Does 5G pose health risks? (part 2)

Larry Desjardin - April 24, 2019

In Part 1 of this series on possible health effects of cellular radiation, 5G mmWave radiation in particular, I examined two possible impacts to human health from 5G: ionization and thermal effects. I concluded both effects were manageable. Ionization can't take place at mmWave frequencies because a mmWave photon doesn't have the energy to remove an electron from an atom. Similarly, thermal effects are minimal, and could occur only situationally by placing a transmitter next to the skin. Even then, it was unclear that the one-degree threshold could be exceeded. Using headphones or placing a cell phone in speakerphone mode solved that issue completely.

Thermal effects are the only effects recognized and regulated by national regulators, such as the Federal Communications Commission (FCC). For Part 2, we will look at electromagnetic (EM) effects, which are much more controversial. I will restate to the readers that I have no pre-conceived bias on whether EM effects, or any other effects, are harmful or not.

The concerns about 5G EM health impacts are shared by a wide number of researchers and public health officials. An international petition with over 63,000 signatories from 168 countries has called for a halt to 5G deployment. They state, "5G will massively increase exposure to radio frequency (RF) radiation on top of the 2G, 3G and 4G networks for telecommunications already in place. RF radiation has been proven harmful for humans and the environment. The deployment of 5G constitutes an experiment on humanity and the environment that is defined as a crime under international law." That's quite the accusation. Given that this is a technical column, and not a legal column, I will not dive into international law. Instead, I'll take a look at the assertion that RF radiation has proven to be harmful to humans.

From my research, I can see why 5G is controversial. It's nearly impossible to perform a study with rigorously defined treatment and control groups. Ideally, it would be desirable to split a population into two similar groups with the only difference being one group was exposed to 5G radiation (the treatment group), and the other wasn't (the control group). Then wait 20 years and note the difference in health impacts. This, unfortunately, is the case for many environmental health issues.

The fact that a proper human scale experiment can't be performed doesn't mean 5G radiation is harmful or benign; it means that different methods must be used to tease out the answer. There are two alternatives. The first is to look at the proximate effects of radiation on the human body. That is, does the science show the body responds to EM radiation in a way that you could conclude that harm is caused? The second is to create control and treatment groups for non-human organisms, ranging from bacteria to mice.

A source of studies is Environmental Health Trust (EHT), a think tank that bills itself as promoting a healthier environment through research, education, and policy. A recent Issue Brief on 5G details many of the studies of concern. I'll describe each one below, with a link.
A study called “The Modeling of the Absorbance of Sub-THz Radiation by Human Skin,” published by two Israeli scientists in an IEEE journal, looks at mmWave absorption by the human body (IEEE members can sign to in read the paper.) In Part 1, we linked to a study that declared, “Millimeter waves are mostly absorbed within 1 to 2 millimeters of human skin and in the surface areas of the cornea.” At first glance, this would seem to eliminate mmWave effects on internal organs and processes. This recent IEEE study found, however, that upper coiled portion of sweat ducts (Figure 1) could be regarded as a helical antenna at these frequencies, and then transmitted by a waveguide-like structure internally to the body. The summary of this is that the surface of the body is not the absorbing shield we once thought it was. One of the authors concludes, “In light of our work and a growing number of publications showing the frequency of 5G can have serious biological effects, we believe that current efforts to accelerate the implementation of 5G should be delayed until additional studies are made to assess the critical impact on human health.”

![Figure 1](image_url) Sweat glands may act as waveguides, routing mmWaves into the body.

A study published in *Applied Microbiology and Biotechnology* examined the effects of mmWave radiation on bacteria. The study found that mmWaves altered bacteria growth, mainly depressing their growth and changing certain properties and activities. Bacteria and other cells might communicate with each other by high-frequency fields in the mmWave region, thus creating the observed impacts when exposed to mmWaves. The authors also found that bacteria reacted to antibiotics differently when exposed with mmWaves and may “be leading to antibiotic resistance in bacteria.”

Though not specifically relating to mmWaves, a study published in Electromagnetic Biology and Medicine linked radiation from cell towers to damage in human blood. The study compared people living close and far from cell antennas as the treatment and control groups respectively.

The treatment group was within 80 meters of a cell antenna, while the control group resided 300 or more meters from the cell antenna. Human peripheral blood lymphocytes (HPBLs) were cultured from each group. The study found elevated micronucleus levels in the treatment group, which is evidence of DNA damage and an early predictor of cancer development (Figure 2).
A study was performed by comparing the blood from those within 80 meters of a cell tower to that from those greater than 300 meters from a cell tower. Evidence of damaged DNA was found to be more likely for those living closer to a cell tower.

There are many more studies that show a proximate impact on biology functions from current cellular frequencies and mmWaves. But what does this all mean?

My own conclusion is that there could very well be negative impacts from electromagnetic radiation. There is enough evidence to show how a causal link could exist:

- mmWave frequencies conduct to the interior of the body through the sweat glands.
- Bacteria and cells are affected by mmWave frequencies.
- DNA damage is a precursor to cancer.

We know each of the above is true. Together they may show a possible link from mmWaves to cancer or other ailments. The key word is “may.” Also, they may not. However, these risks cannot be simply waved away as nutty conspiracy theories.

The deployment of 5G requires a closely spaced grid of base stations coupled with beamforming antennas to increase the effective radiated power. If a network is deployed on a 400 meter grid, and there is uniform population density, the median distance from a cell is 160 meters. 16% of the population will live within 80 meters of a base station, the distance at which cellular radiation showed DNA damage in the study above. It is unknown whether mmWaves increase or decrease DNA damage when compared to our current cellular frequencies.

So, given that there’s a yet unquantifiable risk, what do we do? Stop 5G until it is proven harmless? Deploy 5G until it is proven dangerous? Something in between?
That is a good policy question for Part 3 of this series.

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