MRI

* Magnetic resonance imaging (MRI) works on the magnetic properties of the body to produce detailed images from any part of the body. For imaging purposes, the hydrogen nucleus is used because of it is available in high amount in water and fat. The hydrogen proton can be taken as the planet earth, spinning on its axis, with a north-south pole. In this respect it behaves like a small bar magnet.
* Under normal conditions, these “bar magnets” spin in the body with their axes randomly aligned. When the body is placed in a MRI Scanner which has strong magnetic field, the protons' axes all line up. Due to this a uniform alignment creates a magnetic vector along the axis of MRI scanner. MRI scanners come in different field strengths, usually between 0.5 and 1.5 tesla. When additional energy is added to the magnetic field, the magnetic vector is changed or deflected.
* The strength of the magnetic field can be changed electronically from top to bottom using a series of gradient electric coils, and, by changing the local magnetic field by these small increments, different parts of the body will resonate as different frequencies are applied on them. When we switch off the radiofrequency source the magnetic vector returns to its resting state, and which causes a signal to be emitted. It is this signal which is used to create the MR images.
* Receiver coils are used around the body part which improves the detection if the emitted signals. Then the received signal is plotted on a grey scale and cross-sectional images are built up. When the radiofrequency pulse is switched off the different emphasis occurs because different tissues relax at different rates.
* The time taken for the protons to relax is measured in two ways. The first is the time taken for the magnetic vector to return to its resting state and the second is the time needed for the axial spin to return to its resting state.
* The first is called T1 relaxation, the second is called T2 relaxation. An MRI examination is thus created by the series of pulse sequences. Different tissues have different relaxation times and can be identified separately.

**Methods of MRI**

In the laboratory we saw different coils for the MRI of different objects with different sizes, there were several coils and with sizes according to the shape of the body or patient. The observations made at the laboratory are: -

* **Size of the coil-**The size of the coil differs as per the shape of the object of study, if the coil doesn’t fit the shape of the object to be observed then the final observations obtained after the study will differ.
* **Diameter of the coil-**The diameter of the coil is an important factor for the measurement as the object should not be greater than the size of the coil's diameter. If the area of the object exceeds the diameter then some part of the object will not be covered to get the correct observation output.

**Results**

Provided in Jupyter Notebook.

**References**

1. Berger, A. (2002). Magnetic resonance imaging. *BMJ : British Medical Journal*, *324*(7328), 35.