

5G: A potential health and environmental catastrophe?

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Pollution caused by the electromagnetic fields of radio frequencies generated by the telecommunication system is one of the greatest environmental problems of the twentieth century. Dode et al (2011)

Wireless radiation has biological effects in all life forms. Dr Sharon Goldberg, MD in internal medicine, professor, and clinical researcher

5G is the stupidest idea in the history of the world. Dr Martin Pall, professor emeritus of biochemistry at Washington State University

Summary:

- **There is clear and abundant evidence to show that existing wireless radiation as used for existing WiFi, 3G and 4G (also known as 'electrosmog') is harmful to health and is linked with cancer, particularly heart and brain tumours**
- **Independent experts insist that the science is settled on this matter**
- **The current government, WHO and telecoms safety assurances about wireless radiation come from the industry-loyal ICNIRP and are out-of-date and inadequate**
- **Studies show that 5G is harmful to all living organisms**
- **Studies show that high-frequency waves used for 5G technology can penetrate the skin and permanently damage the eyes, skin and nervous system, interfere with cell-to-cell communication and promote the resilience of superbugs**
- **5G is toxic to the environment and will have a high carbon footprint due to huge data increases, manufacturing, infrastructure-building and satellite launches**
- **5G has not been safety-tested**
- **5G is being mandatorily rolled out without public consent which may constitute a breach of human rights**
- **5G will entail particularly high densities of antennas in urban areas so as to provide the desired blanket coverage; there will be no escape from high-frequency radiation for any living being**
- **Health symptoms are already being reported from areas where 5G has been switched on and many people report electrosensitivity symptoms from existing wireless radiation; electrosensitivity has been recognised by medical researchers outside the UK**
- **Rollouts have been frozen in Brussels, parts of Geneva, parts of Rome, parts of Australia and parts of the US due to safety concerns**

- **As of 1st January 2019, 247 independent scientists from 42 nations had signed an appeal to the United Nations, UNEP, UN Member States and the World Health Organisation urging a moratorium on the rollout of 5G (emfscientist.org). This was followed by the International Appeal to Stop 5G in space and on earth in response to proposals for 5G satellites in space which would blanket the entire planet. As of June 2019, the appeal had over 100,000 signatories from at least 168 countries from scientists, doctors, biologists, engineers and ordinary citizens.**

What is 5G?

- 5G (like 4G, 3G and WiFi) is a mobile network which uses radio waves at the microwave end of the radio wave spectrum. Wireless radiation is also referred to as 'non-ionising radiation.'
- 4G, 3G and WiFi work on lower frequencies of 6GHz (gigahertz) and below. A gigahertz is a measurement of electromagnetic wave frequency equivalent to one thousand million cycles per second. 5G is being rolled out initially at lower frequencies of around 6GHz but will also use much higher frequency radio waves of up to 100GHz and beyond. 24GHz - 100GHz waves as used for 5G are known as millimetre microwaves (MMWs).
- 5G was originally developed by the military for use with the ADS (Active Denial System) which uses 95GHz waves to disperse crowds, since aiming the beam causes intense heating of the skin. 6G technology and above is currently being developed for specific uses such as holograms.
- 5G is being rolled out all over the UK in such a way that every person, particularly in cities, will be mandatorily exposed to it at all times. 5G will be transmitted across the countryside from large masts and across towns by urban masts. Because high-frequency waves do not travel far, 5G radiation will also be transmitted at the level of every house and street from numerous antennas (some the size of small refrigerators) placed every few houses as well as on all LED streetlights and on bus stops. It is reported that 5G antennas are also being placed beneath manhole covers.

What is 5G for?

The Internet of Things, faster downloads, automated factories, more manufacturing, more virtual gaming, larger data transfer capacity

Driverless cars, remote surgery are some of the more attractive purported benefits

These outcomes will be accompanied by:

Job losses from automated factories and services

Mining for minerals

Likely destruction of natural resources caused by more manufacture

There may be more addiction to virtual gaming and other forms of online entertainment - already considered to be a major mental health issue

According to Tom Wheeler, head of the FCC in the USA and one of the main drivers of 5G, the outcomes are, as yet, unknown, but will be highly lucrative.

According to Professor William Webb, former director of Ofcom and the author of the book *The 5G Myth*, the purported benefits of 5G are in reality unrealisable. Webb recommends better 4G connectivity in rural areas instead. [Note that Webb is not concerned with the health and environmental aspects of 5G or 4G; his opinion relates to the actual uses of 5G only].

5G (and existing wireless radiation) and the environment

5G may have been advertised and promoted as 'green tech' for unsubstantiated reasons which are yet to be proven and which may be outweighed by serious environmental concerns.

The cumulative effect of thousands (or millions and even tens of millions globally) of antennas transmitting microwaves simultaneously is unknown. Safety standards and testing do not appear to be being applied. It was reported in March of this year that ICNIRP are due to vote on relaxing their guidelines around radio frequency emissions so as to accommodate 5G. Permitted levels of wireless radiation are already far higher in the UK than in most other countries (see graph, below).

Satellites: with Elon Musk's advertised launch of 12000 5G satellites into the atmosphere and a further 8000 from three other private companies, if this occurs there will be nowhere left on the planet without 5G radiation. Currently several international appeals from scientists, doctors and environmentalists are underway to stop this enterprise. Astronomers and weather forecasters are also calling for a ban to Musk's 'Starlink' plan as it will interfere with their work and create 'space junk' in Earth's orbit as well as obstructing stargazing.

Bees and other insects

Insects such as bees use magnetic fields to navigate. Existing wireless radiation has been found in studies to interfere with bee navigation and health and is theorised to be an important factor behind reduced bee populations as seen in the following studies:

Behavioural effects (Kumar 2011, Favre 2011)

Disrupted navigation (Goldsworthy 2009, Sainudeen 2011, Kimmel et al 2007)

Decreased egg laying (Sharma and Kumar, 2010)

Reduced colony strength (Sharma and Kumar, 2010, Harst et al, 2006)

Insect decimation & 75% decline in protected areas (Hallmann, Sorg and Jongejans, 2017) full article at: https://www.researchgate.net/publication/320474864_More_than_75_percent_decline_over_27_years_in_total_flying_insect_biomass_in_protected_areas

[320474864_More_than_75_percent_decline_over_27_years_in_total_flying_insect_biomass_in_protected_areas](https://www.researchgate.net/publication/320474864_More_than_75_percent_decline_over_27_years_in_total_flying_insect_biomass_in_protected_areas)

STUDY

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052591/>

Exposure to cell phone radiations produces biochemical changes in worker honey bees.

Cell phone usage is a major public health concern because of potential risk of chronic exposure to low level of radiofrequency and microwave radiation that pulse off the phone antennae in close

proximity to the head. These concerns have induced a large body of research, both epidemiological and experimental, in humans and animals. Honeybees are reliable indicators of environmental status and possess several important ecological, ethological, and morphological characteristics. They are the best experimental animals to study the effect of electromagnetic waves because they possess in their abdomen magnetite granules which help the bees in their orientation flight. Moreover, the integument of bees has semiconductor functions.

STUDY

Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz

Arno Thielens, Duncan Bell, David B. Mortimore, Mark K. Greco, Luc Martens & Wout Joseph
Scientific Reports 8, Article number: 3924 (2018)

A shift of 10% of the incident power density to frequencies above 6 GHz would lead to an increase in absorbed power between 3–370%. This could lead to changes in insect behaviour, physiology, and morphology over time due to an increase in body temperatures, from dielectric heating. The studied insects that are smaller than 1 cm show a peak in absorption at frequencies (above 6 GHz), which are currently not often used for telecommunication, but are planned to be used in the next generation of wireless telecommunication systems

Birds

There have been many anecdotal reports of mass bird deaths at 5G masts. These reports have been widely dismissed as ‘fake news.’ However, given the volume of these reports they would seem to warrant further investigation. This is particularly so given that the hearts of animals and birds function electromagnetically and that heart palpitations are also an anecdotally-recorded symptom of electrosensitivity. (See below for more on electrosensitivity).

Overall harm to wildlife

The US group Physicians for Safe Technology state that ‘there is convincing emerging scientific evidence causing great concern for the environment, with harm to mammals, insects and bacteria...5G technology will also consume significant amounts of energy, contrary to global climate goals.’

The EMF Scientist Appeal state that ‘damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.’

The Environmental Health Trust lists studies on the impact of wireless radiation which show a significant threat to wildlife including bees, other insects, birds and mammals, as well as to plants and trees. Microwave radiation was shown to disrupt migration and navigation systems in a number of species and trials of 5G triggered adverse effects including extreme agitation in cattle.
<https://ehtrust.org/science/bees-butterflies-wildlife-research-electromagnetic-fields-environment/>

Species destruction: Researcher Alfonso Balmori reports in his peer-reviewed article that two-thirds of studies show ecological effects to species from electrosmog. He writes that “At the present time, there are reasonable grounds for believing that microwave radiation constitutes an environmental and health hazard.... Controls must be introduced and technology rendered safe to the environment, since this new ubiquitous and invisible pollutant could deplete the efforts devoted to species conservation.”¹

The Eklipse Report, funded by the EU, reviewed 97 studies on how electromagnetic radiation may affect the environment and concluded that it could indeed pose a risk to bird and insect orientation and plant health.

Mark Shardlow of insect conservation charity Buglife has commented that *There is a credible risk that 5G could impact significantly on wildlife.*

Trees

Trees partially block 5G radiation pathways. A White Paper from the University of Surrey on advancing 5G use recommends taller masts in order to overcome the problem of trees interfering with signals.² However, reports of unprecedented amounts of tree-felling have been made during the last year around urban areas where 5G infrastructures are being established. These reports are unsubstantiated and it has yet to be officially confirmed whether or not they relate to 5G signals, but would seem to warrant further investigation. Council websites state only that trees may be cut down if they are dead, diseased, or for ‘planning purposes.’

A study of 100 trees over a nine-year period has found that the side of trees facing an antenna sustains damage (Waldmann-Selsam, 2016).

Plants such as pine needles and watercress have been demonstrated to age quickly and die when in proximity to very low frequency radio waves.

Carbon footprint: data use increases

An article by environment correspondent John Vidal entitled ‘A Tsunami of Data’ looks at an update to a 2016 report from a Huawei analyst.³ The report contains these key points:

- The industry has encouraged the idea that the digital transformation of economies and large scale energy efficiencies will slash global emissions by 20% or more, but the scale and speed of the revolution has been a surprise.
- **5G will result in vastly increased data transfer which requires huge fuel use. By 2025 the ICT industry could be using up to 20% of the world’s electricity, hampering global attempts to meet climate change targets.**
- Global computing power demand from the projected billions of devices is increasing 20% a year, consuming roughly 3-5% of the world’s electricity in 2015. US researchers expect power consumption to triple in the next five years as one billion more people come online in developing countries, and the “internet of things”, driverless cars, robots, video surveillance and artificial intelligence grows exponentially in rich countries.

- The report's author expects industry power demand to increase from 2-300Twh (Terawatts) of electricity a year now, to 1,200 or even 3,000Twh by 2025. Data centres on their own could produce 1.9Gt (or 3.2% of the global total) carbon emissions.
- The report author is quoted thus: *The situation is alarming. We have a tsunami of data approaching. Everything which can be is being digitalised. It is a perfect storm.*
- A 2016 Berkeley laboratory report for the US government estimated the country's data centres, which held about 350 million terabytes of data in 2015, could together need over 100TWh of electricity a year by 2020. This is the equivalent of about 10 large nuclear power stations. Greenpeace IT analyst Gary Cook says only about 20% of the electricity used in the world's data centres is so far renewable. "The good news is that some companies have certainly embraced their responsibility [to use renewables], and are moving quite aggressively to meet their rapid growth with renewable energy. Others are just growing aggressively."
- Architect David Hughes, who has challenged Apple's new centre in Ireland, says the government should not be taken in by the promises. "Using renewable energy sounds good but no-one else benefits from what will be generated, and it skews national attempts to reduce emissions. Data centres... have eaten into any progress we made to achieving Ireland's 40% carbon emissions reduction target. They are just adding to demand and reducing our percentage. They are getting a free ride at the Irish citizens' expense," says Hughes.
- Eirgrid estimates indicate that by 2025, one in every 3kWh generated in Ireland could be going to a data centre, he added. "We have sleepwalked our way into a 10% increase in electricity consumption." Fossil fuel plants may have to be kept open longer to power other parts of the country and the costs will fall on the consumer, he says. "We will have to upgrade our grid and build more power generation both wind and backup generation for when the wind isn't there and this all goes onto people's bills."

Data use is set to have a bigger carbon footprint than the entire aviation industry, with a tripling in power use over the next ten years, according to reports: https://www.theguardian.com/commentisfree/2018/jul/17/internet-climate-carbon-footprint-data-centres?fbclid=IwAR0gea3zb5ZVn6ik4MHkJLI027qFsO6VfMZT0li83_IMPEQHla8ZKRwbZ0o

- **Satellites** require huge amounts of rocket fuel to launch and Elon Musk's 'Starlink' programme satellites plus those from other private companies totalling around 20K satellites would need to be relaunched every five years due to expiry. Satellites may also deplete the ozone layer: <https://greenworldwarriors.com/2019/02/12/20-000-satellites-for-5g-to-be-launched-sending-beams-of-intense-microwave-radiation-over-the-entire-earth/>
- **The 'Things' required for the Internet of Things:** this requires the disposal of old gadgets and appliances, creating waste which has a major environmental impact, and the purchase of new 'smart' replacements which require raw materials to be extracted and made into consumer items before being transported around the world, all of which uses vast amounts of fossil fuels.

Interference with planetary climate systems

A 2018 *Lancet* article stated that: "The potential effects of these anthropogenic electromagnetic fields on natural electromagnetic fields, such as the Schumann Resonance that controls the weather and climate, have not been properly studied".⁴

Environmental pollution

Wireless radiation is being increasingly recognised as an environmental pollutant. ⁵

Mining

Millions of new transmitters will need to be deployed, including 25 m high towers for rural coverage, medium-sized small cells on lamp posts, buildings and under manhole covers, and tiny micro-transmitters embedded in domestic objects. These transmitters contain metals including gold, copper, silver and lithium all of which have to be mined. Mining is a highly-polluting industry which often takes place in conflict zones such as the Democratic Republic of Congo and which is a cause of child mortality.

Microbes

The published study 'Effect of Mobile Tower Radiation on Microbial Diversity in Soil and Antibiotic Resistance' reports antibiotic resistance found in microbes near base stations. Conclusion: 'Mobile tower radiations can significantly alter the vital systems in microbes and turn them multi drug resistant which is a most important current threat to public health.'

5G and human health

According to increasing numbers of scientists and health experts, 5G poses a serious, if not existential, threat to humans as well as the wider biosphere. The type of radio waves used in 5G (millimetre microwaves or MMWs) have not been tested on human populations and their health effects over long periods of time are not known; however, there is research to show potentially profound damage to biological organisms.

Halts

Rollouts have been frozen in Brussels, parts of Geneva, parts of Rome, parts of Australia and parts of the US due to safety concerns and legal action. Councillors in Glastonbury have called a halt to the rollout and demanded safety testing by independent scientists. 5G is currently being vigorously challenged at council levels on the Isle of Wight.

Some MPs and councillors in the UK are now questioning health concerns around 5G.

Evidence of bioeffects from existing WiFi, 3G and 4G wireless radiation

According to some researchers (see more, below), current guidelines from public health bodies such as Public Health England are based on information which requires updating, particularly in the light of recent studies.

Early studies 'mixed' due to bias:

The World Health Organisation's Interphone Study of 2010 found 'suggestions of an increased risk of glioma [a type of aggressive brain tumour] at the highest exposure levels', and, after correcting for bias, an eighty per cent higher likelihood of having a brain glioma for heavy users. The study found no overall link between mobile phone use and cancer, but note that the study included several studies, some of which did show a link with tumours, which may disguise the overall result^{6,7} The study has also since been re-analysed with different conclusions (see below). The study authors wrote that the overall finding was 'possibly reflecting participation bias or other methodological limitations.' Clearly further research was required, yet the study is widely used by the telecoms industry to claim safety, despite the finding for gliomas.

Industry-funded studies confound the result:

Research has shown that industry-funded studies are less likely than independent studies to show a link with wireless radiation and health problems.^{8,9}

Prasad et al (2017) write: "In our review of the literature and meta-analysis of case-control studies, we found evidence linking mobile phone use and risk of brain tumours especially in long-term users (greater than 10 years). We also found a significantly positive correlation between study quality and outcome in the form of risk of brain tumour associated with use of mobile phones. Higher quality studies show a statistically significant association between mobile phone use and risk of brain tumour. Even the source of funding was found to affect the quality of results produced by the studies."¹⁰

A 'probable carcinogen'?

Mobile phone radiation was classified a class 2B 'possible carcinogen' by the World Health Organisation (WHO) in 2011 after advice from the International Agency for Research on Cancer (IARC), along with advice to ban children from using mobile phones. But in the light of two studies on rats (below), researchers have called for the classification to be upgraded to 'probable carcinogen' (Group 2A) or 'carcinogenic to humans' (Group 1).

New research - three large recent studies

Tumours in rats:

The US Department of Health National Toxicology Program study (2018) showed a 'clear link' between mobile radiation and cancer. When 7000 rats and mice were exposed to mobile radiation for nine hours a day, DNA strands were damaged in brain cells and male rats developed more tumours on the heart muscles and, again in males only, incidences of brain tumours were three per cent higher. There were also lower birth rates and higher rates of infant mortality. The study was reviewed for accuracy by fifteen external physicians who confirmed the conclusion that mobile radiation causes cancer. It should be noted that although three per cent is a relatively small amount proportionally, in real numbers of humans this could translate to millions or tens of millions of people globally.¹¹

Critics are quick to point out that overall, statistically the exposed rats lived longer than the control group, since there seemed to be fewer incidences of kidney problems for reasons which are not

clear from the study report. However, this does not detract from the result clearly linking mobile radiation and cancer.

The Director of the US Food and Drug Administration, Jeffrey Shuren, stated immediately: 'We deny the conclusions of the report,' based on the fact that everyday exposure of mobile radiation to humans is lower than in the tests. However, independently and at the same time, using verifiable strict standards of laboratory science, cancer researcher Fiorella Belpoggi of Bologna studied 2000 rats exposed to the equivalent amount of radio frequency radiation as humans are over a lifetime and obtained similar results. ¹²

In a 2015 study in Germany, rats grew more tumours when exposed to mobile phone radiation 'well below exposure limits for users of mobile phones.' ¹³

Humans and tumours

A Swedish study led by Lennart Hardell suggested that young people who use mobile phones for making phone calls have a five times higher risk of developing glioma than those who do not; those who use cordless phones have a four times higher risk. They were also five times more likely to develop acoustic neuromas, benign tumours which cause deafness. After the age of twenty, when the brain is fully developed, the risk was reduced. Hardell recommends that young people only use mobile phones for phone calls in emergencies and that they text rather than calling. He added that most tumours develop decades after the exposure period, and that as mobile phones are relatively new, it could take many years for the problem to show. ^{14, 15}

In a 2017 article in the International Journal of Oncology, Hardell states: In spite of this, in most countries little or nothing has been done to reduce exposure and educate people on health hazards from RF radiation. On the contrary ambient levels have increased. ¹⁶

Rats and humans: rats are relevant research subjects because they have almost identical disease patterns to humans, according to the Human Genome Project research. ¹⁷

Since these two studies, the ICNIRP (see below for more on this group) has declined to update their guidelines. Professor Ronald Melnick of the National Toxicology Program study has spoken against the ICNIRP refusal to reassess cell phone radiation exposure guidelines, now 20 years old, after the US National Toxicology Program's 'clear evidence of cancer in experimental animals.' He has refuted every point of the ICNIRP document claiming that it has 'numerous false and misleading statements.' His paper in the peer-reviewed journal *Environmental Research* documents the 'unfounded criticisms' of the National Toxicology Program paper. Dr Belpoggi has also posted comments to say that no bias affected the NTP results or her own Ramazzini Institute results. 'We are scientists, our role is to produce solid evidence for hazard and risk assessment. Underestimating the evidence from carcinogen bioassays and delays in regulation have already proven many times to have severe consequences, as in the case of asbestos, smoking and vinyl chloride.' (Ramazzini Institute Statement on ICNIRP Note). (Critique of the ICNIRP Note of Sept 4, 2018 Regarding Recent Animal Carcinogenesis Studies.)

New study: glioma rates have doubled in England

Studies of brain tumour incidence have hitherto shown mixed results. However, a large new study reveals that rates of Glioblastoma Multiforme (GBM), the specific type of brain tumour associated with mobile radiation, have doubled. Researchers analysed 79,241 malignant brain tumours over 21 years and found that cases of GBM in England have increased from 1,250 per year in 1995 to

just under 3,000. This is the first study to analyse in detail the different types of tumours; scientists at the Physicians' Health Initiative for Radiation and Environment (PHIRE) say that the increase of GMB has until now been masked by the overall fall in incidence of other types of brain tumour, which could explain the lack of an apparent spike in brain tumours. The researchers concluded that the increasing rate of tumours in the frontal temporal lobe 'raises the suspicion that mobile and cordless phone use may be promoting gliomas.' Professor Denis Henshaw said 'Our findings illustrate the need to look more carefully at, and try to explain the mechanisms behind, these cancer trends, instead of brushing the causal factors under the carpet and focusing only on cures.'

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Epidemiologist and Professor Emeritus Anthony Miller says that link with cancer 'can no longer be ignored':

Miller, an expert cancer researcher and advisor to the World Health Organization International Agency for Research on Cancer (WHO/IARC) (International Agency for Research on Cancer) has issued his scientific opinion that radiofrequency (RF) radiation from any source – such as the signals emitted by cell phones, other wireless and cordless and sensor devices, and wireless networks – fully meets criteria to be classified as a "Group 1 carcinogenic to humans" agent, based on scientific evidence associating RF exposure to cancer development and cancer promotion.

He says, 'The evidence indicating wireless is carcinogenic has increased and can no longer be ignored.' His opinion includes recent scientific publications which include the 2017 re-analysis of data from the Interphone study, the 2014 French National CERENAT Study, several new publications on Swedish cancer data, and the 2016 results of the National Toxicology Program.

Dr. Lennart Hardell and Michael Carlberg have published several epidemiological studies that found increased brain cancer associated with long-term cell phone use and conclude that "RF radiation should be regarded as a human carcinogen causing glioma." A review of epidemiological studies by Hardell and Carlsberg (Int. J. Environ. Res. Public Health 2014) shows persons diagnosed with brain cancer had decreased survival rates associated with higher wireless phone use. The abstract states: *Due to the relationship with survival the classification of IARC is strengthened and RF-EMF should be regarded as a human carcinogen requiring urgent revision of current exposure guidelines.*

A December 2018 review in The Lancet of the existing 2,000+ peer-reviewed studies on the impact of wireless technology on human and animal systems revealed that 68.2% find significant biological effects. The Lancet review concludes: "This weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks at the currently permitted non-thermal radio-frequency exposure levels".¹⁹

Sperm damage and brain development

The Environmental Health Trust online lists studies including:

Dr. Devra Davis has shown that wireless radiation results in sperm damage and alters brain development.

Dr. Marc Arazi presented data released by the cell phone radiation test program of the Government of France, which found that when cell phones are tested in body contact positions, RF radiation exposure exceeds regulatory limits.

Damage to the blood-brain barrier

It is commonly claimed that wireless radiation does not penetrate the blood-brain barrier, which is key to protecting the brain from damage. However, a Swedish study from 1997 showed that this is not the case. ²⁰

“Neuronal damage may not have immediately demonstrable consequences, even if repeated. It may, however, in the long run, result in reduced brain reserve capacity that might be unveiled by other later neuronal disease or even the wear and tear of ageing. We cannot exclude that after some decades of (often), daily use, a whole generation of users, may suffer negative effects such as autoimmune and neurodegenerative diseases maybe already in their middle age”. ²¹

Electrosensitivity

Electrosensitivity is a condition not yet recognised by the medical establishment in the UK, but it is recognised in Sweden and has been demonstrated by researcher Dominique Belpomme and others (16). Numbers of people reporting symptoms (such as headache, dizziness and tinnitus) anecdotally are growing. Dr Erica Mallory-Blythe is a doctor and 5G campaigner who raises awareness about ES. Please see phire.org.

For ES sufferers, blanket 5G coverage will result in job loss and debilitating health symptoms. It could also be logically conjectured that with 5G and over time from existing wireless radiation, ES sufferers will grow in number.

Research from Professor Martin Pall

Professor Emeritus of Biochemistry Dr Martin Pall has extensively studied the way in which existing wireless radiation has a detrimental impact on health, including DNA damage and oxidative stress. New research shows mechanisms by which damage from non-ionising radiation occurs involving calcium channels in cells. The US Federal Communications Commission standard is based on the thermal effect - how much it heats tissue - but the regulations are 20 years old. Pall shows how safety studies are based only on thermal effects but that non-thermal effects are extensively documented and essential to recognise.

Pall (widely quoted as saying ‘5G is the stupidest idea in the history of the world’) lists four main dangers to humans from 5G: 1) an extraordinary number of antennae are required, 2) high outputs are needed for penetration, 3) pulsation levels will be very high, and 4) 5G will have an impact on the human body’s cellular electrical field. He warns that pulsed radiation used by 5G satellites is biologically active and can produce radiation effects deep within human bodies. The voltage

sensors within human cells are sensitive to radiation, and when cells are exposed to radiation, excessively charged ions flow into the cell. Side-effects may include: DNA damage causing cancer and mutations, cancer caused by several mechanisms, endocrine (hormonal) system disruption, lowered libido, lowered fertility, neurological damage, nervous system damage, neuropsychiatric effects, cell apoptosis, free radical damage, excessive intracellular calcium.

Pall's paper looking at 23 controlled, scientific studies:

'Wi-Fi is an important threat to human health.' Environmental Research, Volume 164, July 2018, Pages 405-416 <https://www.sciencedirect.com/science/article/pii/S0013935118300355>

ABSTRACT: Repeated Wi-Fi studies show that Wi-Fi causes: oxidative stress, sperm/testicular damage, neuropsychiatric effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload. Each of these effects are also caused by exposures to other microwave frequency EMFs, with each such effect being documented in from 10 to 16 reviews. Therefore, each of these seven EMF effects are established effects of Wi-Fi and of other microwave frequency EMFs. Each of these seven is also produced by downstream effects of the main action of such EMFs, voltage-gated calcium channel (VGCC) activation. While VGCC activation via EMF interaction with the VGCC voltage sensor seems to be the predominant mechanism of action of EMFs, other mechanisms appear to have minor roles. Minor roles include activation of other voltage-gated ion channels, calcium cyclotron resonance and the geomagnetic magnetoreception mechanism. Five properties of non-thermal EMF effects are discussed. These are that pulsed EMFs are, in most cases, more active than are non-pulsed EMFs; artificial EMFs are polarized and such polarized EMFs are much more active than non-polarized EMFs; dose-response curves are non-linear and non-monotone; EMF effects are often cumulative; and EMFs may impact young people more than adults. These general findings and data presented earlier on Wi-Fi effects were used to assess the Foster and Moulder (F&M) review of Wi-Fi. The F&M study claimed that there were seven important studies of Wi-Fi that each showed no effect. However, none of these were Wi-Fi studies, with each differing from genuine Wi-Fi in three distinct ways. The tiny numbers studied in each of these seven F&M-linked studies show that each of them lack power to make any substantive conclusions. In conclusion, there are seven repeatedly found Wi-Fi effects which have also been shown to be caused by other similar EMF exposures. Each of the seven should be considered, therefore, as established effects of Wi-Fi.

Pall's booklet can be downloaded for free online. <https://peaceinspace.blogs.com/files/5g-emf-hazards--dr-martin-l.-pall--eu-emf2018-6-11us3.pdf>

Presentation to the NIH: <https://www.youtube.com/watch?v=lulKq3FMGGs>

Other expert sources

Ronald Melnick PhD, retired Senior Toxicologist at the US National Institute of Environmental Health, has spoken publicly about the threat to health from wireless radiation.

Dr Sharon Goldberg is a radiation researcher and expert witness at legal cases against 5G masts in the US who states that there is no longer any debate around the harm to health posed by our existing wireless radiation.

Dr Erica Mallory-Blythe is a UK authority whose work can be found at phire.org.

Extra risks for babies and children

In 2017 neuroscientist [Dr Sarah Starkey](#) submitted a list of evidence of damage to human health from WiFi, 3G and 4G to the Westminster Parliamentary Science and Technology Committee for their Inquiry into Early Years Interventions, which has so far been ignored. A full list of her study references is available here: https://cdn.website-editor.net/2479f24c54de4c7598d60987e3d81157/files/uploaded/Early_Years_Inquiry_EY10062.pdf?fbclid=IwAR1ZldB_ozZECf7-Fte0OSMdQQaSYsFmRfkSNBZMUWpmwGMc-HLdplJndjw.²² Starkey states that current UK government guidelines do not reflect the evidence base. Children, babies and pregnant women are of particular concern, since children absorb microwave radiation from, for example, WiFi in the home, much more readily than adults.²³ In 2013 an independent group called SSITA (Safe Schools Information Technology Alliance) complained to Public Health England about their failure to provide precautionary advice on pulsed microwave-emitting technologies other than mobile phones, particularly the use of wireless networks in schools, based on studies such as those cited by Dr Starkey.²⁴

Starkey's summary:

A limited number of studies in humans, plus substantial evidence from animal studies, point to wireless radiofrequency signals being able to cause physical damage during development (prenatally, postnatally, in childhood and adolescence), as well as in adulthood, which may result in serious negative health, wellbeing or developmental outcomes. That effects are seen in animal studies indicates that the radiofrequency signals themselves can have adverse effects, and it is not just children or young people accessing social media/internet through mobile devices, or time spent looking at screens. Exposures to wireless radiofrequency signals need to be considered when looking at developmental, health, behavioural, wellbeing and mental health issues in children and young people. If children are to be protected from harm, or possible harm, restrictions and regulations need to be introduced.

Martin Pall's paper in *Environmental Research* (as above) shows that microwave frequency EMFs may be much more damaging to young children because of their much smaller skulls and more easily-penetrable skulls. *EMFs have also been shown to be particularly active in producing effects on embryonic stem cells. Because such stem cells occur at much higher cell densities in children, with stem cell densities the highest in the fetus and decreasing with increasing age, impacts on young children are likely to be much higher than in adults. The decreased DNA repair and increased DNA damage following EMF exposure, in conjunction with the increased cell division in young children, strongly suggest that young children may be increasingly susceptible to cancer following such exposures. Two reviews discussed in the next chapter provide further evidence on higher cancer susceptibility of children. EMF action on stem cells may also cause young children to be particularly susceptible to disruption of brain development, something that may be relevant to autism causation.*

'Electrosmog' versus mobile phones

Mobile phones emit more intense electromagnetic radiation than Wi-Fi systems. However, as SSITA (Safe Schools Information Technology Information) doctors have written in a complaint to Public Health England: 'Failure to promote precaution in the case of other wireless technologies such as Wi-Fi and smart meters cannot be justified on the grounds that exposures are less than from mobile phones. This does not take into account the fact that exposure from Wi-Fi in schools and smart meters is constant whereas mobile phone exposure only occurs during phone calls. Furthermore, mobile phone exposure is voluntary whereas in the case of Wi-Fi in schools and smart meters in homes it is involuntary, i.e. people are being forced to be exposed to the pulsed microwaves and cannot choose to exercise precaution. This is arguably a violation of the Right to Health Protection as outlined in Section 4 of the article 'Precautionary Environmental Protection and Human Rights' (2007).'²⁵

Base stations and cell towers

The standard advice from Cancer Research UK is that proximity to cell masts does not increase cancer risk. The *British Medical Journal* claims there is no association, based on a study of children whose mothers lived by base stations during pregnancy, and this is widely-cited by the press and government bodies.

Yet an article in the *British Medical Journal*²⁶ states:

Dr Grahame Blackwell, Independent UK physicist and consultant has summarised six studies of masts and effects:

"These above six studies are the only studies known of that specifically consider the effects of masts on people. All six of these studies show clear and significant ill-health effects. There are no known studies relating to health effects of masts that do not show such ill-health effects.

Professor Santini et al. Pathol Biol (Paris)

"... it is advisable that mobile phone base stations not be sited closer than 300 meters to populations." Netherlands Organization for Applied Scientific Research (TNO)

Study for the Netherlands Ministries of Economic Affairs, Housing, Spatial Planning and the Environment, and Health, Welfare and Sport found significant effects on wellbeing, according to a number of internationally-recognised criteria (including headaches, muscle fatigue/pain, dizziness etc) from 3G mast emissions well below accepted 'safety' levels (less than 1/25,000th of ICNIRP guidelines).

The article also states that conflicts of interest cloud results when looking at RF radiation generally and that this may also apply to studies of proximity to masts.

One study²⁷ shows adverse effects, particularly within 80 metres:

The RF power density of the exposed individuals was significantly higher ($p < 0.0001$) when compared to the control group. The HPBLs were cultured and the DNA damage was assessed by cytokinesis blocked micronucleus (MN) assay in the binucleate lymphocytes. The analyses of data from the exposed group ($n = 40$), residing within a perimeter of 80 m of mobile base stations, showed significantly ($p < 0.0001$) higher frequency of micronuclei when compared to the control group, residing 300 m away from the mobile base station/s. The analysis of various antioxidants in

the plasma of exposed individuals revealed a significant attrition in glutathione (GSH) concentration ($p < 0.01$), activities of catalase (CAT) ($p < 0.001$) and superoxide dismutase (SOD) ($p < 0.001$) and rise in lipid peroxidation (LOO) when compared to controls. Multiple linear regression analyses revealed a significant association among reduced GSH concentration ($p < 0.05$), CAT ($p < 0.001$) and SOD ($p < 0.001$) activities and elevated MN frequency ($p < 0.001$) and LOO ($p < 0.001$) with increasing RF power density.

Five Studies Showing Ill-Health Effects From Masts
Document produced by Dr Grahame Blackwell 21 Feb 20051

1. Study of the health of people living in the vicinity of mobile phone base stations.

Santini et al.

Pathol Biol (Paris) [Pathologie Biologie (Paris)] 2002; 50: 369 – 73

Found significant health effects on people living within 300 metres of mobile phone base stations.

Conclusions include the recommendation:

"... it is advisable that mobile phone base stations not be sited closer than 300meters to populations"

2. Netherlands Organization for Applied Scientific Research (TNO)

Study for the Netherlands Ministries of Economic Affairs, Housing, Spatial Planning and the Environment, and Health, Welfare and Sport

"Effects of Global Communications System Radio-Frequency Fields On Well Being and Cognitive Function of Human Subjects With and Without Subjective Complaints"

(September 2003)

Found significant effects on wellbeing, according to a number of internationally-recognised criteria (including headaches, muscle fatigue/pain, dizziness etc) from 3G mast emissions well below accepted 'safety' levels (less than 1/25,000th of ICNIRP guidelines). Those who had previously been noted as 'electrosensitive' under a scheme in that country were shown to have more pronounced ill-effects, though others were also shown to experience significant effects.

3. THE MICROWAVE SYNDROME – FURTHER ASPECTS OF A SPANISH STUDY

Oberfeld Gerd¹, Navarro A. Enrique³, Portoles Manue¹², Maestu Ceferino⁴, Gomez-Perretta Claudio²

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2 University Hospital La Fe. Valencia, Spain

3 Department of Applied Physics, University Valencia, Spain

4 Foundation European Bioelectromagnetism (FEB) Madrid, Spain

Presented at an International Conference in Kos (Greece), 2004

This study found significant ill-health effects in those living in the vicinity of two GSM mobile phone base stations. They observed that:

"The strongest five associations found are depressive tendency, fatigue, sleeping disorder, difficulty in concentration and cardiovascular problems."

As their conclusion the research team wrote: "Based on the data of this study the advice would be to strive for levels not higher than 0.02 V/m for the sum total, which is equal to a power density of 0.0001 $\mu\text{W}/\text{cm}^2$ or 1 $\mu\text{W}/\text{m}^2$, which is the indoor exposure value for GSM base stations proposed on empirical evidence by the Public Health Office of the Government of Salzburg in 2002."

4. INCREASED INCIDENCE OF CANCER NEAR A CELL-PHONE TRANSMITTER STATION.

Ronni Wolf MD1, Danny Wolf MD2

- 1 The Dermatology Unit, Kaplan Medical Center, Rehovot, and
- 2 the Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, ISRAEL.
- 3 The Pediatric Outpatient Clinic, Hasharon Region, Kupat Holim, ISRAEL.

Published in: International Journal of Cancer Prevention Volume 1, No. 2, April 2004

This study, based on medical records of people living within 350 metres of a long-established phone mast, showed a fourfold increased incidence of cancer generally compared with the general population of Israel, and a tenfold increase specifically among women, compared with the surrounding locality further from the mast.

5. Naila Study, Germany (November 2004)

Report by researchers (five medical doctors)

Following the call by Wolfram König, President of the Bundesamt für Strahlenschutz (Federal Agency for radiation protection), to all doctors of medicine to collaborate actively in the assessment of the risk posed by cellular radiation, the aim of our study was to examine whether people living close to cellular transmitter antennas were exposed to a heightened risk of taking ill with malignant tumors. The basis of the data used for the survey were PC files of the case histories of patients between the years 1994 and 2004. While adhering to data protection, the personal data of almost 1.000 patients were evaluated for this study, which was completed without any external financial support.

It is intended to continue the project in the form of a register.

The result of the study shows that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which has been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier. In the years 1999-2004, i.e. after five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.

NOTE: These are the only studies known of that specifically consider the effects of masts on people. All five of these studies show clear and significant ill-health effects. There are no known studies relating to health effects of masts that do not show such ill-health effects.

In this respect, any statement by industry or official sources that claims (or suggests) that:

(a) There is no evidence of ill-health effects from masts;

or

(b) The overwhelming evidence is that masts do not cause ill-health effects; is completely and blatantly untrue.

Dr Grahame Blackwell

In 2008 a cancer cluster was reported in the area around a tower in Dudley found to have the highest levels of radiation in the UK (yet still within safety guidelines).

In 2014 government inspectors are reported to have turned down the erection of a mast due to potential health issues. <https://www.emfacts.com/2014/08/uk-mobile-phone-company-banned-from-erecting-a-mast-because-of-health-fears/>.

A ten-year study from Brazil entitled 'Mortality by neoplasia and cellular telephone base stations' found elevated cancer mortality amongst those living less than 500m from base stations. After this study almost half of the city antennas were removed and cell phone companies were sued. ²⁸

It would seem crucial to investigate further any bias in BMJ studies and **to note also that with 5G masts added to existing stations that radiation levels will be greater.**

Health issues specific to 5G microwave radiation:

5G antennas will greatly increase levels of existing wireless radiation. The UK radiation level limits are already set much higher than in other countries (see chart below, under 'ICNIRP') and in addition the ICNIRP have voted to relax guidelines.

5G will use current frequencies in addition to high millimetre wave and sub-millimetre wave frequencies of 100GHz and beyond. Therefore bioeffects from both increased cumulative effects of existing radiation, which may be synergistic and not just additive as well as those specific to high-frequency radiation may be anticipated.

Professor Joel Moskowitz of the University of California

Joel M. Moskowitz is a Professor Emeritus of radiation at the School of Public Health at the University of California Berkeley and an expert in mobile phone radiation and electromagnetic fields. He states:

- Millimetre waves such as those in use by 5G are absorbed by the first 1-2 mm of skin and the eye cornea. Since the skin contains nerve endings and capillaries, bio-effects may be transmitted further.
- Thermal (or heating) effects as used by the military's ADS system occur when the power density of the waves is above 5–10 mW/cm². The maximum permissible exposure that the FCC permits for the general public is 1.0 mW/cm² averaged over 30 minutes for frequencies that range from 1.5 GHz to 100 GHz. This guideline was adopted in 1996 to protect humans from acute exposure to thermal levels of radiofrequency radiation. However, the guidelines were not designed to protect us from nonthermal risks that may occur with prolonged or long-term exposure to radiofrequency radiation.
- With the deployment of fifth generation wireless infrastructure (aka 5G), much of the nation will be exposed to MMWs for the first time on a continuous basis. Due to FCC guidelines, these exposures will likely be of low intensity. Hence, the health consequences of 5G exposure will be limited to non-thermal effects produced by prolonged exposure to MMWs [ie high-frequency millimetre waves] in conjunction with exposure to low- and mid-band radiofrequency radiation [from existing radiation]. Few studies have examined prolonged exposure to low-intensity MMWs, and no research has focused on exposure to MMWs combined with other radiofrequency radiation. It has not therefore been proven safe.

- Biologic effects of low-intensity MMWs have been studied for decades, particularly in Eastern Europe, study results are often inconsistent because the effects are related to many factors including the frequency, modulation, power density, and duration of the exposures, as well as the type of tissue or cells being investigated. Therefore results vary across studies with not all showing harmful effects.
- MMWs have been shown to induce or inhibit cell death and enhance or suppress cell proliferation. Some studies found that the radiation inhibits cell cycle progression, and some studies reported no biologic effects (Le Drean et al., 2013)
- A review of the research in 2010 noted that “A large number of cellular studies have indicated that MMW may alter structural and functional properties of membranes.” Exposure to MMWs may affect the plasma membrane either by modifying ion channel activity or by modifying the phospholipid bilayer. Water molecules also seem to play a role in these effects. Skin nerve endings are a likely target of MMWs and the possible starting point of numerous biological effects. MMWs may activate the immune system through stimulation of the peripheral neural system (Ramundo-Orlando, 2010).
- In 1998, five scientists employed by U.S. Army and Air Force research institutes published a seminal review of the research on MMWs. They reported:
 - Increased sensitivity and even hypersensitivity of individual specimens to MMW may be real. Depending on the exposure characteristics, especially wavelength, a low-intensity MMW radiation was perceived by 30 to 80% of healthy examinees (Lebedeva, 1993, 1995). Some clinical studies reported MMW hypersensitivity, which was or was not limited to a certain wavelength (Golovacheva, 1995).
 - It is important to note that, even with the variety of bioeffects reported, no studies have provided evidence that a low-intensity MMW radiation represents a health hazard for human beings but they have also not looked at health risks. In view of numerous bioeffects and growing usage of MMW technologies this research objective seems very reasonable. Such MMW effects as alterations of cell growth rate and UV light sensitivity, biochemical and antibiotic resistivity changes in pathogenic bacteria, as well as many others are of potential significance for safety standards, but even local and short-term exposures were reported to produce marked effects. It should also be realized that biological effects of a prolonged or chronic MMW exposure of the whole body or a large body area have never been investigated. Safety limits for these types of exposures are based solely on predictions of energy deposition and MMW heating, but in view of recent studies this approach is not necessarily adequate.” (Pakhomov et al., 1998)
- Microbes are also affected by MMW radiation. In 2016 a review of the research on the effects of MMWs on bacteria was published (Soghomonyan et al., 2016). The authors summarized their findings as follows: “...bacteria and other cells might communicate with each other by electromagnetic field of sub-extremely high frequency range. These MMW affected Escherichia coli and many other bacteria, mainly depressing their growth and changing properties and activity. These effects were non-thermal and depended on different factors. The significant cellular targets for MMW effects could be water, cell plasma membrane, and genome....The consequences of MMW interaction with bacteria are the changes in their sensitivity to different biologically active chemicals, including antibiotics....These effects are of significance for understanding changed metabolic pathways and distinguish role of bacteria in environment; they might be leading to antibiotic resistance in bacteria.”

- Changing the sensitivity of bacteria to antibiotics by MMW irradiation can be important for the understanding of antibiotic resistance in the environment. In this respect, it is interesting that bacteria [that] survived near telecommunication-based stations like *Bacillus* and *Clostridium* spp. have been found to be multidrug resistant (Adebayo et al. 2014), (Soghomonyan et al. 2016)
- In 1977, N.P. Zalyubovskaya published a study, "Biological effects of millimeter waves," in a Russian-language journal, "Vracheboyne Delo." The CIA declassified this paper in 2012. The study examined the effects of exposing mice to millimeter radiation (37-60 GHz; 1 milliwatt per square centimeter) for 15 minutes daily for 60 days. The animal results were compared to a sample of people working with millimeter generators. Here is a brief summary of the paper: studies conducted on humans and animals showed structural alterations in the skin and internal organs, changes in blood and bone marrow composition, changes in enzymatic activity and nucleic metabolism. 'the degree of unfavourable effect of radiation depended on the duration of the radiation and individual characteristics of the organism.'
- In sum, the peer-reviewed research demonstrates that short-term exposure to low-intensity millimeter wave (MMW) radiation not only affects human cells, it may result in the growth of multi-drug resistant bacteria harmful to humans. Since little research has been conducted on the health consequences from long-term exposure to MMWs, widespread deployment of 5G or 5th generation wireless infrastructure constitutes a massive experiment that may have adverse impacts on the public's health.

The research review **5G Wireless Expansion: Public Health and Environmental Implications** documents the range of reported adverse effects of RF and millimeter waves. These effects range from cancer to changes in bacteria growth and even to DNA damage. The study concludes that "a moratorium on the deployment of 5G is warranted" and "the addition of this added high frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome ... from both physical and mental health perspectives" (Russell 2018).²⁹

Tissue damage

(Neufeld & Kuster, 2018) showed that due to the heating effect of 5G electromagnetic waves, the exposure times 'tolerated by the International Council on Non-Ionizing Radiation Protection guidelines may lead to permanent tissue damage after even short exposures, highlighting the importance of revisiting existing exposure guidelines.'³⁰

Sweat ducts

A 2018 study entitled *The human skin as a sub-THz receiver - Does 5G pose a danger to it or not?* showed that sweat ducts act as mini antennas:³¹

In the interaction of microwave radiation and human beings, the skin is traditionally considered as just an absorbing sponge stratum filled with water. In previous works, we showed that this view is flawed when we demonstrated that the coiled portion of the sweat duct in upper skin layer is regarded as a helical antenna in the sub-THz band....The presence of the sweat duct led to a high

specific absorption rate (SAR) of the skin in extremely high frequency band. In this paper, we summarize the physical evidence for this phenomenon and consider its implication for the future exploitation of the electromagnetic spectrum by wireless communication. Starting from July 2016 the US Federal Communications Commission (FCC) has adopted new rules for wireless broadband operations above 24 GHz (5 G). This trend of exploitation is predicted to expand to higher frequencies in the sub-THz region. One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to which the sweat duct (as a helical antenna) is most attuned. We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored.

Dr Sharon Goldberg

Goldberg, MD in internal medicine, professor, and clinical researcher has testified at 5G legislation in Michigan. This testimony can be viewed online. Some notes from the testimony:

Wireless radiation has biological effects in all life forms. Clear evidence of cancer in humans now, DNA damage, cardiomyopathy, neuropsychiatric effects - the science is settled. Unsustainable healthcare expenditures. We have been sitting on the evidence for decades. Epidemics are linked. Diabetes is linked according to peer-reviewed literature; the nearer to a cell tower the higher your glucose and therefore 5G antennas are dangerous. The way to create diabetes in rats in the lab is to expose them to 2.2GHz. Diabetes causes chronic kidney disease. Mental health epidemic, suicide, violent crime, opioids - the peer-reviewed literature in PubMed shows clear links which have been glossed over by the wireless industry; industry-funded studies are not clear but independent studies are very clear. We need to start measuring how much radiation people are exposed to before we roll out 5G. US Toxicology Programme study is just one cell phone but we have cell towers, smart meters, wifi, 4G and so on - many layers. Don't roll out a new untested technology. The American Cancer Society saying there is no evidence: this is due to conflicts of interests. In academia 5G is 'an untested application of a technology we know is harmful from the science. It's called human subjects research. You can't just roll out a research on human beings unless you inform them and have their approval. We have decades of evidence to show that it is not safe.

SCHEER (the EU Scientific Committee on Health, Environmental and Emerging Risks) SCHEER state in their 2018 report that 'the lack of clear evidence to inform the development of exposure guidelines to 5G technology leaves open the possibility of unintended biological consequences' and include electromagnetic radiation, especially from 5G, along with e-cigarettes, nanoparticles and other toxins in their list of concerns. ³²

Further resources

<http://phiremedical.org/full-overview/> headed by Dr Erica Mallory-Blythe, 5G campaigner and speaker

EMF Appeal <https://www.emfscientist.org>

Bioinitiative.org: a group of MDs and professors with a large body of evidence showing harm to living organisms.

EH Trust <https://ehtrust.org/scientific-research-on-5g-and-health/> has compiled a list of the key published research showing adverse effects of radiofrequency exposure from the 5G rollout.

Anecdotal reports of EMF toxicity symptoms from existing 5G areas

UN staff worker Claire Edwards in Vienna where 5G has been rolled out on reports of EMF poisoning: *Friends and acquaintances and their children in Vienna are already reporting the classic symptoms of EMR poisoning: nosebleeds, headaches, eye pains, chest pains, nausea, fatigue, vomiting, tinnitus, dizziness, flu-like symptoms, and cardiac pain. They also report a tight band around the head; pressure on the top of the head; short, stabbing pains around the body; and buzzing internal organs. Other biological effects such as tumours and dementia usually take longer to manifest, but in the case of 5G, which has never been tested for health or safety, who knows?*

Coalitions of scientists appealing to freeze 5G

The 5G Appeal Scientists and doctors from 36 countries have signed the Appeal calling for a moratorium on the roll-out of 5G and the mandatory exposure to wireless radiation this would impose on humans and the environment.

The 5G Space Appeal Hundreds of scientists from the Appeal state: 'RF radiation has been proven harmful for humans and the environment. The deployment of 5G constitutes an experiment on humanity and the environment that is defined as a crime under international law.' With "the implementation of 5G threaten serious, irreversible consequences for humans," warn more than 400 physicians and scientists.

The EMF Scientist Appeal 230 scientists from all over the world have stated in the Appeal that 'numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines.'

Scientific basis for our common concerns: Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.

These findings justify our appeal to the United Nations (UN) and, all member States in the world, to encourage the World Health Organization (WHO) to exert strong leadership in fostering the development of more protective EMF guidelines, encouraging precautionary measures, and educating the public about health risks, particularly risk to children and fetal development. By not taking action, the WHO is failing to fulfill its role as the preeminent international public health agency.

Since there is controversy about a rationale for setting standards to avoid adverse health effects, we recommend that the United Nations Environmental Programme (UNEP) convene and fund an

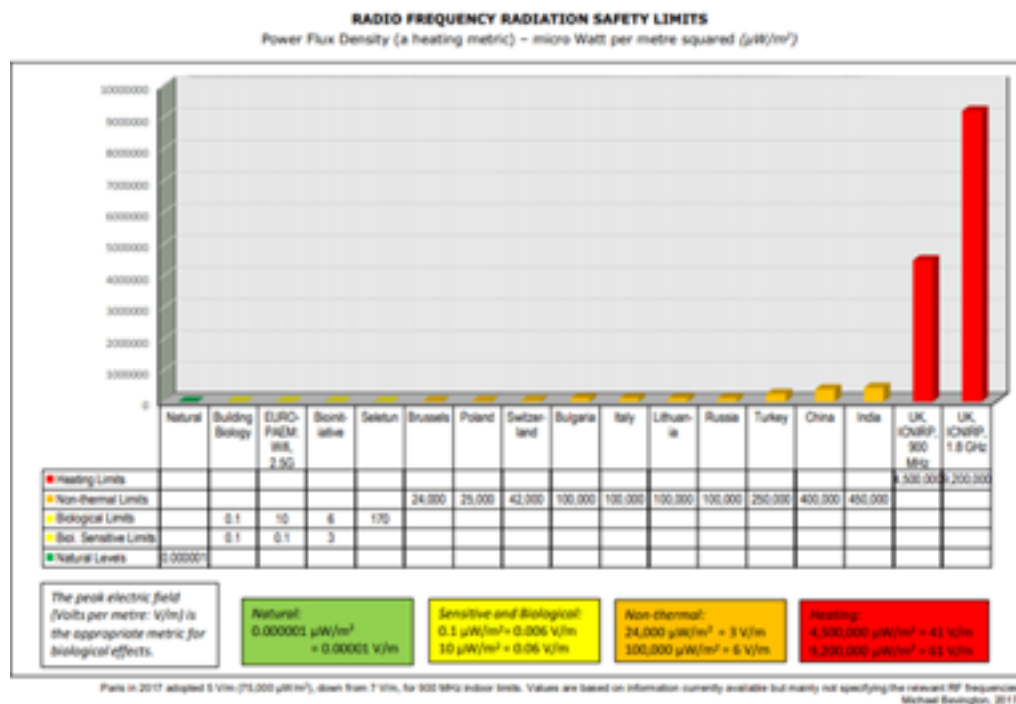
independent multidisciplinary committee to explore the pros and cons of alternatives to current practices that could substantially lower human exposures to RF and ELF fields. The deliberations of this group should be conducted in a transparent and impartial way. Although it is essential that industry be involved and cooperate in this process, industry should not be allowed to bias its processes or conclusions. This group should provide their analysis to the UN and the WHO to guide precautionary action.

Further info: <https://www.emfscientist.org>

ICNIRP guidelines on mobile radiation exposure

These guidelines are based on thermal effects only, despite the fact that non-thermal effects have been well-documented (as above).

Current UK guidelines are already comparatively extremely high and are due to be relaxed further:



For more on UK limits see: <http://phiremedical.org/safety-limits-and-political-conflicts-of-interest/>

The ICNIRP (International Committee on Non-Ionising Radiation Protection) is a small, private, non-accountable, industry-loyal group which sets the guidelines for radiation exposure. Bodies such as the WHO and PHE (Public Health England) as well as the NHS ultimately take their cue from the ICNIRP.

The author of a *Journal of Oncology* article writes: ³³

In 2014 the WHO launched a draft of a Monograph on RF fields and health for public comments. It turned out that five of the six members of the Core Group in charge of the draft are affiliated with

International Commission on Non-Ionizing Radiation Protection (ICNIRP), an industry loyal NGO, and thus have a serious conflict of interest. Just as by ICNIRP, evaluation of non-thermal biological effects from RF radiation are dismissed as scientific evidence of adverse health effects in the Monograph. This has provoked many comments sent to the WHO. However, at a meeting on March 3, 2017 at the WHO Geneva office it was stated that the WHO has no intention to change the Core Group.

The only proven adverse health effect of radiofrequency electromagnetic fields cited by ICNIRP is the heating of the tissue, as occurs at high dosage, as happens with a microwave oven. According to ICNIRP, after 2 watts per kg of body weight the tissue temperature rises measurably. The association set the value in 1998 and today's limits from base stations and mobile phones are based on that. Critics say that the restriction on the heating effect is arbitrary. High-frequency beams also produce non-thermal effects in living cells, even when they are low-dose. Biological processes are always based on electrochemical processes, such as the transmission of nerve impulses. The members of ICNIRP do not deny that. "We just are not convinced that these effects have been proven to be harmful to health," explains its chairman, the Dutch biologist Eric van Rongen.

A recent petition to Parliament to halt the 5G rollout elicited this Government response: *Exposure to radio waves has been carefully researched and reviewed. The overall weight of evidence does not suggest devices producing exposures within current guidelines pose a risk to public health.* However, the Government's response is based upon outdated research from Public Health England (all but one study cited is pre-2013) that only looks at thermal effects i.e. heating of the body. As the above studies show, non-thermal effects from non-ionizing radiation are highly significant.

EMF scientist appeal criticism: It is our opinion that, because the ICNIRP guidelines do not cover long-term exposure and low-intensity effects [of 4G and 3G], they are insufficient to protect public health.

Bioinitiative: (<https://bioinitiative.org>) 29 professors and medical researchers from eleven countries represent all of the required disciplines such as cancer research, molecular biology and epidemiology published a counter-report to the ICNIRP position.

They state: *The biological effects of cell phone radiation prevent the body from healing damaged DNA and reducing its resistance to disease*, the authors write, citing more than 1,000 scientific publications. *This could profoundly affect the metabolic and reproductive functions.* According to Swedish oncologist Lennart Hardell, one of the lead authors, studies with several thousand cell phone users surveyed have *proven that high-frequency electromagnetic radiation increases the risk of brain tumors.*

Public Health England

In 2013 SSITA (Safe Schools Information Technology Alliance) complained to PHE about their failure to provide appropriate precautionary advice on pulsed microwave-emitting technologies other than mobile phones, particularly the use of wireless networks in schools and homes, and Smart Meters in homes and small businesses. The HPA (previous body similar to PHE) did not mention studies showing the risks. 'This is arguably a violation of the Right to Health Protection as outlined in Section 4 of the article 'Precautionary Environmental Protection and Human Rights' (2007).'

AGNIR (Advisory Group on Non-Ionising Radiation) the now-defunct government group on non-ionising radiation who advise PHE, conclude that 'there is no convincing evidence that radio wave exposures below the ICNIRP guideline levels cause health effects in adults or children.' However, the SSITA strongly disagrees with this statement, saying that 'a large body of published scientific data has found that pulsed radiofrequency microwaves below the guideline levels can cause biological and adverse health effects, although many of these papers were omitted from the AGNIR 2012 report...As stated in the Benevento Resolution (2006) from the International Commission for Electromagnetic Safety, 'arguments that weak (low intensity) EMF cannot affect biological systems do not represent the current spectrum of scientific opinion.'

SAR levels

Official US advice on the SAR (Specific Absorption Rate) of phones is that this should be 1.6 watts or less per kg of body weight or 2 w/kg in Europe. SAR levels are not independently tested; industries can self-report. Moreover, in hot spots 'realistic mobile phone exposure' SAR levels can reach 40 watts per kilo. ³⁴

Legal action and councils

The public has not been consulted on whether or not it wants 5G. The rollout of 5G entails mandatorily subjecting every member of the public to 5G exposure, with especially high levels in cities.

Currently litigators are working in the US and Australia on behalf of those affected by 5G; in Australia cases are made on the grounds of 'assault and technological trespass.'

In the UK some groups are beginning to look into crowdfunding legal action whilst others are attempting to hold local councils to account. Councillors claim no obligation but as they contract the suppliers and the central government has given the responsibility to local councils to contract out, for example, lampposts, this is not in fact the case. Councils and mayors have a duty of care to their citizens. Communities are being advised on taking Class Actions and public interest challenges whereby government and local councils are the defendants, for example against a local council, since on the one hand, it is a commercial partner of companies that develop and operate infrastructure (and pay for the use of council property and street lights to site base stations and antenna), versus its obligations to residents as regards human health and environmental protection.

Notices of Liability will be lodged by individual residents targeting telecoms companies and infrastructure providers. Freedom of Information requests should be answered when submitted.

In February 2019, national planning laws were changed to accommodate 5G demands (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf pp. 33-34). These effectively prevent local councils from refusing installation of 5G infrastructure and the amendments make it very difficult for householders to prevent 5G-enabled antennas from being installed in the street where they live, or even on the walls of their homes.

The Nuremberg Code of 1947 states that experiments cannot be performed on human populations without informed consent.

Shareholders in telecoms companies are warned about changing values caused by safety concerns: As Vodafone notes in the 2017 annual report: "Electromagnetic signals emitted by mobile devices and base stations can pose health risks with potential consequences, including: changes in national legislation, a reduction in mobile phone use or litigation." Deutsche Telekom also warns its Shareholders said there was "a risk of regulatory intervention, such as lowering electromagnetic field limits or implementing precautionary measures in mobile communications".

The "legal information" supplied by phone manufacturers advise keeping the phone an inch from the body. 'Failure to do so may cause your smartphone to exceed the specified limits.'

Insurance companies will not insure for wireless radiation damage due to 'high impact risk.'

Safe technology alternatives to explore

Fibre optics; cables

Ethernet

WiFi in schools

4G (at a minimum) instead of 5G, using fibre optics

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Further reading and resources

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Claire Edwards' report from Vienna: <https://www.globalresearch.ca/5g-wireless-technology-is-war-against-humanity/5679372>

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Physicians for safe technology: <https://mdsafetech.org/5g-telecommunications-science/>
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<https://www.gov.uk/government/groups/committee-on-medical-aspects-of-radiation-in-the-environment-comare> why do they ignore the safety studies cited by sarah starkey?

Senator Richard Blumenthal, senator for Connecticut, raises concerns: <https://www.youtube.com/watch?v=hsil3VQE5K4>

Senator Patrick Colbeck: YouTube video about health concerns: <https://www.youtube.com/watch?v=Ov1iskVvFSs&feature=youtu.be&fbclid=IwAR0vXTO5LQpBdFQ1P9IX9PYmjpVE-f8cetBtFRXjYEAYE1WU1XvxLHzKqBI>

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Further studies on millimetre waves

Belyaev IY, Shcheglov VS, Alipov ED, Ushakov VD. Nonthermal effects of extremely high-frequency microwaves on chromatin conformation in cells in vitro—Dependence on physical, physiological, and genetic factors. *IEEE Transactions on Microwave Theory and Techniques*. 2000; 48(11):2172-2179.

This finding suggested an interaction of microwaves with cell-to-cell communication. Such dependence on several genetic, physiological, and physical variables might be a reason why, in some studies, the authors failed to reproduce the original data of others.

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Ramundo-Orlando A. Effects of millimeter waves radiation on cell membrane - A brief review. *Journal of Infrared, Millimeter, and Terahertz Waves*. 2010; 31(12):1400–1411.

Abstract

The millimeter waves (MMW) region of the electromagnetic spectrum, extending from 30 to 300 GHz in terms of frequency (corresponding to wavelengths from 10 mm to 1 mm), is officially used in non-invasive complementary medicine in many Eastern European countries against a variety of diseases such as gastro duodenal ulcers, cardiovascular disorders, traumatism and tumor. On the other hand, besides technological applications in traffic and military systems, in the near future MMW will also find applications in high resolution and high-speed wireless communication technology. This has led to restoring interest in research on MMW induced biological effects. In this review emphasis has been given to the MMW-induced effects on cell membranes that are considered the major target for the interaction between MMW and biological systems.

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Abstract

Currently, technology is being developed that makes use of the millimeter wave (MMW) range (30-300 GHz) of the radio frequency region of the electromagnetic spectrum. As more and more systems come on line and are used in everyday applications, the possibility of inadvertent exposure of personnel to MMWs increases. To date, there has been no published discussion regarding the health effects of MMWs; this review attempts to fill that void. Because of the shallow depth of penetration, the energy and, therefore, heat associated with MMWs will be deposited within the first 1-2 mm of human skin. MMWs have been used in states of the former Soviet Union to provide therapeutic benefit in a number of diverse disease states, including skin

disorders, gastric ulcers, heart disease and cancer. Conversely, the possibility exists that hazards might be associated with accidental overexposure to MMWs. This review attempts to critically analyze the likelihood of such acute effects as burn and eye damage, as well as potential long-term effects, including cancer.

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Soghomonian D, Trchounian K, Trchounian A. Millimeter waves or extremely high frequency electromagnetic fields in the environment: what are their effects on bacteria? *Appl Microbiol Biotechnol*. 2016; 100(11):4761-71. doi: 10.1007/s00253-016-7538-0.

Abstract

Millimeter waves (MMW) or electromagnetic fields of extremely high frequencies at low intensity is a new environmental factor, the level of which is increased as technology advance. It is of interest that bacteria and other cells might communicate with each other by electromagnetic field of sub-extremely high frequency range. These MMW affected *Escherichia coli* and many other bacteria, mainly depressing their growth and changing properties and activity. These effects were non-thermal and depended on different factors. The significant cellular targets for MMW effects could be water, cell plasma membrane, and genome. The model for the MMW interaction with bacteria is suggested; a role of the membrane-associated proton FOF1-ATPase, key enzyme of bioenergetic relevance, is proposed. The consequences of MMW interaction with bacteria are the changes in their sensitivity to different biologically active chemicals, including antibiotics. Novel data on MMW effects on bacteria and their sensitivity to different antibiotics are presented and discussed; the combined action of MMW and antibiotics resulted with more strong effects. These effects are of significance for understanding changed metabolic pathways and distinguish role of bacteria in environment; they might be leading to antibiotic resistance in bacteria. The effects might have applications in the development of technique, therapeutic practices, and food protection technology.

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Torgomyan H, Trchounian A. Bactericidal effects of low-intensity extremely high frequency electromagnetic field: an overview with phenomenon, mechanisms, targets and consequences. *Crit Rev Microbiol*. 2013; 39(1):102-11.

Abstract

Low-intensity electromagnetic field (EMF) of extremely high frequencies is a widespread environmental factor. This field is used in telecommunication systems, therapeutic practices and food protection. Particularly, in medicine and food industries EMF is used for its bactericidal effects. The significant targets of cellular mechanisms for EMF effects at resonant frequencies in bacteria could be water (H₂O), cell membrane and genome. The changes in H₂O cluster structure and properties might be leading to increase of chemical activity or hydration of proteins and other cellular structures. These effects are likely to be specific and long-term. Moreover, cell membrane with its surface characteristics, substance transport and energy-converting processes is also altered. Then, the genome is affected because the conformational changes in DNA and the transition of bacterial pro-phages from lysogenic to lytic state have been detected. The consequences for EMF interaction with bacteria are the changes in their sensitivity to different chemicals, including antibiotics. These effects are important to understand distinguishing role of bacteria in environment, leading to changed metabolic pathways in bacteria and their antibiotic resistance. This EMF may also affect the cell-to-cell interactions in bacterial populations, since bacteria might interact with each other through EMF of sub-extremely high frequency range.

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