Cell Tower Radiation Linked to Genetic Changes in Nearby Residents

More Chromosomal Aberrations
A Finding Too Hot To Handle

July 1, 2024
Last updated July 9, 2026

Senior European scientists are reporting that people living near cell phone towers show significant changes in their genetic makeup. This is the first time that chronic exposure to cell tower radiation has been linked to unrepairable genetic damage.

A team led by Wilhelm Mosgöller of the Medical University of Vienna and Igor Belyaev of the Slovak Academy of Sciences in Bratislava contend that years of low-dose RF exposure can increase the incidence of a number of different types of chromosomal aberrations. Such changes could lead to serious, though uncertain, health consequences, including cancer and neurological disease. (Chromosomes are strands of DNA coiled around proteins.)

The new study is small —but provocative. It's persuaded Mosgöller and Belyaev that they may have identified a "biologically plausible mechanism" for how RF radiation can cause cancer.

This is all spelled out in a paper which was posted online on May 30 in *Ecotoxicology and Environmental Safety,* a peer-reviewed journal. It's open access.

Assessing Genetic Damage

The research team recruited 24 healthy adults with homes in rural Germany. Half lived near a mobile phone base station transmitting LTE/GSM signals at frequencies below 2.5 GHz. They were compared to 12 others, similar in most respects except for their proximity to the tower.

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Blood samples were taken from the participants and were assayed for oxidative stress, DNA breaks and chromosomal damage in Belyaev's lab in Bratislava. A double-blind protocol was followed to guard against potential biases.

The most notable finding is a statistically significant higher incidence of chromosomal aberrations among those living near the tower —the link held for exposures based on both RF measurements and distance from the transmitters.

DNA breaks and oxidative stress were found to be elevated, but neither change reached statistical significance. (Single-strand DNA breaks were significantly higher.) Mosgöller maintains that they could lead to chromosomal damage over the long-term. "It accumulates slowly over time because natural processes cannot repair a broken chromosome," Mosgöller told me in an extended interview. "The chromosomal aberrations may only become clearly visible after years of exposure."

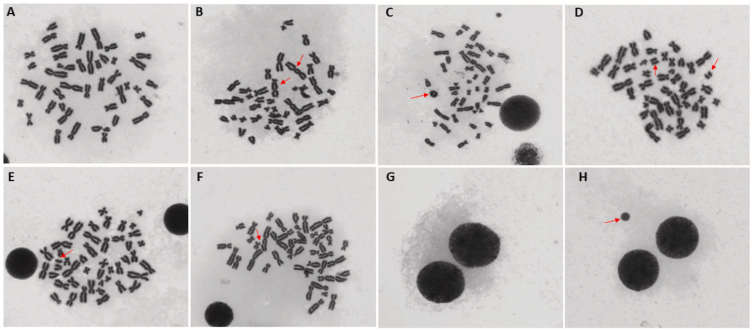


Fig. 1. Metaphase chromosomal spreads to observe chromosomal aberrations: normal metaphase without signs of damage (A); examples of different chromosomal aberrations like dicentric chromosomes (B), ring chromosome (C), acentric chromosome (D), fragments (E) and chromatid gap (F). Micronucleus assay for visualization of permanent DNA damage; the Cytokinesis Block produces binucleated cells (G), prevalent chromosomal fragments appear as micronucleus (H).

Examples of chromosomal aberrations from Mosgöller and Belyaev's paper (click to expand)

In the paper they submitted for peer review in early February, Mosgöller and Belyaev concluded:

> "The most likely cause for this higher rate of chromosomal aberrations in the exposed group appear[s] to be the chronic exposure to the RF-EMF signals GSM 900 and LTE."

But that sentence does not appear in the paper released by the journal last month.

"Real Is Real"

The tower study was carried out under a project known as ATHEM-3 —short for "Athermal Effects of EMF Exposure Associated with Mobile Communications." The 3 indicates that this is the third phase within the ATHEM research program, which began back in 2002.

ATHEM-1 and -2 were sponsored by the Austrian Workers Compensation Board (AUVA). This third chapter was supported by the Kompetenzinitiative, a German non-profit launched in 2007 to

promote health and environmental protection from wireless technology.

ATHEM is the longest running non-governmental research project on RF radiation and health. Mosgöller has been involved from the beginning.

Before investigating chromosomal damage in humans, Mosgöller worked on RF-induced DNA breaks in cell cultures. He saw them there too—just as Hugo Rüdiger had in the REFLEX project. REFLEX, which was funded by the EC, had kicked off a few years before ATHEM.




Wilhelm Mosgöller (left) and Igor Belyaev

Rüdiger and Mosgöller were colleagues at the Vienna medical school, and Mosgöller watched as Rüdiger paid dearly for what he found and published. The mobile phone industry and the German government sought to discredit Rüdiger. He had to be wrong, they argued: RF cannot affect DNA because that would violate the laws of physics. One relentless critic, Alexander Lerchl, accused Rüdiger of fabricating his data.

Mosgöller might have helped resolve, or at least short-circuit, that long, nasty controversy, but he was left on the sidelines. “I was discouraged from getting involved and making public statements,” he told me years ago.

ATHEM had a much lower public profile than REFLEX, and Mosgöller was not tormented to the same extent. But he too has suffered along the way. As recently as a couple years ago, Mosgöller said that he had to hire a lawyer to defend himself from Lerchl in court. Rüdiger, shaken and demoralized, had retreated into retirement. Mosgöller carried on.

“One of my motivations for looking at chromosomal aberrations among residents living near towers was to extend the DNA work to a real-world situation,” Mosgöller told me recently. “In vitro is interesting, but real is real.”

Mosgöller is now planning a follow-up study with more participants.

Belyaev has also had a long and distinguished career. He too has worked on RF-induced DNA breaks and oxidative stress. Educated in Russia, Belyaev has held professorships at Stockholm University, the Russian Academy of Sciences and, presently, at the

Slovak Academy of Sciences. In 2011, one of his publications was named the most influential paper in the journal *Bioelectromagnetics* between 2005 and 2009.

Cumulative Low-Level Effects

Rüdiger and Mosgöller were following up on Henry Lai and NP Singh's now landmark DNA break study. Back in 1995, they showed that RF could damage the DNA in the brains of live rats. Like Rüdiger, Lai and Singh were disparaged in public and in the press for years. In a leaked memo, Motorola called it "war gaming." (More about all that here.)

Today, the scientific consensus is that they were right. RF radiation *can* lead to DNA breaks. Not because RF photons can split a chemical bond in the double helix but by activating biochemical processes that lead to oxidative stress and compromised DNA repair.

Those early experiments with rats and cell cultures only looked at acute or immediate effects. Lai and Singh exposed their rats for just two hours. Rüdiger irradiated his cells for no more than 24 hours. Mosgöller and Belyaev, on the other hand, are checking on long-term effects. To qualify for their study, residents had to have lived near a cell phone tower for at least five years.

"The new study offers an indication of the possible long-term consequences of the DNA breaks we observed after short-term exposures," Lai told me by email.

Here again, the prevailing dogma says this is all pie in the sky. Genetic effects — indeed, any long-term effect— are deemed to be impossible, just as DNA breaks were 20 years ago. That's the official position of those running the RF programs and setting exposure standards at WHO, ICNIRP and the IEEE.

The new study implicates very low ambient levels of RF, far below of any of those exposure limits. They are "spectacularly low," Mosgöller says —on the order of a thousand times lower than those adopted by ICNIRP and the IEEE.

Far from being innocuous, those weak fields may be biologically active, according to Lai. He has been cataloguing long-term, low-intensity RF studies for many years and has concluded, he said, "that low-intensity exposure is more potent than high-intensities in causing biological effects."

Mosgöller and Belyaev are well-known critics of the thermal-only dogma. Belyaev is a commissioner of the recently formed ICBE-EMF, an international group of scientists who came together to challenge ICNIRP. Both were expert witnesses for the plaintiffs who allege brain tumor risks from cell phones in the marathon court case, Murray v Motorola.

Previous Studies on Chromosomal Aberrations

This new study is far from the first to link RF radiation to chromosomal aberrations. Some of the most notable work was carried out 30 years ago by Vera Garaj-Vrhovac's team at the Institute for Medical Research at the University of Zagreb in Croatia. "We found the same type of chromosomal abnormalities among workers exposed to radar radiation and in cells exposed in vitro," she told *Microwave News* for a cover story in 1992. (Radar typically uses higher peak pulses than cell tower signals.)

In 2010, researchers at Selcuk University medical school in Turkey published a study similar to ATHEM-3's. They looked for chromosomal aberrations in lymphocytes among 14 individuals people living near a mobile phone tower and found no statistically significant differences compared to controls. But, importantly, they cautioned against any firm conclusions. A "close look" at the data, they wrote, indicates "higher values in the study group," which might mean that the statistics would change with a larger study population.

The impact of chromosomal aberrations on human health is not clear. Lai suggested that the types of aberrations seen by Mosgöller and Belyaev are more likely to cause cell death than cancer. Cell death in the nervous system might lead to neurological diseases, he said. (More background on CAs here and here.)

"Our finding of chromosomal aberrations is not so new," Mosgöller said. Though, he added, "We were surprised by the strength and clarity of our results."

Downplaying RF Causation

When Mosgöller and Belyaev submitted their paper to *Ecotoxicology and Environmental Safety,* a copy of the manuscript was also posted on SSRN, the Social Science Research Network, an online platform run by Elsevier, which publishes the journal, among thousands of others. SSRN was established to promote sharing works in progress. (The manuscript continues to be available as a free download.)

Reproduced below is the original Mosgöller-Belyaev abstract with its key inference that chronic RF exposure is the most likely cause of the observed chromosomal aberrations highlighted. This was later removed and replaced by a more rambling text that sidesteps the issue of causation.

Abstract

Human exposure to radiofrequency electromagnetic fields (RF-EMF) is usually restricted by guidelines to prevent thermal effects in the tissue. However, at very low intensities "non-thermal" biological effects, like oxidative stress, DNA or chromosomal aberrations, etc. collectively termed genomic-instability are possible. Little is known about chronic (years long) exposure with non-thermal RF-EMF. We identified two adjacent housing estates in a rural region with residents exposed to either relatively low (control-group) or relatively high (exposed-group) RF-EMF GSM-900 and LTE-signals emitted from nearby mobile phone base stations. 24 healthy adults that lived in their homes at least for 5 years volunteered. Their homes were surveyed for common types of EMF and their blood samples were tested for oxidative status, transient DNA alterations, permanent chromosomal damage, and specific cancer related genetic markers like MLL gene rearrangements. We documented possible confounders, like age, sex, nutrition, life-exposure to ionizing radiation (X-rays), occupational exposures, etc. The groups matched well in terms of age, sex and occupational risk factors. The years long exposure had no measurable effect on MLL gene rearrangements and c-Abl-gene transcription modification. Associated with higher exposure, we found higher levels of lipid oxidation and oxidative DNA-lesions, though not statistically significant. DNA double strand breaks, micronuclei, ring chromosomes, and acentric chromosomes were not significantly different between the groups. Chromosomal aberrations like dicentric chromosomes (p=0,007), chromatid gaps (p=0,019), chromosomal fragments (p<0,001) and the total of chromosomal aberrations (p<0,001) were significantly higher in the exposed group. No potential confounder interfered with these findings. The most likely cause for this higher rate of chromosomal aberrations in the exposed group appear to be the chronic exposure to the RF-EMF signals GSM 900 and LTE.

On spotting the change, I wondered whether this was a consequence of the extreme polarization that pervades RF science, where clear statements that contradict the WHO/ICNIRP party line are discouraged, if not suppressed.

I asked Mosgöller if the deletion had been mandated by the peer reviewers. “No,” he replied, “It was our decision.” He explained that RF causation was an opinion rather than an observation and was probably best left out.

“The deletion was a way to get the manuscript off our desk so we could carry on with the research,” he explained. The strategy worked. “The resubmitted manuscript was immediately accepted,” Mosgöller said.

Differing Views

The paper quickly drew the attention of Diagnose:Funk, a German-Swiss environmental protection group. It posted a news story featuring a short interview with Mosgöller. “The results are worrying,” Peter Hensinger, a member of the D:F board, told me by email, “They must have consequences for radiation protection.”

Wilma Miles, an EMF consultant based in Cape Town, South Africa, was the first to post the news on X/Twitter. She provided a link to the paper but offered no additional comment.



The Swiss Research Foundation for Electricity and Mobile Communications (FSM) in Zurich quickly stepped in, retweeting what Miles had posted with the addition of the first sentence of the paper's conclusions: "In this study, we found no statistically significant DNA damages and/or oxidative stress attributable to residency nearby mobile phone base stations."



Frank de Vocht, an incoming member of ICNIRP, reposted FSM's Tweet. This caught the attention of Colin Legg, a photographer based in Perth, Australia, prompting him to check out the paper. He saw the "Highlights" box on the journal's website and and Tweeted a reply to FSM:



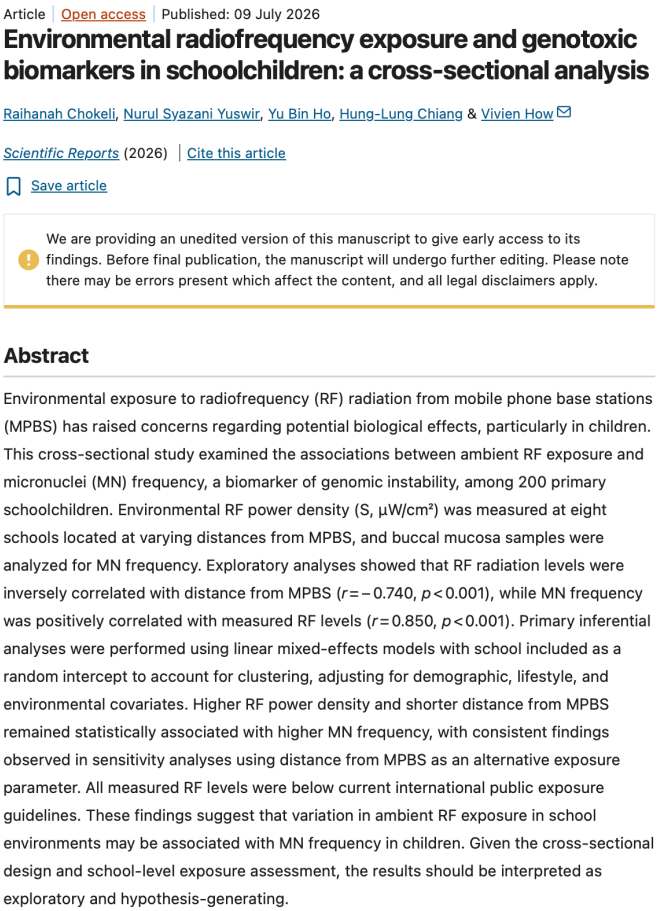
I asked Jürg Eberhard, FSM’s managing director, why he had not cited the significant difference in chromosomal aberrations in his post on X. “For reasons of space, we have only mentioned the first sentence in our Tweet,” he replied. “This sentence is directly related to the title of the paper.”

One of FSM’s main missions is “to communicate research findings to society.” The Foundation, which also funds health studies, currently has five principal sponsors, which provide the bulk of its annual budget: Cellnex, Ericsson, Sunrise, Swisscom —all telecom companies— and Swissgrid, which manages the country’s electrical transmission lines.

Environmental RF Exposure and Genotoxic Biomarkers in Schoolchildren

July 9, 2026

Published today:



Article | Open access | Published: 09 July 2026

Environmental radiofrequency exposure and genotoxic biomarkers in schoolchildren: a cross-sectional analysis

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Abstract

Environmental exposure to radiofrequency (RF) radiation from mobile phone base stations (MPBS) has raised concerns regarding potential biological effects, particularly in children. This cross-sectional study examined the associations between ambient RF exposure and micronuclei (MN) frequency, a biomarker of genomic instability, among 200 primary schoolchildren. Environmental RF power density (S, μW/cm²) was measured at eight schools located at varying distances from MPBS, and buccal mucosa samples were analyzed for MN frequency. Exploratory analyses showed that RF radiation levels were inversely correlated with distance from MPBS ($r = -0.740$, $p < 0.001$), while MN frequency was positively correlated with measured RF levels ($r = 0.850$, $p < 0.001$). Primary inferential analyses were performed using linear mixed-effects models with school included as a random intercept to account for clustering, adjusting for demographic, lifestyle, and environmental covariates. Higher RF power density and shorter distance from MPBS remained statistically associated with higher MN frequency, with consistent findings observed in sensitivity analyses using distance from MPBS as an alternative exposure parameter. All measured RF levels were below current international public exposure guidelines. These findings suggest that variation in ambient RF exposure in school environments may be associated with MN frequency in children. Given the cross-sectional design and school-level exposure assessment, the results should be interpreted as exploratory and hypothesis-generating.

cell towers, genetic effect, chromosomal aberrations, oxidative stress, Igor Belyaev, Wilhelm Mosgöller, Henry Lai, Alexander Lerchl, Peter Hensinger, FSM Foundation, Swiss Research Foundation on Mobile Communications, Jürg Eberhard,

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