensory Systems

Systems differ in how many receptor types they have.

Visual system: Two broad classes of receptors (rods and cones); transduce light energy of different wavelengths.

Auditory system: Two classes of receptors (inner and outer hair cells of the cochlea); transduce mechanical energy.

Somatosensory system: Large number of receptor types; transduce a variety of mechanical stimuli (e.g., light touch, hair deformation, vibration, temperature, tissue destruction, muscle stretch).

Receptors

Wide Assortment

Comprises those peripheral afferents and specialized receptors subserving interoceptive, proprioceptive (joint, muscle) and cutaneous (exteroceptive) sensitivity.

The cutaneous senses are usually defined to include:

- tactile (pressure, vibration, texture)
- thermal
- pain
- itch

Somatosensory Receptors

Wide Assortment

Our skin contains a wide assortment of receptors:

Mechanoreceptors: respond to mechanical stimulation or pressure.

Somatosensory Receptors

Kinesthetic Receptors

In addition to the ones in our skin, other types of mechanoreceptors exist within our muscles, tendons, and joints:

Kinesthetic receptors: Play an important role in the sense of where one's limbs are, and what kinds of movements are being made.

Somatosensory Receptors

Ian Waterman

Somatosensory Receptors

Ian Waterman

"At the tender age of only nineteen, Ian Waterman became sick with a viral diarrhea which slowly begun to diminish his co-ordination… The virus had caused him to lose all sense of touch and proprioception from the neck down. He could initiate a movement but did not have any control over it or where it happened…he could be lying on the bed and yet not feel his body at all, and if he did not look at them, he could not tell where his arms or legs, or any other part of his body, were at any given time. Through constant concentration and visual input, Ian Waterman, slowly learnt to move again. He was able to do so by planning, and concentrating on, every movement his body had to make in order to produce the desired action."

Somatosensory Receptors

Wide Assortment

Our skin contains a wide assortment of receptors:

Mechanoreceptors: respond to mechanical stimulation or pressure.

Thermoreceptors: respond to changes in skin temperature.

Somatosensory Receptors

Somatosensory Receptors

Thermoreceptors: Sensory receptors that signal information about changes in skin temperature.

Two distinct populations of thermoreceptors: warmth fibers, cold fibers.

Somatosensory Receptors

Wide Assortment

Our skin contains a wide assortment of receptors:

Mechanoreceptors: respond to mechanical stimulation or pressure.

Thermoreceptors: respond to changes in skin temperature.

Nociceptors: respond to “painful” stimuli.

Somatosensory Receptors

Nociceptors

Nociceptors: Sensory receptors that transmit information about noxious stimulation that causes damage or potential damage to the skin.

Somatosensory Receptors

Ms. C.

"…she felt no pain when parts of her body were subjected to strong electric shock, to hot water at temperatures that usually produce reports of burning pain, or to prolonged ice-bath….She could not remember ever sneezing or coughing, the gag reflex could only be elicited with great difficulty, and corneal reflexes (to protect the eyes) were absent.

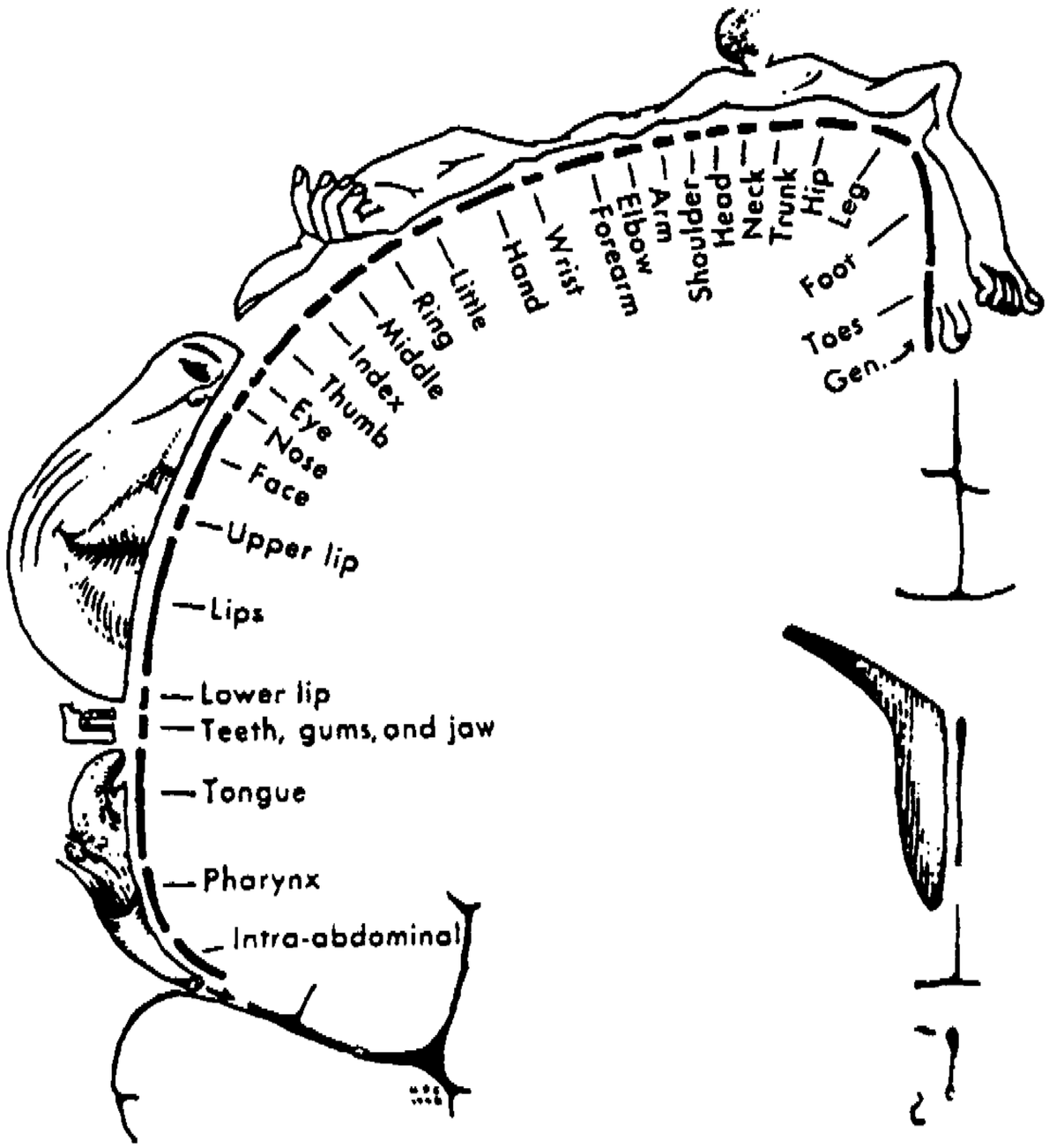
Miss C had severe medical problems. She exhibited pathological changes in her knees, hip and spine, and underwent several orthopaedic operations. Her surgeon attributed these changes to the lack of protection to joints usually given by pain sensations. She apparently failed to shift her weight when standing, to turn over in her sleep, or to avoid certain postures, which normally prevent inflammation of joints.

Miss C died at the age of twenty-nine of massive infections that could not be brought under control." (from Melzack & Wall, 1983)

Nociceptors

Phantom Limbs

Pain



Somatosensory Homunculus