Neuronal Communication

British Neuroscience Association

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Background

The aim of this session is to introduce students (aged 5-11) to the brain and how neurons communicate with one another. Students will have the opportunity to discuss what they already know about the brain, understand that neuronal communication is vital to brain function and the basics of how this occurs. This information sheet should be used in conjunction with the 'Primary– Neuronal communication PPT' PowerPoint presentation.

Introducing the Brain 'Scientist says'

(Slide 1) Title slide. **(2)** A great way to start any session is to get the students moving around. Based on the familiar children's game 'Simon says', 'Scientist says' will introduce the students to the brain, its multiple functions and allow you to explore their previous knowledge and level.

Ask the class to stand up and find some space around them. Although the rules may be familiar to them, reiterate that they must only carry out the action when you begin with 'Scientist says'. Ask each student to sit down when they incorrectly carry out an action without 'Scientist says' included beforehand.

Possible actions could include: Wave your left arm, lift your right leg, wiggle your nose, stick out your tongue.

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When the game is complete, instruct students to sit down and ask them what they think is responsible for carrying out these actions (you may encourage answers of the brain by pointing to your own head). Emphasise that the brain has many jobs, not just in making actions happen but also stopping them as well.

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(3) Ask the students what else they know about the brain. This is also a good opportunity for you to tell the students some interesting brain facts, including:

- 'The human adult brain is just a bit heavier than a bag of sugar' (1.3kg).'
- 'The top of the brain looks similar to a walnut with a wrinkly part on top. If the brains wrinkles were spread out, it would be about the size of 4 pieces of paper' (A4).
- 'The brain floats around in a clear(ish) liquid, like water, protected by a hard skull because it is soft and may be damaged easily.'

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(4) Ask the students what they think the machine is/ does. Inform them that this is a brain scanner and allows scientists to see inside people's heads and their brains, as shown in the accompanying MRI image.

(5) With the latest technology we can see how the brain is connected, like in this video.

Summarise by informing the students that the brain is the control centre for the body and incredibly important for everything we do. It makes us who we are!

Tip: Visual aids (e.g. model of the brain) may help you keep the attention of the students and boost your own confidence. If a screen is available, you could use a 3D brain model such as the one found at brainfacts.org/3d-brain.

Roche

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What is a neuron?

N.B. The following section is taken from the 'making a neuron' activity in the module 'Neurons'. You may wish to use this introduction and/or activity before teaching about neuronal communication below.

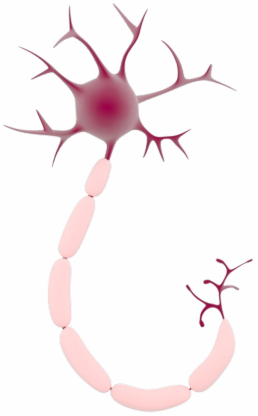
(6) You may wish to ask questions to stimulate discussion such as 'Do you know what the brain is made up of?'

At primary level, the students may not have encountered the concept of cells. Therefore, it may be useful to start with an analogy based around something they are familiar with e.g. LEGO bricks as pieces of a whole structure.

(7) To give some sense of scale, you can inform students that although neurons differ in size, the axons of the biggest neurons are just smaller (3x) than the width of a human hair. There are also around 86 billion neurons in an adult brain - more than 10X the number of people on earth.

(8) Inform the students that we can look at neurons up close by using microscopes. On the left image, we can see a single neuron with its main body and what look like arms or branches on a tree. On the right image, you can see lots of neurons, all connected together in the brain. Neurons can come in a number of different shapes and have different jobs.

(9) Inform the students that because there are so many branches, it is sometimes difficult to see which neuron they belong to. Therefore, scientists can make each neuron glow a different colour (a bit like glow sticks!) and see where they go - this is called a 'Brainbow'.



N.B. At this stage, you may wish to carry out the 'making a neuron' activity from the 'Neuron' module.

Activity - Neuronal Communication

(10) Ask the students how a teacher would get them to carry out a task. You could use an example like picking up toys or books at the end of break. Take suggestions leading to talking or communicating. Explain that neurons 'talk' to one another to make the brain work. They are constantly 'talking' and, unlike people, they can listen and talk to many other neurons at the same time.

Ask the students to suggest how a message is sent along a neuron, from one end to another. You may wish to turn the light switch on and off and ask the students what powers the lights in the classroom. Take suggestions leading to the answer of electricity, and highlight the travel of electricity from one end of the neuron to the other.

Pick 5 volunteers and ask them to stand in a row, all facing the same direction, one behind the other. Instruct the students to place their right hand on the right shoulder of the person in front. Inform the students that this row is a single neuron. Instruct the students that when they feel their shoulder being squeezed by the person behind them, they must squeeze the shoulder of the next person. This illustrates the electrical message being passed along one neuron.

Pose the question to the students that, if they want to move their arm, how long does it take for their arm to move? Is it fast or slow? Do we even have to think about it? Take suggestions leading to the fact that messages are sent very rapidly. Inform the students that messages along neurons can be sent at up to 120 metres/second - approximately 3-4 times as fast as your car on the motorway (at 70mph). (*N.B. You could calculate how long it would take to get to the nearest large city for context*).

(11) Pick another 5 volunteers and also ask them to stand in row, again facing the same direction, one behind the other, approximately a metre in front of the previous row (so you now have a row of 10 children all behind the other, split into two groups of 5, with a metre gap between the two groups). Instruct the students to place their hand on the shoulder of the person in front (in their own row). Inform the students that they are another single neuron. Instruct the students that when they feel their shoulder being squeezed, they must squeeze the shoulder of the next person (same activity as the first 5 volunteers).

Ask the students what problem they could face if they tried to send a message from one row to another i.e. from one neuron to another neuron. Take suggestions leading to answer of gap between neurons. For upper primary school age groups, you may wish to introduce the term 'synapse'.

(12) Inform the students that, in order for the message to cross the gap, it must change. The electrical message travelling along the neuron, now changes into a chemical message to cross this gap.

Give the student at the end of the first group of 5 a pot of bubbles. This time, instruct the students to send a message by squeezing shoulders and when it reaches the last person in their group, they should blow bubbles over to the next person, the first person in the second group of 5. This person will catch the bubble and then squeeze the shoulder of the next person, continuing the electrical message. Inform the students that the electrical message in the neuron is very quick, but the chemical message is slower when crossing the gap. **(13)** Once the chemical message has crossed the synapse, another electrical message starts in the next neuron.

(14) Set up a race between sets of rows or time the whole class to send a message along many rows.

(15) Summarise the lesson. (*N.B. You may wish to give each student bubbles at the end of the lesson*)