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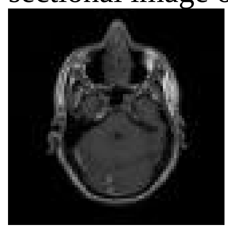
Magnetic Resonance Imaging
November 14, 2005

Magnetic resonance imagining is a radiology technique that uses magnetism, radio waves, and computer algorithms to produce cross sectional images of body structures. As early as the 1930's, scientists, such as Felix Bloch of Stanford, were doing research on how magnetic fields and radio waves cause atoms to give off tiny signals. This research eventually lead to the discovery that this technique could be applied to the atoms in living tissue.

The modern MRI consists of a large superconducting magnet which contains a huge coil of super-conducting wire surrounded by liquid helium at 452.4 degrees below zero. This low temperature makes the resistance of the wire virtually zero, allowing large amount of current to flow through without using up a lot of energy. This produces a magnetic field with an average of 1 tesla of magnetic force (20,000 times that of the magnetic force of the earth). In addition, there are also three gradient magnets which target specific areas of the body.

Because of the magnetic properties of hydrogen, a single proton with a large magnetic moment, the superconducting magnet's field causes the atoms to line up in the body. Most cancel each other out, but one in every million does not. The MRI then applies a radio frequency pulse at the hydrogen's resonant frequency. This causes the free atoms to change their orientation. Last, the three gradient magnets target a specific area by altering the larger magnetic field in that location.

Once all of the magnets are turned off, the hydrogens begin to return to normal and release the energy that had be stored due to the radio frequency. When this happens, they give off a signal that the computer can analyze using a Fourier transform. Different tissues and abnormalities react differently to the fields and give off different signals. The result is a cross sectional image of a target are.



With regard to the skull, an MRI can see through bone, differentiate between grey and white brain matter, and clearly show tumors, which makes it extremely useful. It can also provide clear images of bone, cartilage, ligaments, and tendons. This makes it very popular when dealing with sports injuries.

Unlike other medical imaging devices, the MRI can provide more detailed images, without radiation or other side effects. Also, it can take an image of any plane without the patient moving. However, patients with metal implants, or claustrophobia cannot use this device.

The MRI industry is producing over 2,000 units per year and is currently working to make the units smaller, faster and cheaper. For example, a recent advance in this technology has been the functional MRI (fMRI). It can map the brain in a few seconds allowing changes in brain state to be seen in real time.

Event-related functional MRI: Past, present, and future: Proc Natl Acad Sci U S A. 1998 February 3, Bruce R. Rosen, Randy L. Buckner
How MRIs work:
http://electronics.howstuffworks.com/mri.htm
Imaginis MRI: http://imaginis.com/mri-scan/
Wikipedia: Magnetic Resonance Imaging:
http://en.wikipedia.org/