Testimony about HP 564
submitted to the Committee on Energy, Utilities, and Technology, 26 March, 2025
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Summary: In a rational world, no study committee should be necessary. There is abundant evidence for biological harms from long term exposure to all kinds of radio frequencies. Some people are particularly vulnerable in the here and now, but the radiation hurts us all in the long run. Risks include cancer and Alzheimer's Disease. The effects get dramatically worse with higher frequencies, and 5G works with frequencies more damaging than 3G and 4G.

This is a clear case of powerful financial interests taking precedence over human health and ecosystem conservation.

"**We're taking risks that no rational society would ever take." — Martin Pall**

Already twenty years ago, a great deal was known about the biological effects of ionizing radiation. Studies go back at least to the 1950s, and were documented extensively by our own DoD and corresponding agency in the USSR. Very early, they were looking for ways to weaponize microwave radiation, and military applications exist and are in use today for crowd control.

But 20 years ago, it was all empirical. We knew nothing about the mechanisms. A breakthrough came from the work of Martin Pall on voltage-gated calcium channels. Cell membranes are very selective, and equipped with ion pumps. The concentration of Calcium ions and Sodium ions outside the cell is much higher than inside. Inside the cell, there is Magnesium instead of Calcium and Potassium instead of Sodium. Simms [2014]

Flow is controlled by voltages across the cell membrane. When a section of a cell membrane becomes depolarized, a channel opens up and allows calcium to stream into the cell, displacing magnesium. This is local to one particular place in the cell, and where it happens dictates which of a large number of different signals is initiated.

- Calcium activates several different signal proteins, called kinases
- Calcium drives muscle contraction, and is crucial for heart rhythm
- Calcium signaling controls gene expression AKA epigenetics
- Calcium signaling modulates nerve signaling, though it is sodium channels that are the primary mechanism for transmitting nerve impulses.

What Pall discovered 10 years ago is that VGCCs are very sensitive to radio frequencies (RF). RF radiation opens the channels, allowing calcium into the cell at times when it's not supposed to be there. All of the delicate signaling functions of calcium are distorted. In addition, high level of calcium inside the cell is cytotoxic. **Chronically elevated calcium inside the cell is associated with Alzheimer's Disease.**

There are tens of thousands of studies, hundreds of literature reviews. I can't begin to summarize them. I recommend Pall's eBook as a good place to start.

a) The best-documented effects are on the nervous system. Perhaps this is not surprising because this is the one area of biology where we actually know something about the role of electric potentials. Looking through lists of references, I found plenty of poor quality data and studies that were unconvincing for one reason or another. But there are also some that I found compelling. For example, Oberfeld [2004] studied people who lived near cell phone towers in Spain. He went into people's bedrooms to measure RF power densities and correlated the results with various neurological complaints to look for a dose-response relationship.

   Even in a very small sample of 94 people he found large effect sizes and high statistical significance. For example, Depression was 42 times more likely in the highest exposure group; headaches and sleep disorders were each 7 times as frequent; fatigue was reported 34 times as much, impaired concentration 18 times. p values for all these were all in the 0.001 range. I recommend Martin Pall's 2016 review.

b) Second is the neuroendocrine system, including sex, sex hormones, and fertility. Radiation exposure is associated with lower levels of sex hormones, lower DHEA, lower libido. Agarwal [2009] took samples from human sperm donors in a fertility clinic and put them next to cell phones. After just 1 hour, 11% of the sperm were dead. Magras [1998] raised mice in the neighborhood of cell phone towers, compared to far away. The control mice had 10 to 20 litters in a lifetime, but the exposed mice became irreversibly sterile after 2 litters. Reviewed in Houston [2016]

c) Links to cancer. Glioma is a rare form of brain cancer. Thirty years ago, I had never heard of it, and now I know several people who have died of glioma. The effect of cell phone use on glioma is easy to see because the background rate is so low. If RF is making similar contributions to common cancers like leukemia or colon or breast cancer, we would not be able to see it above the high background levels.

   Cancer is increasing in the developed world. How much of this is due to cell phone exposure? No one knows. But consider this:

   + Cancer often takes many years to develop.
   + Radiation exposure has been rising exponentially just in this century
   + We're already seeing rising cancer rates from cell phone use, but we expect most of the effect is latent, and we will see it gradually emerge in coming years.

What are the policy implications of all this?

We can't rely on theory, and we need to actually perform experiments in animals and then with humans.

5G will up the ante on radiation risk in several ways.

- The frequency spectrum is in the mm range, where there are known absorption lines of biomolecules
- Pulse modulation rates will be much faster than ever (that's the whole point of 5G)
- Phased arrays will be used to beam radiation straight at you
- The Internet of Things will be ubiquitous

What kinds of tests should we be conducting? We have to ask first, what kind of radiation exposures are we talking about? If 5G is fully implemented, so that every self-driving car and every home thermostat and Mr Coffee is in communication with the 5G antenna on the corner lamp post, what will be the radiation environment for a typical city-dweller?

Nowhere have I seen even an estimate of that. How can we hope to do medical science on a complete unknown?

Meanwhile, we're racing to roll out 5G across America and Europe before China beats us in the world technology competition. Well, if it were up to me, I'd rather risk losing this race, just in case this is a race toward a public health catastrophe.

Listen to some of the video presentations by Martin Pall. His refrain, which he'll repeat often:

> **"Even with present technologies, we're taking risks that no rational society would ever take."**