

Sampling of Post-2019 Peer-Reviewed, Published Studies on the Non-Cancerous Health Effects and Environmental Effects of RF Radiation Exposure

Effects of RF Radiation on Children

- Hava Bektas et al., [*Comparison of Effects of 2.4 GHz Wi-Fi and Mobile Phone Exposure on Human Placenta and Cord Blood*](#), BIOTECHNOLOGY & BIOTECHNOLOGICAL EQUIPMENT (2020) (study reports associations between maternal mobile phone exposure and markers of oxidative stress and DNA damage in placenta and cord blood, indicating that “combined effects of Wi-Fi plus mobile phone exposure have a higher potential to cause synergistic harmful effects”).
- Devra Davis et al., [*Wireless Technologies, Non-Ionizing Electromagnetic Fields and Children: Identifying and Reducing Health Risks*](#), CURRENT PROBLEMS IN PEDIATRIC AND ADOLESCENT HEALTH CARE (2023) (co-authored by former National Institute of Environmental Health Sciences Director Dr. Linda Birnbaum, this review describes children’s developmental vulnerabilities and scientific evidence of adverse biological effects from wireless radiation, recommending exposure reduction in schools and healthcare settings to protect children).
- Maninder S. Setia et al., [*Radiofrequency Electromagnetic Field Emissions and Neurodevelopmental Outcomes in Infants: A Prospective Cohort Study*](#), CUREUS (2025) (prospective cohort study finds higher measured household RF levels linked with poorer infant motor, problem-solving, and personal-social developmental scores).
- Maggie Wang et al., [*A Systematic Review of Mobile Phone Use and Pregnancy and Fetal Outcomes*](#), JOURNAL OF EXPOSURE SCIENCE & ENVIRONMENTAL EPIDEMIOLOGY (2026) (systematic review of cell phone use and fetal outcomes by researchers at Columbia University, Johns Hopkins University, and Cornell University reports evidence including altered fetal and neonatal cardiac function and increased preterm birth. The authors conclude that the evidence supports measures to reduce RF exposure).
- Raihanah Chokeli et al., [*Environmental Radiofrequency Exposure and Genotoxic Biomarkers in Schoolchildren: A Cross-Sectional Analysis*](#), SCIENTIFIC REPORTS (2026) (study of schoolchildren reports that higher measured RF exposure and closer school proximity to mobile phone base stations were significantly associated with higher micronuclei frequency, a biomarker of genomic instability, despite exposures below international guidelines).

- Ae-Kyoung Lee et al., [*Real-World Assessment of RF-EMF Exposure From 3G, 4G, and 5G Mobile Networks Across Different Urbanization Levels*](#), IEEE ACCESS (2026) (measurement study reports higher whole-brain RF absorption from base stations in urban areas due to network densification and 20–35% higher RF absorption rates in the child model compared with the adult model).

Ubiquity of RF Radiation Exposure

- Norton Escopelli Soares et al., [*SAR Estimations in a Classroom With Wireless Computers*](#), JOURNAL OF MICROWAVES, OPTOELECTRONICS AND ELECTROMAGNETIC APPLICATIONS (2025) (engineering modeling finds substantially increased localized RF absorption in classroom arrangements with multiple Wi-Fi-emitting laptops (increases up to 40 fold in the back) as compared to a single student and laptop).
- Jiang Liu et al., [*Characterization of EMF Exposure Induced by French Cellular Networks*](#), ANNALS OF TELECOMMUNICATIONS (2026) (measurement study of French networks that estimates that exposures in areas with higher ambient levels (1 V/m ambient-field scenario) from continuous base-station (cell tower) emissions result in these environmental emissions contributing to the majority of exposures (70% of monthly head exposure and 87% of whole-body exposure) exceeding contributions from personal phone use).
- Arno Thielens et al., [*Urban Radio-Frequency Electromagnetic Field Exposure in New York City*](#), ENVIRONMENTAL RESEARCH (2026) (field measurements across all five New York boroughs find mean environmental RF exposure of 0.97 V/m, numerically comparable to the French Liu et al. 2026 study’s 1 V/m scenario, with cellular downlink the largest contributor);

Non-Cancerous Effects of RF Radiation Exposure

- Joshua M. Pearce, [*Limiting Liability With Positioning to Minimize Negative Health Effects of Cellular Phone Towers*](#), ENVIRONMENTAL RESEARCH (2020) (literature-based analysis concludes “there is already enough medical and scientific evidence to warrant long-term liability concerns;” recommends minimizing human exposure when locating cell towers).

- Stephanie L. Smith-Roe 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) (National Toxicology Program/NIEHS study reports increased DNA damage in frontal cortex of male mice leukocytes of female mice, and hippocampus of male rats following long-term RF radiation exposure).
- Sofwatul Mokhtarah Maluin et al., [*Effect of Radiation Emitted by Wireless Devices on Male Reproductive Hormones: A Systematic Review*](#), FRONTIERS IN PHYSIOLOGY (2021) (systematic review reports reduced testosterone following RF exposure, particularly in animal studies).
- Sungjoon Kim et al., [*Effects of Mobile Phone Usage on Sperm Quality—No Time-Dependent Relationship on Usage: A Systematic Review and Updated Meta-Analysis*](#), ENVIRONMENTAL RESEARCH (2021) (systematic review and meta-analysis of 18 studies involving 4,280 samples associates mobile phone exposure with reduced sperm motility, viability, and concentration).
- David Schuermann & Meike Mevissen, [*Manmade Electromagnetic Fields and Oxidative Stress—Biological Effects and Consequences for Health*](#), INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES (2021) (Universities of Basel and Bern review of oxidative stress in animal and cell studies concludes a “trend is emerging..., i.e., that EMF exposure, even in the low dose range, may well lead to changes in cellular oxidative balance” with implications for that very young or old individuals who will be more vulnerable).
- A. M. Dagro et al., [*Computational Modeling Investigation of Pulsed High Peak Power Microwaves and the Potential for Traumatic Brain Injury*](#), SCIENCE ADVANCES (2021) (U.S. Army and Air Force Research Labs computational study predicts high-powered pulsed microwave exposure could cause brain injuries similar to explosive blasts and football head impacts – even at levels deemed safe by FCC RF limits).
- Federico Bertagna et al., [*Effects of Electromagnetic Fields on Neuronal Ion Channels: A Systematic Review*](#), ANNALS OF THE NEW YORK ACADEMY OF SCIENCES (2021) (systematic review of electromagnetic fields including RF radiation identifies diverse effects on neuronal ion-channels and differentially modulated at multiple levels).

- Xue Luo et al., [*Electromagnetic Field Exposure-Induced Depression Features Could Be Alleviated by Heat Acclimation Based on Remodeling the Gut Microbiota*](#), ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY (2021) (animal study reports depression-like features and altered gut microbiota and metabolites following pulsed 2.45 GHz (Wi-Fi frequency) exposure).
- Alfonso Balmori, [*Evidence for a Health Risk by RF on Humans Living Around Mobile Phone Base Stations: From Radiofrequency Sickness to Cancer*](#), ENVIRONMENTAL RESEARCH (2022) (review of 38 studies reports that 73.6% identified adverse health outcomes – radiofrequency sickness, cancer, and changes in biochemical parameters among people living near mobile phone base stations (cell towers)).
- Rita Rahban et al., [*Association Between Self-Reported Mobile Phone Use and the Semen Quality of Young Men*](#), FERTILITY AND STERILITY (2023) (Swiss study involving the University of Geneva, Swiss Tropical and Public Health Institute, and University of Basel associates higher self-reported mobile phone use with lower sperm concentration and total sperm count).
- Jody C. Cantu et al., [*Analysis of Global DNA Methylation Changes in Human Keratinocytes Immediately Following Exposure to a 900 MHz Radiofrequency Field*](#), BIOELECTROMAGNETICS (2023) (Air Force Research Laboratory study finds epigenetic effects, with 114 genes “significantly differentially methylated,” in human skin cells at RF exposure levels that are a fraction of the FCC’s current RF exposure limits).
- Sachin Gulati et al., [*Evaluation of Oxidative Stress and Genetic Instability Among Residents Near Mobile Phone Base Stations in Germany*](#), ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY (2024) (observational study of 24 residents reports greater chromosomal damage in the group with higher measured RF radiation exposure from wireless network base station RF emissions).
- Nicole Bijlsma et al., [*Does Radiofrequency Radiation Impact Sleep? A Double-Blind, Randomised, Placebo-Controlled, Crossover Pilot Study*](#), FRONTIERS IN PUBLIC HEALTH (2024) (trial reports reduced subjective sleep quality and altered NREM-sleep EEG power during repeated overnight exposure to a 2.45 GHz-emitting baby monitor).
- Dimitri Besset et al., [*Influence of Radiofrequency Electromagnetic Fields Exposure on Sleep Patterns in Preterm Neonates*](#), INTERNATIONAL JOURNAL OF RADIATION BIOLOGY (2024) (study associates higher chronic, but not acute, RF exposure with greater sleep fragmentation in preterm infants).

- Henry Lai & B. Blake Levitt, [*Radiofrequency Radiation-Induced Gene Expression*](#), REVIEWS ON ENVIRONMENTAL HEALTH (2025) (review documents RF-related gene-expression changes concluding the “data supports the notion that RFR is a stressor that causes oxidative changes and DNA and protein damage in cells under different exposure conditions, in many biological systems”).
- Bilal Cakir et al., [*Radiofrequency Regulates the BET-Mediated Pathways in Radial Glia Differentiation in Human Cortical Development*](#), CELL REPORTS (2025) (Yale School of Medicine laboratory study in human cortical organoids reports disrupted neural progenitor differentiation and increased autism-associated gene expression following Bluetooth-frequency RF radiation exposure at levels approximately 4,000 times below the FCC’s current RF exposure limit).
- Steven G. Weller et al., [*A Scoping Review and Evidence Map of Radiofrequency Field Exposure and Genotoxicity: Assessing In Vivo, In Vitro, and Epidemiological Data*](#), FRONTIERS IN PUBLIC HEALTH (2025) (scoping review maps more than 500 studies and identifies evidence of RF-related genotoxic effects, including findings at exposures below the FCC’s current RF exposure limits).
- Ronald L. Melnick & Joel M. Moskowitz, [*Exposure Limits to Radiofrequency EMF Do Not Account for Cancer Risk or Reproductive Toxicity Assessed From Data in Experimental Animals*](#), ENVIRONMENTAL HEALTH (2026) (risk assessment applying EPA toxicological methodology to findings from WHO-commissioned reviews estimates that current public RF exposure limits are 8–24 times higher than levels EPA would estimate to be protective of male reproductive health).
- Nushin Naderi et al., [*Influence of Radiofrequency Electromagnetic Radiation on Spermatogenesis and Sperm Function in Rodent Models: A Systematic Review*](#), REPRODUCTIVE TOXICOLOGY (2026) (systematic review of rodent studies reports reduced sperm quality, altered reproductive hormones, oxidative stress, DNA damage, and apoptosis following RF radiation exposure).

Environmental Effects of RF Radiation

- Shalinder Kaur et al., [*Sensitivity of Plants to High Frequency Electromagnetic Radiation: Cellular Mechanisms and Morphological Changes*](#), REVIEWS IN ENVIRONMENTAL SCIENCE AND BIO/TECHNOLOGY (2021) (review examines RF-related changes in plant gene expression, enzyme activity, and growth. Authors propose that the main entry point for the biological effects 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).

- Zhuoheng Zhong et al., [*Morphophysiological and Proteomic Responses on Plants of Irradiation with Electromagnetic Waves*](#), INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES (2021) (review examines millimeter-wave effects finding low powers induce distinct cellular, molecular, and proteomic alterations, and modify metabolic pathways in plants without significant heating).
- B. Blake Levitt et al., *Effects of Non-Ionizing Electromagnetic Fields on Flora and Fauna: [Part 1. Rising Ambient EMF Levels in the Environment](#); [Part 2. Impacts: How Species Interact With Natural and Man-Made EMF](#); [Part 3. Exposure Standards, Public Policy, Laws, and Future Directions](#)*, REVIEWS ON ENVIRONMENTAL HEALTH (2022; published online in 2021) (three-part comprehensive review of over 1,000 studies on non-ionizing EMF (including RF radiation) impacts to flora and fauna documents rising ambient RF exposures and how scientific research on all frequencies and taxa studied indicate that “low-level exposures have numerous adverse effects, including on orientation, migration, food finding, reproduction, mating, nest and den building, territorial maintenance, defense, vitality, longevity, and survivorship.” Gaps in wildlife protection are documented under existing standards and recommendations are made for policy action to address chronic low-level exposure).
- Alain Thill et al., [*Biological Effects of Electromagnetic Fields on Insects: A Systematic Review and Meta-Analysis*](#), REVIEWS ON ENVIRONMENTAL HEALTH (2024) (systematic review and meta-analysis reports the vast majority of studies identified harmful biological effects including disrupted navigation, reduced reproduction and fertility, altered flight dynamics, immune dysfunction, mitochondrial damage, and DNA strand breaks).
- Vera Jeladze et al., [*Numerical Dosimetry of Specific Absorption Rate of Insects Exposed to Far-Field Radiofrequency Electromagnetic Fields*](#), INTERNATIONAL JOURNAL OF RADIATION BIOLOGY (2025) (modeling study of honeybees, wasps, ladybugs, and mantises finds brain and body RF absorption varies substantially with frequency, polarization, and anatomy, with peak tissue absorption at selected frequencies between 6 and 60 GHz).
- Oliver Lindecke et al., [*Disruptive Effects of Brief Radiofrequency Noise Exposure on Migratory Bat Navigation*](#), SCIENCE (2026) (study concludes exposure to broadband RF noise disrupts migratory bats’ flight orientation, with effects persisting for hours after initial exposure).