

Is 5G Going to Kill Us All?

A new generation of superfast wireless internet is coming soon. But no one can say for sure if it's safe.

By **CHRISTOPHER KETCHAM**

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Illustration by Sarah Wilson-Austensen

On a hot day last summer, Debbie Persampire, a 47-year-old homemaker who believes that cell phones are poisoning her children, took me on a tour of her irradiated house on Long Island. Her kids were at school, her husband was at work, and the house, a modest, tidy split-level typical of the suburbs, was spectacularly quiet. She brandished a handheld battery-powered device called an Acoustimeter to measure the radiation and waved me on up the stairs to the second floor, into the rooms where her children slept.

Outside, roughly 70 feet from the beds of her son, who is 12 years old, and her daughter, who is 10, was the source of her concern: a cell site, a nondescript box the shape of a small steamer trunk that was affixed to a utility pole just beyond the fence line. Crown Castle, the nation's largest provider of communications infrastructure, installed the unit in May 2017, and it began operating

seven months later. It emitted, like all cell sites, a constant stream of microwave electromagnetic fields, or EMFs.

The Acoustimeter, detecting high EMF levels, had been buzzing and chirruping, its LED panel spiking. Then abruptly it went silent as we entered her son's room. Persampire swept the device toward the window, with its view of the street and the fence and the utility pole, and the buzzing started up again. With a glint in her eyes, she told me to take note of this fact. "Higher readings by the window," she said. "But along the walls, no."

In April 2019, a few months before my visit, she had put on some old clothes, hauled a ladder in from the garage, and spent the day painting the walls and ceilings of the children's rooms in a grim matte black more suitable for a death metal club. Known as YShield HSF54, the paint came in just one color. She'd purchased it from LessEMF, of Latham, New York, a company that also sells Acoustimeters. LessEMF, whose tagline is "Work, sleep, live better in the electrified world," claims YShield is effective at absorbing EMFs. Persampire had received from LessEMF a shipment of 10 liters of Yshield (just over two and a half gallons) at the hefty price of \$658, along with her Acoustimeter, which set her back \$400 more. With each stroke of the paint, she said, "came a sense of relief, like I could breathe again."

Her husband and children, she told me, trusted she was doing the right thing. “If anyone thought I was crazy, they didn’t say so,” she said. “I didn’t

know much about this topic before Crown Castle placed that antenna. Then I read the science, and now I know more than I ever wanted to know. We live with involuntary 24/7 radiation, even in my children’s beds as they sleep.”

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One of the studies that prompted her concern was a 2018 report by the National Toxicology Program, a branch of the National Institute for Environmental Health Sciences. Commissioned by the Food and Drug Administration to examine the human health risks of cell phone radiation, NTP researchers placed lab rats in “reverberation chambers”—metal boxes resembling microwave ovens—and, over a period of two years, exposed certain rats for nine hours a day, every day, to EMFs of the type that flow ubiquitously from Wi-Fi hubs and cell sites into our laptops, iPads, smartphones, and, of course, our bodies.



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The researchers concluded there was “clear evidence” that cell phone radiation in exposed male rats can cause cancers and precancerous lesions in the heart and brain. The lead designer of the study, veteran toxicologist Ron Melnick, reported that the researchers also found tumors in rats’ prostate glands, DNA damage in brain cells, heart muscle disease, and reduction in birth weights.

Persampire was stunned. “My initial reaction was, How is it possible that this can be ignored? When is this going to catch on like wildfire and have everyone making changes?” She promptly ditched her home Wi-Fi router, hard-wiring the family’s computers and installing a landline phone with a long cord. While that diminished the risk, it hardly eliminated it. Persampire knew from her research that the microwave radiation beamed from cell sites was in the air, all around us. We were exposed whether we used it or not.

The NTP report was not an outlier. There were similarly alarming results in numerous other research studies. With each report she read, Persampire's concern grew into a kind of panic. There was the warning in 2011 by the International Agency for Research on Cancer, a branch of the World Health Organization in Lyon, France, that cell phone radiation was a "possible carcinogen." There was the voluminous BioInitiative Report, begun in 2007, based on the work of 29 scientists and health experts from 10 countries, who reviewed over 1,800 studies of EMF health effects published since 2007. Persampire read every one of its 1,557 pages and even reached out to its co-editor, Dr. David Carpenter, a medical doctor who directs the Institute for Health and the Environment at the State University of New York at Albany. She asked if she should be worried. Carpenter said she should.

Then in 2019, she came across the website of a group called the International EMF Scientists Appeal. Among its more than 250 members, the group counted biophysicists, biochemists, and physicians from 43 countries, including professors at Harvard Medical School, Columbia University, and Johns Hopkins, who collectively had published in professional journals some 2,000 papers and letters on the biological effects of microwave EMFs. In recent years, the group issued a series of "urgent" pleas to the WHO and the United Nations Environment Programme to "address the

global public health concerns related to exposure to cell phones.” The first of its nine recommendations was that “children and pregnant women be protected” from exposure.

The signatories of the EMF Scientists Appeal were particularly concerned with a vaunted new wireless communications system known as 5G, which, they warned, was totally untested for human health risk. Searching online and making a few calls, Persampire soon learned that the cell site 70 feet from her children’s bedrooms was in fact a 5G-capable unit. What this meant for the safety of her kids, she did not know. Worse, she soon realized, nobody did.

On October 13, 1983, Bob Barnett, then the president of Ameritech Mobile Communications, placed the first commercial cell phone call. The recipient, as befitted the historic occasion, was the grandson of Alexander Graham Bell, who had invented the telephone more than a century before. Barnett placed the call on a Motorola DynaTAC 8000X. It weighed two pounds, was 13 inches long, operated only for 30 minutes before needing a charge, and retailed for \$4,000.

No doubt the audio quality was far from perfect, but improvements would come at a breakneck pace. The bricklike first-generation, or

“1G,” phones of the 1980s gave way in subsequent decades to ever more miniaturized and inexpensive 2G devices, which allowed users to hear clearly and talk at length. 2G also enabled a totally new form of communication called texting. The 2000s brought 3G, which offered higher-quality telephony; miraculous-seeming, if torturously slow, internet access; and primitive video. With Long-Term Evolution, or LTE, and 4G systems in the 2010s came full-on internet browsing, streaming movies, Instagram, and porn at your fingertips—the smartphone as we know it today.

On the horizon is the new protocol, 5G, fifth-generation wireless, which has been celebrated as heralding a “fourth industrial

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revolution.” Boasting transmission speeds as much as five times faster than current LTE and 4G systems, 5G promises to usher in a new golden age of wireless, a world of total connectivity.

With 5G, the latency of transmission—the lag between the moment information is sent and received—will drop to very low levels. That means crystal-clear audio, video chats, and teleconferencing in

absolute real time, and films downloaded in mere seconds. It will also, at last, enable the much-ballyhooed “internet of things” to usher in a hyperconnected future. As *Wired* put it, with breathless fanfare: “All the things we hope will make our lives easier, safer, and healthier will require high-speed, always-on internet connections.”

With the internet of things, just about every appliance in your home—televisions, refrigerators, stovetops, dishwashers, coffee kettles, ovens, toasters, and lighting and heating systems—will connect to a seamless slipstream of electromagnetic frequencies and communicate among themselves. Additionally, 5G will make possible the widespread use of driverless cars, piloted by machine intelligence; routine telemedicine procedures conducted robotically by surgeons via remote connections; aerial drone deliveries of goods; and other high-tech magic as yet unimaginable. “5G is about to change the world,” a Qualcomm vice president wrote this year, declaring “potential 5G use cases as infinite, or at least only as finite as the frontier of human innovation.”

All that potential explains why antennas like the one by Persampire’s home are springing up everywhere. The telecom industry has reported that 5G will require over 800,000 cell sites by 2026, over twice the number that has been built to date. The antennas will be clustered lower to the ground, closer to homes,

businesses, offices, schools, and parks; affixed to utility poles, on cell towers, on residences, and rooftops. They likely won't look much different from the unit outside Persampire's house, and most of us will probably not notice their arrival.

The build-out, one of the most expensive communications infrastructure expansions in U.S. history, is expected to require tens of billions of dollars of investment and, it's hoped, bring in many times that in profits, adding over \$17 trillion to the global economy by 2035, by one estimate.

Meanwhile, millions of miles of new fiber-optic cable will be laid underground or strung on utility poles to support the insatiable hunger for bandwidth. And as consumers enter the upgrade cycle for 5G-capable devices, many millions of new phones will be manufactured and sold globally over the next five years, while the total number of connected internet-of-things devices will rise to an estimated 50 billion by 2022.

5G, in other words, is big money, and for obvious reasons the telecom service providers, the phone manufacturers and distributors, the fiber-optic cable and cell site manufacturers and installers would prefer that the rollout proceed without impediment.

One of the central tenets of modern public health regulation is the precautionary principle. This is the commonsense idea that without clear evidence that innovations are safe for the public, their use should be restricted, if not avoided altogether.

When I first wrote about cell phone radiation in 2010, I met a neuroscientist named Allan Frey who had spent decades in the field of bioelectromagnetics, which is the study of the effects of EMFs on living organisms. Working at General Electric's Advanced Electronics Center at Cornell University in the 1960s, Frey devised an experiment whereby frogs would be exposed to certain microwave frequencies. His findings were surprising. The radiation, he discovered, could trigger heart arrhythmias, and with a slight change in the frequencies, he could stop the frogs' hearts from beating altogether.

The prevailing wisdom had previously held that only the ionizing frequencies in the electromagnetic spectrum (x-rays, gamma rays, and the like) could disrupt living cells and produce an adverse biological effect. According to this orthodoxy, the only way frequencies below the ionizing part of the spectrum could alter living organisms is with what's called a thermal effect, when the radiation is directed at very high power to heat up tissue, as in a microwave oven.

Frey's study looked at nonthermal effects from low-power microwave frequencies—the levels similar, as it happens, to those by which our smartphones operate today. Among his most significant discoveries was that such frequencies can indeed be made dangerous using what is known as modulation. In simple terms, modulation occurs when a signal is embedded with another signal that carries information, such as the sounds, pictures, and movies on your phone. This second signal modulates the “carrier” signal.

In a study published in 1975 in the *Annals of the New York Academy of Sciences*—a study famous in the field of bioelectromagnetics—Frey reported that low-power microwave frequencies at certain modulations could induce “leakage” in the barrier between the circulatory system and the brain in rats. Breaching the blood-brain barrier is a serious matter, exposing the brain to toxins, viruses, and bacteria.

Another longtime researcher in this field, Henry Lai, then a professor of bioengineering at the University of Washington, in the 1990s showed with fellow researcher Narendra P. Singh that modulated microwave frequencies in exposed rats could cause breaks in DNA strands, such that genetic mutations might result and be passed on. The damage, shockingly, occurred with a single two-hour exposure.

In 2003, a neurosurgeon named Leif Salford replicated Frey's blood-brain barrier work and went a step further, finding that modulated microwave frequencies could

actually *kill* brain cells in rats. "A rat's brain is very much the same as a human's," Salford told the BBC. "They have the same blood-brain barrier and neurons. We have good reason to believe that what happens in rats' brains also happens in humans'."

What troubles experts in bioelectromagnetics most is that the destructive effects these studies have documented occurred at levels far below the human safety exposure limits set by the Federal Communications Commission.

In September 2017, Dr. Martin Pall, a professor emeritus of biochemistry at Washington State University, presented the evidence of risk at an event sponsored by the National Institutes of Health. Pall cited 18 studies that revealed microwave EMFs could alter the structure of the testes and ovaries, lower sperm count, and diminish

Pall warned that microwave EMFs are “much more active in children than in adults,” because children have thinner skulls.

the production of sex hormones. Twenty-five studies suggested that EMFs could produce “neurological/neuropsychiatric effects,” including, in Pall’s litany, “insomnia, fatigue, depression, headache” in humans and “major changes in brain structure seen in animals.” At least 21 studies, including those conducted by Lai and Singh, attested to single-strand and double-strand breaks in cellular DNA. Some 32 studies found oxidative stress and free radical damage to cells and elevated levels of apoptosis, or programmed cell death, which can cause neurodegenerative disorders such as dementia. Pall warned that microwave EMFs are “much more active in children than in adults,” because children, among other factors, have thinner skulls, allowing EMFs to more deeply penetrate the brain, and higher densities of stem cells that apparently are more sensitive to microwave radiation.

All of these effects, he noted, occur at exposure levels “orders of magnitude” lower than those allowed by current U.S. and international safety guidelines. Pall takes the risk so seriously that he now wears a metal mesh undergarment designed, he says, to deflect the electropollutants emanating from cell sites, mobile phones, and Wi-Fi antennas. He does not carry a cell phone or use Wi-Fi, and his work computer is hard-wired.

At the conclusion of his talk, he turned to the question of 5G technology. He invoked the precautionary principle: Given the research to date about earlier generations of microwave telecom systems, the 5G rollout, Pall told the NIH assembly, was “absolutely insane.”

You can think of an electromagnetic frequency like ocean waves reaching the shore at a set interval. The more frequent the waves, the smaller the distance between them, i.e., the shorter the “wavelength.” So, for example, a frequency of three gigahertz has a wavelength of 99 centimeters; at 300 GHz, the wavelength is less than a millimeter.

The extremely high frequencies—what scientists call millimeter waves, which range from 30 to 300 GHz—carry information at faster speeds. While 2G, 3G, and 4G function at frequencies as low as 700 megahertz and as high as 2.5 GHz, 5G will operate using millimeter waves. These penetrate objects less easily, which explains the need for vastly increased numbers of cell sites at closer proximity to users. (As 5G-capable cell sites come online in the next few years, the earlier generations of microwave systems will not fade away but will remain in operation as a kind of backup, meaning that total levels of exposure will vastly increase.)

Millimeter waves have never before been made available for public communications systems. They have, however, been utilized by the U.S. military, and what little we know about those applications gives some observers pause. The U.S. Air Force, for example, has developed weapons using millimeter waves to cause the skin of enemy combatants (or, as the need arises, unruly crowds of citizens) to heat up painfully. One of these weapons, known as the Active Denial System, can send a high-power beam of energy a distance of up to 1,000 meters to penetrate less than one-sixty-fourth of an inch into the skin, inflaming the skin's surface.

The most comprehensive review of the biological effects of millimeter waves was conducted by a team at the U.S. Army Medical Research Detachment at Brooks Air Force Base, in San Antonio, and published in 1998. The research group observed “[p]rofound MMW effects ... at all biological levels, from cell-free systems, through cells, organs, and tissues, to animal and human organisms.” Significantly, it also noted that “many of the reported effects were principally different from those caused by heating, and their dose and frequency dependencies often suggested nonthermal mechanisms”—which is to say that, once again, the research showed bioeffects from microwave frequencies that occurred well below the power levels required to cause heating.

EMF researchers have pointed out that millimeter waves are less able to penetrate skin than lower-frequency waves, suggesting they should therefore be less dangerous. Yet the variety of bioeffects described by the Army Medical Research team were “quite unexpected from a radiation penetrating less than 1 mm into biological tissues,” as the report stated. The researchers admitted to being confounded by the evidence, saying that the observed effects “could not be readily explained.”

The report added that “biological effects of a prolonged or chronic MMW exposure of the whole body ... have never been

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investigated.” The safety limits, it pointed out, are “based solely on predictions,” an approach it deemed “not necessarily adequate.”

Last October, Dr. Joel Moskowitz, of the School of Public Health at the University of California, Berkeley, asserted in *Scientific American* that exposure to millimeter waves “can have adverse physiological effects.” His article was titled, “We Have No Reason to Believe 5G Is Safe.” Moskowitz has spent more than four decades in the field of public health research and policy, and now directs the

Center for Family and Community Health at Berkeley. According to his review of the recent literature—what little of it there is—millimeter waves might negatively affect the peripheral nervous system, the immune system, and the cardiovascular system. “The research suggests,” he wrote, “that long-term exposure may pose health risks to the skin (e.g., melanoma), the eyes (e.g., ocular melanoma) and the testes (e.g., sterility).”

The research suggests—in other words, we really don’t know.

“When we talk about 5G, we’re not working with a full deck,” Louis Slesin, the editor and publisher of *Microwave News*, a journal that covers microwave technology, told me. “With 5G, not only are there practically no health studies, we don’t have a clue about the modulations that will be used.” He noted that the studies about millimeter waves remain classified. “The government, I think, knows more than it’s willing to say.”

In December 2018, concerned about the health implications of the 5G rollout, Senator Richard Blumenthal, the Democrat from Connecticut, sent a letter to the Federal Communications Commission’s Brendan Carr, noting that “most of our current regulations regarding radiofrequency safety were adopted in 1996

and have not yet been updated for next generation equipment and devices.” He asked him to cite any recent studies demonstrating the technology’s safety. Carr replied in part by citing an FDA statement that claimed “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.”

Blumenthal found Carr’s response so lacking that he pressed the issue two months later, in a February 6 hearing of the Senate Committee on Commerce, Science, and Transportation. The hearing was titled, “Winning the Race to 5G and the Next Era of Technology Innovation in the United States.” The witnesses included, among others, executives from CTIA, the wireless industry trade association.

Declaring that “Americans deserve to know what the health effects are,” Blumenthal asked the hearing’s witnesses directly: “How much money has the industry committed to supporting additional independent research? ... Is that independent research ongoing? Has any been completed?”

What was extraordinary was that these top-tier industry executives freely admitted there were no studies showing 5G systems would be

safe for the public. The telecom industry had dedicated no money to such research; none was ongoing, none had been completed.

“So we are kind of flying blind here, as far as health and safety is concerned,” Blumenthal concluded.

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Still, he didn't seem especially surprised by the nonresponse. The objective of the session was not to protect the public, after all, but to support the industry, and whatever the health risks of 5G, they were quickly brushed aside in an hours-long hearing dominated by demands that government regulators grease the efficiency of the rollout. Meredith Attwell Baker, president of CTIA, counseled the senators that “the U.S. is not the only country to recognize the transformational impact of 5G. There is international consensus: The nations that lead on 5G will capture millions of new jobs and billions in economic growth.”

To hear the witnesses tell it, the only real risks were to American tech-sector profits and national security, due to the commanding position among 5G equipment suppliers of Chinese-owned

companies Huawei and ZTE. (The U.S. has ceded the 5G infrastructure market to foreign manufacturers.)

Michael Wessel, a member of the U.S.-China Economic and Security Review Commission, told the committee that China is “already doing everything it can legally and illegally” to ensure its superiority. Baker framed 5G as part of a global techno-industrial arms race. “We cannot take our foot off the accelerator,” she cautioned. “To fully realize the technological breakthroughs we are talking about, we need more spectrum, and we need it as soon as possible.”

Asked to comment on the lack of research on the potential health effects of the technology the industry is so restless to bring to market, a spokesperson for CTIA insisted that “the safety of consumers is the wireless industry’s first priority,” adding, “We follow the guidance of experts when it comes to cellphones and health effects.” Quoting the FCC’s latest evaluation of the health risks, conducted in 2019, the CTIA spokesperson told me in an email, “No scientific evidence establishes a causal link between wireless device use and cancer or other illnesses.”

The spokesperson directed me to Eric Swanson, a professor of theoretical physics at the University of Pittsburgh and a paid

consultant to the telecom industry. “[F]ederal agencies responsible for regulating the safety of cell phones and wireless infrastructure,” he wrote in an emailed statement that was vetted by CTIA, “have not found any link between electromagnetic fields allowed by the FCC regulations and cancer or other adverse health effects.” Swanson also insisted, “The consensus of the world-wide health and safety organizations is that non-ionizing fields at the levels allowed by the FCC regulations are safe.”

As proof of this “consensus,” he cited declarations of cell phone EMF safety that had been issued by the FDA, the National Cancer Institute, the American Cancer Society, the European Scientific Committee on Emerging and Newly Identified Health Risks, the WHO, and the Institute of Electrical and Electronics Engineers’ International Committee on Electromagnetic Safety.

But while these regulatory and health advocacy organizations may be in agreement, no such consensus exists in the scientific community. I forwarded Swanson’s 3,500-word statement to Joel Moskowitz of Berkeley. “The majority of scientists who study non-ionizing EMFs and publish peer-reviewed research on this topic disagree with these organizations,” he told me. One need only look, for example, to the hundreds of independent researchers—

Moskowitz is one of them—who have signed the International EMF Scientists Appeal.

The 2018 publication of the National Toxicology Program's EMF study prompted considerable relief among researchers and public health advocates alarmed at the lack of discussion around the technology's risks. The findings of cancer and other effects in rats exposed to phone frequencies would, it was hoped, change the national conversation.

Dr. Ron Melnick, 76, oversaw the design and protocols for the EMF rodent experiment. He retired from the NTP in 2009, having spent 28 years studying the toxicity of everything from perfluorinated chemicals, which leach from Teflon cookware, to the by-products of water chlorination. One of his most consequential investigations involved butadiene, a compound found in cigarette smoke and tailpipe emissions. In the wake of Melnick's studies of the chemical, the U.S. Occupational Safety and Health Administration reduced the permissible exposure by 99.9 percent.

The protocols that Melnick crafted for the rodent study—not least the reverberation chambers as an approximation of human exposure—came under rigorous review from officials at the EPA, FDA,

NIOSH, and the Bioelectromagnetics Society, among others. From these peer reviewers, the unanimous conclusion was that this would be the most authoritative animal study yet conducted in the U.S. for assessing human risk. It would also, as it happens, be the most expensive toxicity investigation that taxpayers ever funded, at a cost of \$30 million.

Not long after the publication of the final results of the NTP study, a group of researchers at the Ramazzini Institute, a nonprofit cancer research lab in Bologna, Italy, released the findings of their own study of the health effects of EMF radiation. The lead author of the experiments, Dr. Fiorella Belpoggi, had spent most of her 44-year career, like Melnick, looking at suspect agents—solvents, plastics, pesticides, fuel additives, and asbestos, among others—and now had turned her attention to the toxicity of microwave EMFs.

Rather than using Melnick's custom-designed reverberation chambers to examine the effects of radiation from nearby sources, the Ramazzini team

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examined exposures from more distant “farfield” sources, such as

cell towers. But the results aligned. “They observed, as we did, an increase of glial cell tumors of the brain and Schwann cell tumors of the heart,” Belpoggi told me in an email. “Such rare tumors in the same strain of rats, in both studies statistically significant, at different levels of exposure—near-field and farfield—in two different laboratories, cannot be just by chance.”

I asked Belpoggi about the significance of the NTP and Ramazzini studies for determining human safety exposure limits. “What I do not understand is why, for example, the chemical industry has to demonstrate the safety of a compound before putting it into the market,” she replied, “but the technology industry has no such rule, and they disseminate their products without any study of the impact on public health.” She offered one theory to explain the discrepancy: “The economic value of the telecom industry now is enormous.” Like Martin Pall, Belpoggi called for application of the precautionary principle, both for exposure from current microwave systems and for the new system of 5G millimeter waves. “I cannot affirm that millimeter waves are dangerous,” she told me, “but no one can affirm that they are not.”

In the U.S., the FDA ignored the Ramazzini findings. As for the NTP report, the agency issued a statement in 2018 denying the study’s

validity for determining human safety, despite the fact that it had commissioned the study, and the federal government had lavishly funded it, for that very purpose. Reaffirming the FCC's 1996 exposure limits, the director of the Center for Devices and Radiological Health at the FDA, Jeffrey Shuren, wrote in a letter that the FDA had "concluded that no changes to the current standards are warranted at this time," and stated flatly that "NTP's experimental findings should not be applied to human cell phone usage." The FDA assured the public, in direct contradiction of the NTP results, that "the available scientific evidence to date does not support adverse health effects."

Ron Melnick was shocked. "I've never experienced a government agency dismissing cancer results, as was done by the FDA with cancer and cell phone radiation," he told me. "FDA asked the NTP to assess human risk, the results were provided—and now they're saying they don't accept the results?"

CTIA had asked Eric Swanson, the telecom consultant, to comment on the NTP study, which he attacked, in his emailed statement, for what he called the "unreliable statistical significance of the ... study conclusions." He warned of the likelihood of false positives due to "obvious flaws in the study." Yet the putative flaws he identified, according to Joel Moskowitz, had been debunked by both former

and present NTP staffers, among them Ron Melnick in an article for the journal *Environmental Research*, in which he refuted the “unfounded criticisms” one by one. “The methods employed by the NTP are considered by most toxicologists to be the gold standard,” Moskowitz told me. He called the FDA’s dismissal of the study “a travesty” and suggested that “political considerations” were likely to blame.

Political considerations—meaning industry influence—may be playing an outsize role in the scientific determinations of other groups that have granted microwave telecom systems a clean bill of health. The WHO’s conclusion that the systems are safe, for example, relies on exposure limits recommended by the International Commission for Non-Ionizing Radiation Protection, a nongovernmental organization whose advising scientists on EMF issues are closely tied to telecom companies. Last year, in a series titled “The 5G Mass Experiment,” a pan-European group of investigative journalists found that of the 14 chief scientists at ICNIRP who crafted cell phone EMF safety guidelines, 10 had received funding from industry. The conclusion was that these ICNIRP members comprise a “small circle of insiders who reject alarming research,” effectively serving their telecom paymasters by setting lax exposure limits.

The WHO itself appears to be divided on the issue. Its own cancer research branch, the International Agency for Research on Cancer, classified microwave EMFs as “possibly carcinogenic to humans” in 2011. Last year, an IARC advisory group of 29 scientists examined the peer-reviewed research on cancer risk and then advised that IARC revisit its 2011 decision and prioritize microwave EMFs for another review. It is uncertain whether IARC will do so.

On my way to meet Debbie Persampire, riding the Long Island Rail Road from New York City, I sat in a car near a group of preteens, who each clutched a smartphone close to their body. The kids giggled and swiped and played music and videos as their mothers sat silently nearby, mesmerized by their own phones.

Persampire picked me up at the train station, and I mentioned the scene in the car. “The science is telling us the devices are utterly dangerous,” she said. “The combination of

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the danger with their clearly addictive nature—well, we need to start thinking about what we’re doing.”

Persampire’s answer was to start a grassroots coalition called Citizens for 5G Awareness, which has been busily agitating since its founding in 2018. It has pestered elected officials with email and letter-writing campaigns, testified before county commissions, organized street rallies and protests, hosted public screenings of its new favorite film, *Generation Zapped*, and, not least, shared grim YouTube videos. One documents an experiment conducted by schoolchildren who discovered that plants were unable to grow when placed near a Wi-Fi antenna. Another shows a teenage girl in Eugene, Oregon, testifying that Wi-Fi exposure in her school made her sick.

At Persampire’s house, I met several of the group’s core members, including Fay Tsamis, a real estate manager who tried to convince the local school district to ban Wi-Fi from classrooms. When school officials dismissed her concerns, Tsamis took the enormous step of removing her kids from Wi-Fi exposure to homeschool them.

As I talked with these newly minted citizen activists, I was reminded that modern public health calamities, from asbestos to auto safety to leaded gasoline and tobacco, often follow a predictable narrative.

Industry dismisses the health risk, government regulators shrug and look away, and a beleaguered minority is left to sound the alarm. Sometimes, as with the anti-vax movement, they're proven wrong; but sometimes their warnings are all too prescient. According to Persampire, some 200 new antennas, designed to operate with 5G millimeter waves, have already been built in the Huntington municipality.

In 2017, numerous signatories of the EMF Scientist Appeal called for a moratorium on the rollout of 5G wireless. These scientists were so distressed by the technology's risks that they invoked the principles of the Nuremberg Code regarding experimentation on unwitting subjects. Our embrace of the wonders of wireless, they said, might someday prove to be a vast crime against humanity—one in which the telecom industry treats the public like so many lab rats confined to our personalized toxic reverberation chambers.

Christopher Ketcham is the author of *This Land: How Cowboys, Capitalism and Corruption are Ruining the American West*.