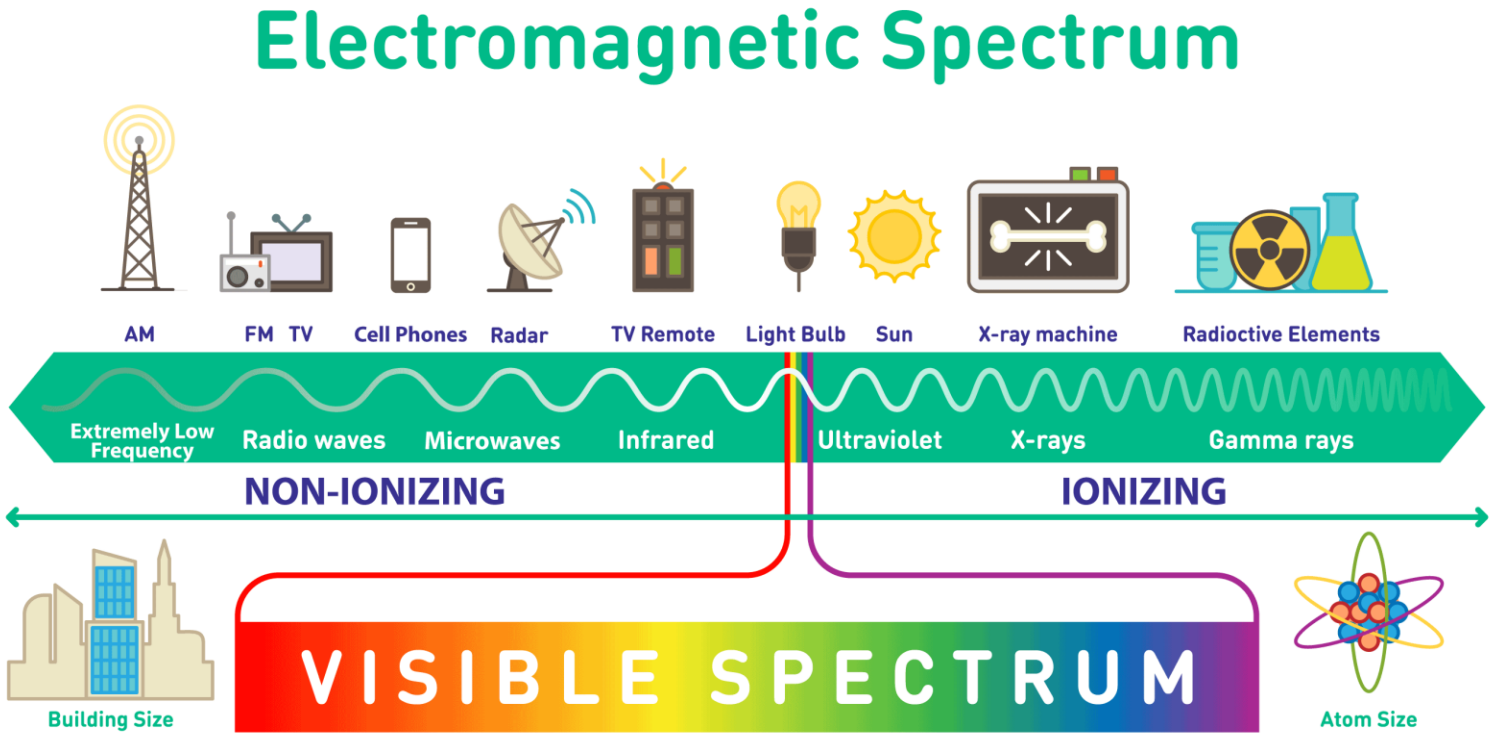
Review of the current literature on the human effects of cell phones and cell towers.

Jonesboro City Council

August 2020

- Radiation
  - Ionizing
    - Able to change DNA
  - Non-ionizing
    - Not able to change DNA
    - Radiofrequency (RF)
      - Heat production

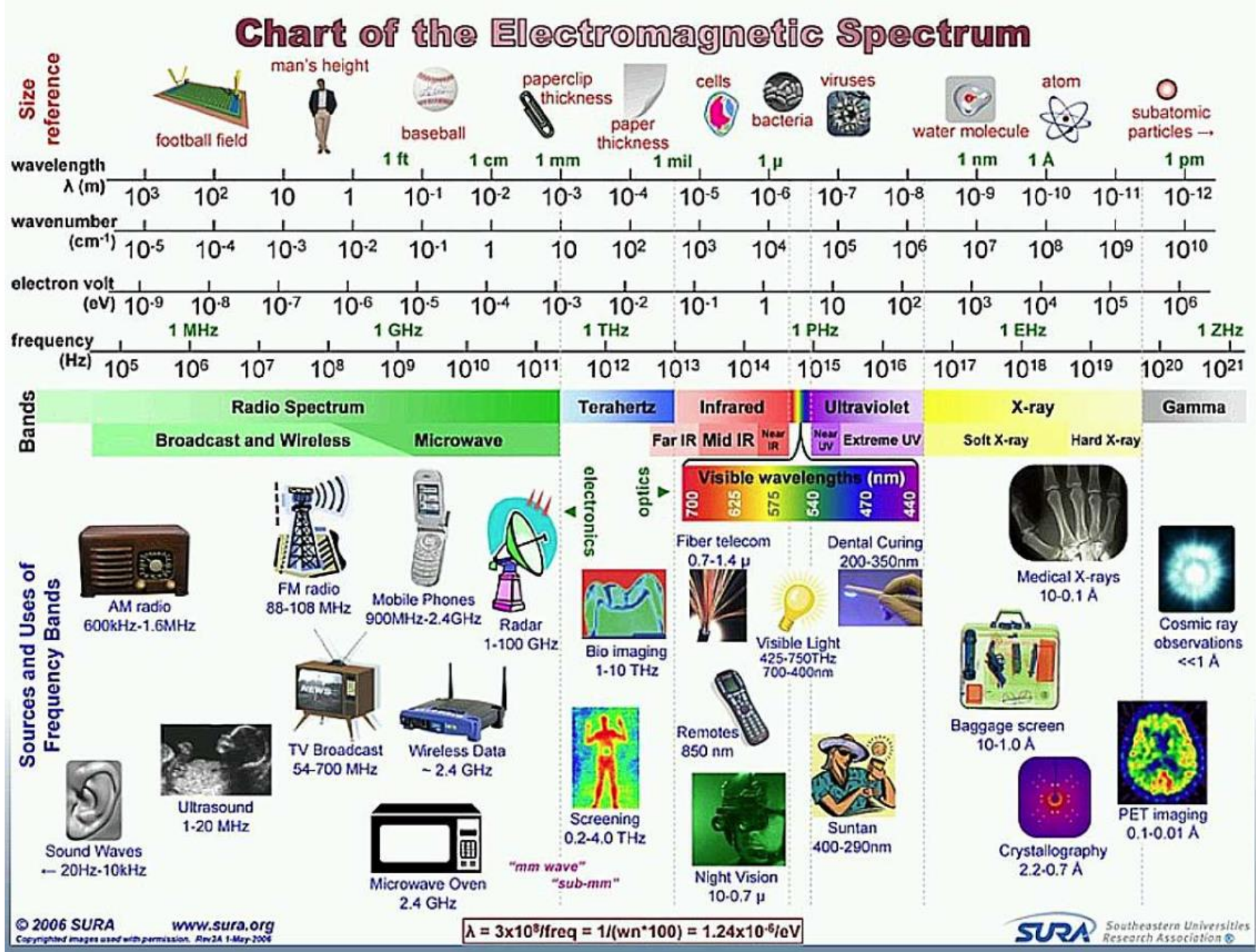


How is non-ionizing radiation different from ionizing radiation?

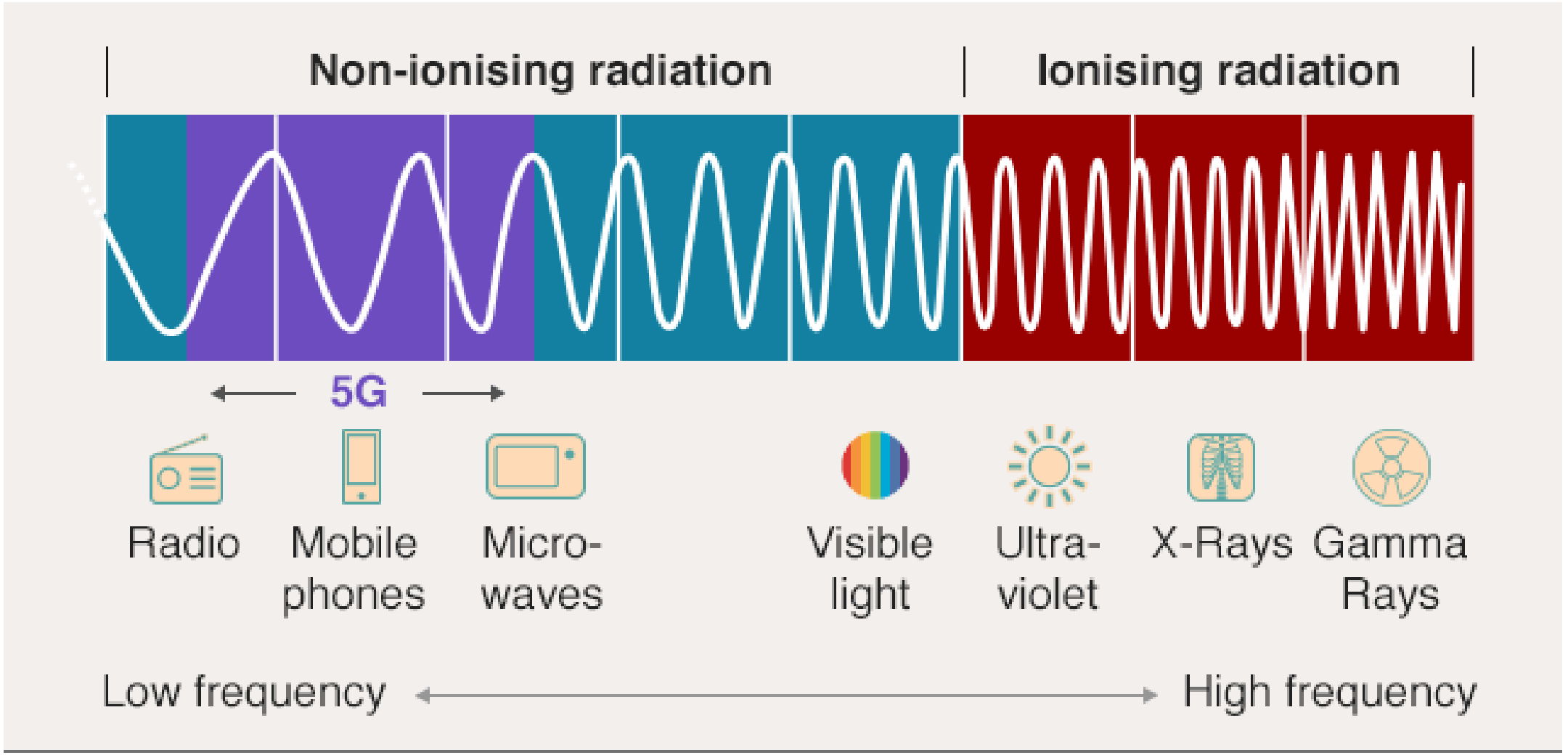
Put simply, non-ionizing radiation differs from ionizing radiation in the way it acts on materials like air, water, and living tissue

Unlike x-rays and other forms of ionizing radiation, non-ionizing radiation does not have enough energy to remove electrons from atoms and molecules. Non-ionizing radiation can heat substances. For example, the microwave radiation inside a microwave oven heats water and food rapidly.

Chart of the Electromagnetic Spectrum



Where 5G fits in the electromagnetic spectrum



Source: SCAMP/Imperial College London/EBU

BBC

The Research

- Publications through PubMed (cell phones in general)
  - British Medical Journal (BMJ), April 2006
    - Population study; Questionnaire about cell phone use for patients with brain cancer
    - No significant increase in brain tumors with cell phone use
  - Journal of Fertility and Sterilization, January 2008
    - Observational study; Infertility in men and associated cell phone use.
    - Positive association with increased cell phone use and male infertility
  - Journal of the American Medical Association (JAMA), February 2011
    - Cell phone effects on brain metabolism on humans
    - Increased glucose metabolism found; unsure what the true effect is
  - National Toxicology Program (NIH), February 2018
    - Rats and Mice study; 2G and 3G; 2 years of exposure; 9 hours/day (10/min on/off)
    - Increase in heart tumors in rats; none noted in mice
  - National Toxicology Program (NIH), November 2018
    - Rat study; 2G and 3G; 2 years of exposure; 18 hr/day for 5-7 days
    - Small increase in brain and heart tumors
    - More studies needed

PMC

PubMed Central® (PMC) is a free full-text archive of biomedical and life sciences journal literature at the U.S. National Institutes of Health's National Library of Medicine (NIH/NLM).

The Research

- Publications
  - British Medical Journal (BMJ); June 2010
    - Living near a cell phone tower during pregnancy
    - Looked at 1400 childhood cancer cases and mothers proximity to a cell tower
    - No association; No difference in groups

MAYO CLINIC

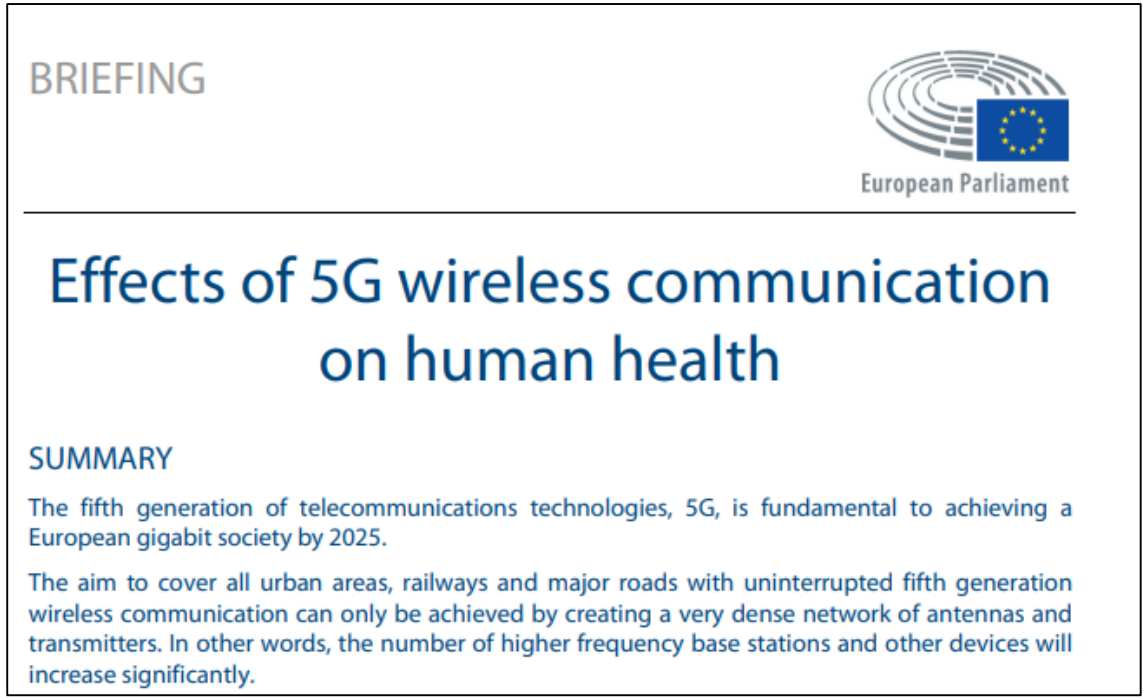
- In one study that followed more than 420,000 cellphone users over a 20-year period, researchers found no evidence of a link between cellphones and brain tumors.
- Another study found an association between cellphones and cancer of the salivary glands. However, only a small number of study participants had malignant tumors.
- Another study suggested a possible increased risk of glioma — a specific type of brain tumor — for the heaviest cellphone users, but no increase in brain tumor risk overall.

The Research

- Publications from Environmental Health Trust
  - Website/Organization
    - Large number of research articles; most are biased, but some offer good counter arguments
    - Majority are “in vitro” (in a culture dish) studies
    - Some are non-human “in vivo” (in a living organism) studies
  - *Environmental Research and Public Health*; June 2020; Evaluation of Inflammation by Cytokine Production Following Combined Exposure to Ultraviolet and Radiofrequency Radiation of Mobile Phones on 3D Reconstructed Human Skin In Vitro
    - Looked at UV + RF effects
    - Didn’t reach statistical difference (p value < 0.05); possible protective effect of RF to UV through signaling mechanism? (non-significant)
  - *IEEE Access*; July 2020; 5G Radiation in Brain Tissue as a Function of Frequency, Power, and Time
    - Increase power density and temperature with 5G radiofrequencies on bovine brains

The Research

- Publications from Environmental Health Trust
  - European Parliament Briefing; 2020; Effects of 5G wireless communication on human health
    - Review of the science for policy makers
    - Considered the large number of devices using this technology.
    - No definite conclusions
    - More research needed.



BRIEFING

European Parliament

Effects of 5G wireless communication on human health

SUMMARY

The fifth generation of telecommunications technologies, 5G, is fundamental to achieving a European gigabit society by 2025.

The aim to cover all urban areas, railways and major roads with uninterrupted fifth generation wireless communication can only be achieved by creating a very dense network of antennas and transmitters. In other words, the number of higher frequency base stations and other devices will increase significantly.

Research on EMF and 5G effects on human health

The academic literature on EMF exposure effects and 5G in particular is growing rapidly. Some research papers support possible health risks, while others do not.

The WHO[14]/International Agency for Research on Cancer (IARC) classified radiofrequency EMF as possibly carcinogenic to humans in 2011. The IARC has recently prioritised EMF radiation for review in the next five years (2020-2024).

Consequently, the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER), replacing the former Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), indicated a preliminary estimate of the importance of 5G as high, in a statement in December 2018. Furthermore, it evaluates the scale, urgency and interactions (with ecosystems and species) of possible hazard as high. It suggested that there could be biological consequences from a 5G environment, due to the fact that there is a lack of 'evidence to inform the development of exposure guidelines to 5G technology'.

The Research

- Publications from Environmental Health Trust (Elsevier)
  - *Environmental Research*; August 2018; 5G wireless telecommunications expansion: Public Health and environmental implications
    - Good review article of 2G, 3G, 4G
    - Urges caution in adoption of 5G due to unknown effects.
    - Mores studies should be concluded by 2022
    - Boils down to Risk vs. benefit
      - What does the public gain vs. the potential risk?

Expert Opinion

- What do the “experts” say?
  - American Cancer Society
    - International Agency For Research on Cancer (IARC)
      - RF radiation is “possibly carcinogenic to humans”
    - U.S. Food and Drug Administration (FDA)
      - “there is insufficient evidence to support a causal association between radiofrequency radiation exposure and tumor formation”
    - National Toxicology Program (NTP/NIH)
      - RF radiation is not listed as a known or reasonably anticipated human carcinogen
    - U.S. Federal Communications Commission (FCC)
      - “no scientific evidence establishes a causal link between wireless device use and cancer or other illnesses” “more studies needed”
    - U.S. Centers for Disease Control and Prevention (CDC)
      - “we do not have the science to link health problems to cell phone use” “studies are underway”
    - The National Cancer Institute
      - “there is currently no consistent evidence that non-ionizing radiation increases cancer risk in humans. The only consistently recognized biological effect of RF in humans is heating”

NATIONAL CANCER INSTITUTE
Surveillance, Epidemiology, and End Results Program

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Cancer Stat Facts: Brain and Other Nervous System Cancer

Estimated New Cases in 2020	23,890
% of All New Cancer Cases	1.3%

Estimated Deaths in 2020	18,020
% of All Cancer Deaths	3.0%

5-Year Relative Survival

32.6%

2010–2016

Total U.S. Rate compared to Five Highest and Five Lowest State Rates

State	Rate	SE	Rank	PD
TOTAL U.S.	158.34	0.09		
Kentucky	194.78	0.88	01(01,01)	23.01[c]
Mississippi	190.06	1.07	02(02,03)	20.03[c]
West Virginia	186.72	1.24	03(02,04)	17.92[c]
Arkansas	181.92	1.02	04(03,07)	14.89[c]
Tennessee	181.00	0.69	05(04,07)	14.31[c]
Arizona	141.01	0.59	47(45,48)	-10.94[c]
Wyoming	140.99	2.11	48(43,49)	-10.96[c]
Colorado	136.25	0.72	49(48,50)	-13.95[c]
Hawaii	132.23	1.24	50(49,50)	-16.49[c]
Utah	125.50	1.03	51(51,51)	-20.74[c]

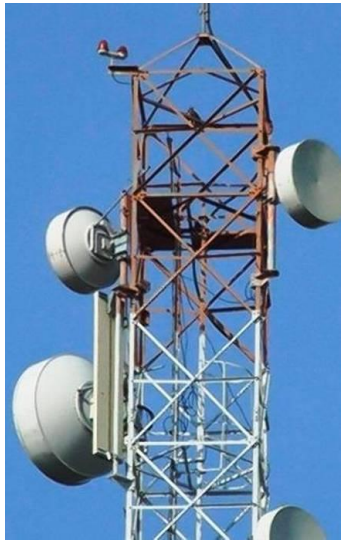
Estimated New Cases in 2020	1,806,590
% of All New Cancer Cases	100.0%

Estimated Deaths in 2020	606,520
% of All Cancer Deaths	100.0%

5-Year Relative Survival

67.4%

2010–2016



Summary

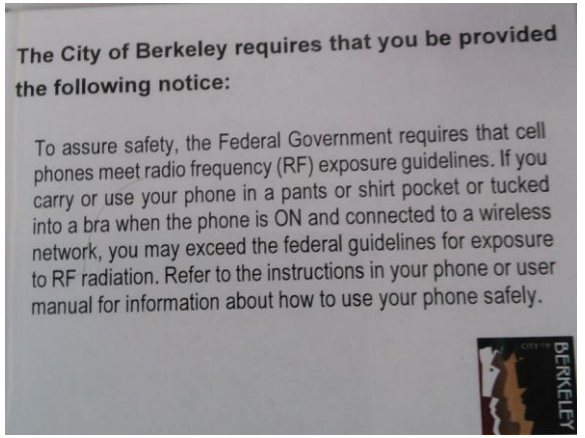
- Generally speaking, there are two concerns:
  - Does cell phone use cause cancer or adverse health effects?
    - Maybe – brain tumors, cancers in the inner ear (acoustic neuroma), salivary gland tumors; male infertility; pregnant women?; children?
    - Biased studies on both sides, but credible evidence shows a possibility (dose dependent)
  - Do cell phone towers cause cancer or adverse health effects?
    - Information is mixed based on how close you live to a cell tower.
    - The majority of the RF exposure goes down rapidly the further you live away from the tower/antenna (which are also higher off the ground). You wouldn't want a 4G antenna at ground level in your backyard.
    - If you weren't already aware, your skin is a big deal.
      - Largely protective of non-ionizing radiation.
      - Doesn't allow the waves to penetrate into the body.

Summary on 5G

- Current 2G, 3G, 4G are non-ionizing radiation, radio frequency waves
- 5G is to be used to connect to the IOT (Internet of Things)
  - All mobile devices, cars, appliances, home (appliances, lights, security, thermostat, vending machines, security, office machines, the list goes on and on)
  - Very large data movement at much faster speeds than 4G
- 5G is also non-ionizing, but is higher frequency and moves closer to micro-waves *which are not as powerful and travel a shorter distance than 2G, 3G, 4G* (hence the need for more of them closer together)
- The 5G concern seems to be centered around the pure volume of use or "pulsations" that will occur as a device connects to the tower. Constant device communication with the tower (streaming, email, texting, conference calls, file sharing, etc.)
- These "pulsed" electromagnetic frequency (EMF) waves are considered more biologically active (potentially cancer causing) than non-EMF waves.
- True effects won't be known for years to come when human data can be obtained.

What are other places doing?

- California - San Francisco, Berkeley, Sacramento
- Portland, Oregon
- Louisiana House of Representatives.
- Hawaii (Big island) – July 23, 2020, ban on 5G
- Tips for Passing Strong City Urgency Wireless Facilities Ordinance for “small cells”
  - https://mdsafetech.files.wordpress.com/2019/10/tips-for-passing-strong-urgency-city-wireless-ordinance-3-pdf.pdf
    - Prohibited zones (i.e. no placement around schools or homes)
    - Conditional Use Permits
    - RF data report requirement (this is a good idea)
    - Public notices



Why is this so hard?

- Fierce debate (and bias) on both sides of the argument.
- At this point we can't prove *causality* with 2G, 3G, or 4G, so we're guessing with 5G.
- There are too many other factors involved to draw accurate, real world conclusions on either side.
- Several cities and towns across the country are erring on the side of safety and waiting for more data to come out.
- Bottom line is that we need more quality studies.

Additional References

- https://www.cdc.gov/nceh/radiation/cell_phones._faq.html
- https://ehtrust.org/science/
- https://www.who.int/peh-emf/publications/facts/fs304/en/
- https://www.who.int/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones
- https://www.iarc.fr/wp-content/uploads/2018/07/pr208_E.pdf
- https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet