Phoenix, AZ

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The Health Effects of Radiofrequency Radiation

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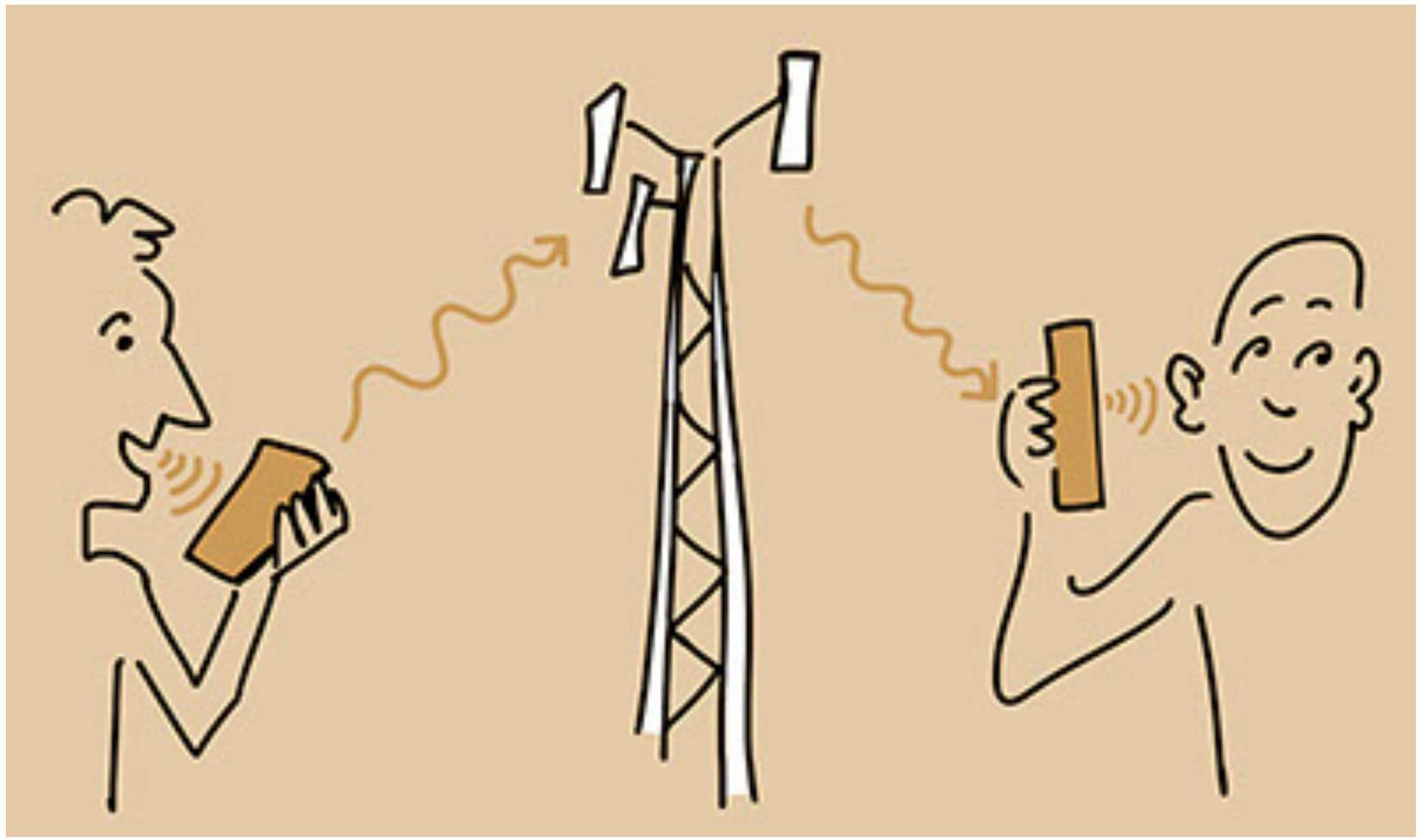
I will be presenting the consensus scientific view on RFR.

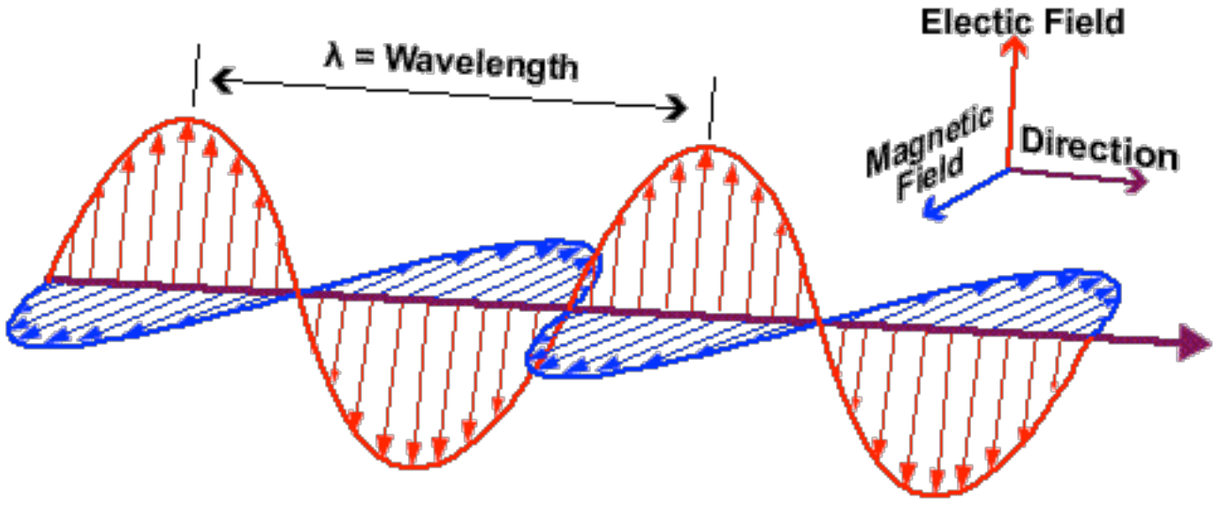
The cellphone network uses electromagnetic waves to communicate between towers and phones.



James Clerk Maxwell

(1831 – 1879)

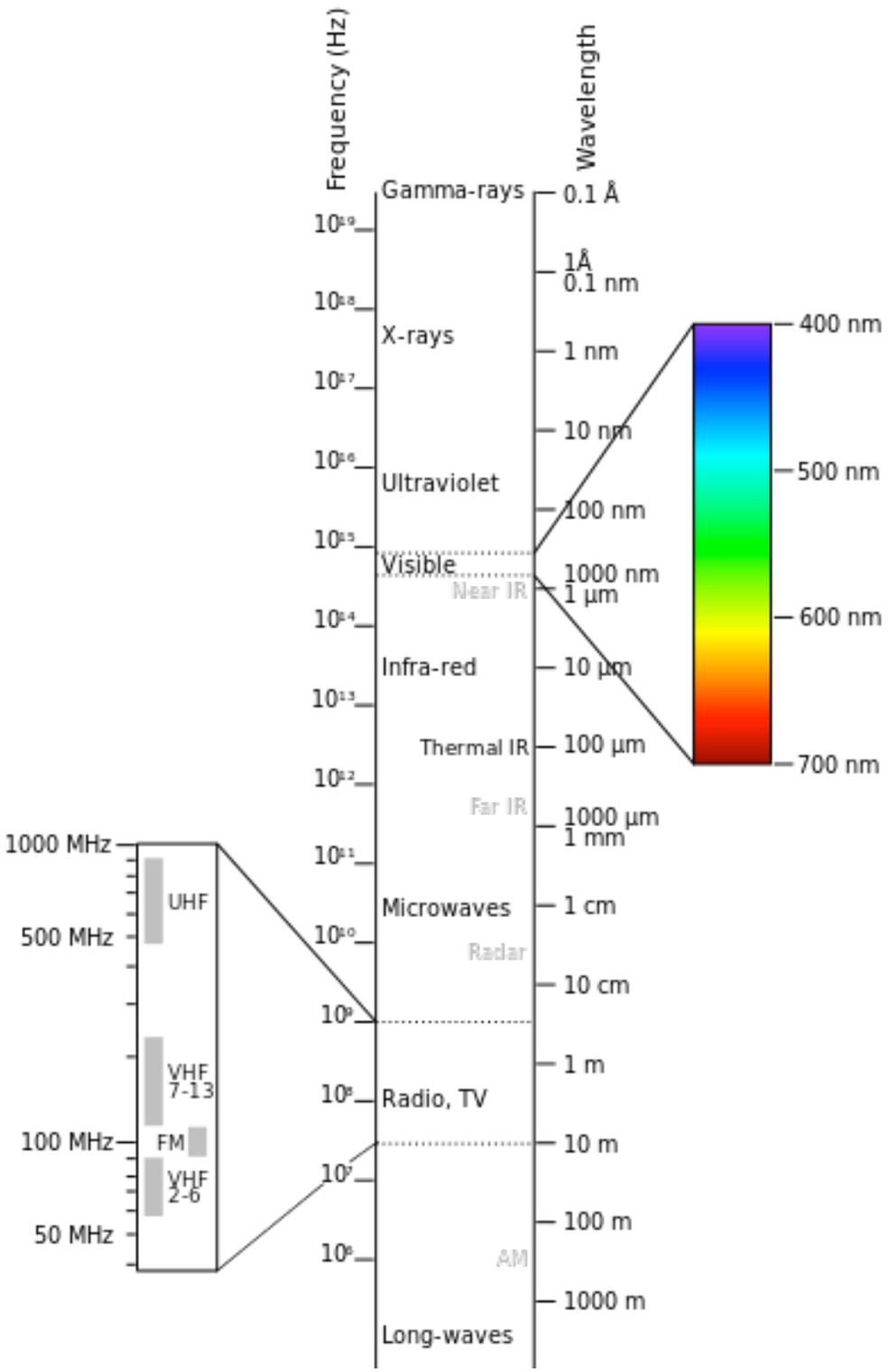
Scottish physicist.

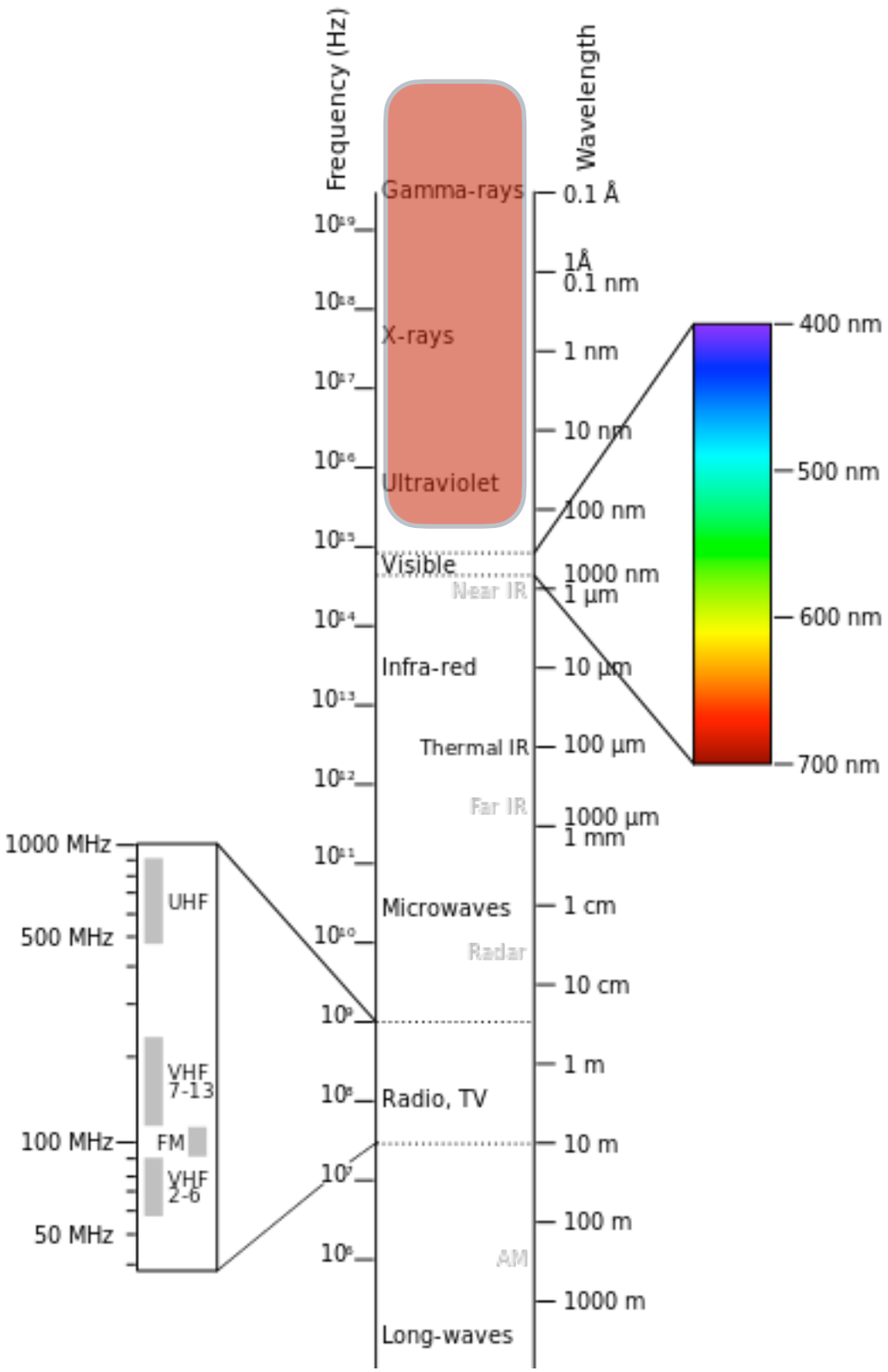


Electromagnetic radiation is the *best understood phenomenon in the universe.*

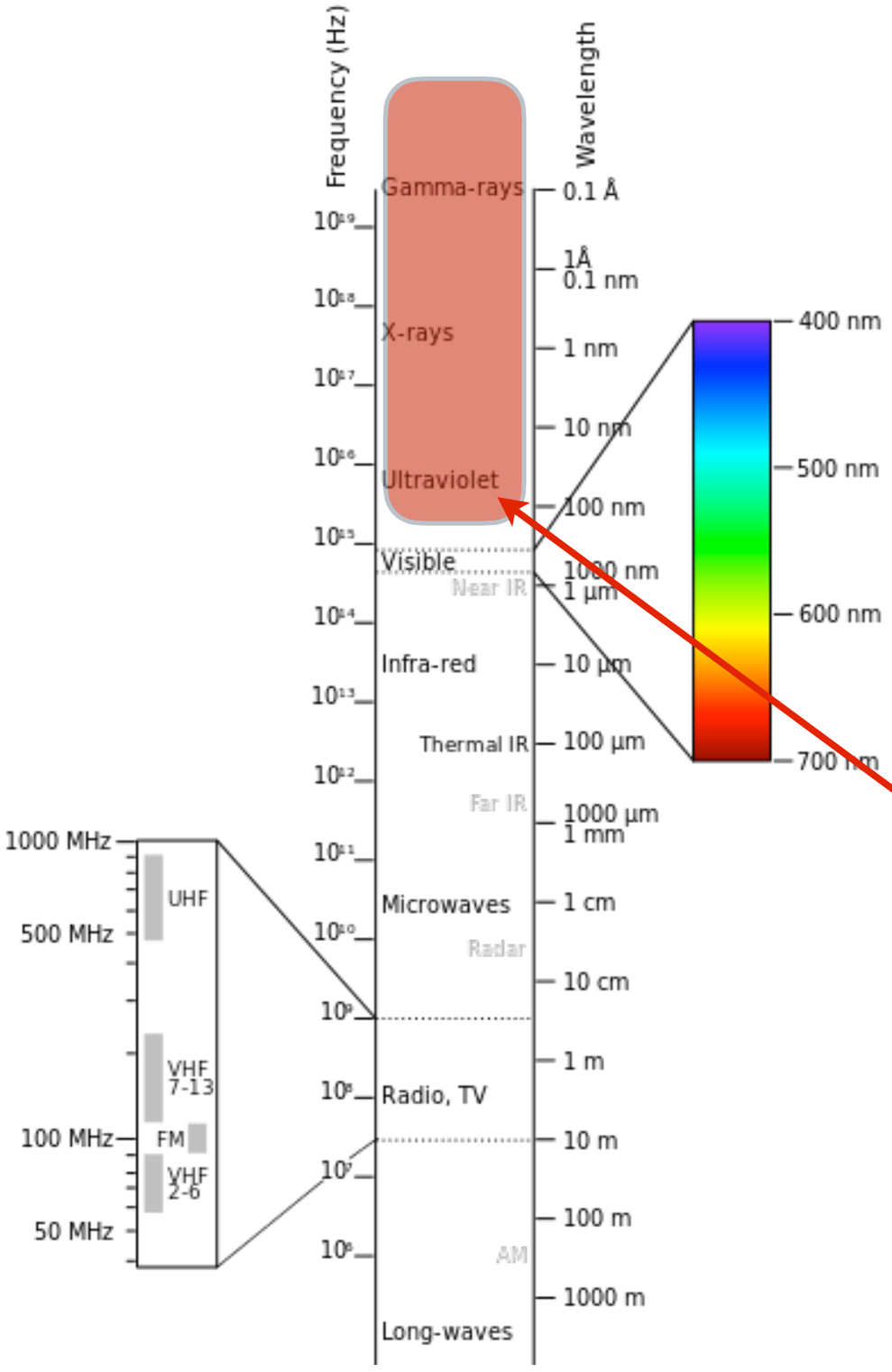
It is **not** nuclear radiation!

Electromagnetic waves form the “spectrum”





Some radiation is ionizing, which means it can strip electrons from atoms, which can sometimes cause cancer.



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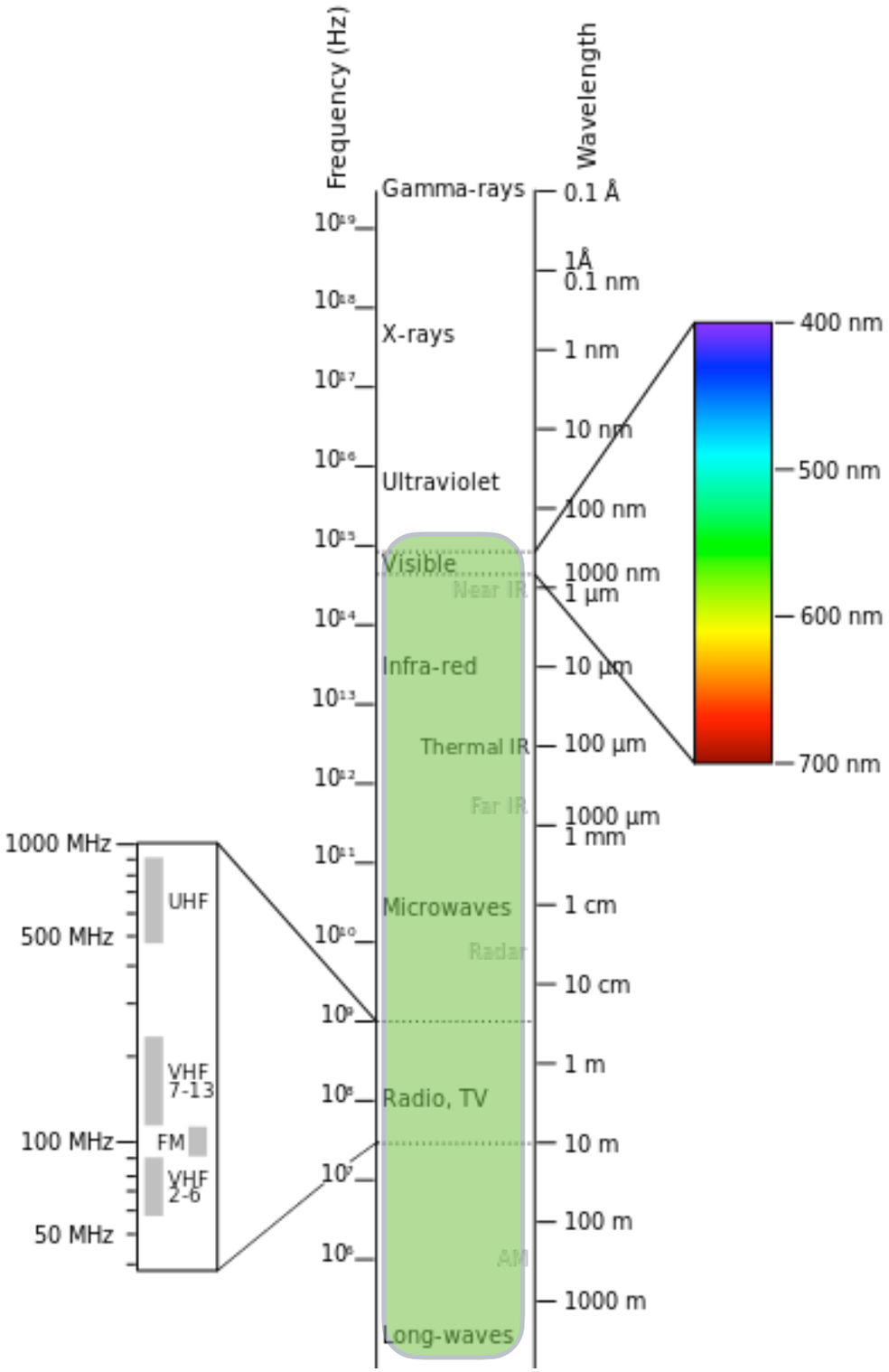
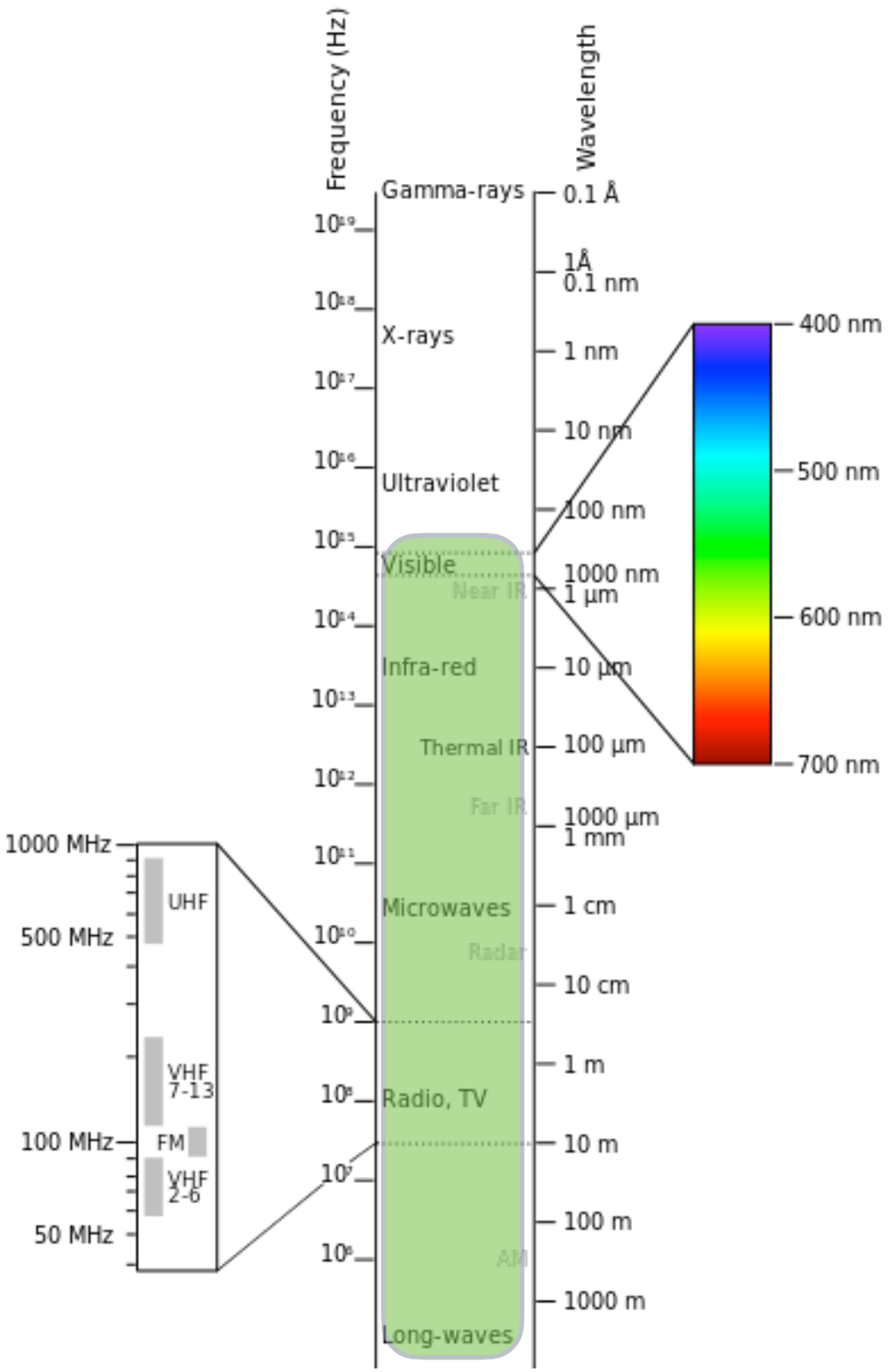
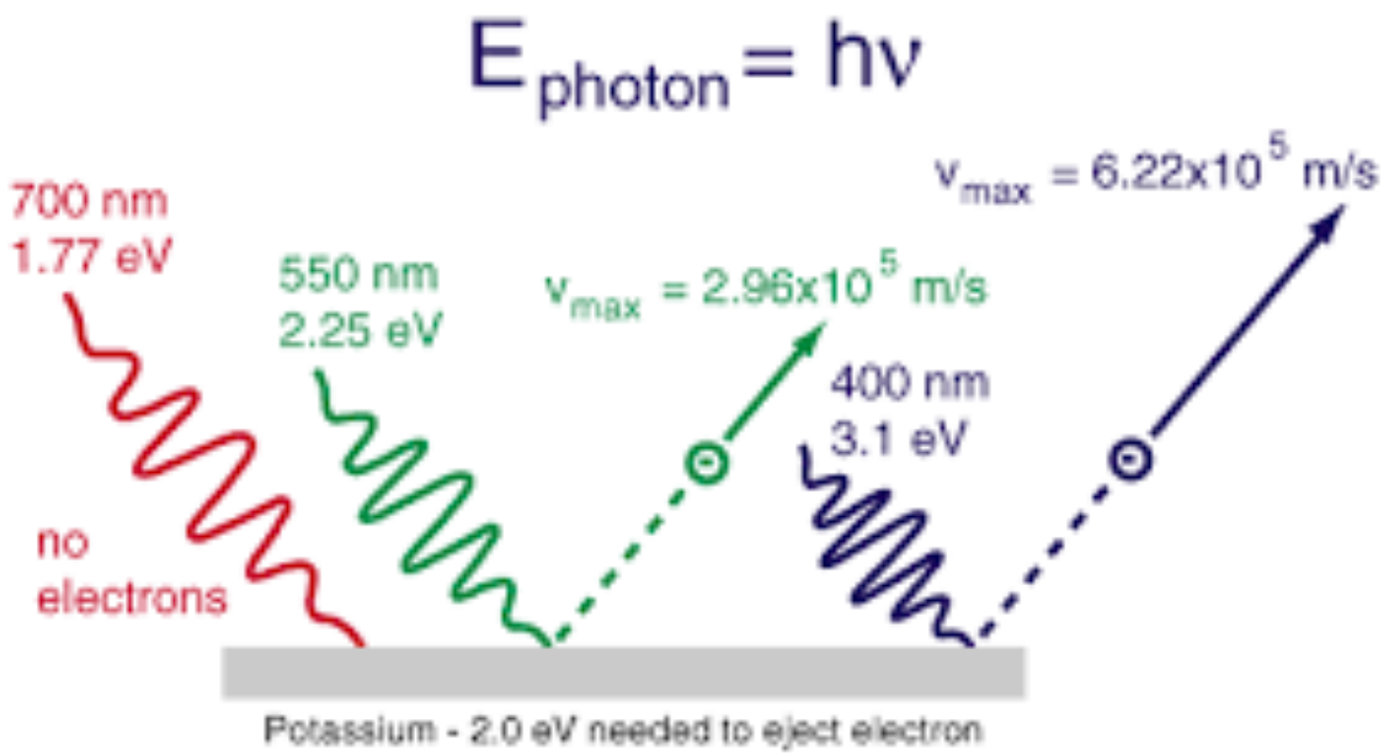


EM waves below the ionization threshold cannot create ions and cannot cause cancer.



Visible light does *not* tan skin, cause sunburn, or cause skin cancer.

the reason for the threshold: the photoelectric effect

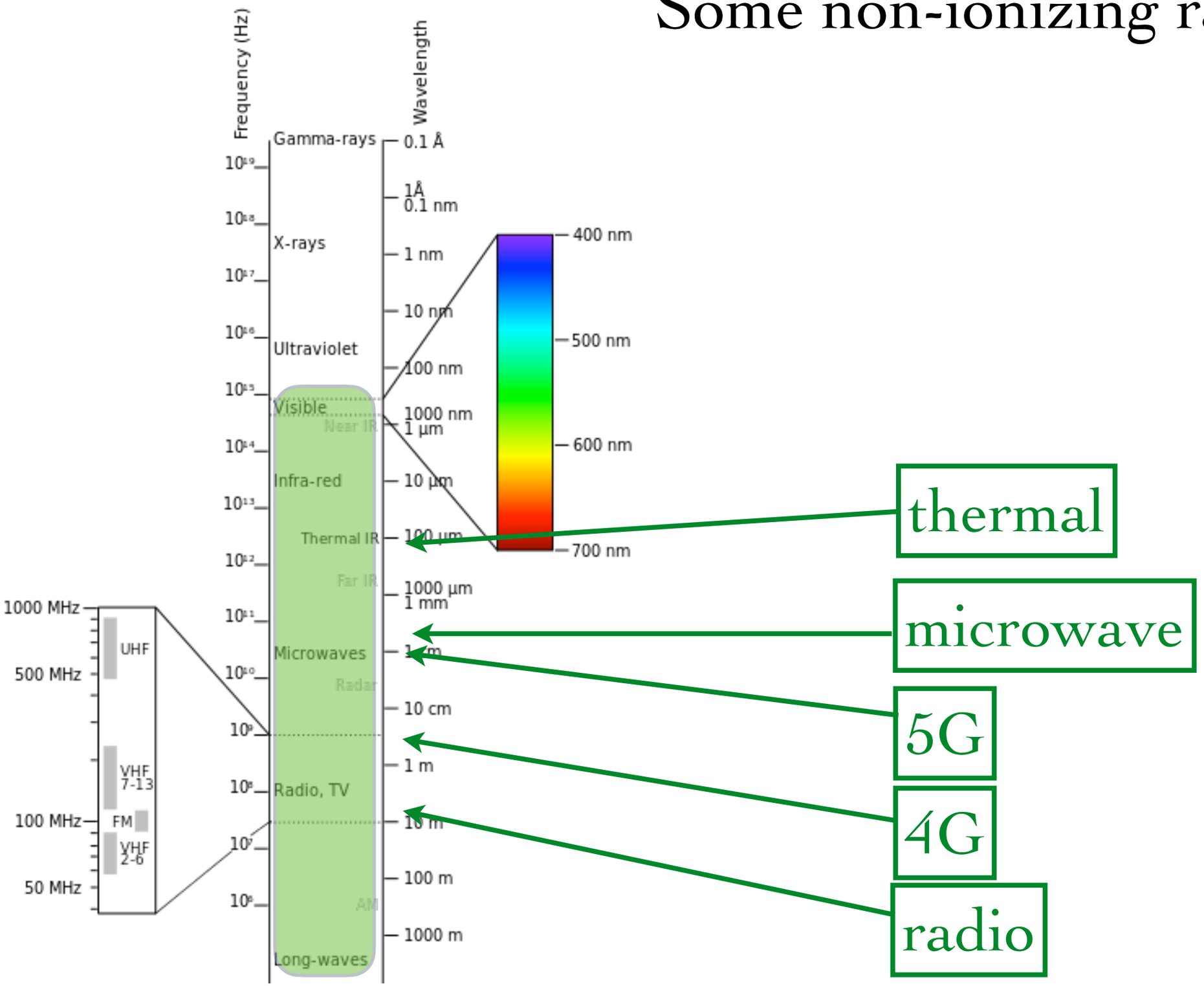


the reason for the threshold: the photoelectric effect

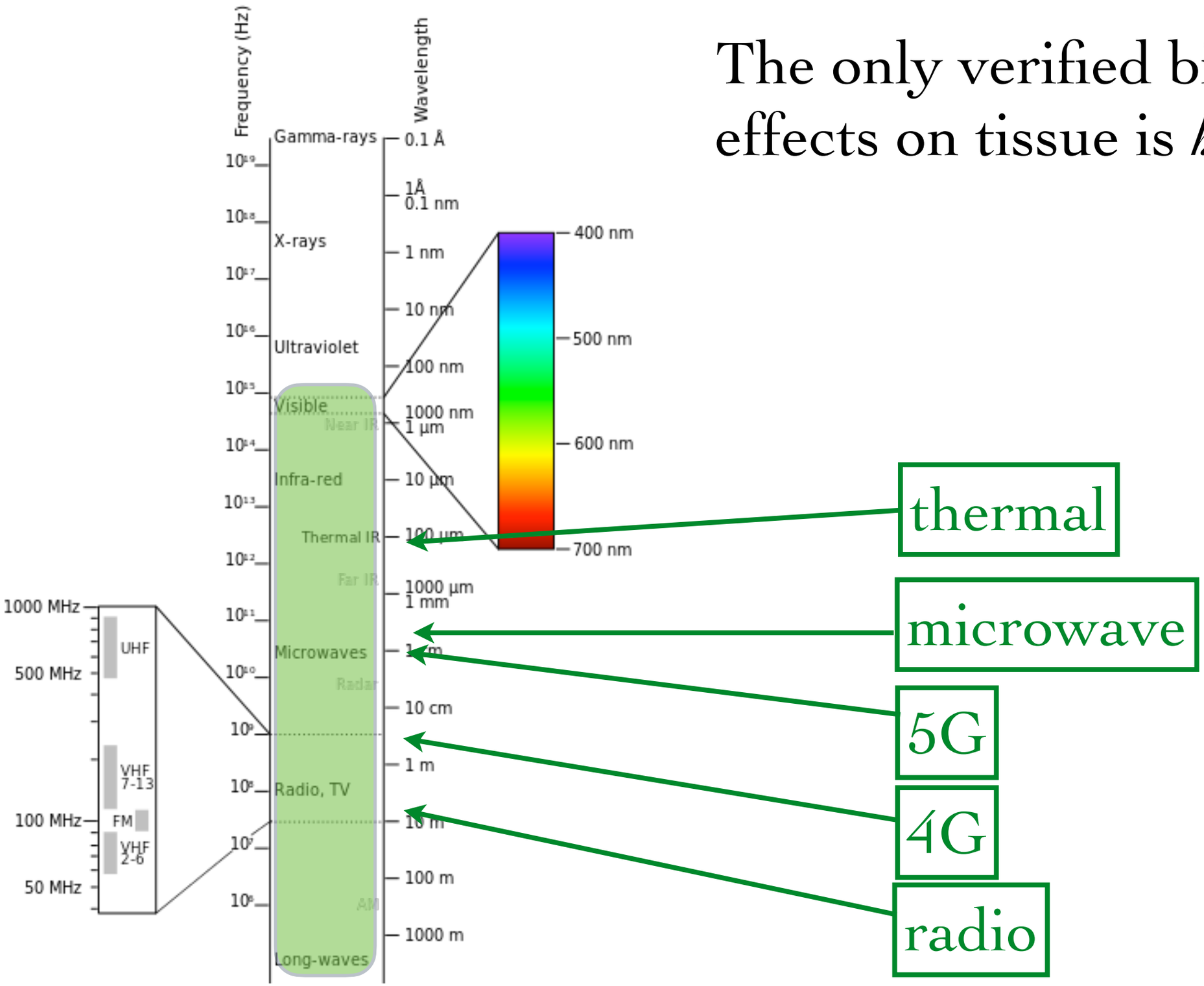
The photoelectric effect tells us that

- there is no "cumulative effect" for causing cancer due to nonionizing radiation
- the **intensity** of nonionizing radiation has no effect on causing cancer

Some non-ionizing radiation:



The only verified biological effects on tissue is *heating*.



The FCC regulates RFR to limit thermal effects.

Limits are very strict, and are set at 1/50 the level of what is detectable in animal experiments.

For comparison, my heating pad produces about 50 times more heating than the FCC permits.

The FCC regulates RFR to limit thermal effects.

The FCC does not conduct experiments — it sets regulatory limits based on the evaluation of relevant literature made by many national and international agencies.

1000's of studies have been examined

FDA, EPA, OSHA, National Institute for Occupational Safety and Health, National Council on Radiation Protection, IEEE, etc

The IEEE has a rigorous policy creation process!

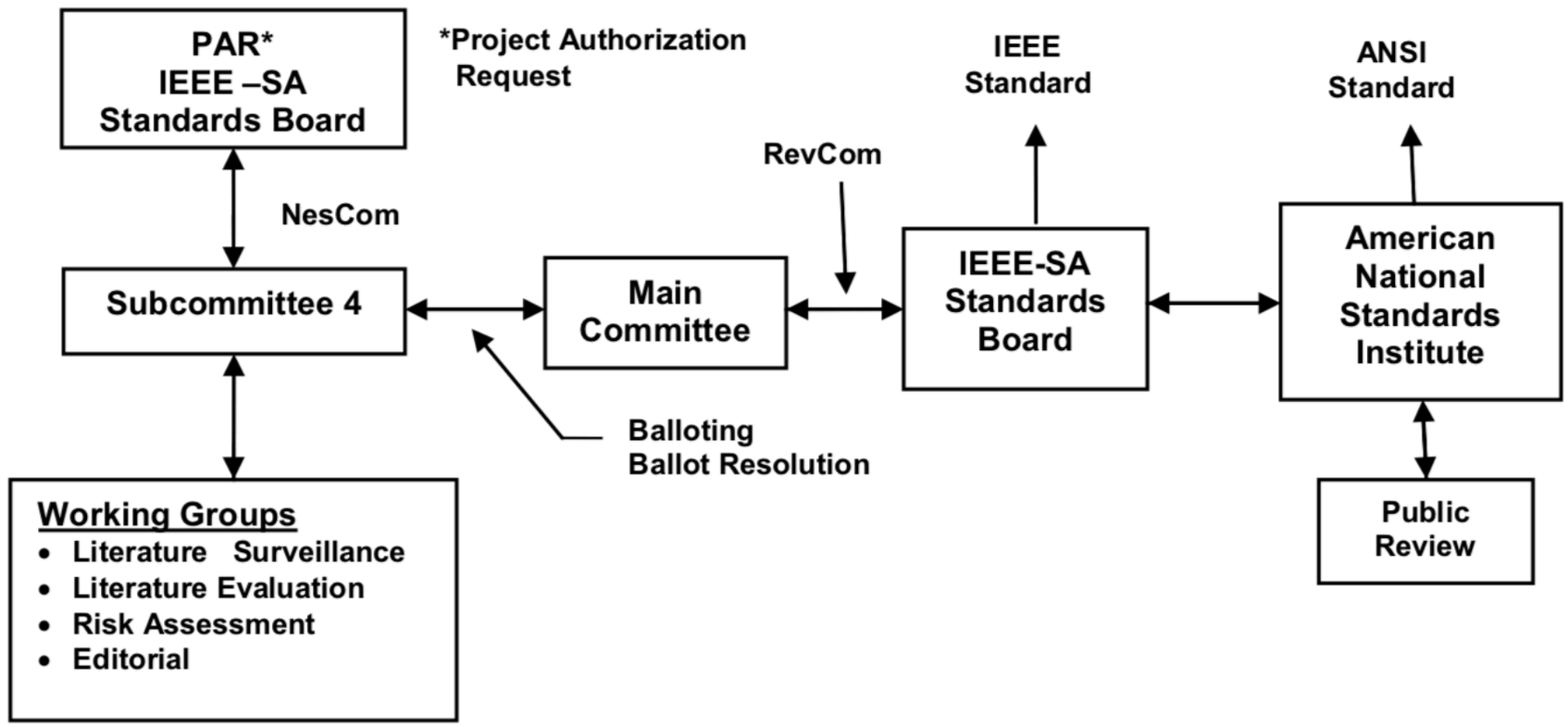


Figure 4—Flowchart of IEEE process for development of C95.1 standards

"At the literature evaluation cutoff date, 31 December 2003, the Literature Surveillance Working Group identified over 2200 papers from a number of databases and inputs from federal agencies and other organizations that were regularly polled. "

Affiliation		Number	Percentage
Research	University:	37	29.6
	Nonprofit	8	6.4
	Military	15	12.0
	Government (FDA, EPA, etc.)	30	24.0
Industry		12	9.6
Industry – Consulting		4	3.2
Government – Administration		5	4.0
General Public and Independent Consultants		14	11.2
Total		125	100

Table 1a. The affiliations of the 125 members of Subcommittee 4 of IEEE Standards Coordinating Committee 28 at the time the 1991 IEEE C95.1 standard was approved.

Principle Discipline	Number	Percentage
Physical Sciences (Physics, Biophysics, etc.)	41	32.8
Life Sciences (Biology, Genetics, etc.)	54	43.2
Medicine (Physicians)	12	9.6
Radiology, Pharmacology, Toxicology	4	3.2
Others (Law, Medical History, Safety, etc.)	14	11.2
Total	125	100

Table 1b. The principle disciplines of the 125 members of Subcommittee 4 of IEEE Standards Coordinating Committee 28 at the time the 1991 C95.1 standard was approved.

Statements from National Bodies

The Federal Communications Commission (FCC):
"As discussed above, radiofrequency emissions from antennas used for cellular and PCS transmissions result in exposure levels on the ground that are typically thousands of times below safety limits. These safety limits were adopted by the FCC based on the recommendations of expert organizations and endorsed by agencies of the Federal Government responsible for health and safety. Therefore, there is no reason to believe that such towers could constitute a potential health hazard to nearby residents or students."

The Food and Drug Administration (FDA):
"Based on our ongoing evaluation of this issue, the totality of the available scientific evidence continues to not support adverse health effects in humans caused by exposures at or under the current radiofrequency energy exposure limits."

National Cancer Institute:
"… although many studies have examined the potential health effects of non-ionizing radiation from radar, microwave ovens, cell phones, and other sources, there is currently no consistent evidence that non-ionizing radiation increases cancer risk in humans."

American Cancer Society:
"At ground level near typical cellular base stations, the amount of RF energy is thousands of times less than the limits for safe exposure set by the US Federal Communication Commission (FCC) and other regulatory authorities … Some people have expressed concern that living, working, or going to school near a cell phone tower might increase the risk of cancer or other health problems. At this time, there is very little evidence to support this idea."

Statements from International Bodies

European Commission, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) (2015):
"Overall, the epidemiological studies on mobile phone RF EMF exposure do not show an increased risk of brain tumours. Furthermore, they do not indicate an increased risk for other cancers of the head and neck region."

World Health Organization (2006):
"Recent surveys have indicated that RF exposures from base stations and wireless technologies in publicly accessible areas (including schools and hospitals) are normally thousands of times below international standards . . . From all evidence accumulated so far, no adverse short- or long-term health effects have been shown to occur from the RF signals produced by base stations."

Health Canada (2014):
"The Panel has concluded that the balance of evidence at this time does not indicate negative health effects from exposure to RF energy below the limits recommended in the Safety Code."

United Kingdom Health Protection Agency Independent Advisory Group on Non-Ionizing Radiation (HPA) (2012):
"In summary, although a substantial amount of research has been conducted in this area, there is no convincing evidence that RF field exposure below guideline levels causes health effects in adults or children."

Swedish Council for Working Life and Social Research (2012):
"Extensive research for more than a decade has not detected anything new regarding interaction mechanisms between radiofrequency fields and the human body and has found no evidence for health risks below current exposure guidelines."

Norwegian Institute for Public Health (2012):
"The studies have been performed on cells and tissues, and in animals and humans. The effects that have been studied apply to changes in organ systems, functions and other effects. There are also a large number of population studies with an emphasis on studies of cancer risk. The large total number of studies provides no evidence that exposure to weak RF fields causes adverse health effects."

Statements from International Bodies

Australian Radiation Protection and Nuclear Safety Agency (Nov, 2019):
"Current research indicates that there is no established evidence for health effects from radio waves used in mobile telecommunications. This includes the upcoming roll-out of the 5G network."

FCC-19-216 (Dec 4, 2019)

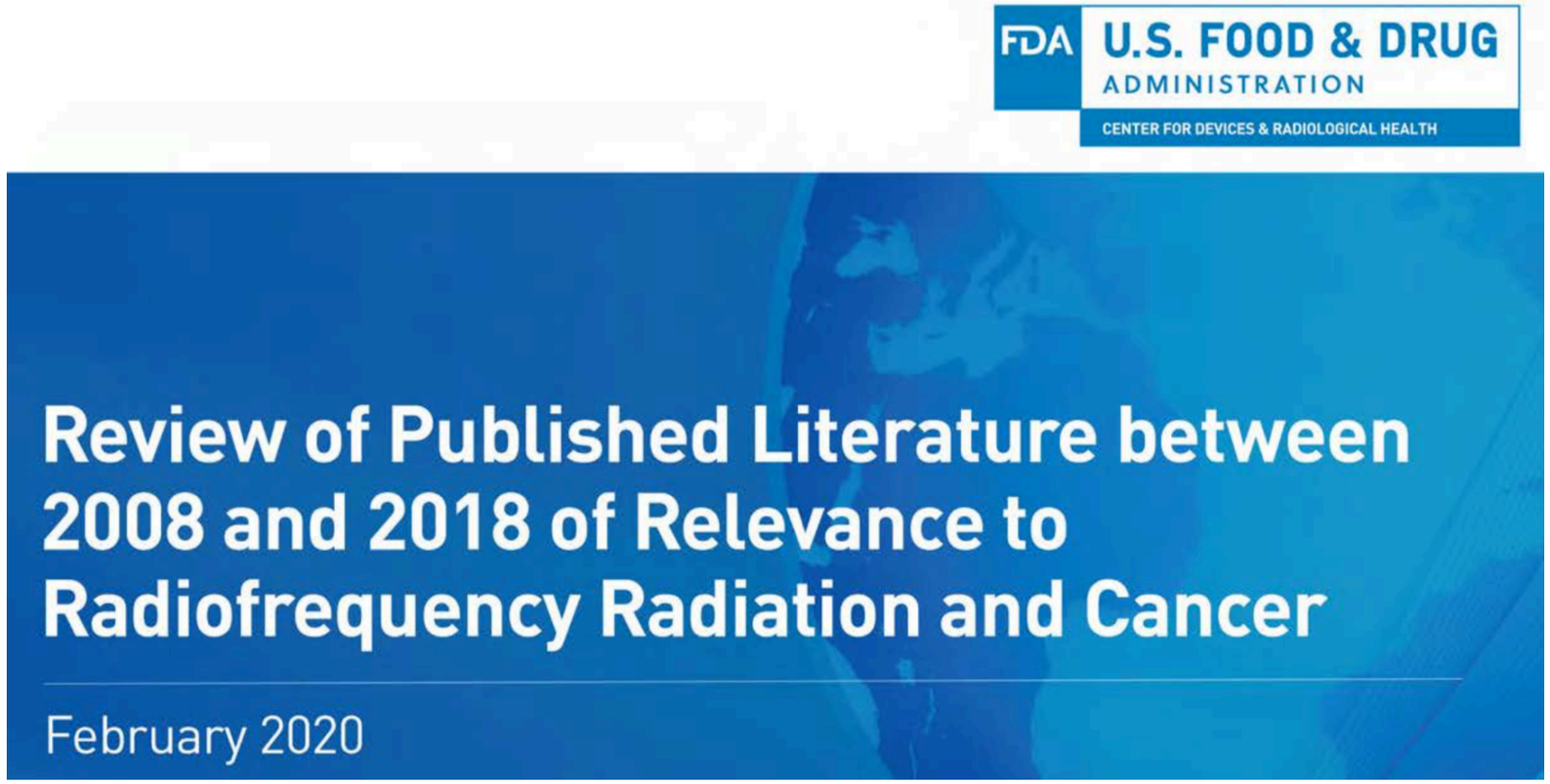
Paragraph 12: "Moreover as noted by the FDA, there is no evidence to support that adverse health effects in humans are caused by exposures at, under, or even in some cases above, the current RF limits. Indeed, no scientific evidence establishes a causal link between wireless device use and cancer or other illnesses."

Paragraph 14: "Thus, even if certified or otherwise authorized devices produce RF exposure levels in excess of Commission limits under normal use, such exposure would still be well below levels considered to be dangerous, and therefore phones legally sold in the United States pose no health risks."

WHO fact-sheet

"In the area of biological effects and medical applications of non-ionizing radiation approximately 25,000 articles have been published over the past 30 years."
"Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, some gaps in knowledge about biological effects exist and need further research."

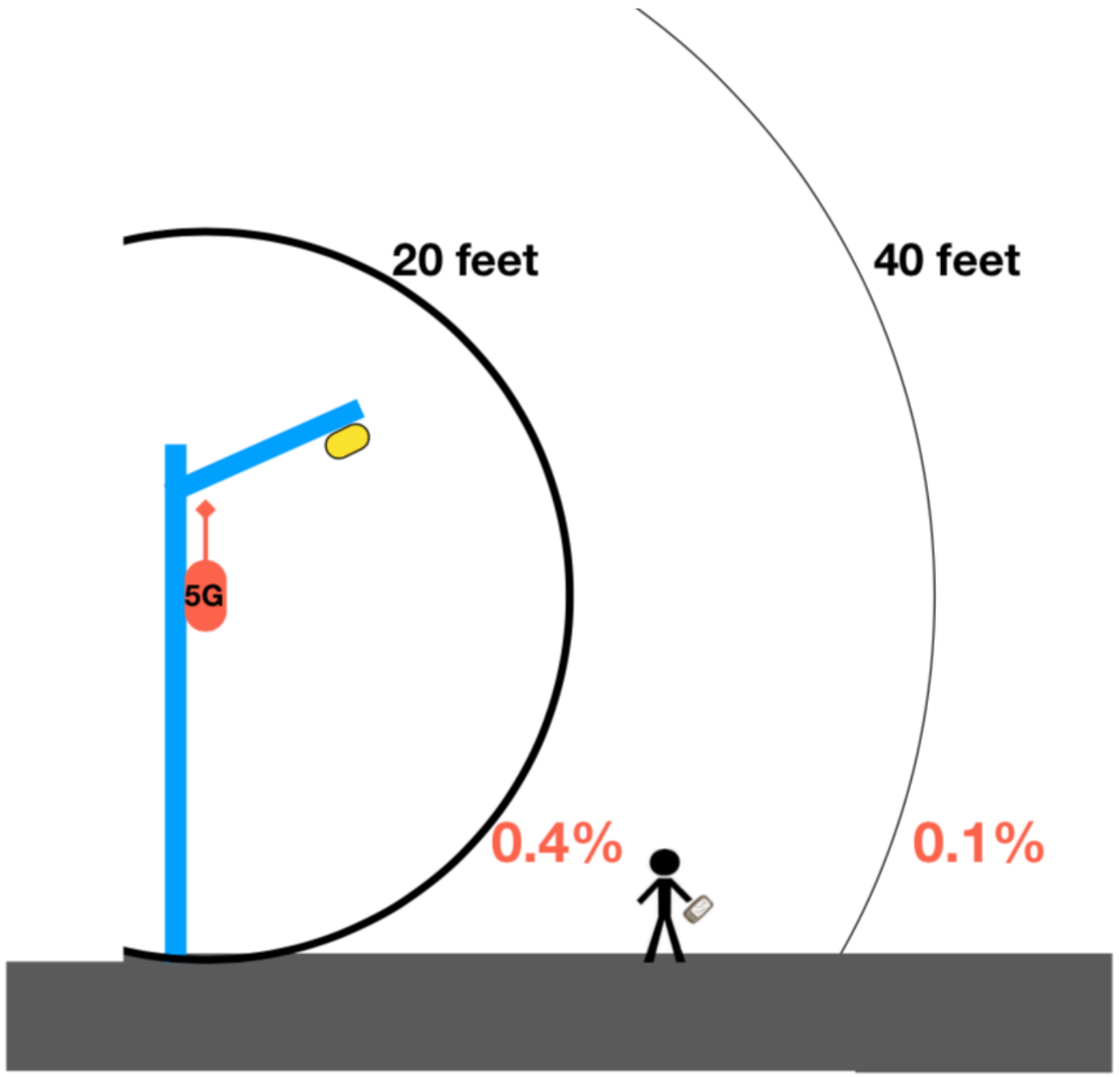
The FCC regularly updates its rules.



“[For 2008-2018] there have been approximately 125 articles that are most relevant for the study of any effects of RFR on animals. However, none have adequately demonstrated that localized exposure of RFR at levels that would be encountered by cell phone users can lead to adverse effects.”

A Comparison

Exposure due to a 5G small cell



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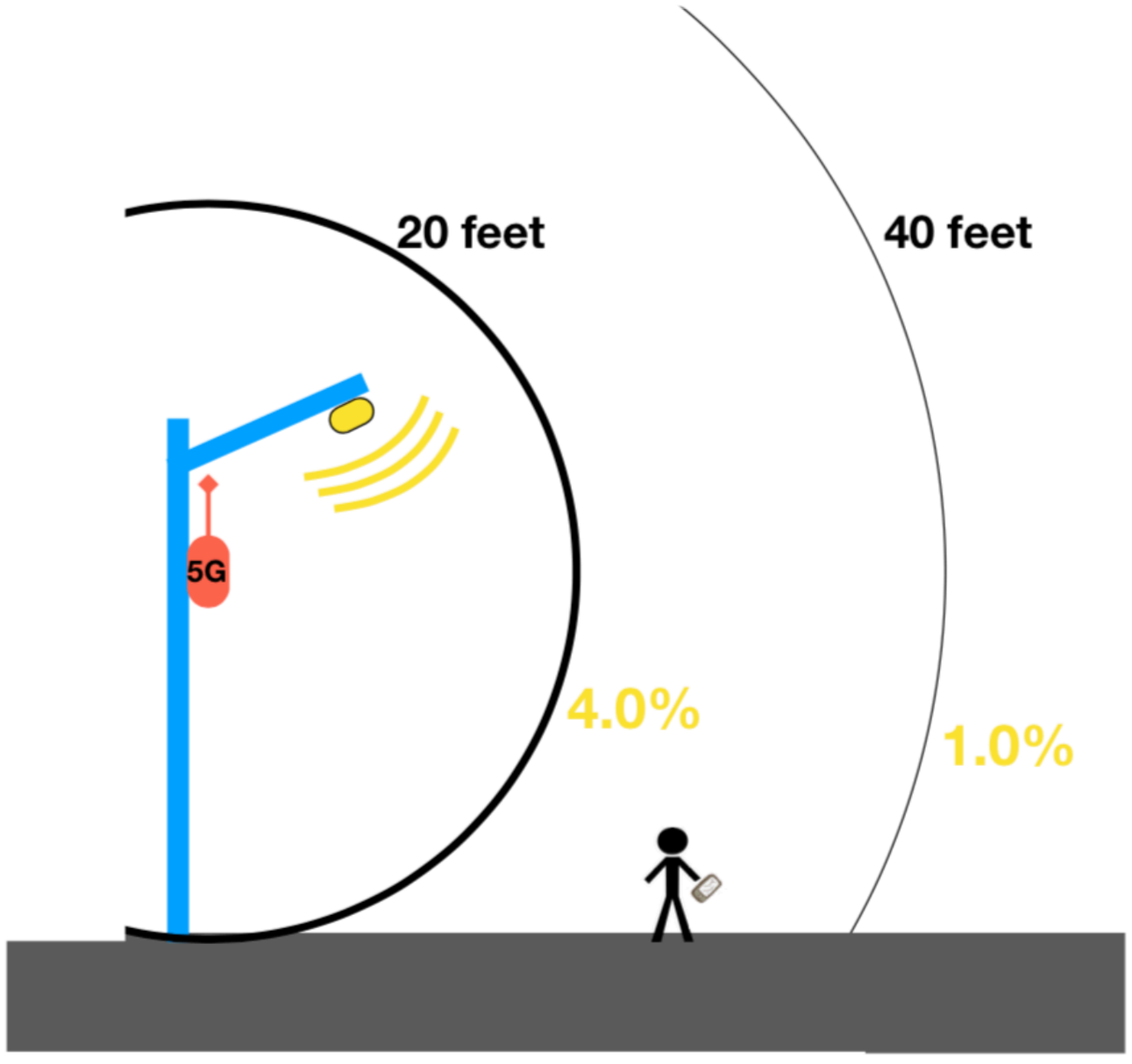
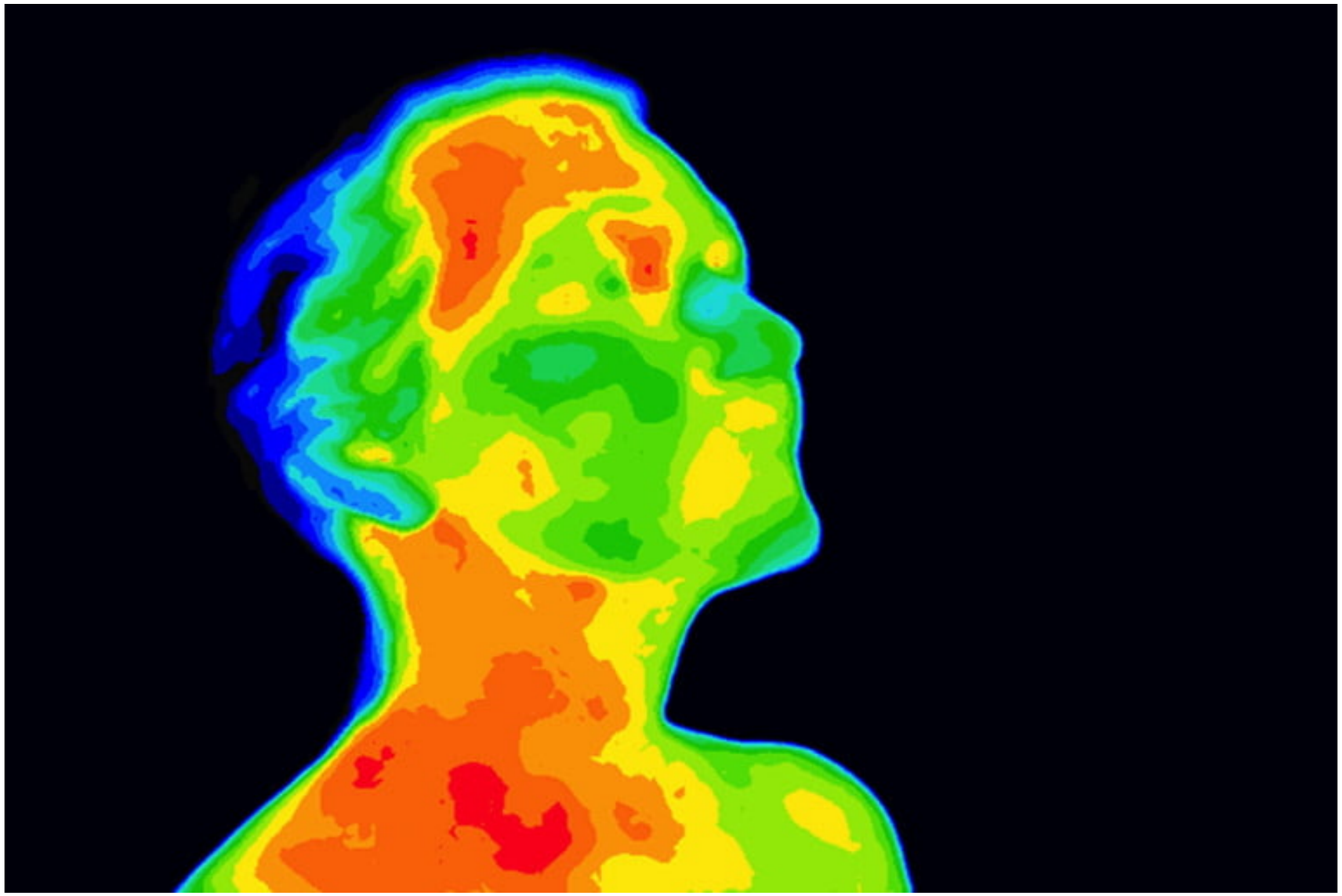


A Comparison

The brain is a 15W electromagnetic thermal radiation transmitter

SAR ~ 15 W/kg

~ 10 x FCC



One often hears of studies that "prove" RFR causes <your most feared disease>.

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Human subject studies are notoriously difficult to perform.

The chief problems are

- the difficulty & expense of working with animal/human subjects
- the rarity of the effects being sought
- =>leading to many false positives

The industry standard false positive rate is 5%, which feeds confirmation bias.

The WHO estimates that 25,000 studies have been made. Statistically, about 1250 of these should find falsely positive results.

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EM Watch

EMF Safety and Health

Power lines EMF

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Cell Phone Radiation
Cell Tower Health Risks

Computer Radiation.
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House Wiring EMF
Microwave Radiation

Living near Power Lines
Other sources of EMF

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Living Close to Power Lines

Power Lines Health Risks

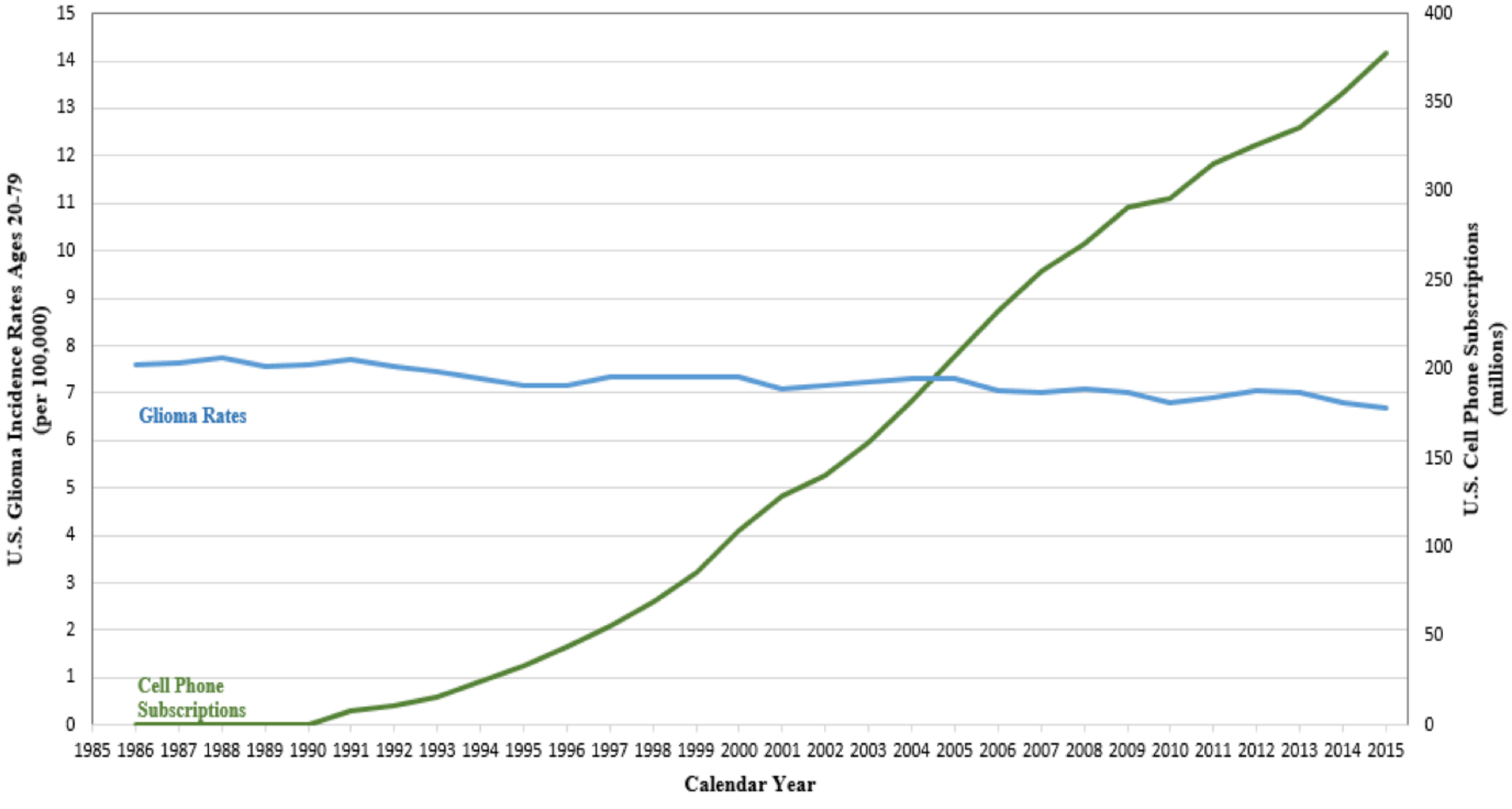
There has been controversy over power line radiation and its effect on human health for at least 40 years. This is not because evidence is lacking.

Living by power lines has been known to increase the risk of leukemia and other cancers since 1979, when convincing evidence was first published by Werthimer and Leeper .

Since then, dozens of published papers have found links between living near power line electromagnetic radiation and a range of health woes including brain cancer and leukemia (especially affecting children), breast cancer, birth defects and reproductive problems, decreased libido, fatigue, depression, blood diseases, hormonal imbalances, heart disease, sleeping disorders and many others.

The bottom line:

Trends in age-standardized incidence rates of glioma in the United States, 1985-2015 (SEER Registry) vs. cell phone subscriptions



Summary

Electromagnetic radiation associated with wireless infrastructure is nonionizing

- laws of physics imply it cannot cause cancer
- preponderance of studies says it does not cause cancer
- cancer rate says it does not cause cancer
- there is no verifiable evidence that it does anything else (other than heating)

There is nothing fundamentally new with 5G technology

The thermal effects of nonionizing radiation are regulated by the FCC and limits are very conservative

Thank you