

## Auszüge aus Berichten nationaler und internationaler Expertengruppen der Jahre 2006 bis 2008 zum Thema „Genotoxizität“



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- **Strahlenschutzkommission (SSK), Deutschland, 2006**  
<http://www.ssk.de/werke/volltext/2006/ssk0620.pdf>

### **Multicenter-Studien erforderlich**

Seit der letzten Empfehlung der Strahlenschutzkommission von 2001 [SSK, 2001] ist eine Vielzahl von Publikationen bezüglich der Wechselwirkung von HF-Feldern mit dem Genom erschienen. Im Hinblick auf genotoxische Wirkungen haben die neueren Arbeiten eine gesundheitsschädigende Wirkung nicht wahrscheinlicher gemacht. Die wenigen positiven Befunde ließen sich selbst in gut entworfenen Wiederholungsstudien nicht bestätigen. Auf der Grundlage des heutigen Erkenntnisstandes sind Einzelarbeiten zur Frage der Interaktion von HF-Feldern mit dem Genom daher kaum noch gerechtfertigt. Für weitere Untersuchungen sind vielmehr Multicenter-Studien mit einem gemeinsamen Studiendesign unbedingt erforderlich.

- **Wissenschaftlicher Beirat Funk (WBF; beratendes Gremium des Bundesministeriums für Verkehr, Innovation und Technologie BMVIT), Österreich, 2008 WBF-Expertenforum 2008**  
[www.wbf.or.at](http://www.wbf.or.at)

### **Kein Beweis für gesundheitliche Gefährdung**

Nach eingehender Analyse, Bewertung und Diskussion von insgesamt 68 wissenschaftlichen Studien/Arbeiten, die zwischen August 2006 und Jänner 2008 publiziert wurden, kamen die Experten – einstimmig – zu folgendem Konsens: Es gibt keinen Beweis, dass es bei Einhaltung der Grenzwerte eine gesundheitliche Gefährdung im Umgang mit dem Mobilfunk gibt.

Speziell zu „Gentoxikologie und Mobilfunk“: Die vorliegenden Studien liefern keine überzeugenden Beweise zu genotoxischen Effekten des Mobilfunks.

- **SSI (Swedish Radiation Protection Authority), Schweden, 2008**  
**Report 2008 “Recent Research on EMF and Health Risks”**  
<http://www.stralsakerhetsmyndigheten.se/Global/Publikationer/Rapport/Str%c3%a5lskydd/2008/ssi-rapp-2008-12.pdf>

**Cell studies:** A large number of in vitro studies have been published recently investigating various outcomes, including effects on reactive oxygen species,

genotoxicity, apoptosis, gene expression, immunology, and enzyme activity. Most of these studies have not demonstrated effects of RF exposure on the studied outcomes, including also attempts to replicate the genotoxic effects observed in the REFLEX European programme. Additional studies are currently underway, for example on gene expression, and some other areas need further investigation, such as effects on apoptosis in primary cell types.

**Animal studies:** Six recent studies on carcinogenicity, some with higher exposure levels than previously used, consistently report lack of carcinogenic effects, and two studies on genotoxicity report no increase in micronuclei or DNA strand breaks after RF exposure. These results are consistent with the majority of previous studies.

**Genotoxicity:** The discrepancies related to genotoxic effects of RF exposure are not fully resolved today, but several replication attempts of the few positive data have failed.

**Conclusion:** The majority of previous in vivo and in vitro studies have generally not shown genotoxic effects from exposure to RF radiation. In particular, the results did not confirm previous findings suggesting increased micronucleus frequency in cells and animals exposed to RF radiation. Strengths of these studies were the use of whole animals and long exposure times.

- **Bundesamt für Umwelt, BAFU, Schweiz, 2007**  
**BAFU Report 2007: „Hochfrequente Strahlung und Gesundheit“**  
**Bewertung von wissenschaftlichen Studien im Niedrigdosisbereich. Stand: September 2006“**  
**<http://www.bafu.admin.ch/php/modules/shop/files/pdf/phppHrt5z.pdf>**

#### **Datenlage zu gering, Wissenslücken weiterhin groß**

Die Studie teilt die erforschten biologischen Effekte von HF-Strahlung in die fünf Kategorien „gesichert“, „wahrscheinlich“, „möglich“, „unwahrscheinlich“ und „nicht beurteilbar“ ein. Neue gesicherte gesundheitliche Auswirkungen gibt es gemäß der Studie nicht. Als „nicht beurteilbar“ wird eingeschätzt, ob die hochfrequente Strahlung bei beruflich Exponierten zu genotoxischen Zellschäden führen kann.

Die wissenschaftliche Datenlage zur Beurteilung der Gesundheitsgefährdung durch HF-Strahlung ist immer noch sehr lückenhaft. Experimentelle Studien am Menschen und an Zellkulturen belegen zwar unmittelbare Auswirkungen der HF-Strahlung. Ob diese aber ein Gesundheitsrisiko darstellen, ist ungewiss.

Insgesamt ist die Datenlage immer noch zu gering, um zu beurteilen, ob hochfrequente Strahlung auf in vivo exponierte menschliche Zellen genotoxisch wirkt.

- **Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), Europäische Kommission, Brüssel, 2007**  
**[http://ec.europa.eu/health/ph\\_risk/committees/04\\_scenihr/docs/scenihr\\_o\\_007.pdf](http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf)**

#### **Recent results suggesting genotoxic effects need to be better understood**

Discussion: Effects of RF fields on different biological systems have been investigated. Although the majority of studies have found no evidence of genotoxic effects,

there are a few positive findings that should be followed up. Some in vitro studies provide evidence that gene expression is affected at RF exposure close to the guidelines. If these studies are confirmed they will be important for a mechanistic understanding of the interaction of RF fields with cellular tissue. Overall, there is little evidence of any health-relevant in vitro effects of RF electromagnetic fields below guidelines. While it seems appropriate to perform experimental studies using pure experimental RF fields, it may be needed to emulate the complex modulation patterns and intensity variations typical to real mobile phone use in future studies. This way data can be obtained which are better suited for comparison to epidemiologic studies.

Conclusion: There is no reliable indication from in vitro research that RF fields affect cells at nonthermal exposure. However, recent results suggesting genotoxic effects need to be better understood.

- **Bioinitiative Report 2007, USA**  
[http://www.bioinitiative.org/report/docs/section\\_1.pdf](http://www.bioinitiative.org/report/docs/section_1.pdf)

**Both ELF and RF exposures can be considered genotoxic (will damage DNA) under certain conditions of exposure, including exposure levels that are lower than existing safety limits.**

Conclusion: From this literature survey, since only 50% of the studies reported effects, it is apparent that there is no consistent pattern that radiofrequency radiation exposure could induce genetic damages/changes in cells and organisms. However, one can conclude that under certain conditions of exposure, radiofrequency radiation is genotoxic. Data available are mainly applicable only to cell phone radiation exposure. Other than the study by Phillips et al [1998], there is no indication that RFR at levels that one can experience in the vicinity of base stations and RF-transmission towers could cause DNA damage.

- **Institution of Engineering and Technology, UK, 2008 Position Statement 2008**  
<http://www.theiet.org/factfiles/bioeffects/index.cfm>

**There is little convincing evidence that EMF exposure can cause carcinogenic or other changes in cells at power frequencies.**

In addition no plausible mechanism has been elucidated by which low-level EMFs would have effects at the cellular level. A large European programme of research (REFLEX) completed in 2004 reported a variety of cellular effects with both power-frequency and RF fields. However, like so many of the findings in this area of research, the independent replications undertaken since the completion of that programme have so far failed to confirm the initial findings.

In general, there continues to be serious doubt about the robustness of claimed cellular effects due to EMF exposure at all frequencies using field strengths to which the public might be exposed. Independent reproducibility of findings is poor and even the effects that have been claimed do not appear to form a consistent or cohesive pattern in terms of exposure parameters or biological response.

In summary, the absence of robust new evidence of harmful effects of EMFs in the past two years is reassuring and is consistent with findings over the past decade.

The public availability of electricity and the widespread use of telecommunications both have many demonstrable benefits to society, including health benefits. BE-PAG is of the opinion that these factors, along with the overall scientific evidence, should be taken into account by policy makers when considering the costs and benefits of both the implementation of precautionary approaches to public exposure and also in the development of exposure guidelines.

- **The National Academy of Sciences (NAS), USA, 2008**  
**“Identification of Research needs relating to potential biological or adverse health effects of wireless communication” 2008**  
[http://books.nap.edu/catalog.php?record\\_id=12036](http://books.nap.edu/catalog.php?record_id=12036)

Cancer-related Endpoints: Genetic Toxicology

Although genetic toxicology studies have failed to identify potential RF health effects (in part due to lack of replication of findings from key positive studies), additional genetic toxicology studies may be warranted should evidence of oncogenicity be identified in any of the ongoing chronic toxicity/oncogenicity bioassays of RF fields in laboratory animals, or in any future studies to be performed using genetically engineered animal models.

- **Department of Communications, Marine and Natural Resources, Ireland**  
**Report 2007 “Health Effects of Electromagnetic Fields”**  
<http://www.dcenr.gov.ie/NR/rdonlyres/9E29937F-1A27-4A16-A8C3-F403A623300C/0/ElectromagneticReport.pdf>

#### **No evidence of genotoxic, mutagenic, or carcinogenic effects**

“Summary: With acknowledgement to the many reviews mentioned above and particularly to two recent publications from the UK (NRPB, 2003; 2005) the following is a summary of the findings so far on the health questions raised by mobile telephony.

**The scientific evidence suggests that RF fields do not cause mutation in the DNA or initiate, progress or promote tumour formation.**

The epidemiological evidence does not suggest a causal association between the occurrence of brain cancer and exposures to RF fields, in particular from mobile phones, and radio and TV transmitters.

Exposures to RF fields of members of the public near mobile phone base stations are a very small fraction of the guideline limits; current scientific evidence indicates that such exposures are unlikely to pose any risk to health.

**Exposures of animals to RF fields characteristic of mobile phone systems have found no evidence of genotoxic, mutagenic, or carcinogenic effects.**

RF exposure does not affect survival or tumour incidence in animals when tumours are induced by x-rays or chemicals. Further well-conducted research in this area is soon to be published (PERFORM-A studies under the EU’s Fifth Framework Research Programme), although preliminary results released by the investigators indicate that none of the studies found any increase in cancer risk from RF exposure.