All links incorporated herein by reference.

Electromagnetic fields disrupt the pollination service by honeybees

https://www.science.org/doi/10.1126/sciadv.adh1455?referrer=https%3A%2F%2Fduckduckgo.com%2F

https://pubmed.ncbi.nlm.nih.gov/20560769/

Abstract

We assessed the effect that electromagnetic field (EMF) exerts on honeybees' pollination efficiency using field and laboratory experiments. First, we measured levels of gene and protein expression in metabolic pathways involved in stress and behavioral responses elicited by EMF. Second, we assessed the effect of EMF on honeybee behavior and seed production by the honeybee-pollinated California poppy and, lastly, by measuring the consequences of pollination failure on plants' community richness and abundance. EMF exposure exerted strong physiological stress on honeybees as shown by the enhanced expression of heat-shock proteins and genes involved in antioxidant activity and affected the expression levels of behavior-related genes. Moreover, California poppy individuals growing near EMF received fewer honeybee visits and produced fewer seeds than plants growing far from EMF. Last, we found a hump-shaped relationship between EMF and plant species richness and plant abundance. Our study provides conclusive evidence of detrimental impacts of EMF on honeybee's pollination behavior, leading to negative effects on plant community.

https://link.springer.com/article/10.1007/s10669-011-9307-z

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Nonthermal GSM RF and ELF EMF effects

upon rat BBB permeability

Abstract

Since the late 1980s, our group has examined the effects of radiofrequency electromagnetic fields (RF-EMF), including pulse-modulated waves of the type emitted by mobile phones, upon the blood–brain barrier. In more than 2,000 rats, we have repeatedly demonstrated a passage of the rats' own albumin from the blood through the brain capillaries into the surrounding brain parenchyma at SAR values down to 0.1mW/kg. In most of these experiments, the animals were exposed in TEM-cells, ventilated by an external electrical fan at 50 Hz. In the present study, we examined whether the extremely low frequency (ELF) magnetic fields from the fan (50 Hz, 0.3–1.5 μT) might add to the RF effect. Sixty-four rats were divided into 4 groups: RF only, ELF only and RF + ELF exposure plus a sham group. The GSM-900 MHz RF exposure was at the very low, nonthermal, average whole-body SAR level 0.4 mW/kg. Demonstration of the normally occurring albumin extravasation in the basal hypothalamus is our inbuilt control proving that the staining is reliable. Two full series of staining of the whole material gave negative results for hypothalamus. Not until we changed to avidin, biotin, and antibodies from a third supplier, we received an acceptable staining. Twenty-five percent of the RF animals had a pathological albumin leakage, while the ELF and RF + ELF groups with three and two pathological findings, respectively, were not significantly different from the control group. We conclude that the use of external fans has had no major influence upon the result.

https://pubmed.ncbi.nlm.nih.gov/20560769/

Mobile phone mast effects on common frog (Rana temporaria) tadpoles: the city turned into a laboratory

Abstract

An experiment has been made exposing eggs and tadpoles of the common frog (Rana temporaria) to electromagnetic radiation from several mobile (cell) phone antennae located at a distance of 140 meters. The experiment lasted two months, from the egg phase until an advanced phase of tadpole prior to metamorphosis. Measurements of electric field intensity (radiofrequencies and microwaves) in V/m obtained with three different devices were 1.8 to 3.5 V/m. In the exposed group (n = 70), low coordination of movements, an asynchronous growth, resulting in both big and small tadpoles, and a high mortality (90%) was observed. Regarding the control group (n = 70) under the same conditions but inside a Faraday cage, the coordination of movements was normal, the development was synchronous, and a mortality of 4.2% was obtained. These results indicate that radiation emitted by phone masts in a real situation may affect the development and may cause an increase in mortality of exposed tadpoles. This research may have huge implications for the natural world, which is now exposed to high microwave radiation levels from a multitude of phone masts.

US Dept. of the Interior
https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf

UNESCO REPORT WILDLIFE DISSAPEARANCE AND PULSED MICROWAVE RADIATION
https://citizensforaradiationfreecommunity.org/wp-content/uploads/2020/01/Mt-Nardi-Wildlife-Report-to-UNESCO-FINAL.pdf

Article…
MILLIONS OF BEES DIE, ARE ELECTROMAGNETIC SIGNALS TO BLAME?
http://www.newmediaexplorer.org/sepp/2007/03/06/millions_of_bees_die_are_electromagnetic_signals_to_blame.htm

https://pubmed.ncbi.nlm.nih.gov/27552133/

Radiofrequency radiation injures trees around mobile phone base stations

Abstract

In the last two decades, the deployment of phone masts around the world has taken place and, for many years, there has been a discussion in the scientific community about the possible environmental impact from mobile phone base stations. Trees have several advantages over animals as experimental subjects and the aim of this study was to verify whether there is a connection between unusual (generally unilateral) tree damage and radiofrequency exposure. To achieve this, a detailed long-term (2006-2015) field monitoring study was performed in the cities of Bamberg and Hallstadt (Germany). During monitoring, observations and photographic recordings of unusual or unexplainable tree damage were taken, alongside the measurement of electromagnetic radiation. In 2015 measurements of RF-EMF (Radiofrequency Electromagnetic Fields) were carried out. A polygon spanning both cities was chosen as the study site, where 144 measurements of the radiofrequency of electromagnetic fields were taken at a height of 1.5m in streets and parks at different locations. By interpolation of the 144 measurement points, we were able to compile an electromagnetic map of the power flux density in Bamberg and Hallstadt. We selected 60 damaged trees, in addition to 30 randomly selected trees and 30 trees in low radiation areas (n=120) in this polygon. The measurements of all trees revealed significant differences between the damaged side facing a phone mast and the opposite side, as well as differences between the exposed side of damaged trees and all other groups of trees in both sides. Thus, we found that side differences in measured values of power flux density corresponded to side differences in damage. The 30 selected trees in low radiation areas (no visual contact to any phone mast and power flux density under 50μW/m^2) showed no damage. Statistical analysis demonstrated that electromagnetic radiation from mobile phone masts is harmful for trees. 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.

https://pubmed.ncbi.nlm.nih.gov/23915130/

Drosophila oogenesis as a bio-marker responding to EMF sources

Abstract

The model biological organisms Drosophila melanogaster and Drosophila virilis have been utilized to assess effects on apoptotic cell death of follicles during oogenesis and reproductive capacity (fecundity) decline. A total of 280 different experiments were performed using newly emerged flies exposed for short time daily for 3-7 d to various EMF sources including: GSM 900/1800 MHz mobile phone, 1880-1900 MHz DECT wireless base, DECT wireless handset, mobile phone-DECT handset combination, 2.44 GHz wireless network (Wi-Fi), 2.44 GHz blue tooth, 92.8 MHz FM generator, 27.15 MHz baby monitor, 900 MHz CW RF generator and microwave oven's 2.44 GHz RF and magnetic field components. Mobile phone was used as a reference exposure system for evaluating factors considered very important in dosimetry extending our published work with D. melanogaster to the insect D. virilis. Distance from the emitting source, the exposure duration and the repeatability were examined. All EMF sources used created statistically significant effects regarding fecundity and cell death-apoptosis induction, even at very low intensity levels (0.3 V/m blue tooth radiation), well below ICNIRP's guidelines, suggesting that Drosophila oogenesis system is suitable to be used as a biomarker for exploring potential EMF bioactivity. Also, there is no linear cumulative effect when increasing the duration of exposure or using one EMF source after the other (i.e. mobile phone and DECT handset) at the specific conditions used. The role of the average versus the peak E-field values as measured by spectrum analyzers on the final effects is discussed.

https://link.springer.com/article/10.1007/s10669-009-9248-y

The incidence of electromagnetic pollution on wild mammals: A new “poison” with a slow effect on nature?

Abstract

A review on the effects of radiofrequency radiation from wireless telecommunications on living organisms and its possible impact on wild mammals are presented. Physical and technological characteristics of mobile telephone and phone masts, the scientific discoveries that are of interest in the study of their effects on the wildlife, action mechanisms on biological systems and experimental difficulties are described. Keeping in mind that electromagnetic pollution (in the microwave and radiofrequency range) is a possible source for decline of some mammal populations, it is of great importance to carry out studies on the effects of this new pollutant to wildlife. Some research types that could be useful to determine adverse health effects are proposed.

https://pubmed.ncbi.nlm.nih.gov/23977878/

Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some wireless apparatus

Abstract

Society is confronted with an increasing number of applications making use of wireless communication. We also notice an increasing awareness about potentially harmful effects of the related electromagnetic fields on living organisms. At

present, it is not realistic to expect that wireless communication will decrease or disappear within the near future. That is why we currently are investigating the mechanisms behind these effects and the effectiveness of possible solutions. In order to be efficient and effective, we designed and validated a fast and easy test on ants - these insects being used as a biological model - for revealing the effect of wireless equipments like mobile phones, smartphones, digital enhanced cordless telephone (DECT) phones, WiFi routers and so on. This test includes quantification of ants' locomotion under natural conditions, then in the vicinity of such wireless equipments. Observations, numerical results and statistical results allow detecting any effect of a radiating source on these living organisms.

Mobile phone mast effects on common frog (Rana temporaria) tadpoles: the city turned into a laboratory

Abstract

An experiment has been made exposing eggs and tadpoles of the common frog (Rana temporaria) to electromagnetic radiation from several mobile (cell) phone antennae located at a distance of 140 meters. The experiment lasted two months, from the egg phase until an advanced phase of tadpole prior to metamorphosis. Measurements of electric field intensity (radiofrequencies and microwaves) in V/m obtained with three different devices were 1.8 to 3.5 V/m. In the exposed group (n = 70), low coordination of movements, an asynchronous growth, resulting in both big and small tadpoles, and a high mortality (90%) was observed. Regarding the control group (n = 70) under the same conditions but inside a Faraday cage, the coordination of movements was normal, the development was synchronous, and a mortality of 4.2% was obtained. These results indicate that radiation emitted by phone masts in a real situation may affect the development and may cause an increase in mortality of exposed tadpoles. This research may have huge implications for the natural world, which is now exposed to high microwave radiation levels from a multitude of phone masts.

https://pmc.ncbi.nlm.nih.gov/articles/PMC3052591/

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

Abstract

The present study was carried out to find the effect of cell phone radiations on various biomolecules in the adult workers of *Apis mellifera* L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.

https://www.researchgate.net/publication/336408960_Increased_aggression_and_reduced_aversive_learning_in_honey_bees_exposed_to_extremely_low_frequency_electromagnetic_fields

Increased aggression and reduced aversive learning in honey bees exposed to extremely low frequency electromagnetic fields

Honey bees, Apis mellifera, are a globally significant pollinator species and are currently in decline, with losses attributed to an array of interacting environmental stressors. Extremely low frequency electromagnetic fields (ELF EMFs) are a lesser-known abiotic environmental factor that are emitted from a variety of anthropogenic sources, including power lines, and have recently been shown to have a significant impact on the cognitive abilities and behaviour of honey bees.

Here we have investigated the effects of field-realistic levels of ELF EMFs on aversive learning and aggression levels, which are critical factors for bees to maintain colony strength. Bees were exposed for 17 h to 100 μT or 1000 μT ELF EMFs, or a sham control. A sting extension response (SER) assay was conducted to determine the effects of ELF EMFs on aversive learning, while an intruder assay was conducted to determine the effects of ELF EMFs on aggression levels. Exposure to both 100 μT and 1000 μT ELF EMF reduced aversive learning performance by over 20%. Exposure to 100 μT ELF EMFs also increased aggression scores by 60%, in response to intruder bees from foreign hives. These results indicate that short-term exposure to ELF EMFs, at levels that could be encountered in bee hives placed under power lines, reduced aversive learning and increased aggression levels. These behavioural changes could have wider ecological implications in terms of the ability of bees to interact with, and respond appropriately to, threats and negative environmental stimuli.

https://ui.adsabs.harvard.edu/abs/1996ScTEn.180...75M/abstract

The effect of electromagnetic radiation from the Skrunda Radio Location Station on Spirodela polyrhiza (L.) Schleiden cultures

ABSTRACT

The effect of electromagnetic radiation from the Skrunda Radio Location Station was studied on the vegetative growth and morphology of the duckweed Spirodela polyrhiza (L.) Schleiden plant in the next generation. The impact of plant development stage and length of the exposure period were examined. The effect of short-term (5-day) exposures of Spirodela cultures depended on the stage of development at the time of exposure. Generally, the vegetative reproduction rate was accelerated in the first 20 days after the end of exposure. Exposure of plants just beginning formation lowered the vegetative growth rate. Eighty-eight-hour exposure caused the appearance of some abnormal individuals after 30 days of growth. At 55 days, various morphological and developmental abnormalities appeared in 6—10 daughter plants from 10 exposed mother plants, compared with 0.1 plants per 10 in the control condition. Plants developed completely to daughter fronds under exposure from the electromagnetic field had a shorter life-span (67

days compared to 87 days in the control) and fewer subsequent daughters (total eight compared to 10 in the control group).

https://link.springer.com/article/10.1007/s10661-024-12623-0

1.

Review on the impact of cell phone radiation effects on green plants

Abstract

The aim of this review is to assess the impact of cell phone radiation effects on green plants. Rapid progress in networking and communication systems has introduced frequency- and amplitude-modulated technologies to the world with higher allowed bands and greater speed by using high-powered radio generators, which facilitate high definition connectivity, rapid transfer of larger data files, and quick multiple accesses. These cause frequent exposure of cellular radiation to the biological world from a number of sources. Key factors like a range of frequencies, time durations, power densities, and electric fields were found to have differential impacts on the growth and development of green plants. As far as the effects on green plants are concerned in this review, alterations in their morphological characteristics like overall growth, canopy density, and pigmentation to physiological variations like chlorophyll fluorescence and change in membrane potential etc. have been found to be affected by cellular radiation. On the other hand, elevated oxidative status of the cell, macromolecular damage, and lipid peroxidation have been found frequently. On the chromosomal level, micronuclei formation, spindle detachments, and increased mitotic indexes etc. have been noticed. Transcription factors were found to be overexpressed in many cases due to the cellular radiation impact, which shows effects at the molecular level.

https://onlinelibrary.wiley.com/doi/epdf/10.1155/2010/836278

Adverse Influence of Radio Frequency Background on

Trembling Aspen Seedlings: Preliminary Observations

Research article

https://link.springer.com/article/10.1007/s11157-020-09563-9

Sensitivity of plants to high frequency electromagnetic radiation: cellular mechanisms and morphological changes

ABSTRACT

The technological advancement and increased usage of wireless and other communication devices have greatly enhanced the level of radiofrequency electromagnetic field radiation (EMF-r) in the environment. It has resulted in unprecedented increased exposure of living organisms to these radiations. Most of the studies in past have, however, focused on animal systems and comparatively less attention has been paid to plants with studies reporting various, sometimes contradictory effects. This review is an attempt to provide a critical appraisal of the available reports regarding the impacts of these radiations on plant development and the underlying physiological, biochemical, and molecular mechanisms involved. Here, we propose that the main entry point for the biological effects of EMF-r corresponds to an increase in ROS metabolism and cytosolic calcium that leads to various cellular responses including changes in gene expression and/or enzymatic activities, which could ultimately result in immediate cellular alterations or delayed plant growth. This may constitute a new perspective in the interpretation of plant responses to EMF-r exposure. Understanding the impacts of EMF-r and the inherent abilities of plants to cope up with such changes should lead to EMF-r being considered as full-fledged environmental signals that are perceived by the plants and integrated into their development patterns.

https://www.tandfonline.com/doi/full/10.1080/15368378.2016.1220389

Weak radiofrequency radiation exposure from mobile phone radiation on plants

The aim of this article was to explore the hypothesis that non-thermal, weak, radiofrequency electromagnetic fields (RF-EMF) have an effect on living plants. *Subject and methods*: In this study, we performed an analysis of the data extracted from the 45 peer-reviewed scientific publications (1996–2016) describing 169 experimental observations to detect the physiological and morphological changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation. Twenty-nine different species of plants were considered in this work. *Results*: Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%, $p < 0.001$). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that 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 ($p = 0.0161$). *Conclusion*: The available literature on the effect of RF-EMFs on plants to date observed the significant trend
of radiofrequency radiation influence on plants. Hence, this study provides new evidence supporting our hypothesis. Nonetheless, this endorses the need for more experiments to observe the effects of RF-EMFs, especially for the longer exposure durations, using the whole organisms. The above observation agrees with our earlier study, in that it supported that it is not a well-grounded method to characterize biological effects without considering the exposure duration. Nevertheless, none of these findings can be directly associated with human; however, on the other hand, this cannot be excluded, as it can impact the human welfare and health, either directly or indirectly, due to their complexity and varied effects (calcium metabolism, stress proteins, etc.). This study should be useful as a reference for researchers conducting epidemiological studies and the long-term experiments, using whole organisms, to observe the effects of RF-EMFs.

https://pubs.acs.org/estlcu/article/11/1/3/345739/Addressing-Wildlife-Exposure-to-Radiofrequency

Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action

ABSTRACT

With the rapid global expansion of mobile communication networks and the introduction of new radiofrequencies, especially above 6 GHz with the emergence of 5G/6G technology, there is an urgent requirement to investigate and tackle the possible effects of radiofrequency electromagnetic field emissions on wildlife. Here, we highlight (i) the pressing need for robust research on this topic, (ii) the inadequacy of existing guidelines from the International Commission for Non-Ionizing Radiation Protection, which solely address human health, and (iii) the lack of attention given to wildlife exposure to radiofrequency electromagnetic field levels when creating and/or restoring wildlife habitats and deploying new radiofrequency electromagnetic field sources. We call for a common worldwide agenda that would prioritize research on wildlife exposure to radiofrequency electromagnetic fields and for an independent international organization to address this issue. Finally, we provide key recommendations aimed at reducing wildlife exposure to radiofrequency electromagnetic fields while awaiting further evidence.

https://www.nature.com/articles/s41598-018-22271-3

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

Abstract

Insects are continually exposed to Radio-Frequency (RF) electromagnetic fields at different frequencies. The range of frequencies used for wireless telecommunication systems will increase in the near future from below 6 GHz (2 G, 3 G, 4 G, and WiFi) to frequencies up to 120 GHz (5 G). This paper is the first to report the absorbed RF electromagnetic power in four different types of insects as a function of frequency from 2 GHz to 120 GHz. A set of insect models was obtained using novel Micro-CT (computer tomography) imaging. These models were used for the first time in finite-difference time-domain electromagnetic simulations. All insects showed a dependence of the absorbed power on the frequency. All insects showed a general increase in absorbed RF power at and above 6 GHz, in comparison to the absorbed RF power below 6 GHz. Our simulations showed that a shift of 10% of the incident power density to frequencies above 6 GHz would lead to an increase in absorbed power between 3–370%.