

Health Hazards of Wireless Technologies: What do we know now?

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September 25, 2024 Webinar

[Saferemr.com](https://www.saferemr.com)

Berkeley Public Health

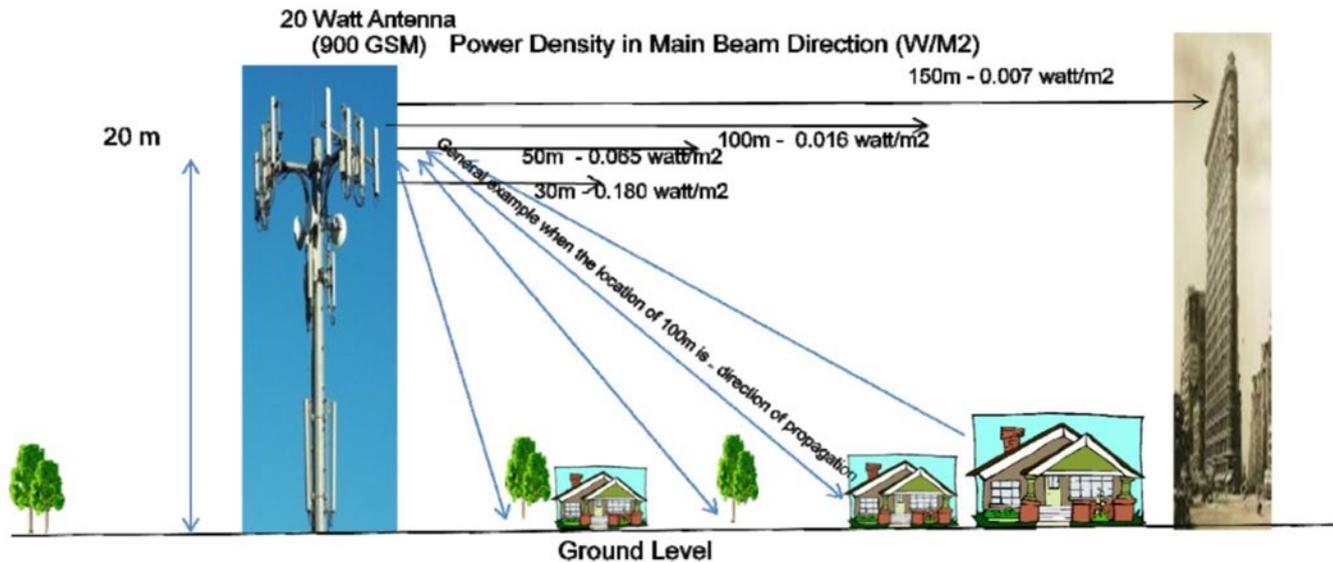
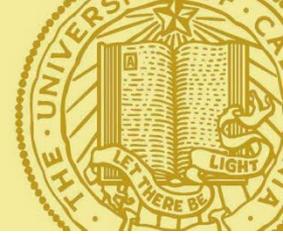


Webinar learning objectives

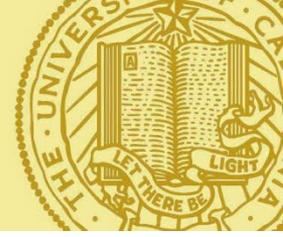


- **What is radiofrequency radiation (RFR)?**
- **How are we exposed?**
- **Health effects (focus on tumor risk)?**
- **Role of government?**
- **Role of industry?**
- **Personal safety tips**

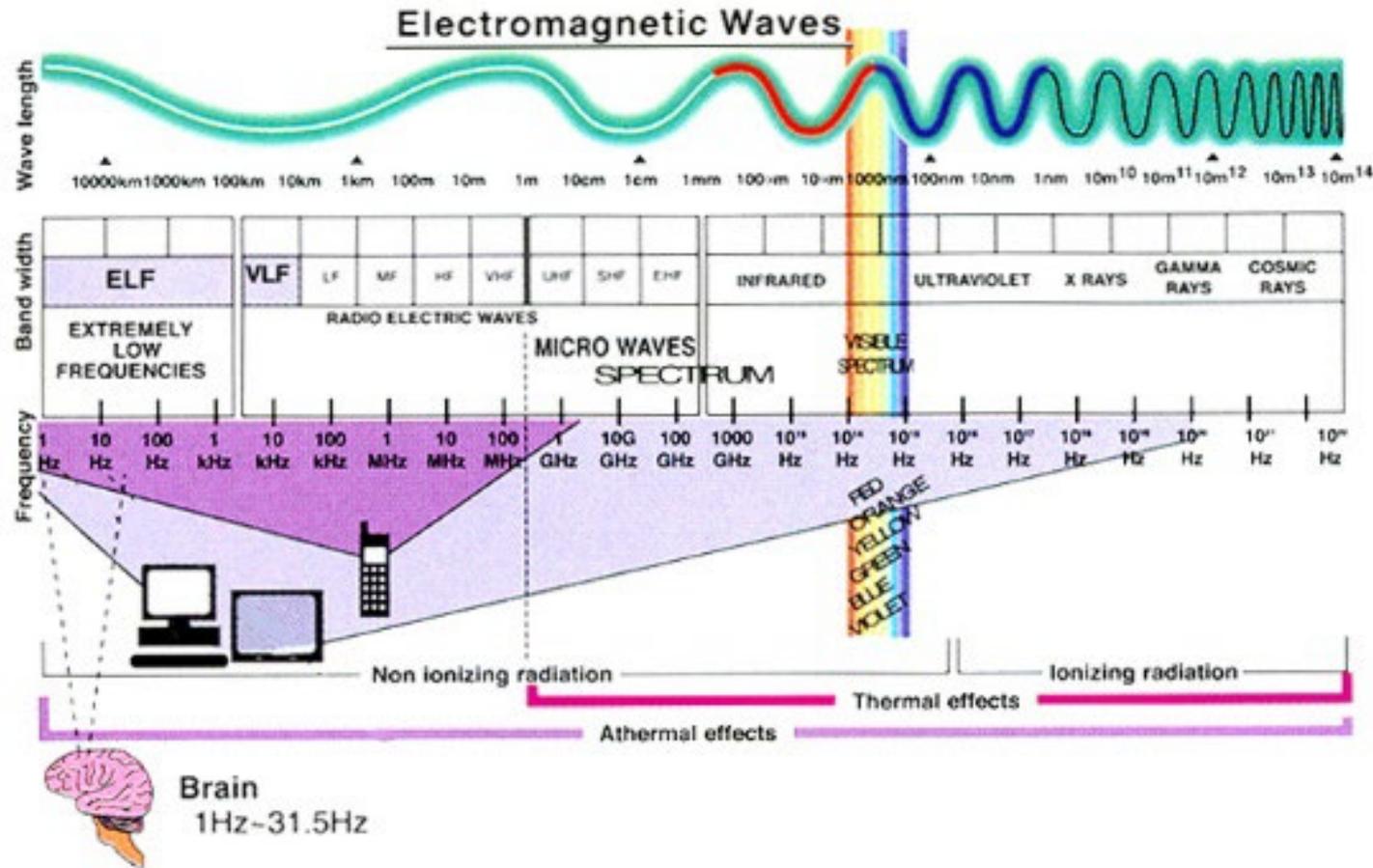
Communications technology and radiofrequency radiation



The intensity of Radio waves at ground level shall be much lesser than that of in Main Beam direction.

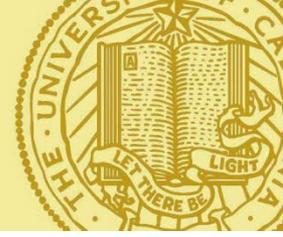


Electromagnetic spectrum: cellular technology

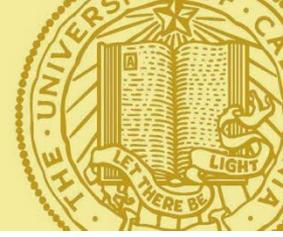


Martin Blank. EMF and health risk: a scientific perspective.
Commonwealth Club, San Francisco, 2010.

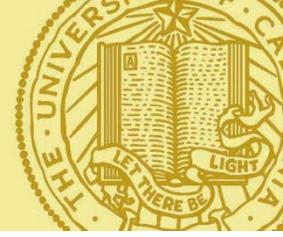
Does industry control government regulatory agencies?



U.S. government research



FDA called for more research in 1999



- “The existing exposure guidelines are based on protection from acute injury from thermal effects of radio frequency radiation exposure, and may not be protective against any non-thermal effects of chronic exposure.”
- “A significant research effort is needed... to provide the basis to assess the risk to human health of wireless communications devices.”

<http://bit.ly/FDA1999>



National Toxicology Program Study: Final Reports (2018)



National Toxicology Program

Headquartered at the
National Institute of Environmental
Health Sciences NIH-HHS

Cell Phone Radio Frequency Radiation Studies

What did the studies find?

NTP studies found that exposure to high levels of RFR, like that used in 2G and 3G cell phones, was associated with:

- **Clear evidence of tumors in the hearts of male rats.** The tumors were malignant schwannomas.
- **Some evidence of tumors in the brains of male rats.** The tumors were malignant gliomas.
- **Some evidence of tumors in the adrenal glands of male rats.** The tumors were pheochromocytomas.

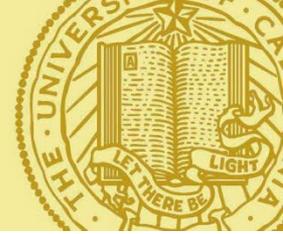
For female rats, and male and female mice, it was unclear, also known as equivocal, whether cancers observed in the studies were associated with exposure to RFR.

Do the rat and mouse findings apply to humans?

The findings in animals cannot be directly applied to humans for two key reasons:

- *The exposure levels and durations were greater than what people may receive from cell phones.*
- *The rats and mice received RFR across their whole bodies, which is different from the more localized exposures humans may receive, like from a cell phone in their pocket or next to their head.*

However, the studies question the long-held assumption that radio frequency radiation is of no concern as long as the energy level is low and does not significantly heat the tissues.

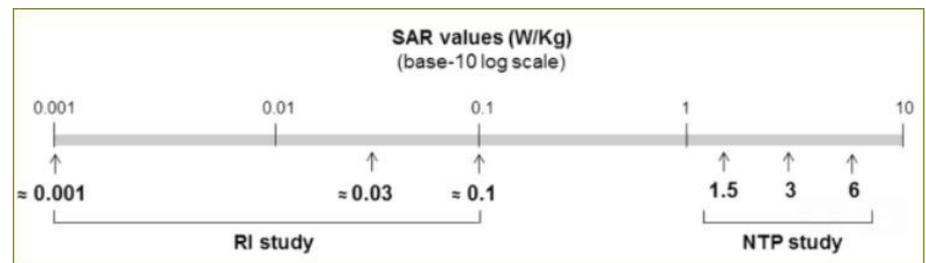


NTP Study: Additional effects

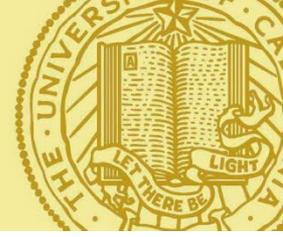
- DNA damage in brains of mice & rats (male & female).
- Increased degeneration in hearts of male & female rats.
- Decreased birth weights in rats exposed prenatally.
- Overall tumor incidence in **male rats** was greater after 2 years of cell phone radiation exposure (see Appendix).
 - Highest overall cancer incidence (42%-46%) in middle exposure group (3 watts per kilogram [W/kg]); significantly greater than sham control group (27%).
 - Lowest exposure group (1.5 W/kg) had significantly greater non-malignant tumor incidence (73%-76%) vs. sham control group (54%).

- Ramazzini Institute study

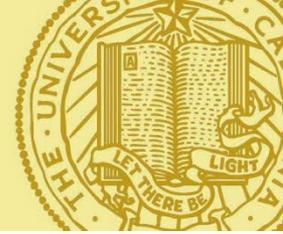
Results confirm key NTP findings with lower exposure.



Other research on wireless radiation health effects



Oxidative stress from low-intensity radio frequency radiation



Yakymenko et al. (2015) review

- 93 of 100 studies (73 animal/plant, 16 cell samples, 4 human studies) found significant evidence of oxidative stress.
- Oxidative stress = imbalance between free radical production & body's ability to counteract harmful effects via antioxidants.
- Effects = disrupted cell signaling, stress proteins, free radical formation, DNA-damage → neurologic disorders and cancer.

<http://bit.ly/keycellphonestudies>

Preponderance of peer-reviewed research finds adverse biologic effects



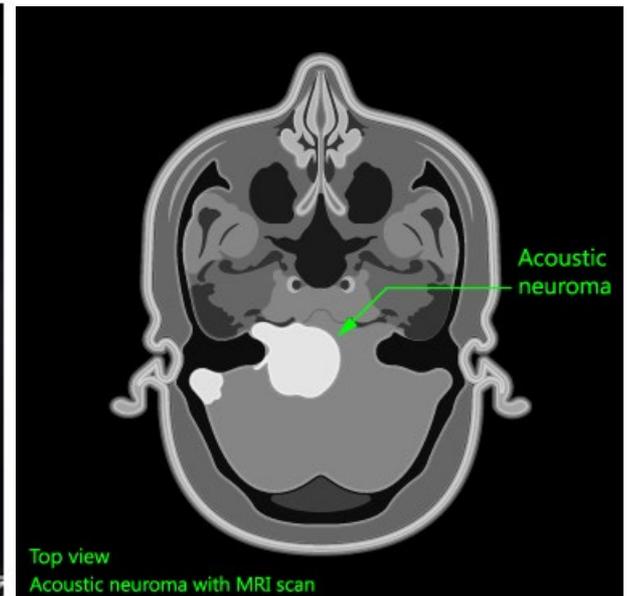
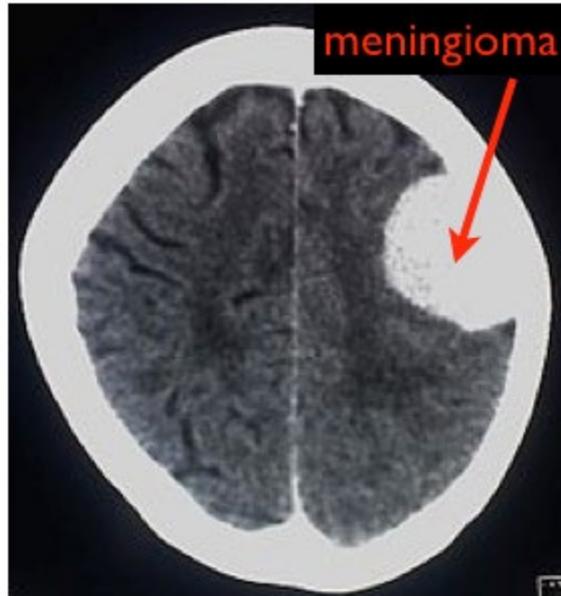
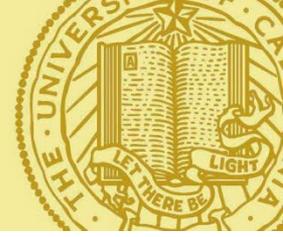
- 1,000+ biological studies from 1990-2024 found effects of radio frequency radiation.
- Significant effects found in ...
 - 89% of 367 oxidative effects and free radical studies,
 - 83% of 335 reproduction / development studies,
 - 77% of 435 neurological studies, and
 - 70% of 466 genetic effect & DNA comet assay studies.

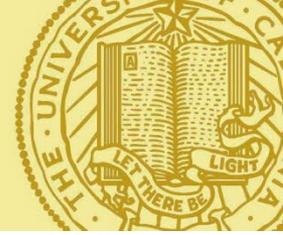
From [Dr. Henry Lai's research summaries](#)

See also:

[Recent Research on Wireless Radiation & EMF](#)

Research on tumor risk from cell phone radiation

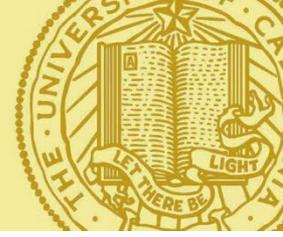




Meta-analysis: Heavy, long-term cellphone use increased tumor risk

- Our 2020 review of 46 case-control studies updated our [2009 review](#) in *Journal of Clinical Oncology*.
- Study results
 - No consistent pattern for any regular cellphone use (once a week for 6 months).
 - 60% increased tumor risk for cumulative call time >1,000 hours (average 17 minutes/day over 10 years) based on 8 studies (OR=1.60, 95% CI=1.12-2.30).

Choi, Moskowitz, Myung, Lee, Hong. Cellular Phone Use and Risk of Tumors: Systematic Review and Meta-Analysis. *Int J Environ Res Public Health*. 2020; 17(21):8079. doi: [10.3390/ijerph17218079](https://doi.org/10.3390/ijerph17218079).

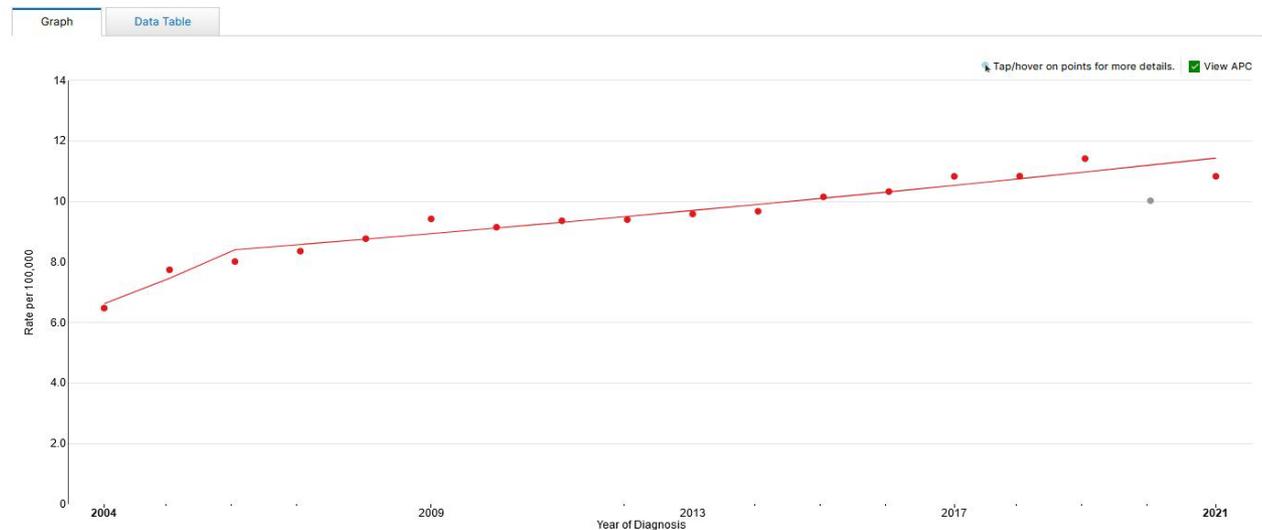


Increases in brain tumor incidence over time in U.S. (registry data)

- Glioma in frontal lobe in adults 20-29 years of age
- Glioblastoma in frontal & temporal lobes & cerebellum
- Malignant brain & central nervous system tumors among children (0-14 years of age)
- Nonmalignant meningioma across all age groups.

Non-malignant Meningioma of the Brain and ONS
Recent Trends in SEER Age-Adjusted Incidence Rates, 2004-2021
Observed SEER Incidence Rate By Age, Both Sexes, All Races / Ethnicities

The 2020 incidence rate(s) were not used in the fit of the trend line(s) and are displayed on the graph as gray data points. [Impact of COVID on SEER Cancer Incidence 2020 data](#)



<http://bit.ly/risingtumors>

<https://bit.ly/3ErsXi6>



Child's brain absorbs 2X the radiation

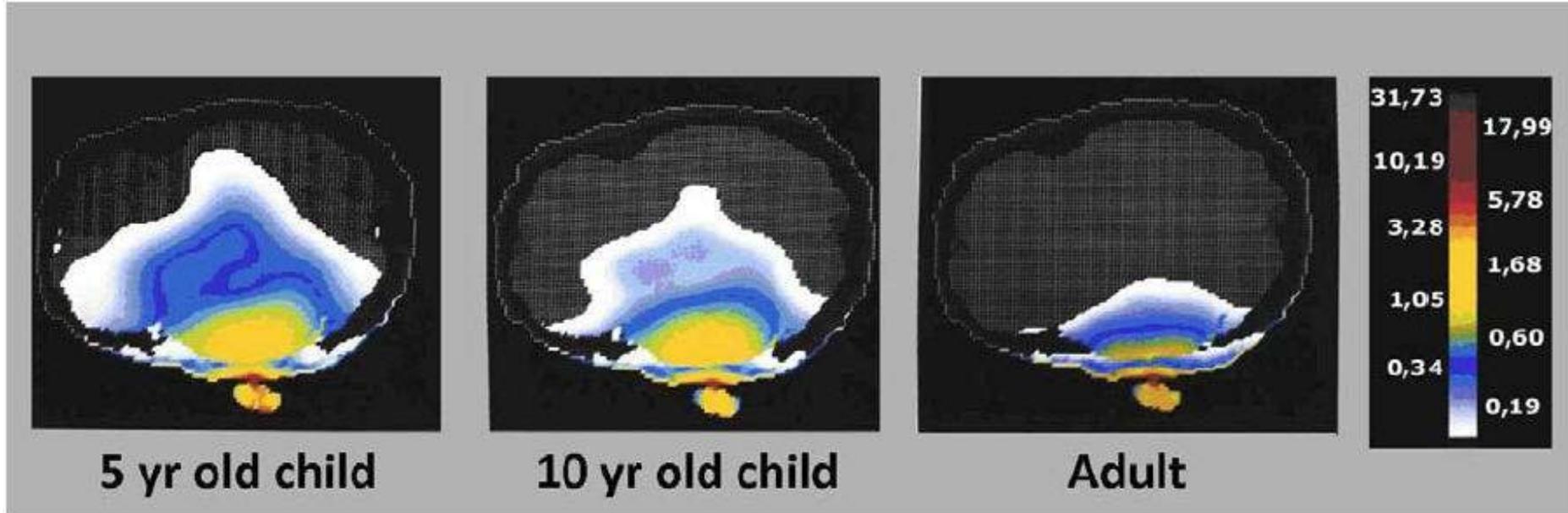
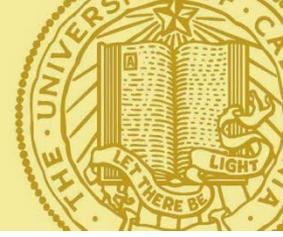


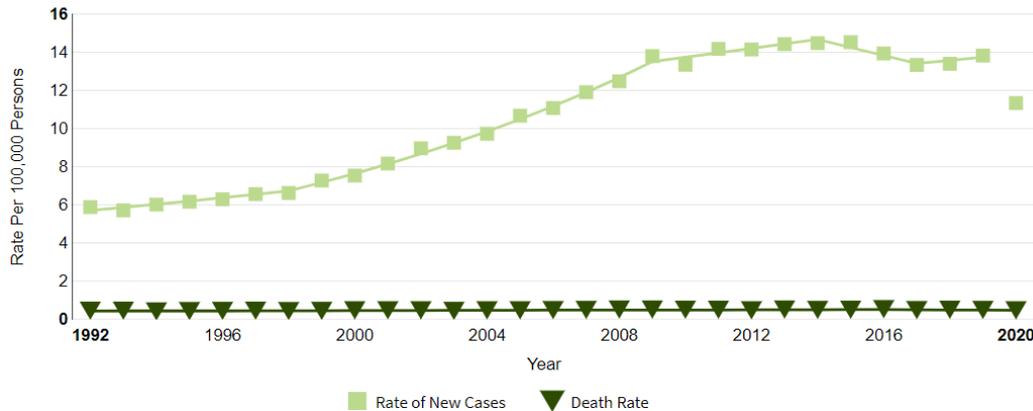
Figure 1. Estimation of the penetration of electromagnetic radiation from a cell phone based on age (Frequency GSM 900 Mhz) (On the right, a scale showing the *Specific Absorption Rate* at different depths, in W/kg) [1]*

Gandhi et al., 2012

<https://bit.ly/keycellphonestudies>



Thyroid cancer incidence vs. cellular technology use & case-control study



New cases come from SEER 12. Deaths come from U.S. Mortality.
All Races, Both Sexes. Rates are Age-Adjusted.

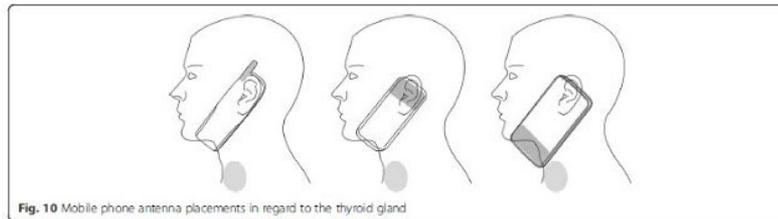
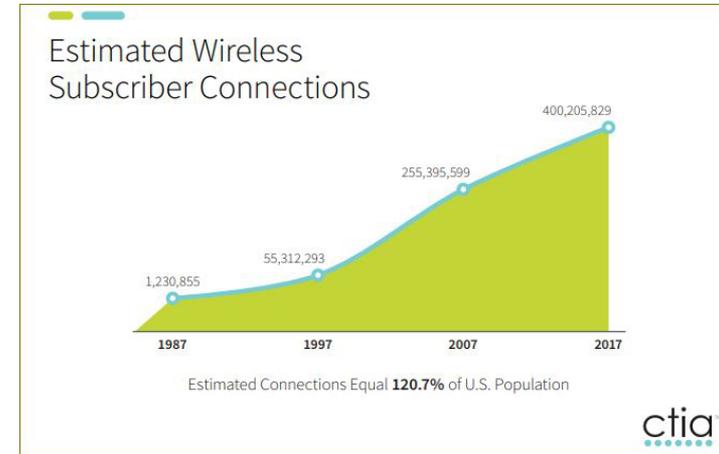
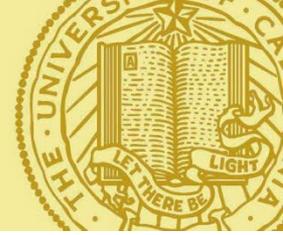


Fig. 10 Mobile phone antenna placements in regard to the thyroid gland

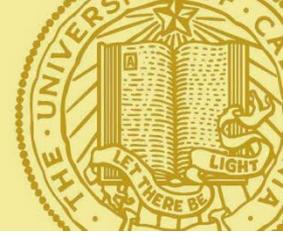
Luo et al (2019). Cell phone use and risk of thyroid cancer: a population-based case-control study in Connecticut. *Annals of Epidemiology*. <http://bit.ly/saferEMRthyroid> (2010-2011 data)

Luo et al (2020). Genetic susceptibility may modify the association between cell phone use and thyroid cancer: A population-based case-control study in Connecticut. *Environmental Research*. <http://bit.ly/EMRthyroid>

Human studies find various health risks associated with cell phone use



- **Tumor risk:** glioma, meningioma, acoustic neuroma; thyroid, parotid & pituitary glands; breast
- **Reproductive harm:** sperm damage, male infertility, miscarriage, preterm birth
- **Prenatal/Children:** headaches, hearing problems, impaired memory, ADHD
- **Electromagnetic hypersensitivity:** headaches, memory impairment, fatigue, insomnia, heart palpitations, muscle pain, skin conditions, etc.



Human cell tower studies

Environmental Research 214 (2022) 113851



Contents lists available at [ScienceDirect](#)

Environmental Research

journal homepage: www.elsevier.com/locate/envres



Evidence for a health risk by RF on humans living around mobile phone base stations: From radiofrequency sickness to cancer

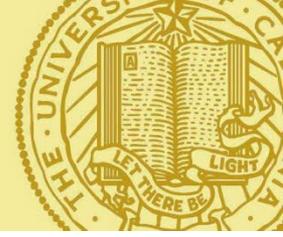


A. Balmori¹

“Overall results of this review show three types of effects by base station antennas on the health of people: radiofrequency sickness (RS), cancer (C) and changes in biochemical parameters (CBP). Considering all the studies reviewed globally (n = 38), 73.6% (28/38) showed effects: 73.9% (17/23) for radiofrequency sickness, 76.9% (10/13) for cancer and 75.0% (6/8) for changes in biochemical parameters....”

<https://bit.ly/saferEMRtower>

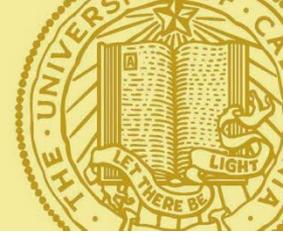
Electromagnetic fields (EMF) threaten wildlife



“Numerous studies ... indicate that current low-level anthropogenic EMF can have myriad adverse and synergistic effects, including on orientation and migration, food finding, reproduction, mating, nest and den building, territorial maintenance and defense, and on vitality, longevity and survivorship itself. Effects have been observed in mammals ... and on birds, insects, amphibians, reptiles, microbes and many species of flora.”

Levitt, Lai, and Manville (2021) – for summaries of this 150-page monograph and related research see <https://bit.ly/EMRwildlife>.

2018 CTIA campaign: “The Global Race to 5G”

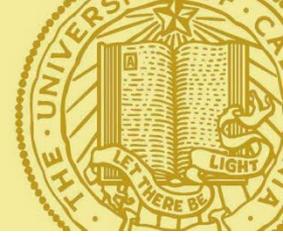


Winning the Race to 5G

<http://bit.ly/CTIArace>

<https://bit.ly/44CWKio>





Thursday August 20, 2020 Study 5 G First



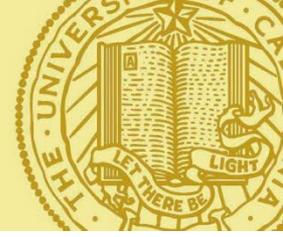
DILBERT.COM @SCOTTADAMSSAYS



8-20-20 2020 Scott Adams, Inc./Dist. by Andrews McMeel



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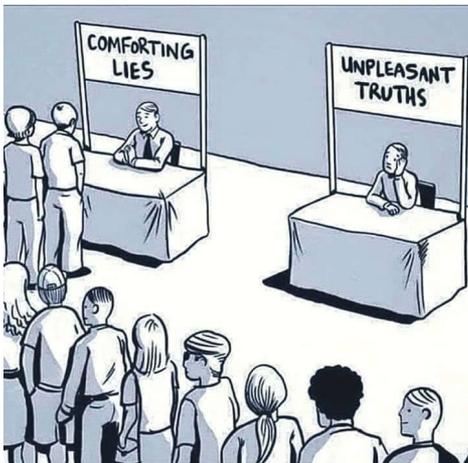
We Have No Reason to Believe 5G Is Safe

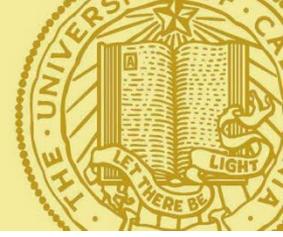
The technology is coming, but contrary to what some people say, there could be health risks

By Joel M. Moskowitz on October 17, 2019

<https://bit.ly/5GSciAmJMM>

<https://bit.ly/3s4F55B>



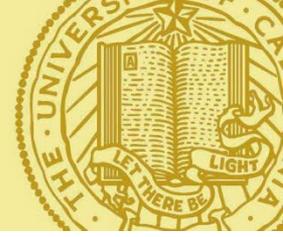


Key points in my 2019 SciAm op-ed

- FCC exposure limits based upon 2 studies which observed behavioral change in 8 rats & 5 monkeys exposed to microwave radiation for 40-60 minutes.
- Limits designed to protect us only from short-term heating risks, not from chronic disease.
- 500+ studies found adverse biologic or health effects from low-intensity (sub-thermal) exposure to microwave radiation.
- No research on effects of 5G available.
- Senator Richard Blumenthal (2019): 5G

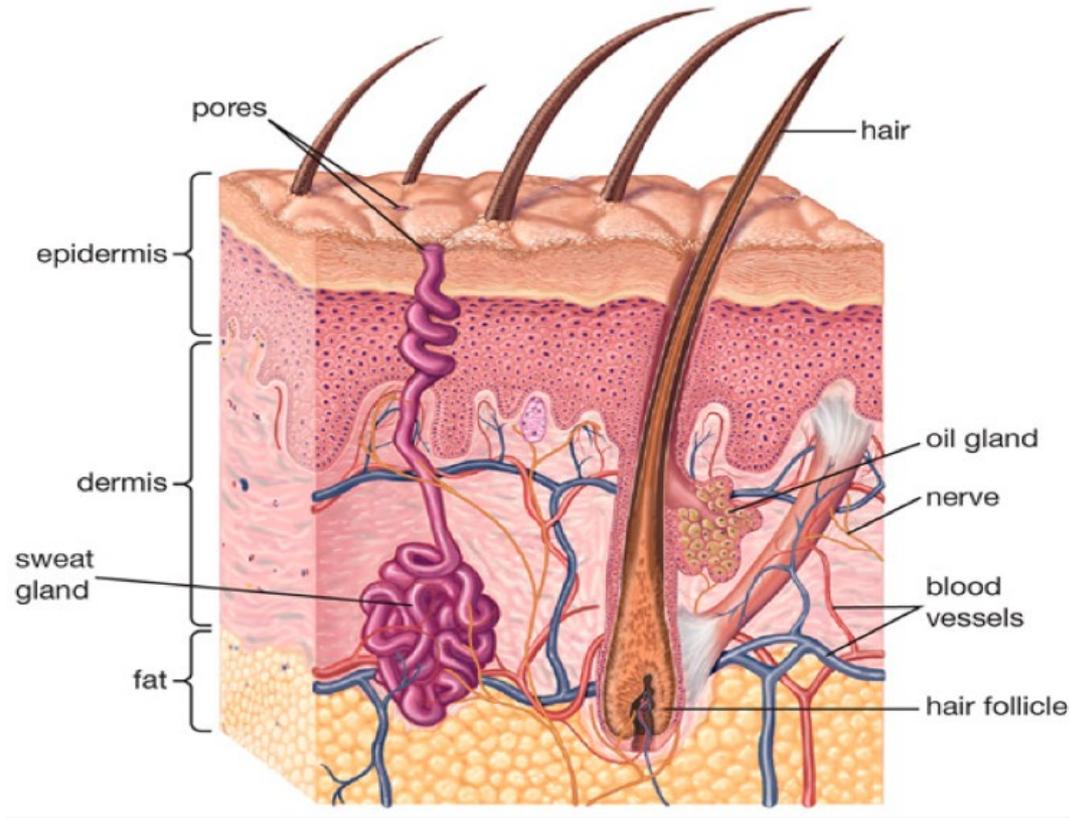
At the end of the exchange, Blumenthal concluded, “So there really is no research ongoing. We’re kind of flying blind here, as far as health and safety is concerned.”





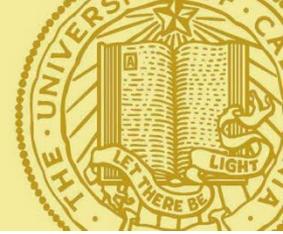
Millimeter wave effects

Figure 1. Schematic for human skin structure [38]. Radiation in the lower frequency portion of the MMW band penetrates down into the dermis. The schematic obtained from [38] an open access encyclopædia (Encyclopædia Britannica).



<https://www.mdpi.com/1424-8220/20/5/1480>

Review: Millimeter wave effects on head and neck region



Dagli N et al. Interaction of Millimetre Waves Used in 5G Network with Cells and Tissues of Head-and-Neck Region: A Literature Review. *Advances in Human Biology* 13(2):168-176, 2023. doi: [10.4103/aihb.aihb_133_22](https://doi.org/10.4103/aihb.aihb_133_22).

“Five of 24 studies were done on animals, four on humans, five on models, and ten on various cells. Ten of 24 studies demonstrated the harmful effects of millimetre waves. Results are ambivalent, and no association is found between particular frequency and impact on tissue, animals or humans. Pathophysiological effects observed in most studies were mild, reversible, and limited to the cellular level. Available evidence reported temperature rise after millimetre wave exposure, which was within safety limits. Any biological impact on a cellular level noticed due to radiation’s thermal effects were insignificant and did not affect the organ level. However, **only a few studies have mentioned non-thermal impact, but those effects should not be overlooked. Clinical trials on a large population and for a longer duration are required to establish the safety of millimetre waves before deploying a 5G network worldwide.**”

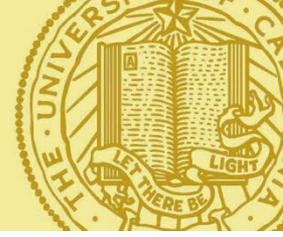


5G biological & health effects

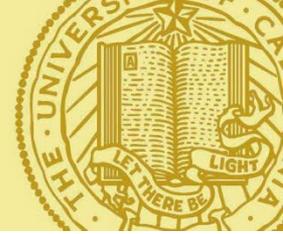
- EMF-Portal lists 33 “5G” effects studies.
 - Studies found ”adverse effects on the neuroendocrine system, the cardiovascular system, sleep quality, sperm quality, bone quality, gene expression, and sensorimotor responses.”
 - All 33 used 5G carrier frequencies; only 5 used 5G modulation & only 4 had other key features of 5G (e.g., beamforming, massive MIMO; phased antenna arrays).

<https://bit.ly/is5Gsafe>

Increasing scientific consensus or scientific controversy?



International Agency for Research on Cancer expert working group



International Agency for Research on Cancer



PRESS RELEASE
N° 208

31 May 2011

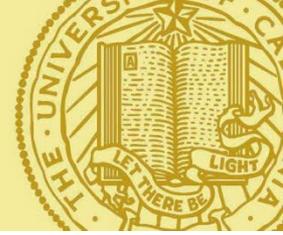
**IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS
POSSIBLY CARCINOGENIC TO HUMANS**

THE LANCET
Oncology

IARC Monographs Priorities Group [†] • [Show footnotes](#)

Published: April 17, 2019 • DOI: [https://doi.org/10.1016/S1470-2045\(19\)30246-3](https://doi.org/10.1016/S1470-2045(19)30246-3)

<https://www.thelancet.com/action/showPdf?pii=S1470-2045%2819%2930246-3>



International EMF Scientist Appeal



“Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.”

5G appeal: Scientists & doctors call for moratorium on deployment



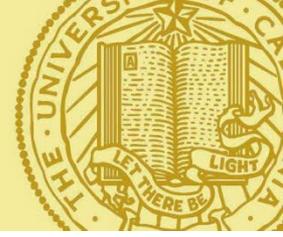
The 5G appeal

Scientists and doctors call for a moratorium on the roll-out of 5G. 5G will substantially increase exposure to radiofrequency electromagnetic fields RF-EMF, that has been proven to be harmful for humans and the environment.

- 2017: Submitted to European Commission
- Currently signed by more than 430 scientists & physicians from 47 nations including ~100 EMF scientists.

www.5gappeal.eu

ICBE-EMF: Royal Society of Medicine 2023 webinar



Radiofrequency Radiation from Wireless Communication Sources Are Safety Limits Valid?

International Commission on Biological Effects of Electromagnetic Fields



14th June, 2-5:30 PM
times in London (BST)
ONLINE WEBINAR!

Prof. Kent Chamberlin



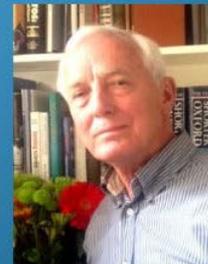
Dr. Erica Mallery-Blythe



Prof. James Lin



Mr. David Gee

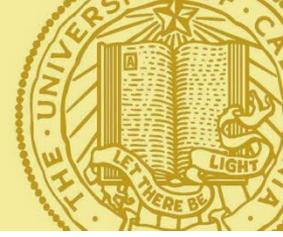


Prof. John Frank



Recording available online: <https://icbe-emf.org/activities/webinar-june-14-2023/>

ICBE-EMF: Peer-reviewed publications



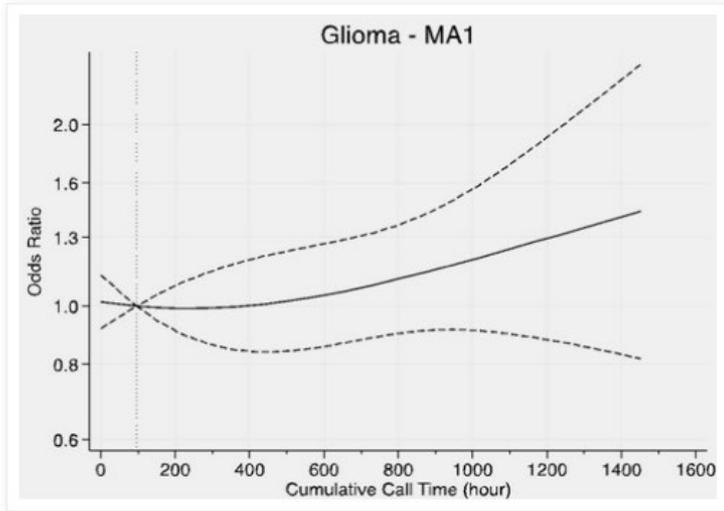
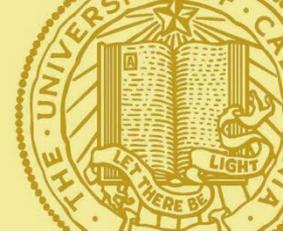
Scientific evidence invalidates health assumptions underlying the FCC and ICNIRP exposure limit determinations for radiofrequency radiation: Implications for 5G (2022)

Cell phone radiation exposure limits and engineering solutions (2023)

COSMOS: A methodologically-flawed cohort study of the health effects from exposure to radiofrequency radiation from mobile phone use (2024)

A critical appraisal of the WHO 2024 systematic review of the effects of RF-EMF exposure on tinnitus, migraine/headache, and non-specific symptoms (2024)

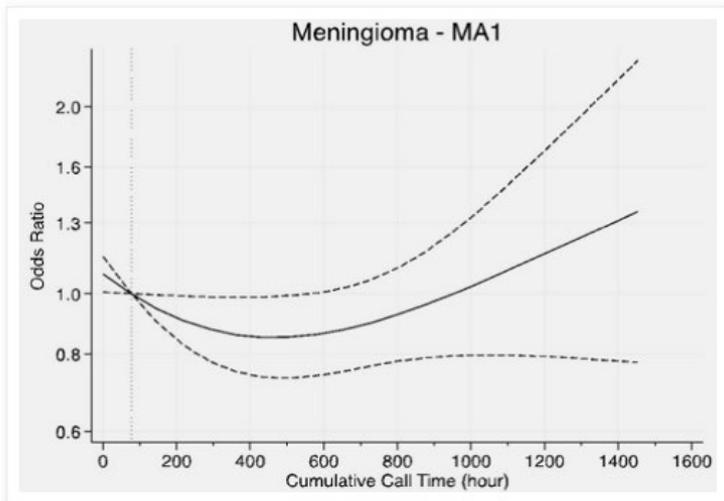
Critical commentary on WHO reviews of RF radiation health effects



[Biased WHO-commissioned review claims no cancer link to cellphone use](#)

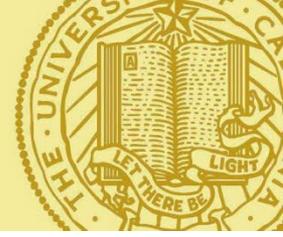
[WHO Radiofrequency EMF Health Risk Assessment Monograph](#)

[Old Wine in New Bottles: Decoding New WHO-ICNIRP Cancer Review Game Over? Likely Not \(Microwave News\)](#)



[A critical appraisal of the WHO 2024 systematic review of the effects of RF-EMF exposure on tinnitus, migraine/headache, and non-specific symptoms \(Reviews on Environmental Health\)](#)

Safety tips



How to Reduce Exposure to Radiofrequency Energy from Cell Phones

How can you reduce your exposure?

Keep your phone away from your body. Keeping your phone just a few feet away from you can make a big difference.

- **When you talk on your cell phone, avoid holding it to your head—use the speakerphone or a headset instead.** Wireless (Bluetooth) and wired headsets emit much less RF energy than cell phones.
- **Send text messages instead of talking on the phone.**
- **If you are streaming or if you are downloading or sending large files, try to keep the phone away from your head and body.**
- **Carry your cell phone in a backpack, briefcase, or purse; NOT in a pocket, bra or belt holster.** Because your phone's antenna tries to stay connected with a cell tower whenever it's on, it emits some RF energy even when you are not using it. It does not emit RF energy when it's in airplane mode. (Airplane mode turns off cellular, Wi-Fi, and Bluetooth.)

Reduce or avoid using your cell phone when it is sending out high levels of RF energy. This happens mainly when:

- **You see only one or two bars displayed.** Cell phones put out more RF energy to connect with cell towers when the signal is weak. If you must use your phone when the signal is weak, try to follow the other guidance on this page.
- **You are in a fast-moving car, bus, or train.** Your phone puts out more RF energy to maintain connections to avoid dropping calls as it switches connections from one cell tower to the next unless it is in airplane mode.
- **You are streaming audio or video, or downloading or sending large files.** To watch movies or listen to playlists on your phone, download them first, then switch to airplane mode while you watch or listen.

Don't sleep with your phone in your bed or near your head. Unless the phone is off or in airplane mode, keep it at least a few feet away from your bed.

Take off the headset when you're not on a call. Headsets release small amounts of RF energy even when you are not using your phone.



What about children?

Children may be more at risk for harm from exposure to RF energy because:

- RF energy can reach a larger area of a child's brain than an adult's brain.
- A child's brain and body grow and develop through the teen years. During this time, the body may be more easily affected by RF energy and the effect may be more harmful and longer lasting.
- A child who uses a cell phone will have many more years of exposure to RF energy in his or her lifetime than someone who started using a cell phone as an adult.

There is not a lot of research about the effects of cell phone RF energy on children or teenagers, but a few studies have shown that there may be hearing loss or ringing in the ears, headaches, and decreased general well-being.

TIPS TO REDUCE YOUR WIRELESS RADIATION EXPOSURE

WHERE & WHEN

Keep a distance. Avoid holding your cell phone or cordless phone near your head or body during phone calls. Don't carry your cell phone in your pocket, in your bra, or close to your body when it is powered on. Especially keep the phone away from your head and reproductive organs. Use speakerphone, text, or wired headset. Avoid talking longer than necessary.

Reduce secondhand exposure. Reduce the time you spend in locations where many people are using cell phones in close proximity to each other, especially on public transit.

Turn off wireless devices at bedtime. Turn off your cell phone, Wi-Fi router, and other wireless devices at bedtime and at other times when not in use.

Wait for a good signal. When the signal is poor, your wireless devices emit more radiation so avoid use when surrounded by metal such as in an elevator, or while travelling in automobiles, buses, trains or aircraft.

WHO & HOW

Minimize children's use & exposure to wireless radiation. Children's health risks are greater so limit their use of cell phones and other wireless devices. Turn off Wi-Fi and cellular on devices used by kids. Teach children to use wireless technology safely.

Pregnancy & fertility. If you are pregnant or planning for a baby be especially careful as wireless radiation exposure is linked to reproductive health effects and also to sperm damage. Do not use a wireless tablet or laptop in your lap.

Use airplane mode. Turn off cell phones and other wireless devices when not in use or switch to Airplane Mode. Turn off Wi-Fi and Bluetooth when not in use.

Use wired connections. Use a wired, land line phone whenever possible. Forward cell phone calls to your land line and check on them when you get home. Use wired Internet connections.

TAKE ACTION

Electromagnetic hypersensitivity. If you think you are developing allergic symptoms from wireless radiation exposure, keep a log of your exposures and your symptoms. Then reduce your exposures for two weeks, and see if your symptoms are reduced. Discuss the results with your healthcare provider.

Governmental action is essential. Send the *International EMF Scientist Appeal* (EMFscientist.org) to your elected representatives. Ask them to adopt policies to make wireless technology safer. Encourage them to fund education and research through a modest fee on mobile device subscriptions (e.g. a nickel a month). Work with others to get schools to remove Wi-Fi and provide students with Internet access via wired networks.

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Electromagnetic Radiation Safety
Website: <http://www.saferemr.com>
Facebook: <http://www.facebook.com/SaferEMR>
News Releases: <http://pressroom.prlog.org/jmm716/>
Twitter: @berkeleyprc

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<http://bit.ly/EMRsafetyTips>

<http://bit.ly/CDPHtips3>



Concluding thoughts

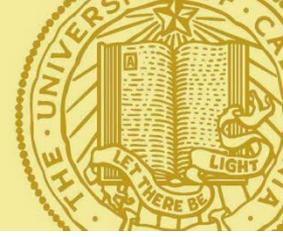
“We are guinea pigs in a massive technological experiment that threatens our health. Our government must fund the research needed to determine a safe level of wireless radiation exposure and strengthen the FCC's radio frequency exposure limits.

In the meantime, the government should impose a moratorium on technologies that increase our wireless radiation exposure, especially to new forms of wireless radiation like 5G.”

Joel M. Moskowitz, Ph.D.

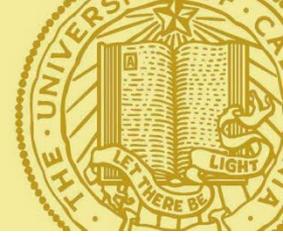
[NTP Cell Phone Radiation: Final Reports](#)

Resources



“How the FCC Shields Cellphone Companies From Safety Concerns” Peter Elkind, ProPublica, Nov 10, 2022

Key Cell Phone Radiation Research Studies
Intl. Commission on the Biological Effects of EMF
International EMF Scientist Appeal
Physicians for Safe Technology
Environmental Health Trust
5G Appeal
EMF-Portal



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