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Health Impacts of RF Radiation

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HEALTH EFFECTS OF RADIOFREQUENCY AND ELECTROMAGNETIC FIELD EXPOSURE
Scientific discussion of biological effects, neurological and cognitive effects, DNA damage, 5G exposure, and potential risks to children and infants

1.1. Biological and cellular effects of wireless radiation
The document Health Effects from Wireless Radiation identifies peer-reviewed research on RF-EMF exposure, including studies of oxidative stress, cellular responses, reproductive effects, neurological outcomes, carcinogenicity, and DNA damage. It also identifies research evaluating the biological assumptions underlying FCC exposure limits.

Lai and Levitt (2023), in Cellular and Molecular Effects of Non-Ionizing Electromagnetic Fields, describe a cellular stress response involving damage to cellular macromolecules and subsequent repair processes. They state:

“It is triggered by cellular macromolecular damage (in proteins, lipids, and DNA)” (Lai & Levitt, 2023).

The authors discuss how responses may depend on exposure duration, intensity, and characteristics of the biological system. Their review addresses both radiofrequency and extremely-low-frequency electromagnetic fields and examines oxidative processes as a possible mechanism underlying reported cellular effects.

These findings make cellular stress responses, oxidative processes, and DNA integrity relevant endpoints for evaluating potential biological effects of non-ionizing electromagnetic fields.

1.2. Neurological and cognitive effects
There are Neurological/Cognitive Effects that lists experimental studies examining learning, memory, hippocampal morphology, neuronal development, blood-brain barrier permeability, and behavior following exposure to RF fields. There are many cited studies that include investigations of 2.45 GHz microwave radiation, Wi-Fi, mobile-phone frequencies, and LTE signals.

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Adolescent memory performance. Foerster et al. (2018) conducted a prospective cohort study of Swiss adolescents, modeling individual brain exposure to RF-EMF and evaluating changes in memory performance over one year. The study included approximately 670 participants. The authors reported an association between cumulative RF-EMF brain dose and changes in figural memory, particularly among adolescents who predominantly used mobile phones on the right side of the head.

“We aimed to follow-up our previous results using a new study population, dose estimation, and approach to controlling for confounding from media usage itself.” (Foerster et al., 2018).

The study is relevant because it assessed modeled individual brain dose rather than relying exclusively on reported mobile-phone use. Its findings concern an epidemiological association; they do not independently establish that RF exposure caused the observed memory changes.

Early-life LTE exposure and behavior. Broom et al. (2019) investigated pulsed LTE downlink signals at 1,846 MHz in mice exposed from late pregnancy through weaning. Animals received 30 minutes of exposure per day, five days per week, at whole-body average specific absorption rates (SARs) of 0.5 or 1 W/kg. Behavioral outcomes were evaluated from 12 to 28 weeks of age.

“The exposure caused significant effects on both appetitive behaviors and activity of offspring that depended on the SAR.” (Broom et al., 2019).

The study observed changes in drinking frequency, distance moved, and duration of movement that persisted into adulthood. The authors noted that the exposure-response pattern was not consistent and that further work was needed to establish the mechanisms involved.

These findings are relevant to developmental exposure research because the experimental exposure period included prenatal development and early postnatal life. They provide animal evidence of persistent behavioral changes under the conditions tested, rather than direct proof of equivalent outcomes in human infants.

1.3. DNA damage and genotoxic effects

There are Effects on DNA that identifies research investigating DNA damage, genetic susceptibility, oxidative stress, and biological mechanisms associated with electromagnetic-field exposure. There is a health-effects reference study that also lists the Smith-Roe et al. (2020) study of cell-phone RF radiation in rats and mice.

Experimental evidence of DNA damage. Smith-Roe et al. (2020) evaluated genotoxicity following subchronic exposure to cell-phone RF radiation. The researchers used the alkaline comet assay to assess DNA damage in multiple tissues, including brain

regions, liver, and peripheral blood leukocytes. They also used the micronucleus assay to evaluate chromosomal damage in red blood cells.

“These results suggest that exposure to RFR is associated with an increase in DNA damage.” (Smith-Roe et al., 2020).

Significant increases in DNA damage were observed in the frontal cortex of male mice exposed to both tested modulations, in leukocytes of female mice exposed to CDMA signals, and in the hippocampus of male rats exposed to CDMA signals. No significant increases in micronucleated red blood cells were observed.

The results are pertinent to assessing possible genotoxic effects because they identify tissue-specific DNA damage in experimental animals. The distinction between positive comet-assay findings and the absence of significant micronucleus-assay findings must be preserved when interpreting the study.

1.4. RF exposure standards and 5G

There are health-effects that specifically lists the 2022 paper by the International Commission on the Biological Effects of Electromagnetic Fields (ICBE-EMF), titled Scientific Evidence Invalidates Health Assumptions Underlying the FCC and ICNIRP Exposure Limit Determinations for Radiofrequency Radiation: Implications for 5G.

"Adverse effects observed at exposures below the assumed threshold SAR include non-thermal induction of reactive oxygen species, DNA damage, cardiomyopathy, carcinogenicity, sperm damage, and neurological effects" (ICBE-EMF, 2022).

The paper argues that the FCC and ICNIRP exposure limits rely on assumptions that biological effects arise from excessive tissue heating and do not occur below a specified threshold. The authors contend that research published over the subsequent 25 years challenges those assumptions. They also identify inadequate health-effects research concerning novel forms of radiation associated with 5G telecommunications as a concern.

This publication is directly relevant to evaluating whether RF exposure standards adequately address reported non-thermal biological effects. It presents a scientific challenge to the regulatory assumptions; it does not establish that every 5G installation or exposure produces an identical health outcome.

1.5. Children, infants, and early-life exposures

Davis et al. (2023), in Wireless Technologies, Non-Ionizing Electromagnetic Fields and Children: Identifying and Reducing Health Risks, review experimental, epidemiological, and clinical evidence relating to wireless technologies and children. The authors discuss the need to investigate exposures from infancy through young adulthood and recommend further independent research into long-term physical and psychological impacts.

They conclude:
"an approach that recommends that microwave radiation exposures be As Low As Reasonably Achievable (ALARA) seems sensible and prudent" (Davis et al., 2023).

The review identifies schools and health-care settings as environments where reducing wireless exposure warrants consideration. It also calls for research and monitoring of the long-term impacts of changing wireless technologies.

The Broom et al. study provides additional experimental evidence relevant to early-life exposure: mice exposed to pulsed LTE signals during prenatal and early postnatal

development exhibited persistent changes in activity and behavior. The results support the scientific importance of studying developmental exposure windows, while the species and exposure conditions must be considered when assessing applicability to humans.

1.6. Scientific implications

The supplied health-effects references identify peer-reviewed research addressing several relevant biological endpoints: cellular stress responses, oxidative processes, neurological and cognitive outcomes, developmental behavior, and DNA damage. The cited studies include human epidemiological research, controlled animal experiments, and reviews challenging the assumptions underlying current RF exposure standards.

Taken together, these publications provide a scientific basis for examining potential biological effects of RF-EMF exposure, the adequacy of exposure limits, and the need for further research concerning children and developing organisms. The strength of each finding depends on study design, exposure conditions, measured endpoints, and reproducibility. The cited research should therefore be evaluated at the level of the specific outcomes reported rather than treated as proof that every wireless device or exposure causes the same harm.

References

1. Foerster M, Thielens A, Joseph W, Eeftens M, Röösli M. A Prospective Cohort Study of Adolescents' Memory Performance and Individual Brain Dose of Microwave Radiation from Wireless Communication. Environmental Health Perspectives. 2018;126(7):077007. https://doi.org/10.1289/EHP2427

2. Broom KA, Findlay R, Addison DS, Goiceanu C, Sienkiewicz Z. Early-Life Exposure to Pulsed LTE Radiofrequency Fields Causes Persistent Changes in Activity and Behavior in C57BL/6J Mice. Bioelectromagnetics. 2019;40(7):498–511. https://doi.org/10.1002/bem.22217

3. Smith-Roe SL et al. Evaluation of the Genotoxicity of Cell Phone Radiofrequency Radiation in Male and Female Rats and Mice Following Subchronic Exposure. Environmental and Molecular Mutagenesis. 2020;61:276–290. https://doi.org/10.1002/em.22343

4. International Commission on the Biological Effects of Electromagnetic Fields (ICBE-EMF). Scientific Evidence Invalidates Health Assumptions Underlying the FCC and ICNIRP Exposure Limit Determinations for Radiofrequency Radiation: Implications for 5G. Environmental Health. 2022;21:92. https://doi.org/10.1186/s12940-022-00900-9

5. Davis D, Birnbaum L, Ben-Ishai P, Taylor H, Sears M, Butler T, Scarato T. Wireless Technologies, Non-Ionizing Electromagnetic Fields and Children: Identifying and Reducing Health Risks. Current Problems in Pediatric and Adolescent Health Care. 2023;53(2):101374. https://doi.org/10.1016/j.cppeds.2023.101374

6. Lai H, Levitt BB. Cellular and Molecular Effects of Non-Ionizing Electromagnetic Fields. Reviews on Environmental Health. 2024;39(3):519–529. https://doi.org/10.1515/reveh-2023-0023