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# WiFi and Concerns over Risks to Health

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- In assessing the safety of electromagnetic environments, great care must be taken to observe relevant comparisons, to include scientific evidence, and to account for observed responses.
- The technology is novel in human experience, the effects are most likely to be long-term, and the low levels are entirely comparative.
- Environmental levels of electromagnetic fields should always be compared with the natural environment, not with other man-made sources.

## Power and frequency

500 watts in a microwave oven at 2.4GHz will cook a potato in minutes. A 500 watt light bulb in a metal box will not. Equating the energy or the number of photons emitted by a light bulb with any microwave device, as if the sensitivity of the human retina to light had any bearing on the electromagnetic response of a living cell membrane to microwave frequencies, is quite erroneous. The light bulb is a very inefficient converter of electric energy to photons and the visible spectrum is far removed from the microwave. Photon sizes and energies are markedly different.

*The comparison between WiFi transmissions and light bulbs is incorrect and irrelevant.*

## Latent bioresponse

Mammalian retinal cells respond chemically to visible spectra, which have been part of the natural environment within which the mammalian eye evolved: this was an evolutionary advantage under circumstances where latent biological response of cells to light already existed. Microwave background radiation at 2.4GHz is not part of that evolutionary environment. This does not mean that other cells have no response. Had this radiation been present, the facility to use it may well have developed. Sharks, for example have exquisite sensitivity to electric fields via electroreceptors (ampullae of Lorenzini). The latent responsiveness of certain cells made this evolutionary development as likely as retinal response, thereby creating what we term the 'visible' spectra.

*The assertion that because the human body has no attuned receptor to microwave frequencies there can be no effect, is a non sequitur.*

## Scientific knowledge

What we do know very clearly from very substantial research, is that body tissues do respond to electromagnetic fields at very low levels indeed. We know that the

response appears to be windowed by frequency and power (ie the response is non-linear, and specific ranges of frequency and power elicit greater response than those above and below these ranges). We know that the effect is cumulative rather than purely instantaneous, and that cascade effects, from gene expression to protein modification, to cellular ion transport are all affected. We also know that pulse-characterised signals such as employed in the WiFi (IEEE 802.11) standard elicit a stronger response than pure carrier frequencies.

*The assertion that there is no scientific evidence for microwave fields affecting living organisms at the levels experienced in highly modified modern electromagnetic environments is plainly untrue.*

## Human experience

People burnt their hands on fire long before the mechanisms of oxidation and combustion were understood. Many people, although they form a minority of the population, exhibit hypersensitive responses to many stimulants. For some the problem is nuts, for others specific chemicals or mixtures, whilst others are triggered by electric or electromagnetic fields. Observation in real life, where fields are highly complex, suggest that frequency combinations matter more than radical exposure in predicting how electrosensitive people will respond.

*The assertion that because simplified provocation trials under laboratory conditions appear not to reveal a linear predictable response among people claiming to be sensitive, does not disprove their real-world experience. It simply indicates that complex electromagnetic environments where other common factors may co-relate are not easily replicated in the laboratory.*

## Response and regulation

The most linear dosimetric bioresponse to electromagnetic fields is in the area of acute exposure where energy deposition results in thermal damage to tissue. Acute shock or rapid local heating will cause predictable damage. There is no dosimetric assessment for low level exposure, despite exposure effects on whole living organisms (systems, not tissues) being well established. The assessment and categorisation of any environmental circumstance should be with the natural condition, not with other sources. We do not compare dioxins from chimneys with dioxins from other sources, but with an extremely low natural base. We do not compare high tar and low tar cigarettes any more, but tar in general with the natural lung environment. We should not compare WiFi with proximity to a mobile phone. WiFi exposure levels in a classroom, for example, from a number of PCs and servers (not just the input power to a base unit or router) must be compared with natural environmental conditions at these frequencies.

*There are no regulatory guidelines for chronic low level exposure to microwave fields around 2.4GHz, or any other non-ionising spectra.*

## Response and harm

It is often said that a biological response does not imply a risk to health. We are not harmed by the eye's response to visible spectra providing this is not too intense. The shark is not harmed by ambient electric fields, though it may be repelled by a strong field. With microwave spectra there is no attuned organ or receptor, but we do know there is molecular and cellular response. We also know that molecular and cellular cascade effects exist that, for example, help to explain the wide range of symptoms that characterise electrosensitivity.

*The assertion that there is no scientific evidence for harm, though there is evidence of biological response, is disproved by the cascade effects of those known effects, which tend rather to explain the variety of felt experiences.*

## Conclusion and recommendations

- WiFi and wireless networking is regarded popularly as innocuous because it is relatively new, readily available, cheap and convenient. Convergence of wireless technologies brings undoubted efficiencies, so functionally it is very attractive.
- Biological responses by living systems are well attested, anecdotal evidence of adverse reactions are very well established, and analysis of researched biological response suggest there can be long-term risk from exposure.
- Refutation of potential harm is based almost entirely on erroneous and irrelevant comparisons.
- Where wireless networks involve daily exposure by children, or by workers, in enclosed environments (particularly where there are microwave-reflective structures such as reinforced concrete, metal joists, steel furniture etc.) there is more indication of potential harm, than clear reassurance of there being no effect on anyone.
- Continuous exposure to WiFi, even at these low levels, is not to be recommended.

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