

*Executive Report****Electromagnetic Fields and Health****By Andrew Goldsworthy*

Andrew Goldsworthy was born in 1939. After a conventional Grammar School education he obtained a First Class Honors Degree in Botany followed by a PhD for research into Plant Physiology and Biochemistry at the University of Wales. He went on to lecture in Biology at Imperial College London where, apart from short intervals working on plant physiology in the USA and doing industrial research in the UK, he spent the rest of his career. He has had many teaching and research interests, including, plant and animal electrophysiology, biochemistry and the biology of space flight. He was also a scientific advisor to the European Space Agency and currently advises several European charities concerned with the biological and health effects of non-ionizing electromagnetic radiation. He retired from full-time teaching in 2004 and, in his retirement, he pieced together nuggets of information from a wide range of scientific journals and created a simple layperson's explanation of how weak electromagnetic fields affect us all. This can be found on the h.e.s.e.-Project website at: <http://tinyurl.com/28lo82>.

**Membrane leakage**

All the living cells in our bodies are surrounded by membranes just two molecules thick. Most of these molecules are negatively charged and tend to repel one another. However, they are held together by positive ions (mainly calcium) that fit in between them. The ions' forces of attraction for the negative molecules on either side help to bind them together like mortar holding together the bricks of a wall.

Extremely weak alternating electromagnetic fields, similar to those produced by Wifi, cell phones, cordless phones, and their respective base stations, can act on these calcium ions and dislodge them. This weakens the membrane and makes it more inclined to leak. Very little energy is required since the calcium has to be moved only far enough from the membrane for an alternative ion (usually potassium) to sneak into its place. Since potassium (with only one positive charge) is less good than calcium (which has two charges) at holding the membrane together, it still leaks.

**Effects on fertility and cancer**

This leakage can have all sorts of unwanted biological effects totally unconnected with their so-called thermal effects. These include allowing foreign materials, such as toxins, carcinogens and allergens to enter cells more easily. Also, the leakage of digestive enzymes through their internal membranes can

damage the DNA, leading to the formation of genetically aberrant cells. When this occurs in the sex organs, there is a loss of fertility. Also, genetically damaged cells in any part of the body can be carcinogenic, although this may not become evident until later on in life when the natural ability of the immune system to deal with carcinogens deteriorates.

**Electromagnetic hypersensitivity (EHS)**

All of us are electrosensitive to some degree, but some more so than others. This too seems to be due to membrane leakage. The precise effects depend on which cells leak and the source of the radiation.

When the cells of the skin leak, it causes inflammation. When our sensory cells leak, it can make them send false signals to the brain, so we may get sensations of heat, burning, pins and needles, etc.

If the cells of the inner ear leak, we can get false sensations of sound (tinnitus) or our sense of balance is affected so we feel dizzy and may get all the symptoms of motion sickness.

When neurons in the brain leak, they become more inclined to transmit nerve impulses. This makes the brain hyperactive so that it is more difficult to get to sleep and we may get stress headaches.

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Another effect of brain hyperactivity is to speed our reaction times to outside stimulation. However, because some of the nerve impulses are false, it tends also to cloud our thinking; we lose concentration and become more easily distracted.

This may cause attention deficit hyperactivity disorder (ADHD) in children. In adults, it may be partly responsible for the increased accident rate when people use cell phones while driving. You are four times more likely to have an accident, even with hands-free types.

On the whole, the body sees these effects as harmful and does what it can to minimise them, but the best solution is to avoid the radiation.

Some of the symptoms may be the body's way of telling us to do just that.

We become sensitised to the radiation, just as a wound remains tender (i.e. more sensitive to pain) for some time after an injury. This forces us to protect it from further damage while it is healing. In the case of EHS, it may not be easy to escape the radiation and the symptoms continue. The consolation is that these symptoms are not life-threatening; they do go away when you remove the source of radiation and, if there is no further exposure, you may gradually become desensitised.

References and more information (including effects of CFLs) at:  
<http://tinyurl.com/55286a> and  
<http://tinyurl.com/92r7nc>

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