

## Biological Risks of MRI

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The safety of MRI and spectroscopic studies can be considered in two broad categories: physical and chemical. This presentation focuses on physical aspects. The chemical effects refer to those associated with contrast media toxicity and in the future, large quantities of C-13 compounds.

The MRI procedure involves a static field, time-varying gradients, and the rapidly alternating magnetic transmission from the rf probe. The bio-hazards are considered under these three categories.

1. Static magnetic field effects. There are no known harmful physiological effects on man from static magnetic fields with experiments ranging to 2T. The major concern for static magnetic field effects is the attraction that the magnet has on ferromagnetic objects and some steels associated with skeletal prostheses, heart valves, and surgical clips. The force involves scales with the field squared. Known biological effects include the influence of very low magnetic fields on bacteria, insects, and perhaps other species. Torques on sickle cells and isolated retinal rods occur at fields of about 0.5 T. Recent reports of effects of static fields on cell generation times and effects of static and gradient fields on temperature changes in small animals have been shown to result in either inadequate temperature control or physiological responses of animals to the experimental environment.

Effects of low fields on pacemakers is through the activation of a reed switch designed to be affected by fields in the range of 1 to 2 mT. The possibility that fields as low as 0.05 mT might affect the pacemaker (though unlikely) is the basis for the advisory to post warnings at the "5 gauss line." However, fields in the range of 0.3 to 0.7 mT are commonly experienced in electrically powered public transportation. Fields of 10 mT and 3 to 5 mT are measured at the surface of the speaker crystals of headsets for entertainment and the receiver base of telephones, respectively.

Another measurable effect of static magnetic fields is the induction of a potential difference in a conductor flowing orthogonal to a static field. The potential difference expected from blood flowing in fields of 1 T is a

*10 G practical level (but ruins credit cards)  
Prostheses - heart valve, dental*