Introduction to research studies
MRI scans

autism west midlands

This information sheet is designed to give you an introduction to what might happen during a research study that uses brain scans so that, if you choose to take part, you have a better idea of what to expect.

We advertise research on our website – www.autismwestmidlands.org.uk/research. Some research studies simply ask people to fill in a questionnaire. Others might involve visiting researchers for a brain scan. Brain scans are an important part of autism research because they can help us understand how people with autism might see the world differently. As we are currently advertising research asking people to take part in an MRI scan, we sent our research officer, Dr Liz Hurley, to Aston University to find out more and have a go.

Introduction to MRI scans

What is an MRI scan?

MRI stands for Magnetic Resonance Imaging. MRI scans are completely non-invasive, and are used to take detailed pictures of the inside of your body. They use very strong magnets and radio waves to do this (see Box: How does the MRI scan work?).

The MRI scanner is a big machine that looks like a long tube. The scanner is placed in a special room to reduce interference from other signals, so that it can take clear pictures, and also so that the magnetic field from the MRI scanner does not disrupt other equipment like computers.

An MRI scanner

So what happened when Liz went for her MRI scan?

Robert, the researcher, emailed Liz to organise the MRI scan. Liz had previously taken part in another research study which measured activity in her brain while she did certain tasks using a different type of brain scan called magnetoencephalography (MEG) (***see Information sheet – Introduction to research: MEG scans***). This MRI scan is the second part of Robert's study. The MRI scan is used to pinpoint exactly where in the brain the activity recorded in the MEG scan is taking place.

Robert sent Liz a questionnaire to look through and information on what to wear on the day. The MRI scanner is a very powerful magnet. This means that metal can disrupt the scanner, and even cause damage to it. It can also be dangerous if you have anything metallic inside your body, like a metal plate. So, the questionnaire is used to make sure that you do not have anything metallic on you, or in your body.

When Liz arrived for her scan, Robert went through the questionnaire with her, and Liz had the opportunity to ask as many questions as she wanted.

What happens if you answer yes to any of the questions?

When Liz was given the questionnaire, she answered yes to one of the questions (about dental work). Answering yes does not automatically mean that you cannot take part. The researcher and the MRI technicians will review your answers and assess whether or not there is any danger. If there is any doubt, they will not allow you to take part. This is fine, your safety is the priority.

Preparing for the scan

Liz was taken into a room just outside the MRI scanning room for the final preparations. She asked to see the room where the technicians would be sitting. The technicians sit in a room with a window looking into the scanning room. There are computers there and a television screen so that they can see you during the scan.

Before going into the scanning room, the technicians checked that Liz was not wearing anything metallic, including zips and watches. Then she went into the room and sat on the flat bed.

She was given earplugs to wear and then asked to lie down with her head in a head rest. The MRI technician put some foam wedges by the side of her head so that her head would be as still as possible. Next, a device that looked a bit like a superhero helmet was placed over her head – this contained the sensors that pick up the signals emitted by the protons as they move (see Box). A squeeze ball was also placed on her stomach so that if she needed the scan to stop, she could squeeze the ball and they would stop the scan immediately. Finally, she was given the option of having a mirror so that she could see the researchers in the other room.

A model lies on the flat bed with the "helmet" on her head. She is also holding a squeeze ball so that she can tell the MRI technicicans if she needs to stop.

When she was settled in, the MRI technician moved the flat bed into the scanner and then left the room. Throughout the scan, the technician spoke to her through an intercom system.

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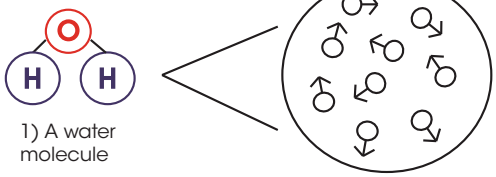
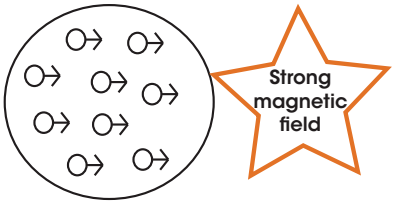
How does the MRI scan work?

1) We have a lot of water molecules in our body. These molecules are made up of hydrogen and oxygen atoms. Because there are so many hydrogen atoms in our body, MRI scans focus on what happens to them during the scan.
2) The nucleus of the hydrogen atom is made of a single proton. Protons are sensitive to magnetic fields. Normally, protons will point in any direction. However, if they are placed inside a strong magnetic field, they will all point in the same direction. This is what happens in an MRI scanner.
3) How fast protons turn to point in the same direction depends on the type of tissue that it is in – it is faster in parts of the body that contain lots of water, like fat and muscle, and slower in bones for example, because they contain less water.
4) So, when you are in the MRI scanner, the protons in your body will all be pointing in the same direction. To measure how fast protons turn, you need to confuse the protons so that they all point in different directions. To do this, the MRI scanner emits radio waves, which stop the protons from being aligned with each other. When the radio waves are switched off, the protons will start to realign. The movement of the protons emits signals which are picked up by receivers placed around the person's head. These signals tell researchers how fast the protons are moving back into alignment and so how much water is in each part of the body.
5) From this data, the researchers can make a picture of the structure of the brain, because there are different amounts of water in different parts of the brain.

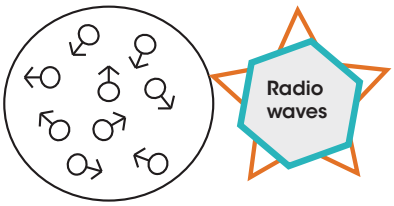


1) A water molecule

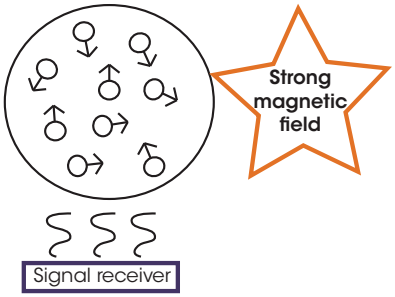
2) Protons all pointing in different directions



3) In the presence of a strong magnetic field (like the MRI scanner), all the protons point towards the magnet.



4) Radio waves confuse the protons, making them all point in different directions.



5) When the radio waves are turned off, the protons move back towards the magnetic field, and emit signals as they move. These signals are picked up by a receiver and form the picture we see in the MRI scan.

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The scan

For this research study, when you are in the MRI scanner, the top half of your body is inside a wide tube.

The top half of your body will be inside a wide tube.

If you have the mirror, you can see the researchers preparing for the scan. The first thing they do is a quick test, to make sure everything is ready.

During the quick test, and throughout the scan, the MRI scanner makes a series of short loud noises, which happen when the motors and magnets inside the scanner move to get a full picture of the brain. These noises are regular, and at quite a low frequency. The earplugs are given to help muffle the sound, and Liz found that it didn't take too long to get used to the sound, because it happened regularly and at the same volume every time.

For this study, Robert only needed to know about how the brain is structured, so Liz was only in the scanner for 10 minutes. Some studies will want to look at how different areas of the body work, and these can take longer (up to 90 minutes).

Every effort is made to make you feel as comfortable as possible during the scan. However, if you do start to feel anxious, or if you do not like the sound made by the scanner, you can use the squeeze ball at any time and the scan will stop straight away.

Remember that you are allowed to withdraw from research studies at any time, and that includes during the scan.

Useful resources

www.nhs.uk/Conditions/MRI-scan/Pages/Introduction.aspx

Introduction to research studies: MEG scans - Autism West Midlands information sheet available to download from www.autismwestmidlands.org.uk/helpadvice/downloads