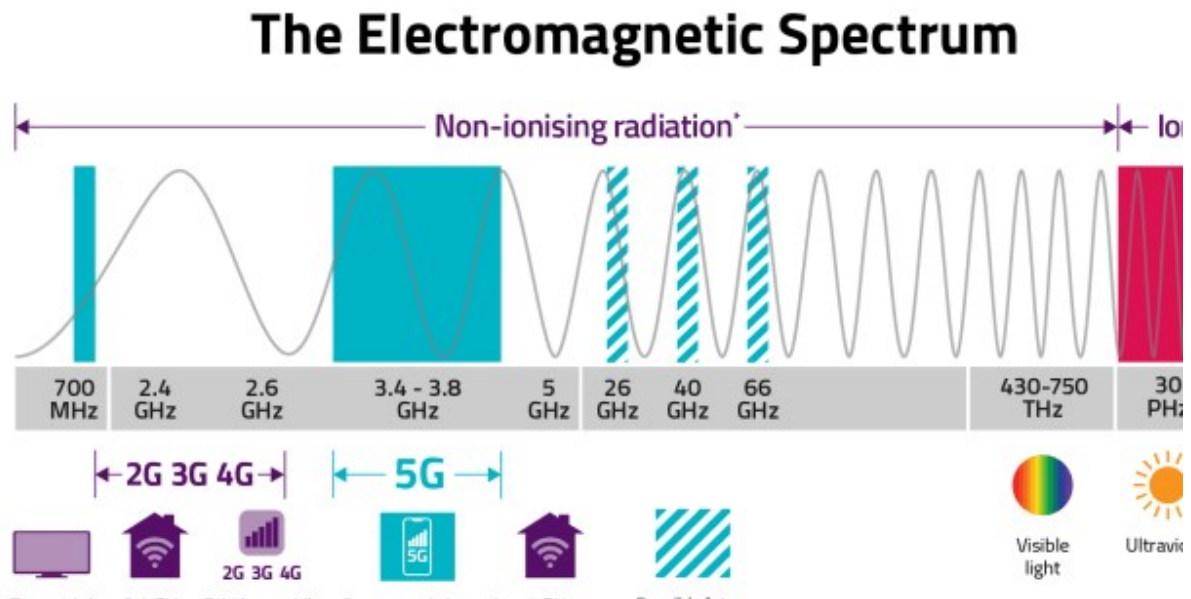


Cancer from Chronic Exposure to RF? – A Study

A [paper published](#) recently (Oct 31, 2022) focused on a crucial question: In this era of widespread cell-phone usage, what are the possible health effects due to long-term microwave and radio frequency (RF) exposure, and is there a relation to a rise in cancer? The author, James C. Lin, is an [emeritus professor at the University of Illinois \(Chicago\)](#) in the fields of Electrical and Computer Engineering, Bioengineering, Physiology and Biophysics, with a productive and well-recognized career in the field of human exposure to electromagnetic radiation (EMR) as evidenced by his [publishing history](#). In this publication, Lin not only takes us through the details of the animal studies but also clearly sketches out the overall social and scientific landscape of the field of safety standards with respect to EMR – a bird’s eye view that is of great value for all the cell-phone users today.

Background

We know that all the information that is transmitted wirelessly by cell-phones or laptops, whether it is voice, text, image, audio or video, involves electromagnetic radiation spanning the radio and microwave frequencies (approximately 800 MHz to 3 GHz). As we move from one generation of telecommunication to the next, through 2G, 3G, 4G and 5G, the frequencies move further away from the radio band into the microwave band.



We also know that a unique feature of modern life is the *continuous* usage of these devices, which makes the issue of long-term exposure extremely important. So any study that seeks to understand the effect of EMR on health must be done over a number of years, in the right frequency range, which was the case in two of the recent studies Lin describes in the publication.

The Studies

The first [study](#) referenced in Lin's publication was done by the [National Toxicology Program](#) (NTP) of the United States [National Institute of Environmental Health Science](#) (NIEHS) in 2018, and was "the largest animal health effect study taken upon by the NTP/NIEHS in its history". Laboratory rats were exposed throughout their life (about 2-3 years) to RF radiation in the 2G and 3G spectrum, which was the range that cell-phones commonly used [between 1991 and 2009](#). Since irradiation causes a rise in body temperature, rats in which the radio-frequency radiation induced a rise in temperature of up to 1°C (or 1.8 °F) were chosen. The findings concluded that there was statistically significant and clear evidence that **two types of cancers – malignant cardiac [schwannoma](#) (a rare type of tumor) and malignant [glioma](#) – increased due to exposure to the radiation. In addition, the rats also suffered from damage to the heart tissue (cardiomyopathy) as a result of the exposure.** It must be noted that both schwannoma and the glioma tumors arise on the cells of the nerve sheath.

The second [study](#), which was published soon after the NTP/NIEHS report, was by Cesare Maltoni Cancer Research Center in Bologna, Italy. This extensive research involved the exposure of the whole body of laboratory rats to 3G, 1800 MHz frequencies, 19 hours per day for approximately 2 years (the remaining lifetime of the rats). They found, just like the NTP/NIEHS report, that there was a "statistically significant rise" in the incidence of cardiac schwannoma in the rats exposed to about 0.1 W/kg of radiation. They also corroborated the first study with respect to the rise in cerebral gliomas.

Hence, according to Lin, two independent "comparatively well-conducted animal investigations with the same strain of rats demonstrated consistent outcomes in significantly elevate cancer risks". These are highly significant results for the question of safety in the case of human exposure.

Reception of the Results

Professor Lin also describes the reception of these results: while the results themselves may appear straightforward, the question of the harms of EMR exposure continued to remain "vexing," "equivocal and controversial." For example, he points out that the World Health Organization's International Agency for Research on Cancer (ICAR) had declared in 2011 that exposure to RF and microwave radiation was a possible carcinogen for humans. However, the guidelines from two influential committees, [International Commission on Nonionizing Radiation Protection \(ICNIRP\)](#) guidelines and [Institute of Electrical and Electronic Engineers International Committee on Electromagnetic Safety \(ICES\)](#) standards, had focused mainly on the *heating effect* of the radiation as the relevant factor, and downplayed the carcinogenic dangers of the radiation itself.

When faced with the results of these two studies, both ICNIRP and ICES continued to insist on the relevance of the heating aspect, while neglecting the direct impact of EMR on the rates of cancer. If they blame the carcinogenic properties on the change of temperature alone, they have to explicitly say something to the effect of “heat causes cancer” – an idea that they do not address at all. So if direct EMR is not carcinogenic, and neither is heat, then what is causing the increased rate of schwannomas and gliomas? The ICNIRP and ICES provided no answers, nor did they alter their guidelines to reflect the findings in these studies.

The stark discrepancy between the ICAR statements on the one hand and the ICNIRP/ICES statements on the other is something that Lin finds to be “concerning”. The reasons for this discrepancy are described eloquently by Lin, which is worth reproducing here:

“There is also the question of how there can be such divergent evaluations and inferences of the identical scientific findings by WHO’s IARC, ICES, and ICNIRP. To be fair, scientists are not impervious to conflicts of interest such as conflicting financial interests or personal relations which could affect the deliberations and reporting through such experiences as groupthink. Also, in some ways, it may parallel the compulsion by big business to choose profit over societal concerns—big businesses often use a range of organized and refined tactics to enhance and protect their commercial interests, and regrettably in some cases these tactics come at the expense of public health. Human beings repeatedly render decisions and select choices that challenge principled logic. Indeed, science has not been devoid of politics—weird as that may sound. Various biases can impair sensible reasoning and result in bad judgments. Groupthink can mislead human beings and inhibit scientists from making understandable inferences. Regrettably, groupthink or herd mentality is as rampant today as ever. Has science become partisan? And if science becomes partisan, is it science or politics, or would it be political science? At times, science gets wrapped up in politics and politics intervenes with science... Scientists may not always be consistent, coherent, or as transparent as promoted.”

The conflicts of interest arising from the political process as well as financial interests are pointed out as the core reasons for the dilution of science – a point that has been noted repeatedly in our work at CHD. While political correctness can discourage scientists from rocking the boat, financial interests can prevent the disclosure of harms to the public health for decades. In the light of this, the possibility of RF and microwave radiation being potential carcinogens suggests that rather than looking to these committees to establish the safety standards, we are perhaps better off doing our best to keep the influence of EMR as low as reasonably achievable (ALARA).

A Note on Physics

The conflicts of interests not only create a bias that prevents the acknowledgement of dangers of EMR, but they also have the potential of preventing the exploration of entire fields of research by ignoring critical scientific phenomena. The point noted by Lin, that safety standards for RF

and microwave radiation are focused mainly on the heating factor, is a significant one, as it is repeated multiple times by official sources:

[FCC:](#)

*Biological effects that result from heating of tissue by RF energy are often referred to as "thermal" effects. It has been known for many years that exposure to very high levels of RF radiation can be harmful due to the **ability of RF energy to heat biological tissue** rapidly... Studies have shown that environmental levels of RF energy routinely encountered by the general public are typically **far below levels necessary to produce significant heating** and increased body temperature.*

[National Cancer Institute:](#)

*The human body does absorb energy from devices that emit radiofrequency radiation. The only consistently recognized biological effect of radiofrequency radiation absorption in humans that the general public might encounter is **heating to the area of the body** where a cell phone is held (e.g., the ear and head). However, that **heating is not sufficient** to measurably increase core body temperature. There are no other clearly established dangerous health effects on the human body from radiofrequency radiation.*

In addition to the heating factor, the only other factor taken into account is *ionization*, or the tendency of substances in the body to become charged, and alter chemical reactions as a result. However, RF and microwave radiation are relegated to the “non-ionizing” “portion of the electromagnetic spectrum, and as a result, it is declared that:

[N]on-ionizing radiation does not have enough energy to break chemical bonds or strip electrons from atoms. Scientific consensus shows that non-ionizing radiation is not a carcinogen and, at or below the radio frequency exposure limits set by the FCC, non-ionizing radiation has not been shown to cause any harm to people. ([source: FDA](#))

However, in addition to heating up and ionizing, there is a third process that barely receives any attention, and that is **electrical conduction**. Whenever RF or microwave radiation impacts a conductor, it induces electrical currents in it. In fact, this was the basis for the discovery of electromagnetic radiation in the first place, when Heinrich Hertz discovered that an electric spark causes electrical currents in nearby metal wires via radio waves. A microwave oven also stimulates electrical currents in objects kept inside it, [especially if they are metals](#). The heating, in the case of these objects, is a result of the electric currents induced in them.

This is also the fundamental principle of the antenna, which responds to incoming radiation by generating an alternating current in the metal. This means that the primary property that has to be studied in living organisms is the effect of alternating electric currents in their conductive parts, and the tendency of that to trigger cancers. It is already known that metallic devices inside the

body are affected by RF exposure: *Studies have shown that handheld cellular phones can affect the operation of heart pacemakers or defibrillators if the phone is placed directly over the device, and there have been reports of interference between cell phones and hearing aids. Individuals with pacemakers, implantable defibrillators, or other body-mounted medical electronic devices, should consult with their physician and/or the phone manufacturer to determine what precautions, if any, should be taken.* ([OSHA](#)) If that is true of metals, why should it not be true for the conductive parts of the body?

The most conductive aspect of the animal and human organism is naturally the nervous system, and in particular the nerve sheaths. It is therefore telling that the predominant tumors detected in the studies referenced by Lin are those that arise in the nerve sheath: glioma and the relatively rare schwannoma. Both [glial cells](#) and [Schwann cells](#) take an active role in conduction of nervous impulses. An American Heart Association journal [article](#) also points out the role of nervous system function in connection with cardiomyopathy, which was also observed in rats. These facts point to the possibility of RF and microwave radiation directly affecting the body by through rapidly alternating currents which disturb the nervous conduction.

The fact that none of the major organizations – ICAR, FCC, FDA, CDC, ICES, ICNIRP – place the conductive disturbances in the human organism due to the RF and microwaves at the center of their safety research is another example of the effect of conflict of interests on research that Lin mentions. While the functioning of the antenna has been ubiquitous in our technologies for more than a century, the very same functioning in the organism is not addressed, and instead attention is shunted sideways to the study of secondary effects like heating or ionization. In the light of the fact that nervous conduction stands at the center of several modern-day afflictions like multiple sclerosis, Alzheimer's disease, Parkinson's disease, etc., it points to the necessity for present day science to peel away the conflicts of interests and look at the subject with fresh eyes to generate *real* solutions and guidelines.