**ACTIVITY: Two-point discrimination**

**Activity idea**

In this activity, students explore how the receptors responsible for the sensation of light touch are distributed over the body.

By the end of this activity, students should be able to:

* explain what a touch receptor is and name at least 2 examples
* explain the term two-point discrimination
* recall areas on the body where there are large and small numbers of touch receptors, explaining why the body is structured in this way.

[Introduction/background](#Introduction)

[What you need](#need)

[What to do](#Do)

[Discussion questions](#questions)

[Extension activities](#extension)

Student worksheet: [Point touch results](#point)

**Introduction/background**

The aim of this activity is to see how the receptors responsible for telling your brain that you are being touched lightly are distributed over the surface of your body.

The human skin helps us identify sensations such as heat, vibration and pain. The skin contains receptor or sensory cells that have the ability to respond to stimuli from the environment.

|  |  |  |
| --- | --- | --- |
| **Type of receptor** | **Stimulus causing reaction** | **Sensation felt** |
| Hair receptor | Hair moved | Brushing |
| Merkel’s disc | Constant indentation | Pressure |
| Pacinian corpuscle | Vibration | Vibration |
| Meissner’s corpuscle | Low vibration | Gentle tickling |
| Ruffini’s corpuscle | Rapid indentation | Stretching |

The receptors are not evenly distributed over the different areas of the body. The back, knees and elbows have a low distribution of receptors, and the lips and palms of the hands have a greater density.

This is the reason why the distance needed to discriminate between 2 points of touch is large on some areas of the body and small on others.

In order to differentiate between 2 distinct points of touch, at least 1 touch receptor must remain unstimulated in between 2 others. This causes 2 distinct signals to be sent to the brain. If 3 receptors in a row were stimulated, only 1 point of touch would register in the brain.

A homunculus is a diagram representing parts of the body as being large where there are many touch receptors present and smaller where there are fewer touch receptors.

Such diagrams have large lips, hands, faces and feet.

This site has an excellent animation of a homunculus and its relationship to the sensory system: <http://faculty.washington.edu/chudler/flash/hom.html>.

***Safety rules***

* Make sure students do not use force when using pointed objects on the skin of others.
* Be aware of students with skin allergies.

**What you need**

* Toothpicks
* Mathematical compass
* Pencil
* Ruler (with millimetre measurements)
* Sticky tape

**What to do**

1. As a class, discuss the structure of the skin and the role of receptors in the skin. Explain that, in pairs, the students will be carrying out an activity into the number of touch receptors in different areas of the skin.
2. Supply each pair with the required materials and have them construct the two-point discrimination device:

* Tape a toothpick to the metal end of the compass.
* Tape another toothpick to the pencil end of the compass.
* Make sure the toothpicks protrude equally 2–3cm from the compass and pencil end.

1. Explain the testing procedure:

* Person A sets the distance between the 2 toothpick points, starting at a distance of 2mm and increasing to 5, 10, 15 and 20mm over the course of the activity.
* Person B closes their eyes and Person A firmly (but carefully!) touches them on the parts of the body indicated in the [point touch results](#point) table. Person A must ensure that both toothpick points touch the skin at exactly the same time and they should not let Person B know how many toothpick points they are using. Each skin/body area and distance must be tested 3 times.
* After each test, Person B must say whether they can feel 1 or 2 points.
* Person A records these results onto the results table.
* Person A and B swap roles.

1. When the testing is complete, ask students to plot their findings on the figure.

**Discussion questions**

* Why did we conduct each test 3 times?
* Compare your results with those of your partner. Which areas of your body seem to be the most sensitive? What evidence do you use to judge this? What advantages might there be for these areas to be sensitive to touch?

**Extension activities**

* As an extension of this activity, the distances could be increased/decreased until Person B can discriminate 1 point from 2 on the various body parts.
* The two point discrimination test is used by medical specialists called neurologists. Research the reasons they use this test.

**Point touch results**

**Name:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part of body** | **Points felt with 2mm gap** | | **Points felt with 5mm gap** | | **Points felt with 10mm gap** | | **Points felt with 15mm gap** | | **Points felt with 20mm gap** | |
| **1** | **2** | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **2** |
| Cheek |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Lip |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Fingertip |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Palm of hand |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Back of hand |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Inner arm |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Knee cap |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Behind knee |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Sole of foot |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

On this body outline, plot the places where you felt 1 or 2 points and the distances between the points. (Use a colour key to show these results.)

|  |  |
| --- | --- |
|  | **COLOUR** |
|  |  |
| 2mm gap – 1 point |  |
|  |  |
| 2mm gap – 2 points |  |
|  |  |
| 5mm gap – 1 point |  |
|  |  |
| 5mm gap – 2 points |  |
|  |  |
| 10mm gap – 1 point |  |
|  |  |
| 10mm gap – 2 points |  |
|  |  |
| 15mm gap – 1 point |  |
|  |  |
| 15mm gap – 2 points |  |
|  |  |
| 20mm gap – 1 point |  |
|  |  |
| 20mm gap – 2 points |  |

