

## Schrijven van Andrew Goldsworthy met repliek van Dennis Henshaw.

Subject: Kerryman Letter

Hello All,

Here is a link to a letter that I wrote to an Irish Newspaper in response to an earlier letter written by Dr Nolan claiming that non ionising radiation had no harmful effects.

<http://www.kerryman.ie/news/letters-radiation-from-phone-masts-1912644.html>

It says: - Wednesday October 14 2009

Sir, I would like to respond to Dr Nolan's letter on safety issues with mobile phone masts, published in The Kerryman of October 7.

Dr Nolan is wrong when he says that non-ionising radiation cannot affect living things if it is too weak to generate significant heat. The most obvious examples are the effects of visible light, which is of course non-ionising. Were it not for its effects on chlorophyll, plants would not be able to photosynthesise and, were it not for its effects on our visual pigments, we would not be able to see.

Non-ionising radio frequencies can affect other important pigments; for example, Ritz and co-workers (Nature, Vol. 429, 13th May 2004) showed that they affect the normal functioning of cryptochrome. Birds, bees and other animals use cryptochrome to sense the direction of the earth's magnetic field for navigation, and radio waves can interfere with this. In fact, the cryptochromes are a family of pigments, present in virtually all animal and plant cells, where they also form a vital part of the biological clock that senses time. In animals that use the sun for navigation, an accurate sense of time is important because it enables them to compensate for its changing position throughout the day. In the case of the bees, which can use either magnetic or solar navigation, radio waves from mobile phone masts will leave them with little or no sense of direction. This is probably the main contributory factor to the so-called colony collapse disorder in which foraging bees simply do not return to the hive. The bees clearly do not like this sort of radiation since, if you place a DECT cordless phone base station (a surrogate mobile phone mast) next to a hive, the bees leave and do not return. These effects now threaten the very survival of the bee population, which in turn threatens us because many of our crops depend on them for pollination.

However, we humans also use cryptochrome in our own biological clocks, and this may be responsible for the poor sleep patterns often reported in people living near mobile phone masts. They suffer fatigue during the day and interrupted sleep at night, just as if their biological clocks had ceased to function normally. This sort of disruption is like a permanent jet-lag and is associated with a damaged immune system (which works best at night), and increases the risk of getting cancer and other diseases. The increased risk of cancer, including breast and colorectal cancers, is well established in people whose rhythms have been disrupted by shift working and is now becoming increasingly reported as cancer clusters around mobile phone masts and radio and television transmitters.

However, the most serious biological effect of non-ionising radiation is its ability to disrupt cell membranes. This has been known since the work of Suzanne Bawin and her coworkers in 1975 (Ann NY Acad Sci Vol 247, pp 74-81). They discovered that amplitude-modulated radio-waves, where the signal strength rises and falls (as it does in mobile phones), could remove structurally important calcium ions from cell membranes at levels far too low to generate significant heat. This makes them leak, which can give a whole range of biological effects that are similar to those of ionising radiation, which also makes cell membranes leak. The mechanism is, however different. Ionising radiation generates highly reactive free radicals, which destroy the fatty components of cell membranes to make permanent holes, whereas non-ionising radiation makes temporary holes as the components of the weakened membrane pull apart from time to time. Nevertheless, the effect is the same; the membranes leak.

In either case, the most serious effect is on the membranes of the lysosomes. These are structures in living cells that contain digestive enzymes and are normally used to digest waste for recycling. When these leak, they can release their enzymes and do serious damage to the rest of the cell, including to its DNA (bacteria, which have no lysosomes, are about a thousand times more resistant to radiation than higher organisms, which do have them). The effects of non-ionising radiation are slower than ionising radiation. For example, it takes several hours for exposure to mobile phone radiation to do serious damage to the DNA in living cells (see [www.bioinitiative.org](http://www.bioinitiative.org)), but the effects are qualitatively the same. The result is an increased risk for

heavy mobile phone users of getting brain and other head cancers in later life. There has also been a mysterious increase in cancers of the thyroid gland (which is in the neck, close to where you hold your mobile phone), and a permanent reduction in thyroid function has been reported in rats exposed for more than three months to power line frequencies. In humans, this would be expected to lead to obesity and other symptoms of hypothyroidism. About one third of the population is currently overweight or clinically obese. There is also a reduction in fertility in people using mobile phones for more than about four hours a day as sperm, and possibly also the eggs, are damaged. Another effect of DNA damage is the disruption of cell division in the bone marrow, which affects the production of healthy white blood cells and can lead to a reduced immunity to disease.

Yet another serious effect of leakage is on the blood-brain barrier. This is a layer of cells, where the gaps between them are sealed to prevent unwanted materials entering the brain from the bloodstream. It has been shown that mobile phone radiation makes this barrier leak, which results in the death of neurons, and is likely to lead to early dementia. There are similar barriers covering all of our body surfaces, both inside and out. Leakage in the skin barrier allows the easier penetration of allergens, and is probably responsible for the recent rise in multiple allergies. Leakage in the nasal barrier will increase the risk of asthma. Leakage in the gut barrier has been linked to autoimmune diseases such as celiac disease, type-1 diabetes and multiple sclerosis, as undigested food enters the bloodstream and damages other cells, which are then destroyed by the immune system. More information on much of this, together with references to the appropriate scientific journals, can be found at <http://tinyurl.com/5ru6e6>.

I'm afraid that Dr Nolan (who is an electronics engineer but not a biologist) is seriously and dangerously incorrect in his claim that weak non-ionising radiation can have no harmful biological effects.

Sincerely,

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Hello Andrew and all

There is another irony in what Dr Nolan failed to understand and what Andrew tells us below.

For something like 50 years it was axiomatic that DNA strand breaks and cancer induced by ionising radiation was (and only could be) a result of the ionising particle (alpha, beta or gamma ray) actually cutting the DNA at the point the break is seen.

Then suddenly these assumptions ended in tears with the discovery of The Bystander Effect in which cells that had never been hit by ionising radiation, but were in the vicinity of those that were, or were cultured in culture medium which had previously had cells in them that were irradiated, had DNA strand breaks induced in them. This occurs by a cell signaling effect from hit cells. In fact, we now know that the link between radon exposure in the home and lung cancer is NOT primarily an effect of DIRECT alpha-particle hits to cells, rather is an effect in 'Bystander cells' – on those not hit !.

The problem is that the term 'strand break' is itself misleading. Here is an extract from some of my notes on this:

### **Magnetic Fields and DNA strand breaks**

Historically, it was argued that unlike ionizing radiation, the low quantum energy of MFs was insufficient to cause DNA strand breaks and therefore could not cause cancer.

The term 'strand break' is potentially misleading to the general reader. Lea (1946) used the term structural change to describe breakages in chromosomes, which appeared to be caused by an ionising particle passing through or in the immediate vicinity of the chromosome at the point where the breakage occurred. Lea acknowledged that such changes were actually due to radiation given to the cell at a stage prior to metaphase. However, adoption of the term breakage implied that the DNA had been broken, chopped or cut by the passage of radiation at that specific location on the chromosome.

Almost 50 years later Nagasawa & Little (1992) demonstrated that genetic chromosomal damage may be induced by low doses of  $\alpha$ -radiation in cell nuclei not actually traversed by an  $\alpha$ -particle. The phenomenon was termed the bystander effect. It has since been demonstrated for high and low-LET radiation, certain chemicals and heavy metals (Little 2006, Xiao et al. 2004) and forms a central concept in modern radiobiology.

The important conceptual conclusion is that chromosomal aberrations reflecting DNA strand breaks represent replication failures in the DNA template. Such failures are associated with coding information and not necessarily quantum energy at the level associated with ionising radiation. The myriad of responses involving genetic damage seen following exposures to MFs are consistent with such loss of coding information.

Lea DE. 1946. Actions of radiations on living cells. Cambridge University Press.

Nagasawa H and Little JB, 1992. Induction of sister chromatid exchanges by extremely low doses of  $\alpha$ -particles. *Cancer Research*, 52, 6394-6396

Xiao Y, de Feyter E, van Outen CH, Stap J, Hoebe R, Havenith S, van Noorden CJF, Aten JA. 2004. Induction and detection of bystander effects after combined treatment of cells with 5-bromo-2'-deoxyurine, Hoechst 33 258 and ultraviolet A light. *International Journal of Radiation Biology* 80:105-114.

Little JB. 2006. Cellular radiation effects and the bystander response. *Mutation Research* 597:113-118.

Thanks again to Andrew

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