

AbstractID: 8383 Title: Can Exposure to a MRI Procedure Elicit Non-Thermal, Non-Stochastic Biological Effects?

Just as the study of the Japanese Atomic Bomb survivors has set stochastic risk estimates for the use of ionizing radiation in diagnostic medicine, the study of populations exposed to magnetic fields associated with electrical power distribution and use can be used to set stochastic risk estimates for exposure to ELF fields (0 to 1000 Hz) from MRI. However, because in both of these situations the risk is low, it is probably impossible to actually demonstrate/validate stochastic risk from these diagnostic imaging modalities. Instead I would like to posit another possibility: that exposure to ELF magnetic fields or ELF modulated radiofrequency fields from MRI can elicit non-thermal somatic effects which can be observed as changes in behaviour and physiology. It has now been shown by a number of laboratories that nerve stimulation is possible as a result of strong ELF magnetic field stimulation having a threshold around 100 Tesla $\cdot \text{sec}^{-1}$. However we are proposing that non-thermal, non-stochastic biological effects may occur at much lower thresholds.

A considerable body of bioelectromagnetics literature published in top journals like *Science* or *Nature* indicate that magnetic fields of earth strength can affect insect, bird, newt, turtle and mollusc behaviour. Perhaps second in reliability is the apparent effect of ELF magnetic fields at around 100 μT that effect opioid related behaviours which has been demonstrated since 1984 and replicated in 4 different, well respected laboratories. In one of these experiments direct exposure to MRI reduced opioid induced analgesia in snails and mice. There is also additional evidence, however somewhat controversial, that other effects, such as temporary alterations in the permeability of the blood brain barrier, can be caused by MRI exposure.

It is well established that the dominant magnetic and electrical activities emanating from the animal and human body are in the ELF frequency range. Although EM fields in this frequency range cannot deposit any significant heat as compared to endogenous heat generation it may be that exogenous exposure to these frequencies elicits a significant non-stochastic effect that can be seen as a change in the physiology and/or behaviour of the exposed subject. I will discuss these possibilities and present data consistent with such an interpretation.

The objectives of this lecture will be to answer the following questions:

1. What non-stochastic biological effects have been observed in animals from exposure to non-thermal ELF magnetic fields?
2. What biophysical transduction mechanism could explain how such fields interact with tissue?
3. Could such effects pose a risk to the MRI patient and/or operational personnel?