

# ElectrosmogReport

Expert information on the significance of electromagnetic fields for the environment and human health



Dear readers,

With the 1/2019 edition, the ElektrosmogReport has been published for the first time in English. Over the past 25 years, the editorial staff of the German edition has reviewed scientific studies each month. The ElektrosmogReport is available online as a free download at the database website [www.EMFData.org](http://www.EMFData.org). In Germany, the ElektrosmogReport is the only professional magazine that reviews available scientific studies on a regular basis. With the new English edition, we would also like to make this report available to a global audience. In view of the rapidly increasing exposure of the public to nonionizing radiation as a result of the massive proliferation of smartphones and 5G technologies, we are urgently in need of scientific clarity to provide well-established arguments for establishing protective and preventive policies.

The ElektrosmogReport will be published every other month. To stay informed about the ElektrosmogReport, simply sign up for the newsletter at [www.EMFData.org](http://www.EMFData.org). If you have any suggestions for reviews and new studies, please e-mail us.

Peter Hensinger,  
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## **2.45 GHz microwave radiation impairs learning, memory, and hippocampal synaptic plasticity in the rat**

By: Karimi N, Bayat M, Haghani M, Saadi H F, Ghazipour G R. Published in: *Toxicology and Industrial Health* 2018; 34(12), 873–883.

The use of wireless communication devices in both the private and the public sector continues to grow. Even though more and more studies on the impact of microwave radiation on human health are being published, there is no unanimous consensus on the negative effects. Data from several studies indicate that 2.45 GHz microwave radiation (emitted by e.g. Wi-Fi routers) leads to cognitive impairment. Exposure to both continuous and pulsed microwaves leads to increased neuronal cell death in the hippocampus. The hippocampus is a distinct structure of the brain and represents a central node of the limbic system. The neuronal damage in the brain due to microwaves is caused by the excessive production of free radicals and reactive oxygen species (ROS). Negative effects of microwave radiation have been challenged by several studies, which showed that whole-body exposure to 2.45 GHz microwave radiation has no effect on learning and memory formation. The authors of the present study examined the effect of microwave radiation on the hippocampal region, memory performance and parameters of synaptic plasticity. Synaptic plasticity is closely related to memory formation by changing the strength of a synaptic transmission. Therefore, the frequent use of certain synapses allows easier excitement of postsynaptic neurons.

### **Study design:**

This study was conducted with adult male Sprague Dawley rats. Twenty-one rats took part in the experiments: 11 animals were exposed, 10 animals were sham-exposed and served as the controls. The sham group underwent the same exposure procedure as the exposure group, but the radiation source was switched off. A 2.45 GHz Wi-Fi device was used to expose the rats for two hours a day for a total of 40 days. This resulted in a whole-body SAR value of 0.017 W/kg. After the exposure period, behavioral tests were conducted to address memory performance. First, a radial arm maze test was performed.

Depending on how fast and reliably the rats pass through the maze, conclusions can be drawn about their memory performance. In addition, the animals were subjected to a passive avoidance test. During the learning phase, the animals were placed in the white chamber of an apparatus consisting of two chambers. When entering the dark chamber, the passage between both chambers was closed and the animals suffered an electric shock through the floor grid. In the actual experiment, the time when the animals entered the dark chamber was recorded. After completion of the passive avoidance test, an electrophysiological study was carried out. The neuronal stimulus transmission in the hippocampus was investigated by use of field electrodes. Afterwards, the cell physiology of the rat brain was evaluated by histochemical methods.

### **Results:**

The microwave radiation led to deficits in learning behavior and spatial memory performance of the experimental animals.

During the learning phase of the radial arm maze test, the exposed animals were significantly slower in meeting the experimental criteria. In addition, significantly more mistakes were made during the experiment and the exposed animals required more time to pass through the maze. During the avoidance test, the animals of the exposed group went statistically significantly faster into the dark chamber. The electrophysiological study showed a reduced excitability of CA1 pyramidal neurons of the hippocampus after exposure.

The difference was statistically significant between a stimulation strength of 450 and 1200  $\mu$ A (minimum stimulation 50  $\mu$ A, maximum stimulation 1200  $\mu$ A). Furthermore, the scientists were able to show that microwave radiation has a negative effect on long-term, but not short-term synaptic plasticity. The histochemical approach discovered a statistically significant reduction in the number of CA1 pyramidal neurons in the brain of exposed rats.

### **Conclusion:**

The researchers were able to show that 2.45 GHz microwave radiation from a Wi-Fi device impairs the spatial memory formation and learning behavior in rats. To understand the cause of this deterioration, the scientists performed an electrophysiological study that suggests a reduced excitability of hippocampal pyramidal neurons. In addition, the synaptic plasticity of the neurons seems to be adversely affected in the long term. (RH)

**„The synaptic plasticity of the neurons seems to be adversely affected in the long term.“**



## **Oxidative stress-mediated alterations on sperm parameters in male Wistar rats exposed to 3G mobile phone radiation**

By: Nirala J, Singh K V, Murmu N N, Gautam R, Rajamani P, Meena R.  
Published in: *Andrologia*. 2018;(October):e13201

The use of mobile phones and other devices generating electromagnetic fields (EMF) is increasing rapidly. The health consequences for humans and the environment cannot be foreseen at this time. However, there is increasing evidence that especially oxidative stress caused by reactive oxygen species (ROS) and free radicals is generated by electromagnetic fields. The exact mechanism as to how mobile phone radiation affects biological systems has yet to be determined. Mobile communication devices emit radiation in the microwave range. 3G devices of the Universal Telecommunications System (UMTS) operate in Germany in the frequency bands 1920–1980 MHz and 2110–2170 MHz. Male sex organs in particular are very sensitive to oxidative stress. Sperm cell membranes are rich in polyunsaturated fatty acids, which are peroxidized by ROS and free radicals. In addition, the body's antioxidant defense system is fairly weak in sperm.

The aim of the present study was to investigate different sperm parameters, ROS, lipid peroxidation, testicular morphology and mitochondrial activity in rats after 3G mobile phone exposure. These “power plants,” the mitochondria, play an important role in cell energy production. Since they are involved in the respiratory chain and thus in intracellular oxygen metabolism, they also generate ROS under physiological conditions.

### **Study design:**

Adult male rats were selected as experimental animals to be exposed to 3G radio-frequency radiation. 16 rats were divided into two groups (control group and exposure group). The exposure group was exposed to 3G radio-frequency radiation for 2 hours per day for 45 days. A mobile phone operating in the UMTS band (1915 MHz) served as the radiation source. The estimated SAR value was 0.26 W/kg. After exposure, the animals were sacrificed and their testicles removed. The sperm morphology (microscopic), sperm survival (eosin staining), membrane integrity (hypo-osmotic swelling test), mitochondrial

sperm activity (DAB test), ROS level (chemiluminescence test), lipid peroxidation (MDA test) and histopathology were analyzed.

### **Results:**

First, testicles of both groups were weighed. The testicular weight of the exposure group was statistically significantly lower than that of the control group. However, there was no difference in the weight of the epididymis (location where spermatogenesis takes place). Subsequently, different sperm parameters were evaluated. Sperm count and survival were significantly reduced in the exposure group compared to the control group. In addition, the scientists found evidence that the cell membrane of sperm in exposed animals showed signs of damage more frequently. The morphological analysis of sperm heads revealed no differences between both groups although they described variations in size of the spermatid ducts, disorders of the germ layer and a reduced number of sperm cells after exposure. The analysis of ROS levels showed a significant increase in the exposure group compared to the control group. Increased lipid peroxidation was induced by exposure as well. Due to this disturbance of the redox balance, the authors also investigated the activity of mitochondria. The number of fully active mitochondria was significantly reduced in the exposed group, while the number of partially active and fully inactive mitochondria was increased.

### **Conclusion:**

The authors conclude from their data that the male reproductive system is impaired by 3G radio-frequency radiation. The triggered oxidative stress seems to alter the testicular structure and sperm parameters (sperm count, morphology, survival and membrane integrity). Moreover, a reduced mitochondrial activity may indicate a reduced sperm motility.

Editor's note: Although the study uses interesting methods and can demonstrate increased oxidative stress as well as decreased sperm quality caused by EMFs, there are a number of problems with the study design. For example, the control group was not sham-exposed. Thus, the animals escaped the stressful procedure of being removed from their cage and transferred to the exposure apparatus (of course, without switching it on). In addition, histopathological examinations of the sperm, germ layer and number of sperm cells were not quantified. Only images confirming the authors' statements have been published, which are hard to verify without quantification. (RH)



## Effects of radiofrequency electromagnetic radiation (RF-EMF) on honey bee development and mating success

By: Odemer R, Odemer F. Published in: *Science of the Total Environment* 661 (2019) 553-562

Mobile phones are used worldwide not only for telephony, but increasingly also for banking, news, social media and other applications, and the trend is rising. The constant communication to and from base stations causes more and more environmental pollution. Many researchers have found changes in plants and insects caused by radio-frequency radiation from wireless communication technologies. Since honey bees play an important role as pollinators (value of 200 billion dollars worldwide, 9.5% of total food production), together with wild bees and other insects, they are crucial to crop yield. In the last century, honey bees have repeatedly suffered heavy losses. This was called Colony Collapse Disorder (CCD) in the United States at the beginning of the 20th century, with the main causes being pests, malnutrition, management and pesticides. An important pest is the varroa mite, which appeared in the 1970s and 1980s in the West. Since its worldwide distribution, beekeepers have to take countermeasures; otherwise, the colonies collapse in a short time. Other contributing factors also include air pollution, nanomaterials, solar radiation, predatory insects and global warming. In 2007, radio-frequency radiation from wireless communication technologies was discussed for the first time as a possible factor. Some studies demonstrated drastic effects on the behavior and ability of bees to return to their hives.

The health and productivity of a bee colony are directly dependent on the queen, which is the only one laying eggs and providing the worker bees every year. Therefore, we investigated in this experiment queen development and the subsequent mating success in the context of mobile phone radiation.

### Study design:

The beehives were set up near the institute of the University of Hohenheim, Germany. The experiment lasted from May to August 2018, using healthy colonies from their own population. The natural food sources consisted mainly of nectar from various plants including dandelion, blackberry and basswood. The average temperature during the experiment ranged from 15.2 to 20.1 °C and precipitation from 45 to 90 L/m<sup>2</sup>. Overall, the weather conditions for food collection and mating were good. A simultaneous double batch of 2 collector colonies was used in the experiment, one of each sham-exposed (control) and exposed. For the development and hatching of the queens, the boxes

were set up at a distance of about 3 km so that the worker bees could not return to their original stock. The queens were exposed with a common 900 MHz mobile phone (GSM) for the entire time of development including pupation (14 days, SAR 0.59 W/kg at head and 1.16 W/kg at trunk). Both SAR values were below the current ICNIRP limit of 2 W/kg. There were fifteen 2-min phone calls every 24 hours over 2 weeks (downlink without conversation). The control group was sham-exposed. The mobile phone was mounted to the center of the box so that the animals were exposed to different SAR levels.

After the young queens had hatched, hatching rates were determined on day 13, preparing the animals for mating. On day 24, the mating success was evaluated. On day 88, the colony strength was measured by counting the number of bees as well as brood cells (open and closed). The counting was performed by the same person in the morning before the start of the bee flight. In addition, 5 full colonies of the sham-exposed and 4 full colonies of the exposed queens were established to investigate differences in their population dynamics.

### Results:

The survival of the queens showed significant differences: exposed queens had a significantly higher mortality. A significant reduction in the animals during the pupal stage was witnessed; the difference between the groups was 44.4%. The mating success on day 24 was cut in half; however, compared to the total number of hatched queens on day 13, no significant differences were observed. The determination of the number of bees and brood cells on day 88 showed no significant differences. Chronic exposure to radio-frequency radiation significantly reduced the hatching of honey bee queens (44%). Mortality occurred during the pupal stage, but not the preceding larval stages. Mating success was not affected by exposure. After exposure, the queens were able to develop intact colonies.

Other factors such as pesticides or higher colony density may also play a role because beekeeping has become fashionable, especially in cities. A higher colony density allows for an easier transfer of pollutants or diseases. It also increases the risk of higher exposures to mobile phone and base station radiation, which is constantly rising, especially in cities. It remains unclear how much of this risk is attributable to electromagnetic fields.

### Conclusions:

The two authors were able to demonstrate that 900 MHz radiation of a common mobile phone clearly has negative effects on the queens of honey bees. Mobile phone radiation significantly reduced the percentage of hatched animals, but not mating success. If exposed queens mated successfully, colony formation was not impaired. The pupal stage can be adversely affected by mobile phone radiation, but if this stage develops normally, no disadvantages in the adult stage were observed. The researchers

state the following about the results: “Even though detrimental effects on ontogenetic queen development were revealed by the outcome of our study, caution is needed in interpreting these results. So far, there have been no serious records of colony losses associated with mobile phone radiation. Moreover, we have created by far a worst-case operator scenario to which honey bee colonies would not be exposed under realistic beekeeping conditions. Duration and level were similar to average operator exposure by the use of a mobile phone, but not to those present at an apiary, neither in rural nor in urban areas. And yet, queens that survived the treatment were able to establish full functional colonies, demonstrating an immense recovering potential.” Therefore, the authors do not expect negative effects on bee health during the middle developmental stage. Acute effects of mobile phone radiation in bees can be ruled out; however, an effect of low-level, but permanent exposure levels cannot be ruled out, in particular chronic sublethal field strengths found in urban areas. Thus, further research with long-term exposure is urgently proposed to determine which impact this type of radiation has on bee health and to be able to perform an appropriate risk assessment. (IW)



## **Effect of 900-, 1800-, and 2100-MHz radiofrequency radiation on DNA and oxidative stress in brain**

By: Alkis M E, Bilgin H M, Akpolat V, Dasdag S, Yegin K, Yavas M C, Akdag M Z. Published in: *Electromagnetic Biology and Medicine*, 2019; 00(00), 1-16.

Mobile phone technology, one of the fastest growing technologies worldwide, has become an indispensable part of our everyday life. It is used at home, in public places, at work and in schools. The potential harmful effects of this technology are therefore an important area of research. Mobile phones emit nonionizing radio-frequency radiation. Various researchers report that radiation emitted by mobile phones can have harmful effects at the cellular and molecular level. These effects include DNA damage, various cancers, oxidative stress, lipid peroxidation and chromosomal abnormalities. Long-term exposure to radio-frequency radiation could lead to the accumulation of negative effects. Possible cumulative effects depend on the intensity and duration of the exposure. The biological mode of action of electromagnetic fields (EMF) is already recorded at intensities far below thermal effects. Therefore, classical thermodynamic theories cannot explain this phenomenon. Since mobile phones are usually kept close to the head during calls, radio-frequency radiation is able to

penetrate 4–6 cm into the head and thus the brain. Our brain is particularly susceptible to reactive oxygen species (ROS) as it contains large amounts of lipids and unsaturated fatty acids. Furthermore, it has a weak antioxidant protection system. Single- or double-strand DNA breaks that are not properly repaired can lead to cancer or chromosomal anomalies. Chromosomal anomalies, however, can cause cell death and mutations. In the scientific literature, no uniform opinion exists as to whether radio-frequency radiation is capable of causing genetic damage. For this reason, the scientists of the present study tried to determine whether DNA damage occurs in the brain as a result of exposure to radio-frequency radiation emitted by mobile phones. In addition, the extent and effects of oxidative stress were investigated.

### **Study design:**

A total of 28 adult male Sprague Dawley rats were studied. They were divided into four groups. Group 1: sham group; group 2: 900 MHz exposure; group 3: 1800 MHz exposure; group 4: 2100 MHz exposure. The RF radiation exposure was carried out over 6 months for 2 hours per day. The generator antenna was placed in the center of a Plexiglass carousel. The heads of the rats were pointing toward the antenna during exposure. The antennas were equivalent to those of mobile phones. The calculated whole-body SAR values were 0.638, 0.166 and 0.174 W/kg, respectively, for 900, 1800 and 2100 MHz. After sample collection, the scientists examined DNA single-strand breaks in the brain. In addition, different markers for oxidative stress were analyzed: TAS (total antioxidant status); TOS (total oxidant status); OSI (oxidative stress index); MDA (Malondialdehyde); 8-OHdG (8-Hydroxydeoxyguanosine); total serum nitrite level. The TAS value determines the antioxidant capacity of a sample. This is specified as the equivalent of the vitamin E derivate Trolox. Similarly, the oxidative capacity of a sample, determined by the TOS value, is specified as H<sub>2</sub>O<sub>2</sub> equivalent. The OSI represents the quotient of TOS and TAS. MDA is formed during lipid peroxidation. 8-OHdG also is a biological marker for oxidative stress and cancer and is induced by DNA oxidation. The serum nitrite level indicates nitrosative stress (reactive nitrogen species).

### **Results:**

The scientists found a statistically significant increase in DNA single-strand breaks only in the 2100 MHz group compared to all other groups. This indicates that higher frequency radiation can cause DNA damage. The TOS value was statistically significantly higher in all exposed groups compared to the sham group. That correlated to a lower TAS value in the exposed groups compared to the sham group. Furthermore, the scientists observed a statistically significant increase in OSI, MDA and 8-OHdG parameters in the exposed groups compared to the sham group. Remarkably, the exposed groups also differed significantly among each other. Thus, a frequency dependence of the oxidative stress in

brain cells can be assumed. In addition, elevated nitrite levels were detected in the 1800 MHz and 2100 MHz groups.

### Conclusion:

The authors of the present study addressed the question of whether long-term exposure to radio-frequency radiation emitted by mobile phones at three different frequencies (900, 1800 and 2100 MHz) is able to cause DNA damage and oxidative stress. The mobile phone radiation appears to be capable of causing oxidative stress, lipid peroxidation and DNA damage in the frontal lobe of the brain. A higher frequency correlates with more severe damage. According to the authors, this is consistent with many recent studies and supports the hypothesis that mobile phone radiation can be responsible for damaging biological tissue. (RH)



## Characterization of the suppressive effects of extremely-low-frequency electric fields on a stress-induced increase in the plasma glucocorticoid level in mice

By: Hori T, Nedachi T, Suzuki H, Harakawa S. Published in: *Bioelectromagnetics* 2018, 39(7), 516-528.

Biological studies on extremely low frequency electromagnetic fields (ELF-EMF) can generally investigate two different aspects: health risks or clinical application. The frequency at which power grids operate (60 Hz North America; 50 Hz Europe, Asia, Australia, large parts of Africa and parts of South America) is considered particularly important due to the nationwide distribution of electricity. ELF-EMFs are associated with both health risks and therapeutic effects such as wound healing or stimulation of bone growth. The authors of this publication investigated an interesting approach to a clinical application, namely stress reduction by 50 Hz and 60 Hz ELF-EMF. Controversial studies on this topic exist. Different working groups found increased, decreased and constant stress levels after ELF-EMF exposure. The stress level of the test animals is measured as the glucocorticoid (GC) level in blood serum. Increased GC levels are a marker for the general physiological state of stress. The aim of the present study was to investigate stress-reducing effects of ELF-EMF in three different scenarios. i) frequencies of 50 and 60 Hz; ii) different ambient illuminance levels; iii) partial or complete shielding of the test animals from ELF-EMF.

### Study design:

As experimental animals, 8-week-old male BALB/c mice were

used. The exposure system consists of three main components: a high-voltage transformer, a DC voltage unit and a parallel plate electrode system. The EMFs operated at 10 kV/m for both frequencies. Only the upper electrode generated EMFs; the lower electrode was grounded. Stress was induced in the mice by immobilizing them in a 50-ml centrifuge tube. The immobilization was always performed in the second 30 minutes of the 60-minute EMF test. For the first experiment (effect of ELF-EMF on immobilization stress), the animals were divided into 6 groups with 6 mice each: one control group [stress (-)/EMF (-)], two groups with exposure only but no immobilization [stress (-)/EMF (50 Hz/60 Hz)], one immobilized group [stress (+)/EMF (-)] and two groups with both stress induction and EMF exposure [stress (+)/EMF (50 Hz/60 Hz)]. The stress levels of the experimental animals were determined by their GC levels in blood plasma.

### Results:

There were no significant differences in plasma GC levels between the two "exposure only" and the control groups. GC levels of immobilized mice were significantly higher than the control group. The GC levels of the two groups that were both immobilized and exposed to ELF-EMF fell between those of the control group and the immobilized group. This indicates that both 50 and 60 Hz ELF-EMFs at 10 kV/m are able to reduce stress levels in experimental animals. In the second experimental setup, the effect of ambient illuminance levels on stress reduction caused by ELF-EMF was addressed. The same experimental procedure was followed, but this time at defined illuminance levels of 0 lux, 200 lux and 490 lux. At 200 lux, a reduction of stress could be observed due to the exposure to ELF-EMF in the EMF + immobilization group compared to the stress-only group. However, no correlation between stress level and illuminance level was found in the control groups or the stress-only group. In the third experimental setup, the centrifuge tubes, which served as immobilization devices, were shielded with polytetrafluoroethylene in various proportions. 5 mm, 20 mm, 80 mm and 200 mm were shielded. 5 mm represented a small fraction of the mouse body, 20 mm approximately 1/4 of the mouse body, 80 mm the entire mouse body and 200 mm the entire mouse body including the tail. The partially shielded mice (5 mm and 20 mm) showed lower GC levels than the stress-only group during the simultaneous treatment with immobilization and EMF. At 80 mm or 200 mm shielding, respectively, the GC levels were comparable to those of the stress-only group.

### Conclusion:

The results of the scientists show the biological effect of ELF-EMF on the hormonal system of mice under acute stress. According to the authors, the attenuating effect of ELF-EMF is a promising candidate for the treatment of stress-related diseases. However, more experiments are necessary to test the long-term effects of ELF-EMF on biological systems in particular. (RH)



## Incidence of glioblastoma – the deadliest of all brain tumors – doubles in England since the introduction of mobile phones

By: Adlkofer F. Published in: Pandora-Stiftung für unabhängige Forschung, <https://stiftung-pandora.eu/2018/12/10/verdoppelungder-haeufigkeit-von-glioblastomen-den-boesartigsten-aller-hirntumorarten-in-england-seit-der-einfuehrung-der-mobiltelefonie/>

Based on a Microwave News report from 28 October 2018, Prof. Adlkofer analyzed two scientific papers that covered the incidence of brain tumor rates in England since the introduction and proliferation of mobile phones. These papers focused especially on the almost always fatal glioblastoma tumors. Both studies considered almost the same time period and similar numbers, but the authors drew very different conclusions. Philips et al. chose the period 1995–2015 and de Vocht 1985–2014. When comparing the results, it is striking that the data describing the incidence and location of the tumors for the period 1995–2014 are the same, but the assessments of the causes vary greatly. Prof. Adlkofer summarizes the studies and offers his own assessment. His conclusion: mobile phone radiation is a cancer risk. The radiation is not only able to cause cancer but also affects the growth and differentiation of cells.

The epidemiological study by Philips et al. was published in 2018 (Philips A, Henshaw DL, Lamburn G, O'Carroll MJ (2018): Brain tumors: rise in glioblastoma multiforme incidence in England 1995–2015 suggests an adverse environmental or lifestyle factor. *Journal of Environmental and Public Health*, <https://www.hindawi.com/journals/jeph/aip/7910754/>, see *ElektrosmogReport* 6/2018). Frank de Vocht's publication is available at <http://www.bris.ac.uk/social-community-medicine/people/frank-gde-vocht/pub/170739034> and was published at the beginning of 2019 as *Analyses of temporal and spatial patterns of glioblastoma multiforme and other brain cancer subtypes in relation to mobile phones using synthetic counterfactuals*. *Environmental Research* 168, 329–335.

The Philips group concluded that the highly significant linear increase in glioblastoma cases over the 21 years from 1995 to 2015 is due to environmental and lifestyle factors. Glioblastomas are clustered in the frontal and temporal lobes of the brain and are present in all age groups, but dominate the over-54 age group in particular. The total number of brain tumors did not increase during the period; however, the number of glioblastomas in the temporal and frontal lobes doubled. The particularly strong increase in glioblastomas, especially in the areas of the brain

more highly exposed to mobile phone radiation, could be associated with the increase in mobile phone use. These results confirm findings of the Hardell group as well as the NTP study. Frank de Vocht followed with a different interpretation of his data. He also sees increases in his data from 1985 to 2014, especially in old age, but denies any association with mobile phone radiation. De Vocht's arguments originate from an arcane method called "synthetic counterfactuals," which, according to Prof. Adlkofer, sounds like "alternative facts." This calculation method is not commonly used in statistics, but actually looks like a shady maneuver to find no association between radio-frequency radiation and cancer at any price. (Frank de Vocht used to be a consultant for EPRI, the Electric Power Research Institute, a nonprofit organization of the American power industry, editorial note). Microwave News would like to resolve the contradictions and asks Philips for a statement, as well as the American neurophysiologist David Carpenter. Both confirm the conclusion that these data together with the epidemiological results of the Swedish oncologist Lennart Hardell and the NTP study show an association between mobile phone use and brain tumors.

### Prof. Adlkofer's conclusions:

Based on many studies with different approaches (in vitro, animal experiments, epidemiology), "...the probability borders on certainty that this agent poses a carcinogenic risk to humans. ... If further proof was needed, Philips et al. as well as de Vocht involuntarily provided the definitive proof with their new research results. Consequently, it has to be assumed that radio-frequency radiation from 1G to 4G causes cancer in humans, among other things." The REFLEX study already demonstrated that genetic damage is generated by mobile phone radiation. The NTP study as well as Lerchl revealed that mobile phone radiation does not only cause cancer, but also influences the differentiation and growth of dormant cancer cells.

With 5G, another technology is added that will increase the radiation exposure even further. In Prof. Adlkofer's opinion, neither the mobile communications industry with its lobbyists such as the ICNIRP nor politicians and the media have any interest in informing the public. Regarding the new 5G technologies, once again claims will be made that there are no harmful effects because of the shallow penetration depth even though there is no data available and therefore no reliable statements can be made. Prof. Adlkofer finally concludes: "If, in the minds of the decision-makers in industry and politics, 5G seems to be indispensable despite the persistence of health risks, they should at least have the courage to admit that citizens have to deal with these risks for overriding reasons so that everyone can protect him- or herself as much as possible. They should be aware that the strategies of denial seriously undermine the functioning of a democratic society." (IW)