

Detective Boxes

Overview: In addition to looking pretty neat with all those loops and whirls, your fingertips are great at multitasking. The skin on them has a ton of receptors that help us to gather a lot of information about our environment such as texture, movement, pressure, and temperature.

This experiment will test your ability to determine textures by using touch receptors. You will use shoeboxes with holes cut into them to make texture boxes. Each box will have a textured surface that you can feel, but not see. Through the receptors in your fingers, you will determine whether the surface is rough, waxy, soft, or smooth.

Materials

- shoeboxes with lids (4)
- soup can
- pencil
- scissors
- sandpaper (1 sheet)
- wax paper (1 sheet)
- flannel fabric (1 piece)
- plastic (1 sheet)
- glue gun
- gloves
- partners

Experiment

1. Using the soup can as a guide, draw a circle at the end of a shoebox. Then use the scissors to cut out the circle. This is the access hole for hands to reach into the box.
2. Cut a piece of sandpaper to fit the bottom of the box (a ruler might also be handy to get an exact measurement). Glue the sandpaper to the inside bottom of the shoebox. Put the lid on the box and label it as Box 1.
3. Repeat the first two steps for each of the boxes, gluing the wax paper, flannel, and plastic in boxes 2-4. Be sure to label each.
4. Now ask a partner to reach into each box, feel the texture, and describe it as rough, waxy, soft, or smooth. Record their answer. Use *undecided* if they aren't sure.
5. Once your friend has identified a texture and you have recorded their response, open the box so that you can both see what material they have evaluated. Be sure to note in your data whether your friend was correct with a *Yes* or *No*. Repeat steps 4 and 5 for each of the boxes.
6. Have your friend leave the room or look away so that you can rearrange the box lids. Then give them the gloves to wear and repeat the test using gloved hands. Record the data and compare the effectiveness of gloved hands. Does this have an impact on the touch receptors?

Detective Boxes Data Table

Box	Description	Correct? <i>(yes or no)</i>
1		
2		
3		
4		
5		

Reading

Our skin is made up of several layers. Epidermis is the outer layer and consists mainly of dead skin cells. The dermis is our second layer of skin and it contains things like hair follicles, blood vessels, sebaceous glands, and nerve endings. Touch receptors called mechanoreceptors are located in the dermis.

Mechanoreceptors are nerve endings (sometimes called corpuscles) and include the following

- Meissner's endings (or Meissner's corpuscles) respond to vibrations and light pressure, such as fluttering or stroking motions. They are located immediately below the epidermis. We have lots of these on our fingers and palm.
- Ruffini's endings (or Ruffini corpuscles) respond to pressure. They are also sensitive to the stretching of skin and tendons.
- Merkel's endings (or Merkel receptors) detect moderate, steady pressure and provide information to the brain about texture.
- Pacini's endings (or Pacinian corpuscles) are embedded deep in the skin and can only detect rapid vibrations.
- Free nerve endings are the most common receptors in our skin and are essentially used in detecting pain.

The fabric of the gloves interferes with the ability of our touch receptors to function fully. Our fingertips are feeling the fabric of the gloves on their receptors, and this makes it difficult to perceive what they are touching through the gloves.

Exercises

1. Name, in order, the three main layers of skin.
2. Which layer of skin contains the mechanoreceptors? Name two more items in this layer.
3. Name the five types of nerve endings and their specialization.

Answers to Exercises: Detective Boxes

1. Name, in order, the three main layers of skin. (epidermis, dermis, and subcutaneous)
2. Which layer of skin contains the mechanoreceptors? Name two more items in this layer. (The dermis, which also contains (any two answers acceptable) hair follicles, blood vessels, sebaceous glands, nerve endings, etc.)
3. Name the five types of nerve endings and their specialization. (Meissner's endings respond to vibrations and light pressure, such as fluttering or stroking motions. Ruffini's endings respond to pressure and are sensitive to stretching.. Merkel's endings detect moderate, steady pressure and provide information to the brain about texture. Pacini's endings detect deep, rapid vibrations. Free nerve endings are used in detecting pain.)