

Notice to Produce Scientific Evidence

Gilakas'la. Nugwa'am : **tugis-kim-giboo-sagaw'een**. That translates to 'Welcome. I am: **tugis-kim-giboo-sagaw'een**.' The Colonial name that was bestowed upon my vessel is Michael Hunt and I dwell upon the land referred to as the territory of Qualicum Nation et al, at [120 Fisheries Rd, Qualicum Beach, near V9K1Z5]

gilakas'la. nugwa'am : **mali'das**. That translates to 'Welcome. I am: **mali'das**.' The Colonial name that was bestowed upon my vessel is Steven Recalma and I dwell upon the land referred to as the territory of Qualicum Nation et al, at [5820 Island Highway West, Qualicum Beach, near V9K2E6]

Dear Mayor Brian Wiese, Councillor Robert Filmer, Councillor Scott Harrison, Councillor Adam Walker and Councillor Teunis Westbroek,

We are communicating to you on behalf of ourselves and our ancestors before us, as originals to the land of Qualicum [sic] with our heritage being the Pentlach, the Kwakwaka'wakw and other nations extending as far north as the territory known as Alaska [sic]. We are not writing this notice to you as representatives of Qualicum First Nation.

At the opening of all Qualicum Town Hall meetings Mayor Brien Weise acknowledges that the town/ municipality of Qualicum Beach [sic] sits within the territory of the Coast Salish peoples. As such the Mayor also recognizes that you are located on Un-ceded-Tribal-Territory.

Today we are writing specifically about the proposed Cell Tower that TELUS© is expecting to install in the Town of Qualicum Beach [sic]. As it appears it has been scientifically documented, please see attached, that the frequency emitted by cell phone towers appears harmful to carbon based life forms. Therefore, before this cell tower or any others is installed within the territory of Qualicum Beach[sic] et al we require vetted and replicatable scientific proof from an independent 3rd party entity that a cell tower will have zero negative effects on ANY of the man-kind, wo-man-kind or wildlife in the surrounding area. Being an original of-the-land my concern, as was my ancestors, is what effect will our 7th generation have to deal with by what is done today?

Therefore, we will give you ten (10) days from receipt of this notice to respond with your intentions. Failure to respond to these terms is, by your silence, tacit consent to submit to our authority over the lands to which the Town of Qualicum Beach [sic] et al has taken under their management and your guarantee that no cell tower or radio communication device(s) of any kind will be installed upon these tribal-lands unless you can provide that Lord Dufferin's 1875 Order et al has been repealed. Any new/re proposals now or in the future must be submitted to our address above with instructions on how you would like to proceed and MUST be accompanied by proof that the proposed technology will have ZERO negative side effects on the habitants, individuals and wildlife of the area and territory.

As tribal stewards of the land it is responsible to err on the side of caution.

Electromagnetic Radiation from Cellphone Towers: A Potential Health Hazard for Birds, Bees, and Humans

By Chanda Siddoo-Atwal

Submitted: November 3rd 2017 Reviewed: March 1st 2018 Published: April 10th 2018

DOI: 10.5772/intechopen.76084

Abstract

Microwave sickness syndrome was first identified in the 1950s by Soviet researchers. Symptoms included headache, fatigue, ocular dysfunction, dizziness, and sleep disorders. The main clinical manifestations were dermatographism, tumors, blood changes, reproductive and cardiovascular abnormalities, depression, irritability, and memory impairment. Later in the 1970s, American researchers reported similar findings. Electromagnetic radiation (EMR) from modern cellphone towers is largely comprised of high-frequency radio waves or microwaves. The adverse biological effects of EMR from cellphone towers have been observed in birds, bees, and humans. The associated decline in fruit-eating seed dispersers such as wild birds and in insect pollinators such as bees could have serious consequences for human food production. In addition to noting this possible indirect effect of microwave radiation, a direct effect on human health was evaluated. According to a new approach to cancer risk assessment, based on an apoptotic model of carcinogenesis, it was determined that proximity to EMR from cellphone towers may pose a potential cancer risk in humans since microwave radiation can induce various apoptotic pathways leading to cell death in transformed human cell lines. The stimulation of cellular apoptosis resulting in deregulated cell proliferation is being increasingly linked to cancer and may provide a possible mechanism for microwave radiation carcinogenesis.

Keywords

electromagnetic radiation

microwave radiation

radiofrequency radiation

microwave radiation carcinogenesis

apoptosis

Chapter and author info

Show +

1. Introduction

The electromagnetic spectrum consists of ionizing and nonionizing radiation. Ionizing radiation includes ultraviolet (UV) rays, X-rays, and gamma (γ) rays. Electromagnetic radiation (EMR) from cellphone towers is largely comprised of high-frequency radio waves or microwaves. Microwaves lie in the nonionizing radiation portion of the electromagnetic spectrum which includes low-frequency (computers, power lines), medium-frequency (television, radio), and high-frequency (microwaves, mobile devices) radio waves ([Figure 1](#)).

ELECTROMAGNETIC SPECTRUM

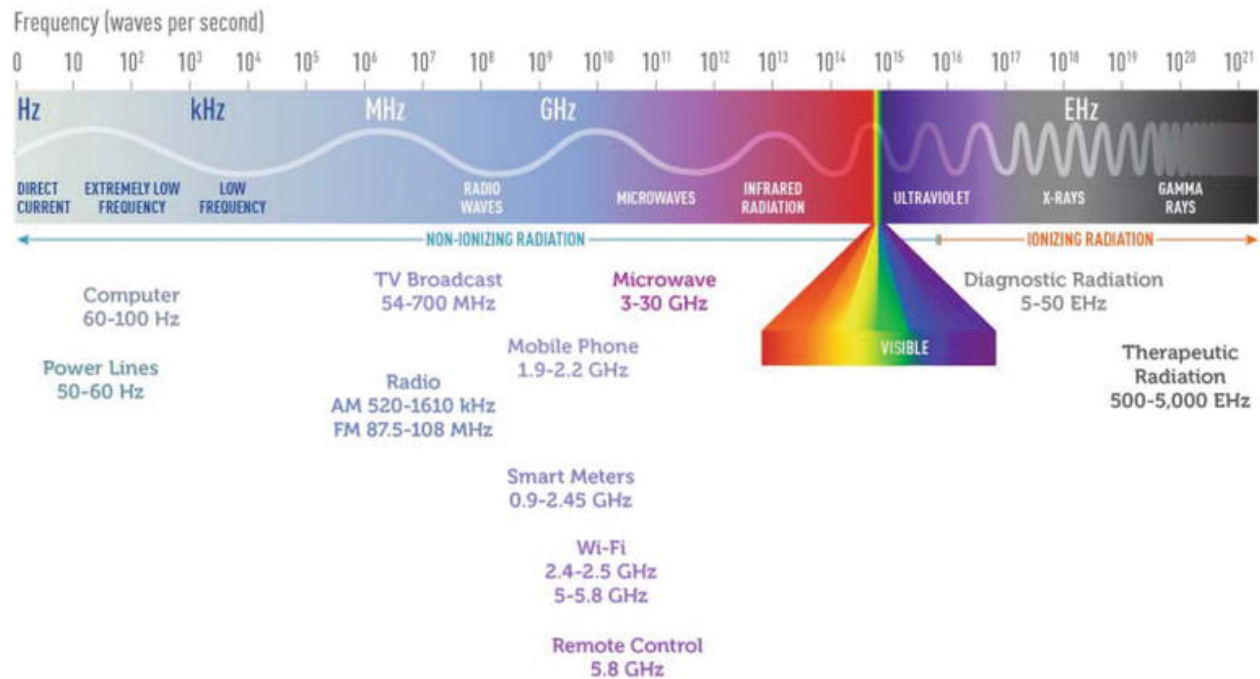


Figure 1.

National Cancer Institute – National Institute of Health; 2016.

Radio-frequency radiation (RFR) is emitted at varying frequencies by cellphone towers, cell phones, computers, Wi-Fi, microwave ovens, and other electronic devices. RFR frequency ranges between 10 KHz and 300 GHz. On average, Wi-Fi applications and microwave ovens utilize 2450 MHz. Cellphone technology uses transmission signals between 800 MHz and 3 GHz, while cellphone towers typically operate at 1900 MHz [1].

The adverse biological effects of EMR from cellphone towers have been reported in frugivores such as potential fruit-eating seed dispersers (birds), insect pollinators (bees), and humans. A decline in sparrow populations and other wild birds has been observed in the vicinity of cellphone towers in India. EMR from similar sources has also been correlated with decreased egg production in honey bees. In fact, in India, the problem is perceived as being sufficiently serious that a panel of scientists has recommended regular auditing of EMR levels and that EMR be recognized as a pollutant. They have also suggested implementation of a special law to protect urban flora and fauna from its effects [2, 3, 4].

The significant radioisotopes released as a result of the Chernobyl nuclear reactor explosion were iodine-131, cesium-137, strontium-90, and plutonium-241. Some of these radioisotopes such as cesium-137 are emitters of gamma radiation. Cesium is one of the radioactive fission products routinely produced by a nuclear reactor during its operation. However, following the Chernobyl event, forest food products in surrounding regions of Europe were found to contain the highest recorded levels of the radioisotope cesium-137. For example, high contamination of reindeer meat was reported in Scandinavia. Pollen data from forests in the Bavarian Alps also show that radiocesium uptake by mosses uniquely reference the Chernobyl incident [5].

Previously, a local reduction in pollinators like bumblebees in the vicinity of Chernobyl has been linked to the production of fewer fruit and stunted fruit trees in highly radioactive areas. Moreover, a direct link has been established between radiation, pollinators, fruit abundance, and an abundance of frugivores such as fruit-eating seed dispersers [6]. Therefore, due to the observed reduction in wild birds and honey bees, it is possible that EMR may negatively impact fruit production, which is an important food crop, in areas of high cell tower concentration. It has already been reported that EMR from cell towers can affect the overall growth of agricultural crops and plants by reducing yield [2]. Since growing certain fruits rich in micronutrients may be beneficial in helping to prevent cancer, such a decline in crop yield could represent a significant loss for the agricultural industry as the demand for these phytochemicals like the polyphenols found in grape skin and grape seeds grows (resveratrol and procyanidins) [7].

In addition to this indirect effect on human health, the potential for a direct effect of EMR on human health was investigated. The adverse health effects of EMR from cell base stations and other cellular infrastructure are certainly contentious. Epidemiological data are lacking in this area and, at times, it is contradictory. Exposure levels are often difficult to quantify due to background EMR including from cell phones, computers, Wi-Fi, microwave ovens, and other electronic household devices. However, there is some research that suggests a degree of caution should be exercised in the installation of such cell base stations. Moreover, substantial evidence relating to microwave radiation exposure exists.

Microwave sickness syndrome was first identified in the 1950s by Soviet medical researchers. Symptoms included headache, fatigue, ocular dysfunction, dizziness, and sleep disorders. Clinically, dermatographism, tumors, blood changes, reproductive and cardiovascular abnormalities, depression, irritability, and memory impairment were reported. Although the syndrome is reversible in its early stages, it is considered to be lethal over time [8].

Later American researchers found symptoms to include eczema, psoriasis, and allergic and inflammatory reactions in staff stationed at the US Embassy in Moscow, which the Soviet government irradiated secretly over a period of approximately 20 years. It is of interest that the power densities of the microwaves employed by the Soviets were comparable to modern cellphone base stations. They also observed neurological problems in males, reproductive problems in females, tumor increases (benign in men, malignant in women), hematological alterations, effects on mood and well-being, and eye problems.

The average exposure time for each individual was between 2 and 4 years [9].

Despite these observed effects and other existing data, no satisfactory explanation for tumor formation based on classical experimental carcinogenesis models has been available so far. Such traditional models rely heavily on DNA damage and the subsequent clonal expansion of mutated cells for their modality. In the past, it has been stated that no mechanism is known to cause cancer in the nonionizing radiation or radiofrequency radiation part of the electromagnetic spectrum since it does not damage DNA or cells directly like ionizing radiation [10]. Thus, it has been largely dismissed as a putative cause of cancer. However, recently, it has become apparent that the pathogenesis of cancer is closely connected with aberrantly regulated apoptotic cell death and the resulting deregulation of cell proliferation. A mechanism for gamma-radiation carcinogenesis based on an apoptotic model has already been proposed [11]. According to a new approach to cancer risk assessment, it was determined that EMR from cellphone towers may pose a cancer risk in humans since microwaves can stimulate p53-mediated caspase-3 activation and cell death in a human brain glioblastoma cell line [12] and Fas-induced and ERK-mediated apoptosis in human lymphocyte cell lines [13, 14].

2. Epidemiology

Aside from the Moscow study of the US Embassy staff, early epidemiological data were gathered from technically trained US naval officers routinely exposed to radar by Robinette et al. [15]. Radar transmission generates electromagnetic waves in the microwave domain. Interestingly, both these groups showed an elevated incidence of leukemia. In another large Polish study, military personnel exposed to radiofrequency microwave radiation from radio and radar showed very significant elevations in leukemia and other cancers [16]. The first epidemiological studies on populations living near cell base stations focused mainly on cognitive changes and neurobehavioral effects and started being conducted in 2002 [17]. However, an early Egyptian cellphone tower study in the Algharbia governate area (1999–2002) suggested an increase in the overall cancer rate of the local population by 7.5% [18]. Later, a German study found elevated cancer incidence in patients who had lived 5–10 years within 400 meters of a cell installation [19]. Another Israeli study indicated an association between increased cancer incidence and living in proximity to a cell base station [20].

There also appears to be a significant body of evidence suggesting that cell phones, which use EMR in the microwave range, can cause brain tumors and disturb brain function [21, 22]. One Swedish study reported that cellphone radiation increases the human brain tumor rate by 2.5 times [23]. In fact, in his extensive review on the subject, Cherry concludes that over 40 studies have revealed adverse biological or human health effects specifically from cellphone radiation and that there is extremely strong evidence that cell sites are risk factors for brain tumors and leukemia [24]. It should be noted that children may be more susceptible to damage from cellphone radiation since their bodies are still developing. There is epidemiological evidence to suggest that children are susceptible to leukemia from high power voltage (HPV) lines which emit low-frequency radio waves [25, 26]. Although no epidemiological data seem to have been collected in children regarding exposure to high-frequency radio waves, there are reports that cellphone radiation penetrates deeper into the head of children and that certain tissues of the head like the bone marrow and eye absorb more radiation than in adults [27, 28, 29]. Specific absorption rate (SAR) is the term used to describe the absorption of RFR in the body and represents the rate of energy absorbed by a unit of tissue.

3. Animal studies

In vivo animal studies have demonstrated that potentially genotoxic effects in male Wistar rats following microwave exposure include the induction of micronuclei, an increase in the production of reactive oxygen species (ROS) which can trigger cellular apoptosis, and increases in various antioxidant enzyme activities like serum glutathione peroxidase, superoxide dismutase, and catalase [2]. Rats exposed to microwaves display a significant reduction in splenic activity of natural killer cells, which may help to provide host defense against the development of tumors [30]. Other cellphone radiation research in animals has shown that it doubles the cancer rate in mice [31]. Also, EMR from cellphones can increase mouse tumor necrosis factor (TNF) production, which is associated with a major apoptotic pathway [32]. Cellphone radiation increases the embryonic mortality of chickens [33]. In vitro, one very elegant set of comparative studies correlating results in human lymphocytes with Chinese hamster cells (V79) has suggested that microwave radiation can induce structural damage in mammalian chromosomal DNA. A significantly higher frequency of specific chromosome aberrations, such as dicentric and ring chromosomes, was observed in irradiated V79 cells than in control samples. Micronuclei were also present in the irradiated V79 cells [34]. Animal studies have demonstrated the neoplastic transformation of a clonal mouse embryo cell line (C3H/10 T1/2) following exposure to modulated microwaves [35]. In other more recent studies, neural cell apoptosis in NGF-differentiated PC12 rat cells has been induced by microwave exposure via the mitochondria-dependent caspase-3 pathway [36]. It represents one of three cellular apoptotic pathways including the extrinsic death receptor-dependent pathway, the intrinsic mitochondria-dependent pathway, and the intrinsic endoplasmic reticulum(ER) stress-mediated pathway [37].

4. Cell studies

Microwave irradiation can produce genotoxic effects in human cells [38]. Induction of micronuclei in human lymphocytes with wide interindividual variability after exposure in vitro to 1800 MHz [39] has been observed and is correlated with specific chromosomal aberrations (acentric fragments and

dicentric chromosomes) [40]. Exposure of human peripheral blood lymphocytes to EMR associated with cell phones (830 MHz) leads to chromosomal instability, specifically aneuploidy, which is known to increase cancer risk [41]. Aneuploidy among other kinds of DNA damage can result in p53-mediated postmitotic apoptosis in human cells [42]. EMR from cell base stations has also been reported to increase the frequency of DNA strand breaks in the lymphocytes of cellphone users and in individuals residing near cell base stations [43, 44]. Cellphone radiation can increase c-fos proto-oncogene activity by more than 40% in embryonic mouse cells and alter c-jun proto-oncogene activity in rat cells [45, 46]. However, there is some conflicting data on this subject, and reports can be inconsistent, while data in humans appear to be lacking. Additionally, there is no evidence to suggest that microwaves can cause point mutations, which are associated with oncogene activation in humans and other mammals [47]. Nevertheless, the c-fos protein can induce cellular apoptosis, and the c-jun gene product has been found to be necessary for neuronal apoptosis in human and other mammalian cells [48, 49]. Microwaves can affect chromatin conformation and histone phosphorylation in human lymphocytes, as well, which may be associated with epigenetic mechanisms at the cellular level [50]. A significant increase in the efflux of calcium ions has been observed in human neuroblastoma cells at extremely low levels of microwave radiation indicating a high degree of sensitivity [51]. This cellular calcium imbalance may reflect the release of calcium ions from internal organelles like mitochondria and the endoplasmic reticulum [ER] as occurs in response to certain heavy metals, and this process is linked to an apoptotic pathway [11]. Microwaves have been reported to induce ERK-mediated apoptosis and cell cycle arrest in a dose-dependent manner in a human natural killer cell line (NK-92) just 1 hour after exposure, which could lead to general immune suppression and the development of tumors [13]. Activation of the Ras/Raf/ERK pathway has been associated with both the intrinsic mitochondrial and the extrinsic death receptor apoptotic pathways [52]. Continuous microwave irradiation (2.45 GHz) can cause Fas-induced apoptosis via the extrinsic death receptor pathway in a human Jurkat T-cell line [14]. Fas is a member of the tumor necrosis factor receptor (TNFR)/nerve growth receptor (NGR) family. In another recent study, microwave radiation exposure from a GSM cellphone simulator (900 MHz) also resulted in a significant increase in the apoptotic rate of a human T-cell line (Jurkat cells) [53]. In addition, the formation of ROS in normal human peripheral blood mononuclear cells can stimulate apoptosis in response to 900 MHz cellphone radiation. In this case, apoptosis is induced via the mitochondrial pathway and is mediated by ROS [54]. Finally, apoptosis can be stimulated in human brain glioblastoma cells directly in response to microwaves. EMR exposure in the cell base station frequency range [1800 MHz] induces apoptosis-related events such as ROS bursts and oxidative DNA damage, which in turn promote p53-dependent caspase-3 activation through release of cytochrome c from mitochondria [12].

5. A possible mechanism of carcinogenesis

Cellphone radiation can alter c-fos and c-jun proto-oncogene activity, and both these gene products have been implicated in the activation of cell death signal transduction pathways [48, 49].

DNA damage including micronucleus formation, chromosomal aberrations, and DNA strand breaks has been reported in human cells in response to microwave radiation. Certain kinds of DNA damage like aneuploidy can result in cell cycle arrest and activation of apoptosis. Double-strand breaks in DNA caused by radiation can also signal apoptosis.

The generation of reactive oxygen species in response to microwave radiation has been observed in various studies. Certain carcinogens like UV rays exert some of their carcinogenic effects via the generation of reactive oxygen species in the cell [55]. This is true of X-rays, as well [56]. Certain oncogenic proteins such as Ras also produce elevations in ROS upon stimulation. Many genes and proteins that respond to conditions of oxidative stress within the cell subsequently trigger apoptosis. Because mitochondria are important regulators of cellular redox status, the induction of oxidative stress exhibits its effects upon these organelles to trigger the intrinsic apoptotic pathway via cytochrome c release and caspase cascade activation [57, 58]. Moreover, an increase in the efflux of calcium ions has been observed in human neuroblastoma cells at extremely low levels of microwave radiation, and this cellular calcium imbalance may reflect the release of calcium ions from internal organelles. In this regard, lead perturbs and alters the release of intracellular calcium stores from organelles like the endoplasmic reticulum (ER) and mitochondria [59, 60]. Mitochondria can accumulate large amounts of calcium, for example, in the presence of inorganic phosphate. The rise in calcium results in an upregulation of energy metabolism and an increase in mitochondrial membrane potential. Then, the release of this accumulated calcium through a special channel, permeability transition pore (PTP), can cause mitochondrial depolarization. According to the model of glutamate toxicity, mitochondrial calcium accumulation and resultant membrane depolarization are clearly linked to the initiation of a cell death pathway in mitochondria [61, 62].

Microwaves can also affect chromatin conformation and histone phosphorylation in human lymphocytes. Interestingly, in addition to causing genetic damage via oxidative and non-oxidative mechanisms (DNA adducts), certain carcinogenic heavy metals can cause significant epigenetic changes in cells such as DNA methylation and histone modifications. These can result in gene silencing or reactivation of gene expression [63]. MicroRNAs (miRNAs) are highly conserved, noncoding small RNAs regulating the expression of broad gene networks at the posttranscriptional level and may represent another epigenetic control mechanism. In many cases, the specific effects of such epigenetic changes still appear to be unknown and could conceivably impact major cellular functions like cell death and/or proliferation [64].

Apoptosis is involved in maintaining cell number in tissues, and, although increased cell proliferation is necessary, it is not sufficient for cell transformation to take place. Normally, in multicellular organisms, a dynamic balance exists between cell birth and cell death to retain constant cell numbers throughout adult life. This homeostasis depends on an integrated balance between apoptosis (cell death) and mitosis (cell division) such that these two activities are counterbalanced and equivalent. In fact, this homeostatic balance may contribute a critical defense mechanism of the cell to various genotoxic agents such as carcinogens [65].

A permanent loss in homeostatic equilibrium between cell division and cell death may be a critical determinant in the transition to tumorigenesis. The increased proliferation in preneoplastic lesions is often accompanied by a parallel increase in cell death, at least in the initial stages of transformation to cancer. Quantitative histological studies in the rat liver model have revealed that the rate of apoptosis tends to increase from normal to preneoplastic to malignant cells [66]. Comparative studies with the rat bladder have also suggested that apoptosis is closely linked to chemically induced carcinogenesis [67]. Additional support for this transition comes from a variety of other models [7]. However, ultimately, tumor formation only seems to occur once the cancer cells have become resistant to apoptosis while continuing to proliferate. In fact, acquired resistance to apoptosis appears to be a pivotal event in cell immortalization and the transition to malignancy [65].

In summary, various laboratory studies on animals and certain human data [68] are suggestive that tumor formation requires at least two discrete events to take place in response to a carcinogen. The first involves an elevation of apoptosis in a particular tissue due to a genetic predisposition, stress, or mutation. The second confers resistance to apoptosis in that same tissue resulting in the formation of an abnormal growth due to a dysregulation of cell number homeostasis. Moreover, there is some evidence to suggest that both these events can be reversible when treated with a selective apoptotic agent and, hence, they may be either genetic or epigenetic in nature.

Thus, according to this new model, apoptosis becomes an important focus of study and key determinant of carcinogenic potential for any particular chemical or other complete carcinogen being studied, especially in normal, non-transformed cells derived from the target tissue [11].

In the microwave radiation exposure model, there are a number of cellular processes and responses that appear to lead to the endpoint of an increased rate of apoptosis in both animals and humans. These parameters include DNA damage, alterations in gene expression, metabolic perturbations in intracellular calcium levels, effects on the immune system involving decreases in natural killer cells and T lymphocytes, and bursts in ROS activity. All these biochemical effects represent early events that can trigger or are linked to apoptosis and, therefore, could be involved in initiating an apoptotic model of carcinogenesis as described above.

6. Discussion

Briefly, epidemiological data on the human effects of microwave radiation suggest a predominance of brain tumors and leukemia. In vivo and in vitro animal studies point to genotoxic effects that can trigger apoptosis and detrimental effects on the immune system. Human cell studies corroborate the genotoxic effects of microwave radiation and its ability to cause various kinds of DNA damage resulting in cell death. Possible immune effects are also recorded. These results are in keeping with a two-stage apoptotic model of carcinogenesis [11].

The induction of apoptosis by microwaves in human and rat neural cells and in human lymphocytes correlates well with the increased incidence of brain tumors and leukemia epidemiologically associated with the high-frequency radio waves emitted by cellphone towers. However, further studies need to be conducted on the apoptotic potential of microwaves in non-transformed neural and human lymphocytes at 1800–1900 MHz in order to test this parameter definitively since significant biochemical differences can exist between transformed and non-transformed cells. Blood cells of children should also specifically be tested since they are susceptible to leukemia from high power voltage (HPV) lines, which emit low-frequency radio waves. The developing tissues of children have already been found to be more susceptible to the penetration of cellphone radiation. According to a new approach to cancer risk assessment, if apoptosis is induced in these normal tissues from adults and children, along with the epidemiological data, this would be sufficient criteria to establish cellphone tower EMR as a complete carcinogen providing that microwave exposure is at a high enough specific absorption rate (SAR).

As an example, sufficiently high SAR levels for microwave radiation are likely to be achieved only very close to or directly in front of cellular antennas mounted on a roof, whereas a distance of up to 400 meters from cellphone towers, which emit more EMR, has been found to be associated with an increased cancer incidence. In any case, access to such rooftop areas with cellular antennas should be restricted or limited [69]. Actually, defraying the total EMR load in this way may be one potential method of decreasing total human exposure in urban neighborhoods. Dividing up the EMR load between several buildings in an urban area could help to minimize overall individual microwave exposure, while having one large cellphone tower in the same area would tend to maximize the microwave exposure of a few.

According to various animal studies, there appears to be a significant effect of microwaves in the cellphone tower frequency range on mammals, avian species, and insect pollinators such as honey bees. There also appears to be a negative impact on plant life in the vicinity of cellphone towers. Decreases in fruit and other crop yields could translate into economic losses. As a result, some countries like India have already taken positive action against the potential threat of cellphone tower EMR to wildlife by proposing to have EMR levels audited and recognized as a pollutant and passing a special law to safeguard the surrounding environment. Other countries should also follow suit in setting safe environmental limits on EMR emission levels from cellphone towers in order to preserve the urban flora and fauna. Such safety standards should always be based on the latest research and must be subject to constant revision as new data become available.

<https://mdsafetech.org/environmental-and-wildlife-effects/>

Environment and Wildlife Effects



Update 5/1/20

Note: This Scientific Literature Page is organized into a group of brief topic summaries followed by detailed lists of scientific references.

Scientific Literature sections are below the summary and ordered as follows:

- *Headlines
- *Reviews on Wildlife
- *Newest Articles All Species
- *Review Articles Wildlife
- *Books
- *Amphibians
- *Bacteria and Fungi
- *Bats
- *Bees and Insects
- *Birds
- *Cell Towers
- *Fish and Marine animals
- *Government Letters and Papers
- *Immune System Effects
- *LED Light Effects on Animals and Insects

*Magneto-reception
*Mammals
*Non-Thermal Effects
*Plants and Seeds
*Reptiles
*Trees

See Also

[Wireless Silent Spring- SCCMA Oct 2, 2018](#)

[A 5G Wireless Future: Will it Give us a Smart Nation or contribute to an Unhealthy One?](#)

Headlines

The Oysters That Knew What Time It Was: Scientists were convinced that biological clocks are predominantly driven by internal rhythms. There was just one problem—involving some mollusks and the moon. Wired. 9/1/2020. <https://www.wired.com/story/oysters-that-knew-what-time-it-was/>

The influence of electromagnetic radiation of cell phones on the behavior of animals. (2020) Vet World. 2020 Mar; 13(3): 549–555. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7183456/>

The Surprising Way Solar Storms [radiofrequency] Can Beach Whales. Feb 28, 2020. Dr. Tony Phillips. Space Weather Archive. <https://spaceweatherarchive.com/2020/02/28/the-surprising-way-solar-storms-beach-whales/>

Effect of Mobile Tower Radiation on Microbial Diversity in Soil and Antibiotic Resistance. (2018) Sharma AB et al. IEEE Explore. 2018 international Conference on Power and Energy, Environment and Intelligent Control. April 13-14, 2018. <https://ieeexplore.ieee.org/document/8665432>

Street lamps are hurting pollination by distracting insects: And pollination during the day can't compensate. (2017) The Verge. Angela Chen. August 2, 2017 . <https://www.theverge.com/2017/8/2/16082726/artificial-light-pollution-pollination-ecology-nocturnal>

Overview Summary

Animal Life and the Earth's Magnetic Field

A diverse array of animal life relies upon the earth's magnetic field for navigation, breeding, feeding, migration and survival. Biologists have [discovered](#) that wireless electromagnetic radiation disturbs internal magneto-receptors used for navigation, as well as disrupting other complex cellular and biologic processes in mammals, birds, fish, insects, trees, plants, seeds and bacteria with profound impacts on the natural environment. Different species have different interactions with radiofrequency radiation (RFR) and differ in their toxic effect. These effects may not be immediately apparent with a slow decline in the health of wildlife seen over time with cumulative exposure.

Increased Radiofrequency Radiation and The Decline of Birds, Bees and Wildlife

Biologists have noted that wildlife are susceptible to harm from manmade ambient electromagnetic fields. Researchers are now attributing RFR from cellular telecommunications to be a contributing cause of bee “colony collapse disorder”, insect disappearance, the decline in house sparrows in London, as well as the steady deterioration of the world's bird population with now than 40% of bird species under critical threat. Scientists note a serious lack of radiation monitoring and protocols to study the impacts and call for precaution in the placement

of cell towers and further expansion of wireless broadband. In the United States, Section 704 of the Telecommunications Act of 1996 does not allow consideration of environmental effects in the placement of cell towers. [Telecommunications Act of 1996](#)

The European Commissions Scientific Committee on Health and Environmental Emerging Risks (SCHEER)

In 2018 SCHEER issued their [emerging risks report](#) . They listed 5G electromagnetic radiation as an emerging risk due to it's effects on wildlife. They pointed to a recent [article](#) "5G wireless telecommunications expansion: Public health and environmental implications. (2018) by Russell CL in Environmental Research.

Other important research includes Dr. Martin Pall's articles [5G: Great Risk for EU](#) and [Wi-Fi is an important threat to human health](#).

Wildlife Are More Vulnerable to Wireless Radiation

Adverse responses from radiofrequency radiation that have been identified include abnormal behavior, developmental abnormalities, diminished reproduction and increased mortality. Birds, bees, turtles, dolphins, salamanders, salmon, amphibians and other animals use the earth's weak magnetic field and their own internal magneto-receptors to navigate. Birds have feathers that can act as antenna and amplify the negative effects of RF radiation [Bigu-del-Blanco](#) (1975). Insects, the base of the food chain, appear particularly susceptible to radiofrequency radiation, especially 5G millimeter wavelengths which are the size of the insect and create a damaging resonance effect.

Mammals, like humans, have similar reproductive organs, immune systems and nervous systems, thus are susceptible to molecular and cellular harm from artificial wireless radiofrequency wavelengths. Katie Singer, in her extensively referenced book *Electronic Silent Spring*, highlights that the earth's living systems evolved their own internal and external signaling systems in the presence of the earth's low electromagnetic environment and thus are vulnerable to the much higher levels of artificial pulsed electromagnetic radiation experienced today.

Cell Towers Emit Wireless Radiation Over Dozens of Miles of Terrain

Stationary cell and radio towers create a circle of high power wireless radiation (1500 feet) around them, with a much larger radius (dozens of miles) of lower power radiation, which scientists have found can contribute to environmental disturbances. In cities the density is much higher with more towers and co-location of multiple antennas on a single tower to accommodate multiple telecommunication carriers. Firstenberg (2017) in his fascinating and well-researched book, *The Invisible Rainbow: A History of Electricity and Life*, describes both observations and biological experiments performed, mostly in Europe, where radio broadcast towers caused not only human symptoms but also affected widespread forest health with loss of birds, thinner growth rings on trees, poor seed germination and loss of [duckweed](#), among other effects. When these towers were removed, not only did local residents symptoms disappear, the forest recovered. [The Skrunda Radio Location Case](#).

Trees are Harmed by Radiofrequency Radiation

In Colorado, Aspen trees have been on the decline and experiments have pointed to radiation from cell towers causing poor growth and smaller leaves- [Haggerty 2010](#) A 4-year experiment by [Waldmann-Selsam](#) et al (2016) clearly demonstrated, with accurate RF emission testing, cell tower radiation causing the death of nearby trees over time. He notes, "These results are consistent with the fact that damage afflicted on trees by mobile phone towers usually start on one side, extending to the whole tree over time." These are truly alarming findings and serve as a dire warning on further wireless expansion, especially with regards to agricultural rural zones or wildlife areas with sensitive species. Research also raises the question of wildfires sparked by dead or dying trees near cell towers.

Plants, Bacteria and Fungi Affected by Microwave Radiation

Numerous studies on plants, bacteria and fungi have shown adverse or enhanced growth patterns with exposure to varying levels of microwave radiation. We do not consider the influence of RF on infections in animals, humans or plants, and how this alters patterns of human and plant infectious diseases. Among the research, a recent project of the California Science and Engineering Science Fair by [Joshi and Omer](#) compared the effects of UVR versus radio frequency radiation (RFR) on lima beans, basil seeds and yeast. They found that RFR reduced growth of lima beans, increased the growth of yeast and had no effect on Basil. On the other hand UV light increased the growth of lima beans and basil but did not affect yeast.

Halgamuge (2017) [reviewed](#) the available science on non-thermal, weak, radiofrequency electromagnetic fields (RF-EMF) and their influence on living plants. After examining 45 peer reviewed publications with 169 experiments on 29 species of plants he found significant physiological and/or morphological effects. He concluded that “maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs.” In addition he noted, “plants seem to be more responsive to certain frequencies, especially the frequencies between (i) 800 and 1500 MHz ($p < 0.0001$), (ii) 1500 and 2400 MHz ($p < 0.0001$) and (iii) 3500 and 8000 MHz ($p = 0.0161$).”

Bird Migration Disrupted More by Weak Magnetic Fields

Biologists have noted that birds magnetic compass orientation appears more susceptible to weak broadband electromagnetic fields. [Schwarze](#) et al (2016), note in their paper that weak magnetic fields can have much more powerful influence on bird migration than strong fields. They state, “Our results indicated that the magnetic compass orientation of European robins could not be disrupted by any of the relatively strong narrow-band electromagnetic fields employed here, but that the weak broadband field very efficiently disrupted their orientation” [Pakhomov \(2017\)](#) and [Wiltshko \(2015\)](#) both confirmed this effect.

Homing Pigeons Magneto-Receptors Disoriented by Wireless Communications

It is well established that magnetite, a form of iron ore, is found in a wide variety of organisms who use this magneto-receptor to sense the earth's low energy magnetic field as a directional reference. (Cadiou and McNaughton). Magnetite acts as an internal compass of sorts. Migrating birds, fish, insects and animals connect these magneto-receptors with the earth's natural geomagnetic forces, to successfully guide them in long and short distance journeys, necessary for feeding and breeding. Modern communications systems with a proliferation of cell towers and smart meters in cities and rural areas, create a fluctuating blanket of continuous pulsating artificial radiofrequency wave mixtures that can alter local magnetic fields and thus impair migration and orientation of birds in addition to effects on pollinators. In 1998, soon after cell towers were installed in Pennsylvania, pigeon races ended in disaster as up to 90% of birds were disoriented and lost their navigational skills. [When Homing Pigeons Don't Go Home Again](#) NY Times. Dec 6, 1998.

Bird Navigation Disabled in Cities

Independently replicated studies have confirmed the radio frequency (RFR) effects on orientation of birds.

[Engles](#) et al (2014) exposed migratory European robins to background electromagnetic noise present in un-screened wooden huts at the University of Oldenburg city campus in Germany and found they could not orient using their magnetic compass. If grounded their orientation reappeared but disappeared again if broadband radiofrequencies were generated inside the huts. He did not believe the effects at first and performed the same double-blinded study many times in 7 years and with different graduate students to confirm the effect before publishing his findings.

Dr. Engles concluded, “The disruptive effect of radiofrequency electromagnetic fields is not confined to a narrow frequency band and birds tested far from sources of electromagnetic noise required no screening to orient with their magnetic compass.” Research has also demonstrated abnormalities in reproduction and behavior of birds nesting near cell towers in addition to harm to amphibians. This raises the question of the health and sustainability of cities with a dense assortment of telecommunications towers.

Bee Colony Collapse Disorder

Bees are a critical pollinator species. Of the 100 crops that provide 90% of the world's food supply, 71 are pollinated by bees, according to the [UN Environmental Program](#). Researchers agree that we are in the midst of a pollinator crisis. The White House in 2014 was so concerned it established a [Federal Strategy](#) with a Pollinator Task Force to promote bee health. As bee numbers have plummeted around the world, scientists have been investigating causes. They have found several contributing factors affecting the health and reproduction of bees, including pesticides, global climate change, loss of habitat and air pollution with new research pointing towards microwave radiation as an important and yet unrecognized cause for concern. Bees contain magnetite granules in their abdomen which offer them the ability to navigate with the earth's natural low power non-pulsating magnetic field.

Bee Behavior Disruption by Cell Phone Radiation

Bees operate in about a 5 kilometer radius and typically find their way without difficulty. [Sharma et al \(2010\)](#) looked at bee behavior placing a cell phone near a hive. They found worker bees returned less and less frequently to the beehive after the installation of a mobile phone. There was a significant decline in colony strength and the rate of queen egg laying.

[Kumar et al \(2011\)](#) looked at physiologic changes in bees exposed to cell phone radiation and found it creates a stress response, increased agitation and increase in carbohydrate metabolism.

[Favre et al \(2017\)](#) clearly demonstrated that bee behavior is disrupted by exposure to cell phone GSM radiofrequency radiation and caused worker bees to emit a piping signal to swarm. Bees have also demonstrated aggression after 30 minutes of cell phone exposure. Dr. Favre notes, "Mobile phone companies and policy makers point to studies with contradictory results." However, his study distinctly demonstrated adverse effects. He invites others to reproduce his research.

Colony Collapse Disorder started After the Use of Pesticides

[Cammaerts \(2017\)](#), biologist and author of 54 peer reviewed publications on insects, observes that the sharp decline of bees did not start with the use of insecticides but much later and removal of pesticides has not been accompanied by the expected rise in bee populations. While she does not discount a role for insecticides causing bee decline, she advises beekeepers to consider that radiofrequency radiation could also have an impact and protect their hives by locating these in a low EMF environment or placing them in a Faraday cage or enclosure.

LED Lights Can Affect Nighttime Pollinators

We usually think of pollination occurring during the day, however, research published in [Nature in 2017](#) revealed that nocturnal pollinators are critical as well. They found a significant reduction in reproduction and fruit production in fields lit during the night with LED lights. The daytime pollinators could not compensate for this loss of evening pollination. LEDs are used extensively now in computers, smart phones and for both indoor and outdoor lighting. There are human health consequences now being demonstrated. LED lights on streetlamps can cause disruption of circadian rhythms in humans. The AMA adopted an [official policy in 2016 recommending removing LEDs](#) from streetlamp. Animals are also [affected](#).

Insects: The Base of Our Food Chain Are In Decline

Bees are not the only insects necessary for sustainability and all are suffering decline. Purdue University among others points out that insects are critical in living ecosystems. They are wild and domestic pollinators, provide a source of food for amphibians, reptiles, birds and mammals, are primary decomposers for fungi, dead plants and animals and also eat other pest insects thus playing a beneficial role in the balance of nature. A Yale report in 2016 highlighted a dramatic drop in insect populations in many parts of the world. Insect traps set up in Germany are showing a startling 4 to 5 fold reduction. Biologists attribute this to monoculture farm-

ing, pesticides and habitat loss, however the scientific literature points to radiofrequency radiation as another significant contributing cause. [Yale report on insect decline](#).

Biodiversity and Abundance of Wild Pollinators

[Lazaro](#) (2016) emphasizes pollination as a key ecosystem service that needs protection. His group measured insect biodiversity on wild pollinator communities including wild bees, hoverflies, bee flies, beetles, butterflies, and wasps on 2 Greek islands at variable distances from telecommunication antennas. He found that all pollinator groups, except butterflies, were affected with a decrease in abundance and composition of insects closer to antennas. He did note an opposite effect on however, that underground-nesting wild bees and bee flies unexpectedly increased with EMR. He stated that this effect on wild insects could have “additional ecological and economic impacts on the maintenance of wild plant diversity, crop production and human welfare.”

Ants Can Be Used as a Bio-indicator for Radiofrequency

Belgian entomologist Marie-Claire [Cammaerts](#) (2017) has done a number of studies on cell phone radiation and found that insects, particularly ants, are extremely sensitive to radiofrequency radiation (RFR). In fact, some methods of insect control use RFR. She performed dozens of experiments on countless numbers of ants with the following observations

Ants lost their olfactory and visual memory after GSM cell phone exposure and with a second exposure causing cumulative damage. ([Cammaerts 2012](#))

3 Minutes of exposure of ants to cell phone radiation caused “locomotion ataxia”, decreased linear speed, and increased angular speed. The ants needed two to four hours for recovery. When the phone was in standby mode under the ants nest, the ants relocated their nests far away from the cell phone with their eggs, larvae and nymphs. They returned after removal of the cell phone. [Cammaerts \(2013\)](#)

Ants under the influence could not follow a pheromone trail or forage for food effectively, return to their nest and after 180 hours there was deterioration of the colony. [Cammaerts \(2013\)](#) notes RFR “effects social insects’ behavior and physiology.”

5G Deployment More Harmful for Insects: The Resonance Effect

The increase the number and density of cell towers in cities and rural areas coincides with insect and bird decline. Older generation technology emits RF frequencies between 100 MHz and 6 GHz with wavelengths in inches to feet. A new 5th generation (5G) of wireless communications is being proposed, adding to the mix millimeter waves (fractions of an inch long) between 6 GHz to over 100 GHz. These high frequency wavelengths pulse at billions of cycles per second (1GHz=1 billion cycles per second). Radiofrequency wavelengths, especially those that are modulated (or pulsed) are known to cause much more disruption to organisms, or structures within the organism, if the frequency wavelength is the same size as the organism, organ structure, cell or cell structure. This phenomenon is called resonance. It leads to heightened vibration and thus injury. Insects are smaller in size and close to the width of 5G frequencies. [Thielens \(2018\)](#) studied this effect on 4 different insects exposed to electromagnetic fields from 2 to 120 GHz. He found “The insects show a maximum in absorbed radio frequency power at wavelengths that are comparable to their body size.....This could lead to changes in insect behaviour, physiology, and morphology over time due to an increase in body temperatures, from dielectric heating.” Insects are thus especially susceptible to 5G microwave frequencies. There has been no premarket testing of this 5G technology however a body of research demonstrates harm to insects. Policies to expand deployment of this technology unfortunately do not consider these biological or environmental effects.

Insect Armageddon

5G Licensed to Kill: The Insect Inspector Discusses the Insect Apocalypse

<https://youtu.be/zwo2E9b9CiU>

As scientists are working to explain the [insect apocalypse](#), this video highlights one common environmental toxin that is known to kill insects, that is 5G as well as 3G and 4G radiation. He points out that “the 30-year radiation from millions of cellular phone masts is the single factor present in every region of insect decline.” Science backs this observation up. Wireless radiation may not be the only factor in this “insect Armageddon” but it may be the critical one. Pesticides can be avoided and habitat can be restored, however, once cell phone masts are placed they are rarely removed and the continuous waves of radiation just intensify to cover broader areas of land with more and more towers. The disappearance of birds and bees points to wireless technology as the yet unrecognized factor hastening this decline. 5G will be like 3G and 4G on steroids as these smaller millimeter wavelengths are the size of insects and the [resonance effect](#) of these continuous waves will set up additive vibrations that destroy the insect and essentially cook it. Microwave radiation is known to kill insects and is already being used for [insect control](#) in stored grains and other foods. Studies in food and agriculture literature confirm this effect. ([Yadav 2014](#)) ([Das 2013](#)) ([Geveke 2009](#)) ([Ponomaryova 2009](#)) ([Zhejiang 2004](#)) ([Geveke 2003](#)) ([Mishenko 2000](#))

Mammals: Reproductive Effects

Magras and Xenos ([1997](#)) performed an in-vivo study looking at prolonged exposure to low intensity radio frequency radiation and reproduction. They used 12 pairs of mice, placing them in various areas in an antenna park in a small mountaintop village in Greece near TV and FM broadcast transmitters. The animals lived in this area for 6 months with levels below CENELEC and IEEE standards. 6 pairs of animals were used as a control and placed in an environment free from RF radiation, about 10 KM from the town of Chortiatis, where the antennas were located. He notes, “Mice from the BALB/c/f breeding colony obtained from the “Theageneion Anticancer Institute of Thessaloniki” have been used for years in our laboratory for reproduction. Repeated pregnancies with a recovery period of 1 – 4 weeks for over a year, had never affected the fertility of the dams or any morphological parameters of the offspring, a fact that to our knowledge has not been questioned in the available literature.” Their study showed a progressive reduction in litter size in the exposed female animals to the point of irreversible sterility by the 5th generation. The males exhibited rough hair and emaciation at the end of the study.

Panagopoulos ([2007](#)) exposed flies to 2 different digital cell phone frequencies for a few minutes a day for the first 6 days of life and found widespread cell death. He states, “Induced cell death is recorded for the first time, in all types of cells constituting an egg chamber (follicle cells, nurse cells and the oocyte) and in all stages of the early and mid-oogenesis....The exposure conditions were similar to those to which a mobile phone user is exposed...”

The NIEHS National Toxicology Program on Cell Phones and Cancer released their results in 2018 looking at non-thermal effects of cell phone non-ionizing radiation. They showed consistent perinatal effects, including lower pup body weights and lower pup survival. The NTP study, at https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/tr595peerdraft.pdf, also noted clear evidence of heart tumors, a statistically significant increase in brain tumors and adrenal gland tumors, as well as DNA damage and cardiomyopathy similar to aging. An abundance of in vitro studies in animals shows that non-ionizing radiation can damage reproduction by creating a stress response in cells producing damaging reactive oxygen species. See also [Physicians for Safe Technology Reproductive Health Effects Scientific Literature](#).

Mammals: Swiss Calves Born with Cataracts

Several studies indicate that low power non-ionizing microwave radiation contributes to and can cause cataracts. Heat is a well-established mechanism for induction of cataracts as the lens does not have vessels that can dissipate heat. Non-thermal effects however have also been demonstrated in some research, which show adverse effects on lens transparency, alteration of epithelial cell proliferation and apoptosis, and a stress response in lens epithelial cells. Damage to lens epithelial cells is associated with cataracts. Hassig et al (2009) investigated in Swiss calves the prevalence of nuclear cataract near mobile phone base stations. They found (32 %) of the calves had various degrees of nuclear cataract. The number of antennas within 100 to 199 meters was associated with oxidative stress and there was an association between oxidative stress and the distance to the nearest mobile phone base station. In a later [study](#), Hassig et al (2012) looked at the incidence of cataracts

in newborn calves before and after a mobile phone cell tower was placed and found a 3.5 times higher rate of significant cataract after the mobile phone station was installed.

Tagging Wildlife Reduces Reproduction and Survival

Tagging animals for tracking is an important tool to help researchers understand their behavior, habitat selection and migration patterns. Some studies have indicated no harm from these tracking devices, however, other studies show lowered survival rates and reproductive rates. There may be a direct interference in the behavior of the animal due to discomfort as well as direct harm from the continuous pulsing radiofrequency which is located on the body, as a growing body of science demonstrates. Balmori (2016) warns, “It is paradoxical that, at the same time, field scientists investigating the movements and other aspects of animal biology are providing animals with radio transmitters that emit the same type of radiation, since this may affect the results concerning their orientation and movement.” There is also concern with regards to successful reproduction and animal behavior with close proximity to RF radiation.

Government Agencies Highlight Cell Tower Risks to Wildlife

The US Fish and Wildlife Service and the Department of Interior (DOI) has had concerns for many years about the adverse impacts of cell towers and electromagnetic radiation on migratory birds and other wildlife. It is conservatively estimated that 4 to 5 million birds die each year in cell tower and guy-wire collisions. (Government- [Manville](#) 2005, 2009). The DOI noted that there were 241 species of birds whose populations merit special protection. Balmori has documented wildlife effects after cell towers were constructed including nest and site abandonment, plumage deterioration, locomotion problems, and death in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. **Scroll down to Government Letters and Papers Cell Towers to see tother Department of Interior letters regarding cell towers and wildlife.**

Robotic Bees: “Smart” or Dumb Pollination?

Are we creating dead zones in cities where urban or rural farmers will not be able to grow food or have a vegetable garden? The tech industry may advise us to use the very technology that is harming ecosystems by using bee [drones](#) to pollinate our crops. Walmart has already filed a [patent](#) for a pollinating robotic bee. What about ownership of drones, privacy, security and adverse effects on sensitive native bees and flowers with the use of these drones? Many questions, no answers but predictable untoward results.

Prevention Smarter Than Cure

Will the situation worsen? Solving the real problems causing the decline of species seems smarter than always trying to develop a new and potentially more toxic industry to fix it. Patients are often given prescriptions to treat the numerous chronic diseases of our modern culture. These medications can cause side effects that may be far worse than the disease. Physicians now understand it is often more sensible and effective to help patients change their diet, add exercise and avoid toxic exposures to promote health and prevent disease. Wireless radiation is another toxic exposure with measurable biological effects. Should we not approach wireless technology with the same preventative precautions as we do pesticides, industrial chemicals and ionizing radiation?

What are Safe Levels of RF Radiation?

Sage, Carpenter, Blank and other scientists note in the Bioinitiative Report that non-thermal bioeffects are clearly established. There is an urgent need for government agencies to adopt a realistic biologically based exposure standard to replace the thermal (SAR) standard, which is far too permissive and not protective of human or environmental health.

The Bioinitiative Report reviewed studies looking at the lowest levels of non-thermal, non-ionizing radiofrequency that did not cause harmful biological effects. Their conclusions, based on peer reviewed research, indicated that there should be a “ scientific benchmark of 0.003 uW/cm² or three nanowatts per centimeter squared for ‘lowest observed effect level’ for RFR is based on mobile phone base station-level studies.” They also suggest “Applying a ten-fold reduction to compensate for the lack of long-term exposure (to provide a safety buffer for chronic exposure, if needed) or for children as a sensitive subpopulation...”. This translates into a [recommended](#) precautionary action exposure level of 0.0003 uW/cm². Our current U.S. [guide-](#)

[lines](#) are regulated by the Federal Communications Commission (FCC) and they follow that of the American National Standards Institute ([ANSI](#)), the Institute of Electrical and Electronics Engineers, Inc. ([IEEE](#)), and the National Council on Radiation Protection and Measurements ([NCRP](#)). Their **guidelines are from 200 uW/cm² to 1000 uW/cm²** (2 W/m² to 10 W/m²) for RF radiation depending on frequency.

Blake Levitt, an award-winning medical and science journalist and former *New York Times* contributor is author of **Cell Towers-Wireless Convenience? or Environmental Hazard? (2011)**, from “Cell Towers Forum: State of the Science/State of the law” environmental conference December 2, 2000. Her book was updated in 2011 and has valuable information on FCC safety guidelines, legal aspects of the Telecommunications Act, cell tower sitings and case law. An [article](#) she and esteemed researcher Henry Lai have written provides a meticulous review on environmental effects of cell towers as well as basic information on terminology and exposure limits.

Human Survival Linked to Biodiversity and Healthy Ecosystems

Human survival depends on biodiversity with complex interrelated ecosystems from bacteria to bees to birds to trees to earthworms for a healthy functioning environment. Maintaining clean air, clean water and sustainable soils with naturally evolved organisms is vital. The environment is our “[Natural Capital](#)”. It appears now under threat from the proliferation of radiofrequency towers along with habitat loss and exposure to other environmental toxins such as pesticides and industrial chemicals. It is critical to consider the adverse effects of the proposed expansion of wireless telecommunications towers and lower atmospheric balloons in cities and rural areas before they are deployed. Like sonic threats [sonic threats](#) for marine mammals the hazards are not seen, heard or felt by humans with harm to animals slow to be realized.

Safer Alternatives

Consideration should be given to relocating antennas away from sensitive wildlife habitats, agricultural zones/farms, residential, school and hospital zones where people live and work. **Converting wireless broadband to [fiber optic cabled systems](#)** is safer and more sustainable in both cities and rural areas.

See also [PST Broadband Expansion](#)

Reviews on Wildlife

Balmori (2015) notes in his latest review “Current evidence indicates that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base station emitters of radio frequencies. **Anthropogenic Radiofrequency Electromagnetic Fields as an Emerging Threat to Wildlife Orientation**. Alfonso Balmori. *Science of The Total Environment*. 518-519:58-60 · July 2015. https://www.researchgate.net/publication/273121908_Anthropogenic_Radiofrequency_Electromagnetic_Fields_as_an_Emerging_Threat_to_Wildlife_Orientation

The Cucurachi Review (2012) of 113 peer-reviewed publications revealed, “In about two thirds of the reviewed studies ecological effects of RF-EMF was reported at high as well as at low dosages. The very low dosages are compatible with real field situations, and could be found under environmental conditions.” **A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)**. *Environment International*. Cucurachi et al. 51C:116-140 · December 2012. https://www.researchgate.net/publication/233974663_A_review_of_the_ecological_effects_of_radiofrequency_electromagnetic_fields_RF-EMF

Panagopoulos (2013) explains in his review of experimental data, how living organisms are in harmony with terrestrial and magnetic fields, which effect their cellular processes and even circadian rhythms. Interference

of this delicate interaction with human wireless technology can adversely affect the health and well-being of ecosystems. **MOBILE TELEPHONY RADIATION EFFECTS ON LIVING ORGANISMS.** Dimitris J. Panagopoulos and Lukas H. Margaritis. Department of Cell Biology and Biophysics, Faculty of Biology, University of Athens, Greece.

The Saravanamuttu Review (2013) found that harm to the environment is demonstrated but there are no long term studies to support safety of this technology. Sivani and Sudarsanam state, “Based on current available literature, it is justified to conclude that RF-EMF radiation exposure can change neurotransmitter functions, blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium efflux, and gene and protein expression in certain types of cells even at lower intensities.” They note that these studies are important to identify the frequencies, intensities and durations that are safer, enabling the use of wireless technology while ensuring the health and sustainability of the environment. **Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem—A review.** Biology and Medicine. 4(4):202-216 · January 2013. https://www.researchgate.net/publication/258521207_Impacts_of_radio-frequency_electromagnetic_field_RF-EMF_from_cell_phone_towers_and_wireless_devices_on_biosystem_and_ecosystem-A_review

A 2010 review paper from the Ministry of Environment and Forests in India reviewed all available peer reviewed research on the impacts of wireless radiofrequency (RF) on living organisms, including birds and bees, plants, animals and humans. Of 919 articles collected 593 showed adverse impacts. In each category of organism, over 60% of the research indicated harm to that biological species. The report looked at 5 mandates * Review literature * Assess impacts of increasing cell towers * Suggest mitigation of effects * Formulate regulatory guidelines for installation of cell towers * Identify research gaps. **Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees.** Ministry of Environment and Forest. India. (2010) <http://www.indiaenvironmentportal.org.in/content/341385/report-on-possible-impacts-of-communication-towers-on-wildlife-including-birds-and-bees/> Here is PDF of the [Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees.](#) (2010) Ministry of the Environment and Forests (MOEF) India.

Blake Levitt and Henry Lai (2010) provide an articulate and thorough review of cell towers and the radiation they emit. This is a classic paper that clearly explains and defines terms used in the literature, providing a foundation of knowledge as well as a review of the literature. **Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays.** (2010) Page 374- Biological Effects at Low intensity) Blake Levitt, Henry Lai. Environmental Reviews, 2010, 18(NA): 369-395. <http://www.nrcresearchpress.com/doi/full/10.1139/A10-018#.WYUjOHeZNo4>

Balmori Review on the Effects of Cell Towers on Wildlife (2009) first notes, “Life has evolved under the influence of two omnipresent forces: gravity and electromagnetism. It should be expected that both play important roles in the functional activities of organisms.” He provides a detailed review of how long term emissions from cell towers (phone masts) causes a general decline in the health of plants and animals in nearby habitats. This could be through a reduction of natural health defenses and reproductive failure. He cites many references in this paper which is a well written critical resource for those in public health, the environmental community as well as legislative members who wish to understand this issue. **Electromagnetic Pollution From Phone Masts. Effects on Wildlife.** Alfonso Balmori. Pathophysiology. Volume 16, Issues 2-3, August 2009 , Pages 191-199 <https://www.sciencedirect.com/science/article/pii/S0928468009000030>

or full article on ResearchGate at https://www.researchgate.net/publication/24180316_Electromagnetic_pollution_from_phone_masts_Effects_on_wildlife

Newest Articles All Species

The influence of electromagnetic radiation of cell phones on the behavior of animals. (2020) Vet World. 2020 Mar; 13(3): 549–555. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7183456/>

Electromagnetic Radiation Disturbed the Photosynthesis of *Microcystis aeruginosa* at the Proteomics Level. (2018) Tang c et al. Scientific Reports. 11 January 2018, volume 8, Article number: 479 (2018). <https://www.nature.com/articles/s41598-017-18953-z>

Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz. (2018) Thielens A et al. Scientific Reports, Article number:3924 (2018). <https://www.nature.com/articles/s41598-018-22271-3>

Review and General Articles Wildlife

EKLIPSE: The impacts of artificial Electromagnetic Radiation on wildlife (fora and fauna). Current knowledge overview: a background document to the web conference. A report of the EKLIPSE project. May 26, 2018. Knowledge and Learning Mechanism on Biodiversity and Ecosystem Services. European Union. http://www.eclipse-mechanism.eu/documents/15803/0/EMR-Knowledge-OverviewReport_FINAL_27042018.pdf/1326791c-f39f-453c-8115-0d1c9d0ec942 Eklipse Home Page– <http://www.eclipse-mechanism.eu/news>

Comments on Environmental Impact of Radiofrequency Fields from Mobile Phone Base Stations. (2016) Panagopoulos D et al. Clinical Reviews in Environmental Science and Technology. April 2016. https://www.researchgate.net/publication/301680565_Comments_on_Environmental_Impact_of_Radiofrequency_Fields_from_Mobile_Phone_Base_Stations

THE BIOLOGICAL EFFECTS OF ELECTROMAGNETIC FIELDS ON HUMAN AND EXPERIMENTAL ANIMALS. (2016) Ebrahim S et al. International

Research Journal of Natural and Applied Sciences

Vol. 3, Issue 10, October 2016. [https://www.researchgate.net/publication/](https://www.researchgate.net/publication/309709601)

[309709601](https://www.researchgate.net/publication/309709601) THE BIOLOGICAL EFFECTS OF ELECTROMAGNETIC FIELDS ON HUMAN AND EXPERIMENTAL ANIMALS

Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation. (2015) Balmori A. Science of the Total Environment. Vol 518-519, 15 June, 2015. Pages 58-60. 68. <https://www.sciencedirect.com/science/article/pii/S0048969715002296> or https://www.researchgate.net/publication/273121908_Anthropogenic_Radiofrequency_Electromagnetic_Fields_as_an_Emerging_Threat_to_Wildlife_Orientation

Electrosmog and species conservation. (2014) Balmori A. Science of The Total Environment. Volume 496, 15 October 2014 , Pages 314-316. <https://www.sciencedirect.com/science/article/pii/S0048969714010912>

Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem—A review. (2013) Saravanamuttu S and Sudarsanam S. Biology and Medicine. 4(4):202-216. January 9. https://www.researchgate.net/publication/258521207_Impacts_of_radio-frequency_electromagnetic_field_RF-EMF_from_cell_phone_towers_and_wireless_devices_on_biosystem_and_ecosystem-A_review

Electromagnetic Interaction Between Environmental Fields and Living Systems Determines Health and Wellbeing. (2013) Dimitris J. Panagopoulos. Electromagnetic Fields: Principles. Biophysical Effects. ©2013. Nova Science Publishers, Inc. https://www.novapublishers.com/catalog/product_info.php?products_id=41753f

A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF). (2012) Cucurachi S et al. Environment International. 51C:116-140. 2012. https://www.researchgate.net/publication/233974663_A_review_of_the_ecological_effects_of_radiofrequency_electromagnetic_fields_RF-EMF

Report on Cell Tower Radiation. Submitted to Secretary, DOT, Delhi, India.(2010) Kumar G. Electrical engineering Department. IIT Bombay, Powai, Mumai <https://www.ee.iitb.ac.in/~mwave/GK-cell-tower-rad-report-DOT-Dec2010.pdf>

Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. (2010) Page 374- Biological Effects at Low intensity) Blake Levitt, Henry Lai. Environmental Reviews, 2010, 18(NA): 369-395. <http://www.nrcresearchpress.com/doi/full/10.1139/A10-018#.WYUIOHeZNo4>

Report on Possible Impacts of Communication Cell Towers on Wildlife Including Birds and Bees. (2010) The Ministry of Environment and Forest. [Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees. \(2010\) Ministry of the Environment and Forests \(MOEF\) India.](#)

The Birds, the Bees and Electromagnetic Pollution. (2009). Andrew Goldsworthy. <https://ecfsapi.fcc.gov/file/7520958012.pdf>

Electromagnetic Pollution From Phone Masts. Effects on Wildlife. (2009) Alfonso Balmori. Pathophysiology. Volume 16, Issues 2-3, August 2009 , Pages 191-199. <https://www.sciencedirect.com/science/article/pii/S0928468009000030> or full article on Researchgate at https://www.researchgate.net/publication/24180316_Electromagnetic_pollution_from_phone_masts_Effects_on_wildlife

[The influence of electromagnetic fields on flora and fauna]. (2009) [Rochalska M. Med Pr.2009;60\(1\):43-50.](#) <https://www.ncbi.nlm.nih.gov/pubmed/19603696>

Mobile telephony radiation effects on living organisms. (2008) DJ Panagapoulos and Margaritas LH. University of Athens. Published by Nova Science Publishers. https://www.researchgate.net/publication/251669858_Mobile_telephony_radiation_effects_on_living_organisms

The effects of microwaves on the trees and other plants. (2003) Balmori Martínez A. Valladolid, Spain, 2003b. http://www.hese-project.org/de/emf/WissenschaftForschung/Balmori_Dr._Alfonso/show-Doc.php?lang=de&header=Dr.%20Balmori&file=THE%20EFFECTS%20OF%20MICROWAVES%20ON%20THE%20TREES%20AND%20OTHER%20PLANTS.html&back=../showAuthor.php?target=Balmori_Dr._Alfonso

THE EFFECTS OF MICROWAVE RADIATION ON THE WILDLIFE. PRELIMINARY RESULTS. (2003) Alfonso Balmori Martínez. Feb 2003. Manuscript submitted for publication to Electromagnetic Biology and Medicine <http://www.whale.to/b/martinez.pdf>

KNOCK Forum-Knowledge Network, Open Community. EMF and Wildlife. http://www.eclipse-mechanism.eu/forum_discussion?p_p_id=forumdiscussions_WAR_EclipseSBportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_count=1&forumdiscussions_WAR_EclipseSBportlet_mvcPath=%2Fhtml%2Fforumdiscussions%2Fview_subject.jsp&forumdiscussions_WAR_EclipseSBportlet_subjectId=6

[Ecological significance of electromagnetic fields: the 20th century–century of electricity, the 21st–century of magnetism]. (2003) [Lazetić B. Med Pregl.2003;56 Suppl 1:31-6.](#) <https://www.ncbi.nlm.nih.gov/pubmed/15510911>

The effects of microwave radiation from mobile telephones on humans and animals. (2000) Galeev AL. Behav. Physiol. 30:187–194, 2000. <https://www.ncbi.nlm.nih.gov/pubmed/10872729>

Concern for Europe’s Tomorrow. Health and the Environment in the European Region. WHO. 1995. http://www.euro.who.int/_data/assets/pdf_file/0004/98266/WA3095CO.pdf

Books

The Invisible Rainbow: A History of Electricity and Life. Arthur Firstenberg . AGB Press. (2017).

Electronic Silent Spring. Katie Singer. Portal Books. (2013)

Cell Towers-Wireless Convenience? or Environmental Hazard? Blake Levitt. iUniverse Publisher. (2011)

Biological Effects of Electromagnetic Fields Mechanisms, Modeling, Biological Effects, Therapeutic Effects, International Standards, Exposure Criteria. Peter Stavroulakis (Ed.) (2003) Springer Publisher. <https://www.springer.com/us/book/9783540429890>

The Body Electric: *Electromagnetism and the Foundation of Life.* (1985) Robert O Becker . Harper Paperbacks.

Amphibians

Mobile Phone Mast Effects on Common Frog (*Rana temporaria*) Tadpoles: The City Turned into a Laboratory. (2010) Balmori A. *Electromagnetic Biology and Medicine*, 29: 31–35, 2010. <https://www.ncbi.nlm.nih.gov/pubmed/20560769>

The incidence of electromagnetic pollution on the amphibian decline: Is this an important piece of the puzzle? (2006) Balmori Martínez A. *Toxicological and Environmental Chemistry*. 88(2): 287- 299, 2006. <https://www.tandfonline.com/doi/abs/10.1080/02772240600687200>

Cleavage planes in frog eggs are altered by strong magnetic fields. (1998) Denegre JM et al. *Proceedings of the National Academy of Science (PNAS)* 95:14729–14732, 1998. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC24517/>

Mobile phone masts effects of electromagnetic radiation on tadpole development in the common frog (*Rana temporaria* L.). (1998) Grefner NM et al. *Russian J. Ecol.* 29:133–134, 1998. <https://www.ncbi.nlm.nih.gov/pubmed/20560769>

Abnormal limb regeneration in adult newts exposed to a pulsed electromagnetic field. (1998) Landesman RH et al. *Teratology* 42:137–, 1990. <https://www.ncbi.nlm.nih.gov/pubmed/2218941>

Bacteria and Fungi

Evaluation of Wi-Fi Radiation Effects on Antibiotic Susceptibility, Metabolic Activity and Biofilm Formation by *Escherichia Coli* 0157H7, *Staphylococcus Aureus* and *Staphylococcus Epidermis*. (2019) Said-Salman IH et al. *J Biomed Phys Eng.* 2019,Oct; 9(5): 579–586. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6820025/>

Effect of Mobile Tower Radiation on Microbial Diversity in Soil and Antibiotic Resistance. (2018) Sharma AB et al. *IEEE Explore.* 2018 international Conference on Power and Energy, Environment and Intelligent Control. April 13-14, 2018. <https://ieeexplore.ieee.org/document/8665432>

Electromagnetic Radiation Disturbed the Photosynthesis of *Microcystis aeruginosa* at the Proteomics Level. (2018) Tang c et al. *Scientific Reports.* 11 January 2018, volume 8, Article number: 479 (2018). <https://www.nature.com/articles/s41598-017-18953-z>

Evaluation of the Effect of Radiofrequency Radiation Emitted From Wi-Fi Router and Mobile Phone Simulator on the Antibacterial Susceptibility of Pathogenic Bacteria *Listeria monocytogenes* and *Escherichia coli*. (2017) Taheri M et al. *Dose Response.* 2017 Jan 23;15(1):1. <https://www.ncbi.nlm.nih.gov/pubmed/28203122>

***Klebsiella pneumoniae*, a Microorganism that Proves the Non-linear Responses to Antibiotics and Window Theory after Exposure to Wi-Fi 2.4 GHz Electromagnetic Radiofrequency Radiation.**

(2015). Tahiti M et al. J Biomed Phys Eng. 2015 Sep 1;5(3):115-20. <https://www.ncbi.nlm.nih.gov/pubmed/26396967><https://www.ncbi.nlm.nih.gov/pubmed/26396967>

Inactivation of *Lactobacillus plantarum* in apple cider, using radio frequency electric fields.

(2009) Geveke DJ et al. J Food Prot. 2009 Mar;72(3):656-61. <https://www.ncbi.nlm.nih.gov/pubmed/19343959>

Inactivation of *Saccharomyces cerevisiae* with radio frequency electric fields. (2003) Geveke DJ

and **Brunkhorst C.** J Food Prot. 2003 Sep;66(9):1712-5. <https://www.ncbi.nlm.nih.gov/pubmed/14503732>

Resonance effect of millimeter waves in the power range from 10(-19) to 3 x 10(-3) W/cm2 on *Escherichia coli* cells at different concentrations (1996) Belyaev IY et al. Bioelectromagnetics. 1996;17(4):312-21. <https://www.ncbi.nlm.nih.gov/pubmed/8891190>

Transgenic nematodes as biomonitors of microwave-induced stress. (1998) Daniells C et al. Mutation Research, 399(1), 55-64, 1998. <https://www.ncbi.nlm.nih.gov/pubmed/9635489>

Bats

The Aversive Effect of Electromagnetic Radiation on Foraging Bats—A Possible Means of Discouraging Bats from Approaching Wind Turbines. (2009) Nicholis B and Racey P. PLoS One. July 16, 2009. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0006246>

Bats Avoid Radar Installations: Could Electromagnetic Fields Deter Bats from Colliding with Wind Turbines? (2007) Nicholis B and Racey P. PLoS ONE 2(3): e297. March 2007, Issue 3. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0000297>

Bees and Insects

Change in Geomagnetic Field Intensity Alters Migration-Associated Traits in a Migratory Insect.

(2020) Wan G et al. Biol Lett. 2020 Apr;16(4):20190940. <https://pubmed.ncbi.nlm.nih.gov/32343935/>

Physical assessments of termites (Termitidae) under 2.45 GHz microwave irradiation. (2020) Yanagawa A et al. Sci Rep. 2020 Mar 23;10(1):5197. <https://pubmed.ncbi.nlm.nih.gov/32251346/>

“Physical assessments of termites (Termitidae) under 2.45 GHz microwave irradiation.” (2020) Yanagawa, Aya et al. *Scientific reports* vol. 10,1 5197. 23 Mar. 2020, doi:10.1038/s41598-020-61902-6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7090069/#!po=52.2727>

Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz. (2018) Thielens A et al. Scientific Reports, Article number:3924 (2018). <https://www.nature.com/articles/s41598-018-22271-3>

Disturbing Honeybees' Behavior with Electromagnetic Waves: a Methodology. (2017) Daniel Favre. Journal of Behavior. August 7, 2017. <https://www.jscimedcentral.com/Behavior/Articles/behavior-2-1010.pdf>

Artificial light at night as a new threat to pollination. (2017) Knop E et al. Nature. Volume 548, pages206–209. <https://www.nature.com/articles/nature23288>

Is Electromagnetism one of the causes of the CCD? A work plan for testing this hypothesis. (2017) Marie-Claire Cammaerts. Journal of Behavior. 2 (1):1006. March 28, 2017. <https://www.jscimedcentral.com/Behavior/behavior-2-1006.php>

Ticks and radio-frequency signals: Behavioural response of ticks (*Dermacentor reticulatus*) in a 900 MHz electromagnetic field.(2017) Systemic and Applied Acarology. 22(5) · May 2017. Vargová B et al. https://www.researchgate.net/publication/316685533_Ticks_and_radio-frequency_signals_Behavioural_response_of_ticks_Dermacentor_reticulatus_in_a_900_MHz_electromagnetic_field

Effects of short-term exposure to mobile phone radiofrequency (900 MHz) on the oxidative response and genotoxicity in honey bee larvae. (2017) Villic M et al. *Journal of Apicultural Research*. July 2017. https://www.researchgate.net/publication/318185267_Effects_of_short-term_exposure_to_mobile_phone_radiofrequency_900_MHz_on_the_oxidative_response_and_genotoxicity_in_honey_bee_larvae

Electromagnetic Radiation of Mobile Communication Antennas Affects the Abundance and composition of Wild Pollinators. (2016) Lazaro,A. *Journal of Insect Conservation* 20(2):1-10, April 2016. https://www.researchgate.net/publication/301647025_Electromagnetic_radiation_of_mobile_telecommunication_antennas_affects_the_abundance_and_composition_of_wild_pollinators

Effect of Electromagnetic (cell phone) radiations on *Apis mellifera*. (2015) Dalio, J. *Journal of Research in Agriculture and Animal Science* Volume 2 ~ Issue 12 (2015) pp:06-10. Feb. 2015. <http://questjournals.org/jraas/papers/vol3-issue1/B310610.pdf>

Effect of high-frequency radiations on survival of the honeybee (*Apis mellifera* L.). (2015) Darney,K. *Apidologie*: 58 59 December 2015. https://www.researchgate.net/publication/287972544_Effect_of_highfrequency_radiations_on_survival_of_the_honeybee_Apis_mellifera_L

Pest control by microwave and radio frequency energy: dielectric properties of stone fruit. (2015) Ling B et al. *Agronomy for sustainable Development*. January 2015, Volume 35, Issue 1, pp 233–240. <https://link.springer.com/article/10.1007/s13593-014-0228-3>

Effect of Short-Term GSM Radiation at Representative Levels in Society on a Biological Model: The Ant *Myrmica sabuleti*. (2014) Cammaerts MC et al. *Journal of Insect Behavior* 27(4) · July 2014. https://www.researchgate.net/publication/262679650_Effect_of_Short-Term_GSM_Radiation_at_Representative_Levels_in_Society_on_a_Biological_Model_The_Ant_Myrmica_sabuleti

A magnetic compass aids monarch butterfly migration. (2014) Guerra PA et al. *Nature Communications*. Volume 5, Article number: 4164 (2014). <https://www.nature.com/articles/ncomms5164>

Effect of electromagnetic radiations on brooding, honey production and foraging behavior of European honeybees (*Apis mellifera* L.) (2014) Mall and Kumar. *African Journal of Agricultural Research*. Vol 9(13); 1078-1085, March 2014. http://www.academicjournals.org/article/article1396540463_Mall%20and%20Kumar.pdf

***Drosophila* oogenesis as a bio-marker responding to EMF sources.** (2014) Margaritas LH et al. *Electromagn Biol Med*. 2014 Sep;33(3):165-89. <http://www.ncbi.nlm.nih.gov/pubmed/23915130>

Microwave technology for disinfestation of cereals and pulses: An overview. (2014) Yadav DN et al. *J Food Sci Technol*. 2014 Dec; 51(12): 3568–3576. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4252428/>

Food collection and response to pheromones in an ant species exposed to electromagnetic radiation. (2013) Cammaerts MC et al. *Electromagn Biol Med*. 2013 Sep;32(3):315-32. <https://www.ncbi.nlm.nih.gov/pubmed/23320633>

Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus. (2013) Cammaerts MC and Johansson O. *Electromagn Biol Med.* 2014 Dec;33(4):282-8. <https://www.ncbi.nlm.nih.gov/pubmed/23977878>

Detection and learning of floral electric fields by bumblebees. (2013) Clarke D et al. *Science.* 2013 Apr 5;340(6128):66-9. <https://www.ncbi.nlm.nih.gov/pubmed/23429701>

Microwave Heating as an Alternative Quarantine Method for Disinfestation of Stored Food Grains. (2013) Das I et al. *Int J Food Sci.* 2013;2013:926468. Epub 2013 Apr 2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4745510/>

GSM 900 MHz radiation inhibits ants' association between food sites and encountered cues. (2012) Cammaerts MC et al. *Electromagnetic Biology and Medicine, Early Online:* 1–15, 2012. <https://www.ncbi.nlm.nih.gov/pubmed/22268919>

Decline of monarch butterflies overwintering in Mexico: is the migratory phenomenon at risk? (2013) Brower LP et al. *Insect conservation and Diversity.* March 21, 2011. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1752-4598.2011.00142.x>

Changes in *Paramecium caudatum* (Protozoa) near a switched-on GSM telephone. (2011) Cammaerts MC et al. *Electromagnetic Biology and medicine.* Volume 30, 2011. <https://www.tandfonline.com/doi/full/10.3109/15368378.2011.566778?src=recsys>

Exposure to cell phone radiations produces biochemical changes in worker honey (2011) Kumar N. *Toxicol Int.* 2011 Jan-Jun; 18(1): 70–72. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052591/>

Electromagnetic Radiation (EMR) Clashes with Honey Bees. (2011) Sahib S. *International Journal of Environmental Sciences.* Vol 1, No.5, 2011. <http://www.ipublishing.co.in/jesvol1no12010/EIJES2044.pdf>

Short Communication. Impact of mobile phones on the density of honeybees. *Journal of public administration and policy research* Vol. 3(4) pp. 131-117 April 2011. Sahib, S. <http://www.academicjournals.org/journal/JHF/article-full-text-pdf/B0ABD121249>

Bioeffects of mobile telephony radiation in relation to its intensity or distance from the antennae. (2010) Panagopoulos DJ et al. *J. Radiat. Biol.,* Vol. 86, No. 5, May 2010, pp. 345–357. <https://www.ncbi.nlm.nih.gov/pubmed/20397839>

Changes in honeybee behavior and biology under the influence of cellphone radiations. (2010) Sharma vp et al. *Current Science* 98:1376–1378. May 2010. https://www.researchgate.net/publication/225187745_Changes_in_honey_bee_behaviour_and_biology_under_the_influence_of_cell_phone_radiations

Report on Possible Impacts of Communication Cell Towers on Wildlife Including Birds and Bees. (2010) The Ministry of Environment and Forest. 2010. http://www.moef.nic.in/downloads/public-information/final_mobile_towers_report.pdf

Bioeffects of mobile telephony radiation in relation to its intensity or distance from the antennae. (2010) Panagopoulos D et al. *Int. J. Radiat. Biol.,* Vol. 86, No. 5, May 2010, pp. 345–357. <https://www.ncbi.nlm.nih.gov/pubmed/20397839>

Mobile phone-induced honeybee worker piping. (2009) Daniel F June 2009. *Apidologie* (2011) 42:270–279. <https://link.springer.com/article/10.1007/s13592-011-0016-x>

Interaction of radio-frequency, high-strength electric fields with harmful insects. (2009) Ponomaryova IA et al. *J Microw Power Electromagn Energy.* 2009;43(4):17-27. <https://www.ncbi.nlm.nih.gov/pubmed/21384727>

Insect control by radio-frequency high-strength electric fields. (2009) Ponomaryova I et al. <https://ieeexplore.ieee.org/document/5393326/>

Radio frequency magnetic fields disrupt magnetoreception in American cockroach. (2009) Vácha M. J Exp Biol. 2009 Nov;212(Pt 21):3473-7 <https://www.ncbi.nlm.nih.gov/pubmed/19837889>

Magnetoreception System in Honeybees (Apis mellifera). (2007) Hsu C-Y et al. PLoS One. 2007; 2(4): e395. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1851986/>

Effects of electromagnetic exposition on the behavior of the honeybee (Apis mellifera). (2007) Kimmel S et al. Environmental Systems Research, 8: 1–8. [http://somr.info/rfr/lib/](http://somr.info/rfr/lib/Kimmel_etal_2007.pdf)

[Kimmel_etal_2007.pdf](https://www.researchgate.net/publication/228510851_Electromagnetic_Radiation_Influences_on_Honeybees_Apis_mellifera) or https://www.researchgate.net/publication/228510851_Electromagnetic_Radiation_Influences_on_Honeybees_Apis_mellifera

Cell death induced by GSM 900-MHz and DCS 1800-MHz mobile telephony radiation.

(2007) Panagopoulos D et al. Mutat Res. 626:69–78. <https://www.ncbi.nlm.nih.gov/pubmed/17045516>

Comparison of bioactivity between GSM 900 MHz and DCS 1800 MHz mobile telephony radiation.

(2007) Panagopoulos DJ. Electromagn Biol Med. 2007;26(1):33-44. <https://www.ncbi.nlm.nih.gov/pubmed/17454081>

Can Electromagnetic Exposure Cause a Change in Behaviour? Studying Possible Non-Thermal Influences on Honey Bees- An Approach within the Framework of Educational Informatics. (2006) Harst W et al. ACTA SYSTEMICA – IAS International Journal, Vol. VI, No. 1, 1-6 2006. (2 Articles) https://www.researchgate.net/publication/237523719_Can_Electromagnetic_Exposure_-_Cause_a_Change_in_Behaviour_Studying_Possible_Non-Thermal_Influences_on_Honey_Bees_-_An_Approach_within_the_Framework_of_Educational_Informatics

https://www.researchgate.net/publication/237523719_Can_Electromagnetic_Exposure_-_Cause_a_Change_in_Behaviour_Studying_Possible_Non-Thermal_Influences_on_Honey_Bees_-_An_Approach_within_the_Framework_of_Educational_Informatics

[Cause a Change in Behaviour Studying Possible Non-Thermal Influences on Honey Bees - An Approach within the Framework of Educational Informatics](https://www.researchgate.net/publication/237523719_Can_Electromagnetic_Exposure_-_Cause_a_Change_in_Behaviour_Studying_Possible_Non-Thermal_Influences_on_Honey_Bees_-_An_Approach_within_the_Framework_of_Educational_Informatics)

Electromagnetic radiation: Influences on honeybees (Apis mellifera). (2006) Kimmel SJ et al. 2006. Researchgate. https://www.researchgate.net/publication/228510851_Electromagnetic_Radiation_Influences_on_Honeybees_Apis_mellifera

AAA Effect of GSM 900 MHz mobile phone radiation on the reproductive capacity of Drosophila melanogaster. (2004) Karabarbounis, A Electromagn. Biol. Med. 23:29–43. <http://informahealthcare.com/doi/abs/10.1081/JBC-120039350>

Radio frequency heating: a potential method for post-harvest pest control in nuts and dry products.

(2004) Zhejiang J et al. Univ Sci. 2004 Oct; 5(10): 1169–1174. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1388719/>

“Effects of Different Kinds of EMFs on the Offspring Production of Insects.” 2nd International Workshop on Biological effects of EMFS.(2002) Panagopoulos DJ. & Margaritis LH. (2002) Rhodes (Greece):

348-452. A list of his works. https://www.researchgate.net/scientific-contributions/38908092_Dimitris_J_Panagopoulos

Complex high-frequency technology for protection of grain against pests. (2000) Mishenko AA et al. J

Microw Power Electromagn Energy. 2000;35(3):179-84. <https://www.ncbi.nlm.nih.gov/pubmed/11098443>

Worker piping associated with foraging in undisturbed queenright colonies of honey bees. (1996) Pratt

SC et al. Apidologie 27 (1996) 13-20. http://www.apidologie.org/articles/apido/abs/1996/01/Apidologie_0044-8435_1996_27_1_ART0002/Apidologie_0044-8435_1996_27_1_ART0002.html

Bursts of magnetic fields induce jumps of misdirection in bees by a mechanism of magnetic resonance. (1988) Korall, H et al. *Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology*, 162(3), 279284. <https://link.springer.com/article/10.1007/BF00606116>

Biological Effects of a 765_kV transmission line: Exposures and thresholds in honeybee colonies. *Bioelectromagnetics*. Greenberg, B. http://www.researchgate.net/publication/227913246_Biological_effects_of_a_765kV_transmission_line_Exposures_and_thresholds_in_honeybee_colonies

Effects of Electric Charges on Honeybees (1976) Warnke, U. *Bee World*. Volume 57, Issue 2. 1976. <https://www.tandfonline.com/doi/abs/10.1080/0005772X.1976.11097592>

Bees and Insect Related articles

Magnetic Sensing through the Abdomen of the Honey bee. (2016) Liang C-H et al. *Nature. Scientific Reports*. Volume 6, Article number: 23657 (2016). <https://www.nature.com/articles/srep23657>

Importance of Insects. Purdue University. (2014) https://extension.entm.purdue.edu/radicalbugs/index.php?page=importance_of_insects

Bees Can Sense Electric Fields of Flowers. (2013) National Geographic. Dr Clarke and Dr. Whitney. U of Bristol. Feb 2013. <http://phenomena.nationalgeographic.com/2013/02/21/bees-can-sense-the-electric-fields-of-flowers/>

Severe Honey Bee (*Apis mellifera*) Losses Correlate with Geomagnetic and Proton Disturbances in Earth's Atmosphere, (2015) Ferrari TE and Tautz J. *Journal of Astrobiology & Outreach*. <https://www.omicsonline.org/open-access/severe-honey-bee-apis-mellifera-losses-correlate-with-geomagnetic-andproton-disturbances-in-earths-atmosphere-2332-2519-1000134.php?aid=57103#corr>

Detection and Learning of Floral Electric Fields by Bumblebees. (2013) Clarke D et al. 2013 Apr 5;340(6128):66-9. <http://dx.doi.org/10.1126/science.1230883>

Birds

Very weak oscillating magnetic field disrupts the magnetic compass of songbird migrants. (2017) Pakhomov A et al. *J R Soc Interface*. 2017 Aug;14(133). <https://www.ncbi.nlm.nih.gov/pubmed/28794163>

Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird (*Erithacus rubecula*) than Strong Narrow-Band Fields. (2016). Schwarze S et al. *Front Behav Neuroscience*. March, 2016. <http://www.ncbi.nlm.nih.gov/pubmed/?term=PMID%3A+27047356>

Magnetoreception in birds: The effect of radio-frequency fields. (2015) Wiltschko R et al. *Journal of The Royal Society Interface* 12(103) · February 2015. https://www.researchgate.net/publication/270002583_Magnetoreception_in_birds_The_effect_of_radio-frequency_fields

Cellular Apoptosis and Blood Brain Barrier Permeability Changes in the Pre-Incubated Chicken Embryo's Brain by Effect of Electromagnetic Fields.(2015) Kalantarai S et al. *Zahedan Journal of Research in Medical Science*. *ZJRMS* 2015, 17(2): 16-21. http://zjrms.ir/browse.php?a_id=3059&slc_lang=en&sid=1&printcase=1&hbnr=1&hmb=1

Electromagnetic Radiations: A Possible Impact on Population of House Sparrow (Passer Domesticus). (2015) Shende VA and Patil KG, Vol 1, 2015. <http://journals.abc.us.org/index.php/ei/article/view/766>

Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird. (2014) Engel S et al. 2014 May 15;509(7500):353-6. <https://www.ncbi.nlm.nih.gov/pubmed/24805233>

Electronics' noise disorients migratory birds. Man-made electromagnetic radiation disrupts robins' internal magnetic compasses.(2014) . Jessica Morrison. Nature- News. 07 May 2014. <https://www.nature.com/news/electronics-noise-disorients-migratory-birds-1.15176>

Case of House Sparrow (Passer Domesticus) Population Decline: Role of Semi-Nomadic Pastoralist Community (Van Gujjars) in Their Conservation. (2014). Hussain A et al. Department of Forestry, India. International Journal of Conservation Science. Volume 5, Issue 4, October-December 2014: 493-502. <http://www.ijcs.uaic.ro/public/IJCS-14-44-Hussain.pdf>

Magnetic orientation of garden warblers (Sylvia borin) under 1.4 MHz radiofrequency magnetic field. (2014) Kavokin K. J R Soc Interface. 2014 Aug 6;11(97):20140451. <https://www.ncbi.nlm.nih.gov/pubmed/24942848>

EFFECT OF MOBILE PHONE FREQUENCY RADIATION ON EARLY DEVELOPMENT OF CHICK EMBRYO.(2014) Jyoti r, Kohli K and Bagai U. International Journal of Science, Environment ISSN 2278-3687 (O) and Technology, Vol. 3, No 3, 2014, 1273 – 1280. <http://www.ijset.net/journal/359.pdf>

Anthropogenic-related Bird Mortality Focusing on Steps to Address Human-caused Problems – a White Paper for the Anthropogenic Panel, 5th International Partners in Flight Conference, August 27, 2013, Snowbird, Utah. Albert M. Manville, II, Ph.D., Senior Wildlife Biologist, Division of Migratory Bird Management, US Fish and Wildlife Service. <https://www.sandiegocounty.gov/content/dam/sdc/dplu/ceqa/Soitec-Documents/Record-Documents/2014-03-01-StephanVolker-Comment-Letter-Exhibit-16-Soitec-Solar-DPEIR.pdf>

Communication Towers Pluck Birds. (2013) January 29, 2013. David Biello. Scientific American. <https://www.scientificamerican.com/podcast/episode/communication-towers-pluck-birds-13-01-29/>

Effect of Electromagnetic Mobile Radiation on Chick Embryo Development.(2012) Fatma Al-Qudsi and Solafa Azzouz. *Life Science Journal*. 9(2):983-991. https://www.researchgate.net/publication/232262365_Effect_of_Electromagnetic_Mobile_Radiation_on_Chick_Embryo_Development

Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. (2010) Levitt and Lai. *Environmental Reviews*, 2010, 18(NA): 369-395. <http://www.nrcresearchpress.com/doi/full/10.1139/A10-018?src=recsys#.W1e35neZPEY>

EFFECT OF CELL PHONE RADIATION ON GAURIYA SPARROWS PASSER DOMESTICUS. (2009) Dongre SD and Verma RG. ISSN-0974-2832, Vol. II, Issue-7 (August 2009) <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.398.1596&rep=rep1&type=pdf>

Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. (2009) Gehring J et al. *Ecol Appl*. 2009 Mar;19(2):505-14. <https://www.ncbi.nlm.nih.gov/pubmed/19323206>

Oscillating magnetic field disrupts magnetic orientation in Zebra finches, Taeniopygia guttata. (2009) Keary N. *Front Zool*. 2009 Oct 23;6:25. <https://frontiersinzoology.biomedcentral.com/articles/10.1186/1742-9994-6-25>

The Urban Decline of the House Sparrow (*Passer domesticus*): A Possible Link with Electromagnetic Radiation. (2007) Balmori A and Hallberg O. *Electromagnetic Biology and Medicine*, 26: 141–151, 2007. <https://www.ncbi.nlm.nih.gov/pubmed/17613041>

A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding house sparrows (*Passer domesticus*) (2007) Everaert and Bauwens. *Electromagnetic Biology and Medicine* 26:63–72 , 2007. <https://www.ncbi.nlm.nih.gov/pubmed/17454083>

Federal Communications Commission. 2006. Effects of communication towers on migratory birds. Notice of Proposed Rulemaking, WT Docket No. 03-187, FCC 06-164, Federal Register 71(225): 67510-67518, November 22. Feb 2, 2007 <http://apps.fcc.gov/ecfs/document/view;jsessionid=nCRdSVrXPXQhlpnr8lbQC3GZQcvNnKhgHnnJWgTLQ2ZCRV3DCsFc!1357496456!-1864380355?id=6518724776>

Exposure to radio frequency radiation emitted by cell phone and mortality in chick embryos (*Gallus domesticus*). (2006) Ingole IV and Ghosh SK. *Biomedical Research* (2006) Volume 17, Issue 3. <http://www.alliedacademies.org/articles/exposure-to-radio-frequency-radiation-emitted-by-cell-phone-and-mortality-in-chick-embryos-gallus-domesticus.html>

Possible Effects of Electromagnetic Fields from Phone Masts on a Population of White Stork (*Ciconia ciconia*) (2005) Balmori A. *Electromagnetic Biology and Medicine*, 24: 109–119, 2005. <https://www.tandfonline.com/doi/abs/10.1080/15368370500205472>

The effects of electromagnetic fields from power lines on avian reproductive biology and physiology: a review. (2005) Kim J. Fernie and James Reynolds. *Journal of Toxicology and Environmental Health*. 8:127-140, 2005. https://www.fws.gov/southwest/es/documents/R2ES/LitCited/LPC_2012/Fernie_and_Reynolds_2005.pdf

Magnetic compass orientation of migratory birds in the presence of a 1.315 MHz oscillating field. (2005) Thalau, P., T. Ritz, K. Stapput, R. Wiltschko, and W. Wiltschko. 2005. *Naturwissenschaften* 92:86-90. <http://www.ncbi.nlm.nih.gov/pubmed/15614508>

Resonance effects indicate a radical-pair mechanism for avian magnetic compass. (2004) Ritz T. *Nature*. 2004 May 13;429(6988):177-80. <https://www.nature.com/articles/nature02534>

The decline of the House Sparrow: a review. (2003) Summers-Smith, *Journal of British Birds*, 96:439–446, 2003. <https://britishbirds.co.uk/article/the-decline-of-the-house-sparrow-a-review/>

Effects of electromagnetic fields on the reproductive success of American kestrels. (2000). Fernie KJ et al. *Biochem. Zool.* 2000, Jan-Feb;73:60–65. <https://www.ncbi.nlm.nih.gov/pubmed/10685907>

Mortality of chicken embryos exposed to EMFs from mobile phones. (1998) Youbicier-Simo BJ et al. Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June 1998. <https://www.buergerwelle.de/assets/files/grn/omega55.htm>

Evidence of a role for endogenous electrical fields in chick embryo development. (1992) Hotary and Robinson *Development* 114:985–996, 1992 <https://www.ncbi.nlm.nih.gov/pubmed/1618158>

The properties of bird feathers as converse piezoelectric transducers and as receptors of microwave radiation. II. Bird feathers as dielectric receptors of microwave radiation. (1975) Bigu-del-Blanco J, Romero-Sierra C. *Biotelemetry*. 1975;2(6):354-64. <https://www.ncbi.nlm.nih.gov/pubmed/1242004>

The properties of bird feathers as converse piezoelectric transducers and as receptors of microwave radiation. Bird feathers as converse piezoelectric transducers. (1975) 1975;2(6):341-53. Bigu-del-Blanco J et al. <https://www.ncbi.nlm.nih.gov/pubmed/1235241>

Birds Related Articles

Forty Percent of the World's Bird Populations Are in Decline, New Study Finds. April 23, 2018. Yale Environment 360. <https://e360.yale.edu/digest/forty-percent-of-the-worlds-bird-populations-are-in-decline-new-study-finds>

Night-migratory songbirds possess a magnetic compass in both eyes. (2012) Engels S et al. PLoS One. 2012;7(9):e43271. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3440406/>

Magnetite-based magnetoreception. (2001) Kirschvink JL et al. Current Opinion in Neurobiology. Volume 11, Issue 4, August 2001, Pages 462-467. <https://www.sciencedirect.com/science/article/pii/S095943880000235X>

Cell Towers

Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem—A review. (2013) [Sivani Saravanamuttu](#). Biology and Medicine. 4(4): 202-216. January 9. https://www.researchgate.net/publication/258521207_Impacts_of_radio-frequency_electromagnetic_field_RF-EMF_from_cell_phone_towers_and_wireless_devices_on_biosystem_and_ecosystem-A_review

[Increased occurrence of nuclear cataract in the calf after erection of a mobile phone base station]. (2012) Hassig M et al. Schweiz Arch Tierheilkd. 2012 Feb;154(2):82-6. <https://www.ncbi.nlm.nih.gov/pubmed/22287140>

Electromagnetic pollution from phone masts. Effects on wildlife.(2009) Balmori Pathophysiology, 16: 191–199. <https://www.ncbi.nlm.nih.gov/pubmed/19264463>

A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding house sparrows (*Passer domesticus*) (2007) Everaert and Bauwens. Electromagnetic Biology and Medicine 26:63–72, 2007. <https://www.ncbi.nlm.nih.gov/pubmed/17454083>

Fish, Whales, Marine Animals

Gray Whales Strand More Often on Days With Increased levels of Atmospheric Radiofrequency Noise. (2020) Granger, J. et al, Current Biology, Volume 30, ISSUE 4, PR155-R156, February 24, 2020. [https://www.cell.com/current-biology/fulltext/S0960-9822\(20\)30028-2](https://www.cell.com/current-biology/fulltext/S0960-9822(20)30028-2)

Orientation and Navigation of the European Eel Using the Earth's Magnetic Field and Its Possible Implications for Management. (2014) Durif C et al. Conference Paper: American Fisheries Society 144th Annual Meeting. https://www.researchgate.net/publication/267898629_Orientation_and_Navigation_of_the_European_Eel_Using_the_Earth%27s_Magnetic_Field_and_Its_Possible_Implications_for_Management

Potential interactions between diadromous fishes of U.K. conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments. (2012) Gill AB et al. J Fish Biol. 2012 Jul;81(2):664-95. <https://www.ncbi.nlm.nih.gov/pubmed/22803729>

Evidence for Geomagnetic Imprinting as a Homing Mechanism in Pacific Salmon. (2012) Putnam NF et al. Current Biology. Volume 23, Issue 4. Pages 312-316. 18 February 2013 <https://www.sciencedirect.com/science/article/pii/S0960982213000031>

Electromagnetic Field Study. Effects of electromagnetic fields on marine species: A literature review. (2010) Oregon Wave Energy Trust. https://tethys.pnnl.gov/sites/default/files/publications/Effects_of_Electromagnetic_Fields_on_Marine_Species.pdf

Offshore windmills and the effects of electromagnetic fields on fish. (2007) Ohman MC et al. *Ambio*. 2007 Dec;36(8):630-3. <https://www.ncbi.nlm.nih.gov/pubmed/18240676>

Offshore windmills and the effects of electromagnetic fields on fish. (2007) Ohman MC et al. *Ambio*. 2007 Dec;36(8):630-3. <https://www.ncbi.nlm.nih.gov/pubmed/18240676>

Government Letters and Papers Cell Towers

(2016) US Fish and Wildlife Service. **Endangered Species. Communications Tower Siting, Construction, Operation, and Decommissioning Recommendations. Service Interim Guidelines.** <https://www.fws.gov/midwest/endangered/section7/telecomguidance.html>

(2014) Department of Interior **Letter to National Telecommunications and Information Administration Regarding Adverse Impact of Cell Tower Radiation on Wildlife.** Willie Taylor, Director, Office of Environmental Policy and Compliance. https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf

(2014) Albert M Manville. **Status of U.S. Fish and Wildlife Service Developments with Communication Towers with a Focus on Migratory Birds: Updates to Service Staff Involved with Tower Issues – A Webinar. Talking Points and Literature Citations, Available to the Public.** <https://www.fws.gov/midwest/es/planning/pdf/usfws2013revisedguidancecommtowerssupportinginfo27sept.pdf>

(2013) **COMMUNICATION TOWER AND ANTENNA CONSULTATION IN NEW JERSEY.** Albert M. Manville, Senior Wildlife Biologist & Avian-Structural Lead

Division of Migratory Bird Management, U.S. Fish & Wildlife Service. <https://www.fws.gov/northeast/njfieldoffice/pdf/celltower.pdf>

(2009) Albert M. Manville. **Towers, turbines, power lines, and buildings – steps being taken by the U.S. Fish and Wildlife Service to avoid or minimize take of migratory birds at these structures.** Manville, A.M., II. 2009. In C.J. Ralph and T.D. Rich (editors). *Proceedings 4th International Partners in Flight Conference*, February 2008, McAllen, TX. <https://www.fws.gov/migratorybirds/pdf/management/manville2009.pdf>

(2009) **U.S. Fish and Wildlife Service Briefing Paper on the Need for Research into the Cumulative Impacts of Communication Towers on Migratory Birds and Other Wildlife in the United States Division of Migratory Bird Management (DMBM) Public Release Briefing April 17, 2009;** Discusses Potential Radiation Impacts to Birds and Other Pollinators serving as a review of some of the literature. <http://electromagnetichealth.org/pdf/CommTowerResearchNeedsPublicBriefing-2-409.pdf>

(2009) **The Effect of Cell Towers on Birds and Bats at Rock Creek Park, Washington, D.C.** Dickey and Gates. University of Maryland Center for Environmental Science to Resource Management Specialist National Park Service. <http://www.npshistory.com/publications/rocr/cell-towers-birds-bats.pdf>

(2007) **Concerns Over Potential Radiation Impacts of Cellular Communication Towers on Migratory Birds and Other Wildlife,** Albert M. Manville, PhD, Senior Wildlife Specialist Gives Congressional Staff Briefing on the Environmental and Human Health Effects of Radiofrequency (RF) Radiation, House Capitol 5, Washington DC. Powerpoint presentation. https://ehtrust.org/wp-content/uploads/manville_dc.compressed.pdf

(2007) **US Fish and Wildlife letter to Federal Communications Commission regarding effects of communication towers on migratory birds. Notice of Proposed Rulemaking,** WT Docket No. 03-187, FCC 06-164, Federal Register 71(225): 67510-67518, November 22. <http://apps.fcc.gov/ecfs/document/>

[view;jsessionid=nCRdSVrXPXQhlpnr8lbQC3GZQcvNnKhgHnnJWgTLQ2ZCRV3DCsFc!1357496456!-1864380355?id=6518724776](https://www.fs.usda.gov/treeearch/pubs/32105)

(2005) Albert M Manville. Bird strikes and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science – next steps toward mitigation. Bird Conservation Implementation in the Americas: Proceedings 3rd International Partners in Flight Conference 2002, C.J. Ralph and T.D. Rich (eds.). U.S.D.A. Forest Service General Technical Report PSW-GTR-191, Pacific Southwest Research Station, Albany, CA: 1051-1064. <https://www.fs.usda.gov/treeearch/pubs/32105>

Immune System Effects

Immune responses of a wall lizard to whole-body exposure to radiofrequency electromagnetic radiation. (2016) Mina D et al. International journal of Radiation Biology. Volume 92, Feb 2016. Issue 3. <https://www.tandfonline.com/doi/abs/10.3109/09553002.2016.1135262>

LED Light Affects on Animals and Insects

Artificial light at night as a new threat to pollination. (2017) Knop E et al. Nature. Volume 548, pages206–209. <https://www.nature.com/articles/nature23288>

Impacts of Artificial Light at Night on Biological Timings. (2017) Gaston et al. Annual Review of Ecology, Evolution and Systematics. Vol 48. 2017. <https://www.annualreviews.org/doi/full/10.1146/annurev-ecolsys-110316-022745>

Magnetoreception

Evidence that Magnetic Navigation and Geomagnetic Imprinting Shape Spatial Genetic Variation in Sea Turtles. (2018) Brothers JR and Lohmann KJ. Curr Biol. 2018 Apr 23;28(8):1325-1329. <https://www.ncbi.nlm.nih.gov/pubmed/29657117>

Glass eels (*Anguilla anguilla*) have a magnetic compass linked to the tidal cycle. (2017) Cresci A et al. Science Advances 09 Jun 2017:Vol. 3, no. 6, <http://advances.sciencemag.org/content/3/6/e1602007>

Very weak oscillating magnetic field disrupts the magnetic compass of songbird migrants. (2017) Pakamov A et al. J R Soc Interface. 2017 Aug;14(133). <https://www.ncbi.nlm.nih.gov/pubmed/28794163>

Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird (*Erithacus rubecula*) than Strong Narrow-Band Fields. (2016). Schwarze S et al. Front Behav Neuroscience. March, 2016. <http://www.ncbi.nlm.nih.gov/pubmed/?term=PMID%3A+27047356>

Magnetoreception in the wood mouse (*Apodemus sylvaticus*): Influence of weak frequency-modulated radio frequency fields. (2015) Malkemper EP et al. Scientific Reports. April 2015. https://www.researchgate.net/publication/275654911_Magnetoreception_in_the_wood_mouse_Apodemus_sylvaticus_Influence_of_weak_frequency-modulated_radio_frequency_fields

Orientation and Navigation of the European Eel Using the Earth's Magnetic Field and Its Possible Implications for Management. (2014) Durif C et al. Conference Paper: American Fisheries Society 144th Annual Meeting. https://www.researchgate.net/publication/267898629_Orientation_and_Navigation_of_the_European_Eel_Using_the_Earth%27s_Magnetic_Field_and_Its_Possible_Implications_for_Management

Geomagnetic imprinting predicts spatio-temporal variation in homing migration of pink and sockeye salmon. (2014) Putman NF J R Soc Interface. 2014 Oct 6;11(99). <https://www.ncbi.nlm.nih.gov/pubmed/25056214>

Sensing Magnetic Directions in Birds: Radical Pair Processes Involving Cryptochrome.(2014) Wiltschko R and Wiltschko W. Biosensors (Basel). 2014 Sep; 4(3): 221–242. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4264356/>

Rapid Learning of Magnetic Compass Direction by C57BL/6 Mice in a 4-Armed ‘Plus’ Water Maze. (2013) Phillips, J et al. *PLoS ONE*8(8):e73112 · August 2013. https://www.researchgate.net/publication/256491013_Rapid_Learning_of_Magnetic_Compass_Direction_by_C57BL6_Mice_in_a_4-Armed_%27Plus%27_Water_Maze

It’s Electric: Biologists Seek to Crack Cell’s Bioelectric Code. (2013) Researchers have found that cells’ bioelectrical communication steers growth and development. It is hoped that if the code can be learned, manipulating cellular signaling could be used to stave off cancer or even regenerate limbs. Scientific America. March 27, 2013. <https://www.scientificamerican.com/article/bioelectric-code/>

Night-migratory songbirds possess a magnetic compass in both eyes. (2012) Engels S et al. *PLoS One*. 2012;7(9):e43271. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3440406/>

The magnetic map of hatchling loggerhead sea turtles. (2012) Lohmann KJ. *Curr Opin Neurobiol*. 2012 Apr;22(2):336-42. <https://www.ncbi.nlm.nih.gov/pubmed/22137566>

Robins have a magnetic compass in both eyes. (2011) Hein CM et al. 2011 Mar 31;471(7340):E11-2; <https://www.ncbi.nlm.nih.gov/pubmed/21455128>

Lateralization of magnetic compass orientation in pigeons. (2010) Hein CM et al. *J R Soc Interface*. 2010 Apr 6;7 Suppl 2:S235-40. <https://www.ncbi.nlm.nih.gov/pubmed/20053653>

Avian magnetite-based magnetoreception: a physiologist’s perspective. (2010). *J R Soc Interface*. 2010 Apr 6; 7(Suppl 2): S193–S205. Cadiou H and McNaughton P. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844004/>

Geomagnetic imprinting: A unifying hypothesis of long-distance natal homing in salmon and sea turtles. (2008) Lohmann KJ et al. *Proc Natl Acad Sci U S A*. 2008 Dec 9;105(49):19096-101. <https://www.ncbi.nlm.nih.gov/pubmed/19060188>

Lateralized response of chicks to magnetic cues. (2008) Rogers LJ et al. *Behav Brain Res*. 2008 Jan 10;186(1):66-71. <https://www.ncbi.nlm.nih.gov/pubmed/17765981>

Two different types of light-dependent responses to magnetic fields in birds.(2005) [Wiltschko R](#), *Curr Biol*. 2005 Aug 23, <http://www.ncbi.nlm.nih.gov/pubmed/16111946>

Resonance effects indicate a radical-pair mechanism for avian magnetic compass. (2004) Ritz T. *Nature*. 2004 May 13;429(6988):177-80. <http://www.ncbi.nlm.nih.gov/pubmed/15141211>

Magnetic compass orientation in European robins is dependent on both wavelength and intensity of light. (2002) Muheim R. *J Exp Biol*. 2002 Dec;205. <http://www.ncbi.nlm.nih.gov/pubmed/12432008>

Magnetite-based magnetoreception. (2001) Kirschvink JL et al. *Current Opinion in Neurobiology*. Volume 11, Issue 4, August 2001 , Pages 462-467. <https://www.sciencedirect.com/science/article/pii/S095943880000235X>

Magnetic Orientation In Birds . (1996). Wiltschko W. and R. Wiltschko *The Journal of Experimental Biology* 199, 29–38 (1996).

Magnetite in human tissues: a mechanism for the biological effects of weak ELF magnetic fields. Kirschvink JL. 1992;Suppl 1:101-13<https://www.ncbi.nlm.nih.gov/pubmed/1285705>

Biogenic Magnetite as a Basis for Magnetic Field Detection in Animals. Biosystems. Vol 13. 181-201. Kirschvink, J., Gould, J. <http://web.gps.caltech.edu/~jkirschvink/pdfs/Biosystems1981.pdf>

The importance of restoration of the atmospheric electrical environment in closed Bioregenerative Life Supporting Systems. (1996) Gorgolewski S. *Adv Space Res.* 1996;18(4-5):283-5. <https://www.ncbi.nlm.nih.gov/pubmed/11538811>

Mammals

(See also PST Scientific Literature Lists on MDSafeTech.org)

The influence of electromagnetic radiation of cell phones on the behavior of animals. (2020) Vet World. 2020 Mar; 13(3): 549–555. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7183456/>

Radiofrequency radiation emitted from Wi-Fi (2.4 GHz) causes impaired insulin secretion and increased oxidative stress in rat pancreatic islets. (2018) Masoumi A et al. *Int J Radiat Biol.* 2018 Sep;94(9): 850-857. <https://www.ncbi.nlm.nih.gov/pubmed/29913098>

Effects of electromagnetic fields exposure on the antioxidant defense system. (2017) Kivrak EG et al. *J Microsc Ultrastructure.* 2017 Oct-Dec; 5(4): 167–176. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6025786/>

Effects of electromagnetic field on testes and semen characteristics in male New Zealand white Rabbits. (2016) Gulay M et al. *Indian Journal of Animal Research* 51(O.F) · October 2016. https://www.researchgate.net/publication/311944035_Effects_of_electromagnetic_field_on_testes_and_semen_characteristics_in_male_New_Zealand_white_Rabbits

[Increased occurrence of nuclear cataract in the calf after erection of a mobile phone base station]. (2012) Hassig et al. *Schweiz Arch Tierheilkd.* 2012 Feb;154(2):82-6. <https://www.ncbi.nlm.nih.gov/pubmed/22287140>

Extremely low-frequency electromagnetic fields disrupt magnetic alignment of ruminant. (2009) Burda H et al. *Proceedings of the National Academy of Science U S A.* 2009 April 7; 106(14): 5708–5713. Published online 2009 March 19. <http://www.pnas.org/content/106/14/5708>

Prevalence of nuclear cataract in Swiss veal calves and its possible association with mobile telephone antenna base stations. (2009) Hässig M et al. *Schweiz Arch Tierheilkd.* 2009 Oct;151(10):471-8. <https://www.ncbi.nlm.nih.gov/pubmed/19780007>

Reproductive and developmental effects of EMF in vertebrate animal models.(2009) Pourlis AF. *August 2009.* Volume 16, Issues 2-3, Pages 179–189. [https://www.pathophysiologyjournal.com/article/S0928-4680\(09\)00015-7/fulltext](https://www.pathophysiologyjournal.com/article/S0928-4680(09)00015-7/fulltext)

Cognitive impairment in rats after long-term exposure to GSM-900 mobile phone radiation. (2008) Nittby H et al. *Bioelectromagnetics* 29: 219-232: 2008. <https://www.ncbi.nlm.nih.gov/pubmed/18044737> Summary: This study showed cognitive impairment in rats after long-term exposure to PM MW radiation. This study of rats shows that after 2 hours per week for 55 weeks there was impaired memory for objects in exposed as compared to sham animals.

Geomagnetic field modulates artificial static magnetic field effect on arterial baroreflex and on microcirculation. (2007) Gimitrov J. *Int J Biometeorol.* 2007 Mar;51(4):335-44. <https://www.ncbi.nlm.nih.gov/pubmed/16983578>

Geomagnetic field effect on cardiovascular regulation. (2004) Gimitrov J and Gimitrov A. Bioelectromagnetics. 2004 Feb;25(2):92-101. <https://www.ncbi.nlm.nih.gov/pubmed/14735558>

Verapamil protective effect on natural and artificial magnetic field cardiovascular impact. (2002) Gmitrov J and Ohkubo C. 2002 Oct;23(7):531-41. <https://www.ncbi.nlm.nih.gov/pubmed/12224057>

Radiation-Induced Changes in the Prenatal Development of Mice. (1997) Magras I and Xenos T. Bioelectromagnetics 18:455-461, 1997. <https://www.ncbi.nlm.nih.gov/pubmed/9261543>

Absence of chronic effect of exposure to short-wave radio broadcast signal on salivary melatonin concentrations in dairy cattle. (1997). Stärk KD et al. Journal of Pineal Research, 22(4), 171-6.. . <http://www.ncbi.nlm.nih.gov/pubmed/9247202>

Non-Thermal, Low Power effects

(See Also PST extensive Scientific Literature lists)

Dr. Martin Pall Literature collection of 170 reviews showing non-thermal effects which are not considered in FCC regulations. <http://electromagnetichealth.org/electromagnetic-health-blog/153-reviews/>

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

Chronic non-thermal exposure of modulated 2450 MHz microwave radiation alters thyroid hormones and behavior of male rats. (2008) Sinha RK. International Journal of Radiation Biology, Vol. 84, No. 6, June 2008, pp. 505 – 513. <https://www.ncbi.nlm.nih.gov/pubmed/18470749>

Microwave Irradiation Affects Gene Expression in G. Ledoigt. (2006) Vian A et al. Plant Signal Behav. 2006 Mar-Apr; 1(2): 67–70. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2633881/>

Transgenic nematodes as biomonitors of microwave-induced stress. (1998) Mutation Research, 399(1), 55-64, 1998. <https://www.sciencedirect.com/science/article/pii/S0027510797002662>

Plants and Seeds

Does Radiation Affect Living Organisms? (2018) Joshi S and Omer I. California Science and Engineering Fair Project 2018. <http://cssf.usc.edu/Current/Projects/J2209.pdf>

Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants. (2017) Halgauge MN. Electromagn Biol Med. 2017;36(2):213-235. <https://www.ncbi.nlm.nih.gov/pubmed/27650031>

Radiofrequency radiations induced genotoxic and carcinogenic effects on chickpea (Cicer arietinum L.) root tip cells. (2017) Qureshi ST. Saudi J Biol Sci. 2017 May;24(4):883-89. <https://www.ncbi.nlm.nih.gov/pubmed/28490961>

Exposure to 915 MHz radiation induces micronuclei in Vicia faba root tips. (2016) [Gustavino B](#), Mutagenesis. 2016 Mar;31(2):187-92. <https://www.ncbi.nlm.nih.gov/pubmed/26476436>

Induction of stress volatiles and changes in essential oil content and composition upon microwave exposure in the aromatic plant Ocimum basilicum. (2016) Lung I et al. Sci Total Environ. 2016 Nov 1;569-570:489-495. <https://www.ncbi.nlm.nih.gov/pubmed/27362630>

Plant Responses to High Frequency Electromagnetic Fields.(2016) A Vian. BioMed Research International. Volume 2016 (2016) <https://www.hindawi.com/journals/bmri/2016/1830262/>

Short-duration exposure to radiofrequency electromagnetic radiation alters the chlorophyll fluorescence of duckweeds (*Lemna minor*). (2014) Senavirathna MD et al. Electromagn Biol Med. 2014 Dec;33(4): 327-34. <https://www.ncbi.nlm.nih.gov/pubmed/24131393>

Influence of microwave frequency electromagnetic radiation on terpene emission and content in aromatic plants. (2014) Soran ML. J Plant Physiol. 2014 Sep 15;171(15):1436-43. <https://www.ncbi.nlm.nih.gov/pubmed/25050479>

Effect of Millimeter Waves with Low Intensity on Peroxidase Total Activity and isoenzyme Composition in Cells of Wheat Seedling Shoots (2013) International Journal of Scientific Research in Environmental Sciences (IJSRES), 1(9), pp. 217-223, 2013. <http://www.ijsrpub.com/uploads/papers/IJSRES/IJSRES-Sep2013/IJSRES-13-54.pdf>

Cell phone radiations affect early growth of *Vigna radiata* (mung bean) through biochemical alterations. (2010) Sharma VP et al. Z Naturforsch C. 2010 Jan-Feb;65(1-2):66-72. <https://www.ncbi.nlm.nih.gov/pubmed/20355324>

Report on Possible Impacts of Communication Cell Towers on Wildlife Including Birds and Bees. The Ministry of Environment and Forest. 2010. http://www.moef.nic.in/downloads/public-information/final_mobile_towers_report.pdf

Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations.(2010) Katie Haggerty. International Journal of Forestry Research, Volume 2010. Article ID 836278 <https://www.hindawi.com/journals/ijfr/2010/836278/>

A possible role for extra-cellular ATP in plant responses to high frequency, low amplitude electromagnetic field. (2008) Roux D et al, Plant Signaling & Behavior 3:6, 383-385; June 2008; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2634308/>

High Frequency (900 MHz) low amplitude (5 V m⁻¹) electromagnetic Field: a genuine environmental stimulus that affects transcription, translation, calcium and energy charge in tomato. (2007) Roux D et al. Planta. 227(4): 88391, 2007. <https://www.ncbi.nlm.nih.gov/pubmed/18026987>

Exposure to radiofrequency radiation induces oxidative stress in duckweed *Lemna minor* L. (2007) Tkalec M et al. Sci Total Environ. 2007 Dec 15;388(1-3):78-89. <https://www.ncbi.nlm.nih.gov/pubmed/17825879>

Plants Respond to GSM-Like Radiation. (2007) Vian A et al. Plant Signal Behav. 2007 Nov-Dec; 2(6): 522–524. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2634357/>

Microwave Irradiation Affects Gene Expression in *G. Ledoigt*.(2006) Vian A et al. Plant Signal Behav. 2006 Mar-Apr; 1(2): 67–70. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2633881/>

Changes in calcium signalling, gravitropism, and statocyte ultrastructure in pea roots induced by calcium channel blockers. (2004) Belyavskaya NA et al. J Gravit Physiol. 2004 Jul;11(2):P209-10. <https://www.ncbi.nlm.nih.gov/pubmed/16240511>

The Effects of Microwaves on the Trees and Other Plants.(2003) Spain. http://www.hese-project.org/de/emf/WissenschaftForschung/Balmori_Dr._Alfonso/showDoc.php?lang=de&header=Dr._%20Balmori&file=THE%20EFFECTS%20OF%20MICROWAVES%20ON%20THE%20TREE%20AND%20OTHER%20PLANTS.html&back=../showAuthor.php?target=Balmori_Dr._Alfonso or http://www.boomaantastingen.nl/onderzoek_bomen_planten.pdf

Growth and yield of winter wheat (*Triticum aestivum* L.) and corn (*Zea mays* L.) near a high voltage transmission line. (2003) Soga G et al. Bioelectromagnetics. 2003 Feb;24(2):91-102. <https://www.ncbi.nlm.nih.gov/pubmed/12524675>

Ultrastructure and calcium balance in meristem cells of pea roots exposed to extremely low magnetic fields. (2001) Belyavskaya NA et al. Adv. Space Res, 28: 645-650. <https://www.ncbi.nlm.nih.gov/pubmed/11803967>

PLANT MITOCHONDRIA AND OXIDATIVE STRESS: Electron Transport, NADPH Turnover, and Metabolism of Reactive Oxygen Species. (2001) Moller IM. *Annu Rev Plant Physiol Plant Mol Biol*. 2001 Jun;52:561-591. <https://www.ncbi.nlm.nih.gov/pubmed/11337409>

[Cytogenetic changes induced by low-intensity microwaves in the species *Triticum aestivum*]. (1998) [Article in Romanian]. Pavel A et al. Rev Med Chir Soc Med Nat Iasi. 1998 Jul-Dec;102(3-4):89-92. <https://www.ncbi.nlm.nih.gov/pubmed/10756851>

Long-term exposure of young spruce and beech trees to 2450-MHz microwave radiation.(1996) Schmutz P et al. Science of the Total Environment. *Volume 180, Issue 1*, 2 February 1996 , Pages 43-48. <https://www.sciencedirect.com/science/article/pii/0048969795049185>

Response of *Pinus sylvestris* L. needles to electromagnetic fields. Cytological and ultrastructural aspects. (1996) Selga Tand Selga M. Skrunda Radio Location Station, Latvia. Science of The Total Environment, 180(1), 65-73, 1996. <https://www.sciencedirect.com/science/article/pii/0048969795049215>

Radio Tracking of Animals

Radiotelemetry and wildlife: Highlighting a gap in the knowledge on radiofrequency radiation effects. (2016) Balmori A. Sci Total Environ. 2016 Feb 1;543(Pt A):662-9. <https://www.ncbi.nlm.nih.gov/pubmed/26615484>

Estimating Duration of Short-Term Acute Effects of Capture Handling and Radiomarking. (2010) Journal of Wildlife Management.(2010) Holt RD et al. 73(6):989 – 995 · December 2010. https://www.researchgate.net/publication/229667015_Estimating_Duration_of_Short-Term_Acute_Effects_of_Capture_Handling_and_Radiomarking

Indirect Negative Impacts of Radio-Collaring: Sex Ratio Variation in Water Voles. (2005) Moorhouse and MacDonald. Journal of Applied Ecology. 22 February 2005. <https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2664.2005.00998.x>

Demography, extinction and intervention in a small population: the case of the Serengeti wild dogs. (1994) Burrows R et al. Proc Biol Sci. 1994 Jun 22;256(1347):281-92. <https://www.ncbi.nlm.nih.gov/pubmed/8058803>

Effects of ear-tagging on survival of moose calves. Journal of Wildlife Management. (1991) 63(1): 354-358 · January 1999. https://www.researchgate.net/publication/236994469_Effects_of_ear-tagging_on_survival_of_moose_calves

EFFECTS OF RADIO TAGS ON SPOTTED OWLS. (1991) Paton P et al. US Forest Service. Department of Agriculture. J Wildl Management 55(4):617-622. <https://www.fs.fed.us/psw/publications/paton/paton1.PDF>

Reproduction

The Effect of Electromagnetic Fields with the Mg²⁺ Cyclotron Frequency on Mouse Reproductive Performance. (2016) Gerardi G et al. *Journal of Electromagnetic Analysis and Applications*, 2016, 8, 115-12. <https://pdfs.semanticscholar.org/28aa/ff0c427d591b52e29bcf83c65ba5d8800486.pdf>

Effects of electromagnetic field on testes and semen characteristics in male New Zealand white Rabbits. (2016) Gulay M et al. *Indian Journal of Animal Research* 51(O.F) · October 2016. https://www.researchgate.net/publication/311944035_Effects_of_electromagnetic_field_on_testes_and_semen_characteristics_in_male_New_Zealand_white_Rabbits

Reptiles

Immune responses of a wall lizard to whole-body exposure to radiofrequency electromagnetic radiation. (2016) Mina D et al. *International journal of Radiation Biology*. Volume 92, Feb 2016. Issue 3. <https://www.tandfonline.com/doi/abs/10.3109/09553002.2016.1135262>

The magnetic map of hatchling loggerhead sea turtles. (2012) Lohmann KJ. *Curr Opin Neurobiol*. 2012 Apr;22(2):336-42. <https://www.ncbi.nlm.nih.gov/pubmed/22137566>

Lizards respond to an extremely low-frequency electromagnetic field. (2010) Nishimura T et al. *Journal of Experimental Biology* 2010 213: 1985-1990. <https://jeb.biologists.org/content/213/12/1985>

Geomagnetic imprinting: A unifying hypothesis of long-distance natal homing in salmon and sea turtles. (2008) Lohmann KJ et al. *Proc Natl Acad Sci U S A*. 2008 Dec 9;105(49):19096-101. <https://www.ncbi.nlm.nih.gov/pubmed/19060188>

Resonance Effect

The Effect of Electromagnetic Fields with the Mg²⁺ Cyclotron Frequency on Mouse Reproductive Performance. (2016) Gerardi G et al. *Journal of Electromagnetic Analysis and Applications*, 2016, 8, 115-12. <https://pdfs.semanticscholar.org/28aa/ff0c427d591b52e29bcf83c65ba5d8800486.pdf>

Trees

Radiofrequency radiation injures trees around mobile phone base stations. (2016) Waldmann-Selsam C. *Sci Total Environ*. 2016 Dec 1;572:554-569. <https://www.ncbi.nlm.nih.gov/pubmed/27552133>

Damage from Chronic High Frequency Exposure; Mobile Telecommunications, WiFi, Radar, Radio Relay Systems, Terrestrial Radio, TV, etc. First Symposium; The effect of electromagnetic radiation on trees, The Groene Paviljoen, Baarn. PowerPoint presentation. (2011) Volker S. Ing. Dipl. Phys. 18.2011.

Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations. (2010) Katie Haggerty. *International Journal of Forestry Research*. Volume 2010, <https://www.hindawi.com/journals/ijfr/2010/836278/>

Does the Skrunda Radio Location Station diminish the radial growth of pine trees. 1996. Balodis VG. et al. *Sci. Total Environ.*, 180: 57-64. <https://www.sciencedirect.com/science/article/pii/S0048969795049207>

Response of Pinus sylvestris L. needles to electromagnetic fields. Cytological and ultrastructural aspects. (1996) *Science of The Total Environment*. Selga and Selga. Volume 180, Issue 1,2. February 1996, Pages 65-73. <https://www.sciencedirect.com/science/article/pii/S0048969795049215>

Studies on the Effects of Radio-Frequency Fields on Conifers. (1996) Lerchl D et al. University of Wuppertal, Chair of Electromagnetic Theory; Conference Poster. <http://www.iddd.de/umtsno/lebewesen/lebewesen7.htm>

Long-term exposure of young spruce and beech trees to 2450-MHz microwave radiation. (1996). Schmutz P et al. Science of the Total Environment. Volume 180, issue 1,2 February 1996 , Pages 43-48. <https://www.sciencedirect.com/science/article/pii/0048969795049185>

Observational Non-published Reports on Pets

Swiss Veterinary Office regarding improvement in pets and wonders health when wireless devices removed. 2007. [Veterinary Clinic Experience with EMF Swiss veterinary clinic paper, english, experience with EMF and animals 2007](#)

Videos – Observational – of Unusual Behavior or Death of Wildlife: Non-Scientific from Community

Birds Fall From Sky in Multiple Locations – cause unknown

<https://www.youtube.com/watch?v=TiFM-uGh51Y&feature=youtu.be>

This observational video shows very unusual behavior and death of birds in several areas, including NASCAR Hall of Fame in Charlotte, North Carolina; Houston, Texas where birds dropped to the ground. [Birds Fall From Sky. 5G Technology?](#)

100 Geese Fall From Sky in Idaho Falls After Lightning Storm

<https://www.facebook.com/LocalNews8/videos/10156360446873872/>

Linda Larson recounts watching 100 geese falling from the sky. It is presumed from lightning storm. April 11, 2018. There is evidence that birds sense storms and avoid them however there have been [reports](#) of dozens of geese dying in lightning storms. [More than 100 dead geese plunge from the sky in Idaho in ‘bizarre’ incident](#)

Bees Die Between 2 Cell Tower Poles

<https://www.youtube.com/watch?v=X5IhKHGDkM>

In Sierra Madre a bystander videos bee death between 2 cell towers that have multiple antenna. A viewer commented that they should be brought to a local university or government [Bee Testing Lab](#) to determine cause of death or if this is normal.

<https://sustainablepulse.com/2018/03/22/worlds-largest-animal-study-on-cell-tower-radiation-confirms-cancer-link/#.X2qLSLvQhsM>

World's Largest Animal Study on Cell Tower Radiation Confirms Cancer Link

Posted on Mar 22 2018 - 11:34pm by [Sustainable Pulse](#)

Researchers with the renowned Ramazzini Institute (RI) in Italy announce that a large-scale lifetime [study](#) of lab animals exposed to environmental levels of cell tower radiation developed cancer. A \$25 million study of much higher levels of cell phone radiofrequency (RF) radiation, from the [US National Toxicology Program](#) (NTP), has also reported finding the same unusual cancer called Schwannoma of the heart in male rats treated at the highest dose. In addition, the RI study of cell tower radiation also found increases in malignant brain (glial) tumors in female rats and precancerous conditions including Schwann cells hyperplasia in both male and female rats.



Source: ehtrust.org

“Our findings of cancerous tumors in rats exposed to environmental levels of RF are consistent with and reinforce the results of the US NTP studies on cell phone radiation, as both reported increases in the same types of tumors of the brain and heart in Sprague-Dawley rats. Together, these studies provide sufficient evidence to call for the International Agency for Research on Cancer (IARC) to re-evaluate and re-classify their conclusions regarding the carcinogenic potential of RFR in humans,” said Fiorella Belpoggi PhD, study author and RI Director of Research.

The Ramazzini study exposed 2448 Sprague-Dawley rats from prenatal life until their natural death to “environmental” cell tower radiation for 19 hours per day (1.8 GHz GSM radiofrequency radiation (RFR) of 5, 25 and 50 V/m). RI exposures mimicked base station emissions like those from cell tow-

er antennas, and exposure levels were far less than those used in the NTP studies of cell phone radiation.

“All of the exposures used in the Ramazzini study were below the US FCC limits. These are permissible exposures according to the FCC. In other words, a person can legally be exposed to this level of radiation. Yet cancers occurred in these animals at these legally permitted levels. The Ramazzini findings are consistent with the NTP study demonstrating these effects are a reproducible finding,” explained Ronald Melnick PhD, formerly the Senior NIH toxicologist who led the design of the NTP study on cell phone radiation now a Senior Science Advisor to Environmental Health Trust (EHT). “Governments need to strengthen regulations to protect the public from these harmful non-thermal exposures.”

“This important article from one of the most acclaimed institutions of its kind in the world provides a major new addition to the technical literature indicating strong reasons for concern about electromagnetic radiation from base stations or cell towers,” stated Editor in Chief of Environmental Research Jose Domingo PhD, Professor of Toxicology, School of Medicine at Reus University, Catalonia, Spain.

“The US NTP results combined now with the Ramazzini study, reinforce human studies from our team and others providing clear evidence that RF radiation causes acoustic neuromas (vestibular schwannoma) and gliomas, and should be classified carcinogenic to humans,” stated Lennart Hardell MD, PhD, physician-epidemiologist with the Department of Oncology, University Hospital, Örebro, Sweden, who has published extensively on environmental causes of cancer including Agent Orange, pesticides and cell phone radiofrequency radiation.

“The evidence indicating wireless is carcinogenic has increased and can no longer be ignored,” stated University of Toronto Dalla Lana School of Public Health Professor Emeritus Anthony B. Miller MD, Member of the Royal Colleges of Physicians of Canada and the UK, and Senior Medical Advisor to EHT who is also a long-term advisor to the World Health Organization.

“This study raises concerns that simply living close to a cell tower will pose threats to human health. Governments need to take measures to reduce exposures from cell tower emissions. Cell towers should not be near schools, hospitals or people’s homes. Public health agencies need to educate the public on how to reduce exposure from all sources of wireless radiofrequency radiation—be it from cell towers or cell phones or Wi-Fi in schools,” stated David O. Carpenter MD, former Dean of the School of Public Health at the University at Albany. “This is particularly urgent because of current plans to place small 5G cell towers about every 300 meters in every street across the country. These 5G ‘small cell’ antennas will result in continuous exposure to everyone living nearby and everyone walking down the street. The increased exposures will increase risk of cancer and other diseases such as electro-hypersensitivity.”

Ramazzini Institute investigators have completed nearly 500 cancer bioassays on more than 200 compounds, and their study design is unique in that animals are allowed to live until their natural deaths in order to allow detection of late-developing tumors. Eighty percent of all human cancers are [late-developing](#), occurring in humans after 60 years of age. This longer observation period has allowed the RI to detect such later-occurring tumors for a number of chemicals, and their published research includes studies of [benzene](#), [xylenes](#), [mancozeb](#), [formaldehyde](#) and [vinyl chloride](#). The Ramazzini research results come in the wake of similar findings from the US National Toxicology Program (NTP) large-scale experimental [studies](#) on cell phone radiation. Both studies [found](#) sta-

tistically significant increases in the development of the same type of very rare and highly malignant tumor in the heart of male rats—schwannomas.

“This publication is a serious cause for concern,” stated Annie J. Sasco MD, DrPH, SM, MPH, retired Director of Research at the INSERM (French NIH) and former Unit Chief at the International Agency for Research on Cancer/World Health Organization, France, who commented that, “some of the results are not statistically significant due to the relatively small number of animals involved. Yet, that does not mean they should be ignored. Larger studies could turn out statistically significant results and in any event statistical significance is just one aspect of evaluation of the relation between exposure and disease. Biological significance and concordance of results between humans and animals clearly reinforces the strength of the evidence of carcinogenicity. The facts that both experimental studies found the same types of rare tumors, which also have pertinence to the human clinical picture, is striking.”

“Such findings of effects at very low levels are not unexpected,” stated Devra Davis PhD, MPH, president of EHT, pointing to a Jacobs University replication animal [study](#) published in 2015 that also found very low levels of RFR promoted tumor growth. “This study confirms an ever growing literature and provides a wake-up call to governments to enact protective policy to limit exposures to the public and to the private sector to make safe radiation-free technology available.”

In January 2017 at an [international conference](#) co-sponsored by Environmental Health Trust and the Israel Institute for Advanced Study at Hebrew University, Fiorella Belpoggi PhD, Director of Research at the Ramazzini Institute, presented the study design and the findings that RFR-exposed animals had significantly lower litter weights. Belpoggi’s [presentation](#) and [slides](#) are available online. The Ramazzini findings of lower litter weights are consistent with the NTP study, which also found lower litter weights in prenatally exposed animals. At that time, the Italian journal Corriere published an [article](#) about the presentation of the Ramazzini study and quoted Belpoggi’s recommendation of “maximum precaution for children and pregnant women.”

Noting that “current standards were not set to protect children, pregnant women, and the growing numbers of infants and toddlers for whom devices have become playthings,” Davis, who is also Visiting Professor of Medicine of Hebrew University Medical Center and Guest Editor in Chief of the journal Environmental Research, added, “Current two-decade old FCC limits were set when the average call was six minutes and costly cell phones were used by very few. These important, new, game-changing studies show that animals develop the same types of unusual cancers that are being seen in those few human epidemiological studies that have been done. In light of these results, Environmental Health Trust joins with public health experts from the states of California, Connecticut and Maryland, as well as those in France, Israel and Belgium to call on government and the private sector to carry out major ongoing public health educational campaigns to promote safer phone and personal device technology, to require and expedite fundamental changes in hardware and software to reduce exposures to RFR/microwave radiation throughout indoor and outdoor environments, and to institute major monitoring, training and research programs to identify solutions, future problems and prevention of related hazards and risks.”

“More than a dozen countries [recommend](#) reducing radiofrequency radiation exposure to children, and countries such as China, Italy, India and Russia have far more stringent cell tower radiation regulations in place when compared to the United States FCC. However, this study provides scientific evidence that governments can use to take even further action,” stated Theodora Scarato, Executive Director of EHT.

The article is “[Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz base station environmental emission](#)” by L. Falcioni, L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, [D. Mandrioli](#), M. Manservigi, F. Manservigi, I. Manzoli, I. Menghetti,

R. Montella, S. Panzacchi, D. Sgargi, V. Stollo, A. Vornoli, F. Belpoggi (doi.org/10.1016/j.envres.2018.01.037). It appears in [Environmental Research](#) published by [Elsevier](#).