Danielle Tulloss
Melissa Wu

How Big is Your Leg in Your Brain?

Purpose: To demonstrate the proportions of the primary somatosensory cortex dedicated to different areas of the body. To show the relationship between receptor field size and touch discrimination.

Materials:

- 4 compasses (or a set of large paperclips)
- 4 rulers
- 4 blindfolds
- pencils
- paper with table for results
- paper with homunculus for coloring
- A poster and Play-Doh that will be used to build a 3-D homunculus.

Procedure:

Touch receptors are called mechanoreceptors and are activated when they detect changes in pressure (when something presses on your skin). The change of pressure causes depolarization (changes from negative to positive) of the cell resulting in an action potential. The action potential allows the sensory neuron to communicate with other cells on a pathway that

travels up the spinal cord and into a part of the brain called the primary somatosensory cortex.

The Somatosensory cortex is arranged somatotopically: like a map of your body. All the neurons that carry information about touch in your hand are located in one area and it's the same for your arm, face, legs etc. However, just because your leg is big, it does not mean that a lot of the somatosensory cortex is dedicated to what your leg feels.

Receptor fields are the area of skin that one neuron senses touch for. Areas of your body that do not have fine touch have large receptive fields. Whereas, areas that have fine touch have very small receptive fields. When touch information travels to the brain, the areas with small receptive fields (lot of neurons) take up more of the somatosensory cortex. This can be demonstrated by a homunculus or a drawing of a person whose body parts are proportional to how much area of the somatosensory cortex is dedicated to them.

1. Split into groups of two or three and choose one person to be the subject.
2. Blindfold the subject.
3. With the compass (or paperclip) set the two ends 5cm apart (use ruler).
4. Place the two ends on a part of the subject's body (Parts: back of hand, finger tip and cheek) and ask whether they feel two points or one. Record in table.
5. Repeat with ends at 2cm, 1cm and 5mm (0.5cm).
6. Determine the relationship between receptor field size and two-point discrimination.
7. Fill in the homunculus with lips, fingers, arm, and body. Color.

Issues: Changes in the shape of a mechanoreceptor cause distortion of ion channels, which open and depolarize the cell. The somatosensory information is sent to the dorsal root ganglia, then the spinal cord and up to the brain in pathways such as the spinothalamic tract and posterior column. Receptive fields are supplied by one neuron, which has multiple receptive endings.