

Magnetic Resonance Imaging
ELE282 Biomedical Engineering Seminar, March 4, 2002
Anna Wagner
Biomedical Engineering, University of Rhode Island
Kingston, RI 02881

Magnetic Resonance Imaging has been around in some form since 1946. It gives doctors the ability to see inside their patient to diagnose problems or help visualize their inner-workings. More recently it has been used to help understand which parts of the brain are used in certain applications. The mechanics behind MRI are rather complicated, but basically you put the object in a strong, externally-imposed magnetic field. This makes the spin-axes of the nuclei line up with the field. Then you add radio frequency parallel to the magnetization vector. The axes tilt. The amount of time it takes them to return to their original state after the frequency is turned off is used to determine what type of tissue you are looking at. The computer then turns this information into pictures. How do you make the magnetic field required? Use a really big magnet!



1.5 Tesla superconducting magnet

When you are dealing with such a huge magnet, certain precautions must be taken. No metal is allowed near the magnet. This means not only that you can't wear jewelry, but you also cannot have pacemakers or any metal implants. Pregnant women are also urged not to go near one, even though there are no known side-effects. Although there are some drawbacks to this machine: enclosed space, loud, you must stay still, and it's expensive; the possible gains are numerous. The ability to diagnose a disease or tumor is priceless. It may save your life. Another plus is that with MRI you can image in any plane: sagittal, frontal, or transverse.

There is no telling where the next step in MRI will be taken. Already there are smaller versions which are more portable. Another use is to explore the brain. This is called functional MRI. The brain is examined as the subject performs certain tasks. For instance, remembering certain faces, or doing problems in your head. With MRI we can see which parts of the brain are active during these exercises.

MRI is a perfect example of the electrical side of biomedical engineering. Hopefully the technology will improve and more and better diagnostic tools will be created.