

The WASHINGTON
SPECTATOR

Wireless Hazards

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Dec 28, 2020 | Health

Originally published online [here](#).

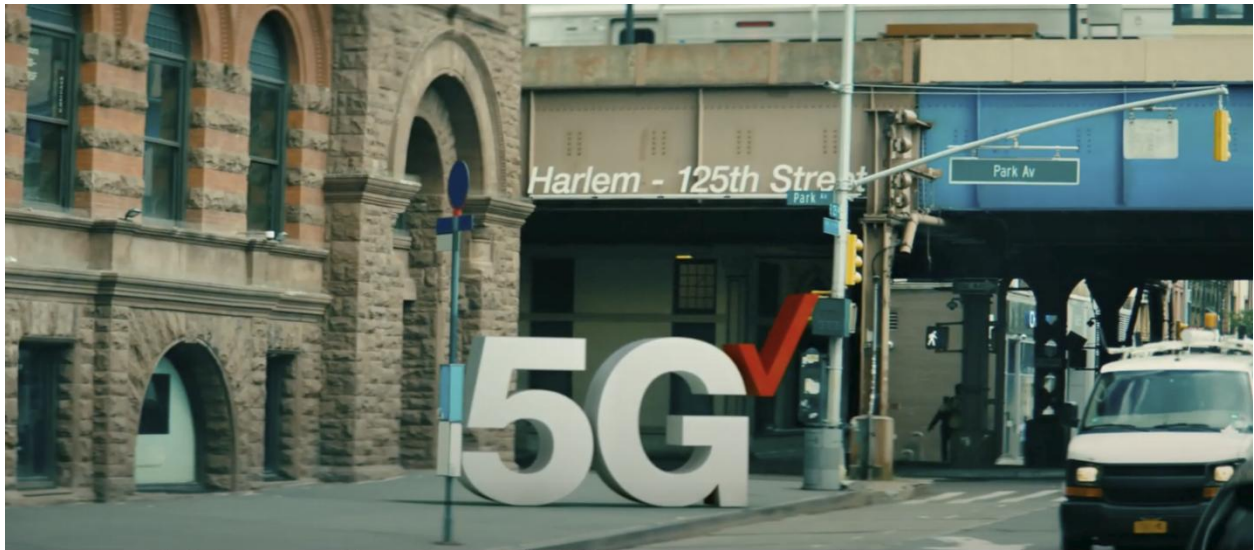


PHOTO CREDIT: Verizon Wireless video advertisement

If you think your cellphone is safe, have you considered why you believe that? Is it a fact or is it based on carefully crafted messages that you've read or heard?

For the past few decades, the telecom wireless industry and its enthusiasts have heralded cellphones as the greatest achievement of the late 20th and early 21st centuries. But as their use soars, scientists worldwide worry about their hazards and have produced over 2,000 studies that tell a darker tale. They warn that the devices and antennas that power them expose humans and wildlife to nonionizing low-frequency electromagnetic fields—also called cellphone, microwave, or radio-frequency radiation. These studies indicate that when people and animals are exposed, they can develop brain, thyroid gland, prostate gland, acoustic nerve, and breast tumors, and other diseases.

Not surprisingly, the industry argues this type of radiation is safe, because it is unlike the high-frequency ionizing radiation used in X-rays, which can directly damage DNA.

Still, scientists say low frequency doesn't mean harmless. For example, based on data from the U.K. Office of National Statistics, Alasdair Philips, an engineer, scientist, and trustee of Children With Cancer U.K., found that cases of brain tumors (glioblastomas) in Great Britain from 1995 to 2015 mushroomed, from 983 to 2,531.

Why? Philips says, "There's adequate proof that exposure from wireless devices affects cancer cells. Even if they don't start the cancers, they speed up the rate at which the cancer cells multiply. This is true of all the devices—cellphones, tablets, and cordless phones people use in their homes—since they have built-in antennas that communicate with cell towers.

"The exposure is quite significant because people hold their devices near their heads for hours while they stream videos and other materials." He warns that the exposure is particularly potent when the reception is poor: "At such time, the signal's strength can increase by even a millionfold."

Philips says the upsurge in tumors is mainly among those over 50—since this age group typically has more tumors. But, although very few 10-to-15-year-olds get brain tumors, that number is also increasing. He adds that "besides promoting cancer, microwave radiation makes lower-grade tumors become more aggressive."

Robert Kane, an electromagnetics engineer who designed and tested wireless devices for Motorola and other firms starting in the 1980s, warned of the dangers in his book *Cellular Telephone: Russian Roulette* (2001). Given his position inside the industry, he was able to confirm that cellphone companies knew their products could harm and even kill, but, like the tobacco, asbestos, and fossil fuel industries, they kept the news quiet. Besides the increased risk of tumors, Kane also described hundreds of studies since the 1950s that found that low-level radiation damaged DNA and tissues and caused loss of memory and motor skills, and cataracts. Kane died of a brain tumor in 2002.

The industry rejects the data. Its main trade group, the Cellular Telecommunications Industry Association, states “wireless devices do not pose a public health risk for adults or children.” Although it admits devices and cell towers emit radio-frequency radiation, it says this exposure can only cause acute, short-term overheating of human and animal tissues. But the CTIA also insists this doesn’t happen, because the amount of radiation is minuscule. Instead, it argues that long-term illnesses such as cancer are a fiction of marginal alarmist researchers.

Even the \$30 million, decade-long study by a National Institutes of Health division called the National Toxicology Program, the results of which were released in 2018, didn’t dent industry’s denials. For two years, NTP scientists exposed rats to cellphone radio-frequency radiation and found “clear evidence of cancer in the male rats’ heart cells, some evidence of increased brain gliomas (brain cancer) and adrenal gland tumors, DNA damage in the brains of male and female rats and mice, lower birth weights of female rats’ offspring, and decreased sperm quality.” Ron Melnick, a senior scientist (now retired) at the NTP who led the design of the study, says they also found tumors in the rats’ prostate glands. The numbers were confirmed by a panel of experts.

Still, the story was squashed: the press mostly ignored or dismissed it. And the U.S. watchdog agencies—the Federal Communications Commission and the Food and Drug Administration, which set the safety regulations for wireless devices—disputed the findings. The FDA argued that “the study was not designed to test the safety of cellphone use in humans, so we cannot draw conclusions about the risks [to humans] from it.” Melnick says, “This statement was odd because when we were designing it, the FDA told us an animal study was needed. But when we announced the results, the FDA said, ‘The current safety limits for cellphone exposure, set in 1996, remain acceptable.’” And the FCC concurred.

Melnick sought feedback from scientists outside the NTP and asked one who worked for Motorola to discuss the results. “He refused. He told me we already have lots of studies that don’t show these effects,” Melnick says.

The FDA and FCC claimed the results were skewed because NTP scientists exposed the rats’ entire bodies to higher doses of radiation than cellphones

typically emit. But their arguments were countered by scientists at Italy's Ramazzini Institute (a nonprofit cancer research center in Bologna) who exposed 2,500 rats in the fetus and until their death to lower doses of radiation than those emitted in cellphones. These animals developed the same rare heart cancers.

Why are the deniers so adamant? "It's all about money, since there are billions, even trillions, at stake," says Jerry Phillips, a biochemist who directs a science center at the University of Colorado. Indeed, in 2018, global cellphone sales were more than a half-trillion dollars.

The industry is spectacularly successful in ensuring that its message echoes far and wide: its profoundly deep pockets purchase seats at all the right tables in the global and national watchdog agencies, media organizations, and scientific associations—which manage the misinformation. Thus, industry's billions decide which scientists and studies get funded or defunded, which get quoted or discredited, which agency commissioners bounce back and forth from telecom companies and corporate law firms, and how dissenters—such as U.S. states and cities—are sued and usually silenced.

At present, the industry and its backers are hyping 5G—the newest generation of devices, following 2G, 3G, and 4G. Online, in newspapers and on television, we are told 5G will change life as we know it—with vastly increased speeds for streaming material and devices that are able to communicate with each other (sometimes called "the internet of things"). The ads also promise that 5G will add \$500 billion to the U.S. economy. Verizon, a key player, even claims it "will help doctors see cancer like never before.

The scientists worry even more. They say 5G technology uses millimeter waves, along with microwaves (the type in current devices). Because 5G waves can only travel short distances, antennas and towers need to be installed every 300 to 600 feet on every block across the country, to receive and send signals. And this, Philips says, "increases the exposures exponentially."

Joel Moskowitz, director of the Center for Family and Community Health at the University of California, Berkeley, says "because the technology is so new, we have no way to know about the long-term health effects. But we do know that

millimeter waves are absorbed in our skin and on the cornea and can harm the immune, nervous, and cardiovascular systems.”

The U.S. Government Accountability Office agrees—although it buried the warning on page 42 of a report it released this past November. The GAO quotes a National Cancer Society scientist who said “no studies of 5G frequencies have been conducted on the long-term health effects because the technology hasn’t been deployed long or widely enough.” Worse, the scientist warns the effects may not be known “for many years, because some outcomes could take decades to develop.”

Still, the GAO has hyped the 5G debut, as have the other U.S. agencies: It posted a video featuring Tom Wheeler, the former FCC chair and CTIA CEO, who, not surprisingly, never mentioned the health issues.

However, given the industry’s daily drumbeat, there is a dramatic disconnect between the critics’ concerns and public awareness. As a result, only 5 percent of U.S. adults worry that cellphones are harmful, and parents buy them for their children: in 2019, 53 percent of children under 12 and 84 percent of teens had them.

Further, few people know that when reception is poor and phones show just one or two bars—say, when users are in subways, elevators, cars, basements, or some rural areas—the devices need more energy to communicate with cell towers and other phones. Philips explained that this leads to a massive increase in exposure. This conclusion was also [noted](#) in a 2017 California Department of Public Health advisory titled *How to Reduce Exposure to Radiofrequency Energy From Cellphones*, which led the department to warn the public not to use phones in such places.

For their part, the manufacturers and telecom companies don’t mention this concern. Instead, they inform users about the proper distance to hold phones from their bodies to avoid excessive exposure (from 5 to 25 millimeters away—about one-fifth of an inch to an inch). But they bury even these modest advisories deep inside the owner manuals.

Moskowitz says, “The problem is that we really don’t know what distance is safe for people who use the devices over many years.” Thus, he and other scientists I interviewed said they only use wired landlines at home; and, when out, they carry cellphones in backpacks, brief cases, or tote bags.

However, the industry’s message is so widely accepted that contradictory information is routinely discarded. One scientist (who asked for anonymity) told me he recently was asked to advise a state committee about 5G guidelines. “When I tried to tell them about the hazards from the hundreds of thousands or millions of new antennas that will be installed, they weren’t interested. Instead, they only looked at materials from a telecom company, which said the ‘greatest risks from cellphones are traffic deaths due to drivers being distracted.’”

Similarly, when the U.K. National Radiological Protection Board warned, as early as 2000, that people should keep calls short and use hands-free earpieces, the FDA and FCC insisted “the scientific evidence does not show a danger.”

The disconnect was striking at two meetings I attended in Washington D.C. about the coming of 5G. Both had panelists from the D.C. government and industry who championed its benefits. During the Q&A, when someone asked about safety issues, panelists confidently claimed there were “none.”

Compromised watchdogs

How does industry carry it off? First, the watchdog agencies continually reaffirm the industry’s message, and because of their authority, they’re considered objective. Yet their conflicts of interest are pervasive. For example, in 2013, President Obama named Tom Wheeler, the CEO of the main trade group, the CTIA, to chair the FCC. In a 2016 talk, Wheeler said, “We won’t wait for standards to be developed. . . . Instead, we will rely on the private sector to produce them.” On 5G, he told doubters to “stay out of the way. . . . Tens of billions of dollars in economic activity . . . is what’s important.”

President Trump replaced Wheeler with Ajit Pai, a former Verizon legal counsel and attorney at Jenner & Block, which represents the CTIA. As Jenner & Block’s site boasts, “No firm has the experience and credibility we enjoy before the FCC.”

This is not an idle claim. Pai—the regulator in chief—dislikes regulations. In 2018, he repealed the FCC’s net neutrality rules, which, *Los Angeles Times* business columnist Michael Hiltzik noted, “involves billions of dollars in potential profits for Verizon and other firms.”

Moreover, Pai is determined to quash 5G opponents. In 2018, the FCC issued an order that would force cities to stop blocking companies that were installing 5G antennas. The order also lets the firms sue cities if they don’t approve their installation plans in 60 or 90 days. Further, it says that companies needn’t wait for health or environmental studies to prove the equipment is safe: instead, they only have to say they comply with FCC rules.

The FDA is just as obliging. Jeffrey Shuren, who heads its Center for Devices and Radiological Health, is an industry loyalist. As Justin Klein, a partner at Vensana, a medical technology venture capital firm, observed, “Shuren has won the trust of the device world through . . . his ‘industry-friendly record.’” A May 2019 CBS news report confirmed this: when France banned certain breast implants that researchers linked to lymphoma in 2019, Shuren said they were safe—and left them on the U.S. market.

Shuren also does not welcome whistleblowers. A 2012 *Orthopedics Journal* story said that when he ran the FDA unit approving new devices, nine of its scientists warned that a CT scanner they were evaluating could cause cancer. Within months, Shuren fired all nine. Two years later, a U.S. congressional committee reported that Shuren had bugged the scientists’ computers to record their activities.

In fact, the U.S. federal government thrives on a thriving telecom industry. In *Captured Agency* (a monograph published in 2015 by Harvard’s Center for Ethics), journalist Norm Alster wrote that the government had reaped nearly \$100 billion in prior years from selling space on the electromagnetic field spectrum, through which the companies send their signals. Alster says local governments also prosper, collecting an average of 19 percent from users’ cellphone bills.

Other deniers

Henry Lai, a University of Washington bioengineer researcher, says the industry's influence is so profound that "even the American Cancer Society accepts its views." So, too, have other respected groups, such as the World Health Organization and the U.S. Centers for Disease Control and Prevention, which repeat the "no radiation problems" refrain.

For example, when the National Toxicology Program released the results of its study—citing cancers in the heart cells, brains, and adrenal glands of laboratory rats exposed to cellphone emissions—an American Cancer Society site said, "Updated Cellphone Study Findings Still Inconclusive," the exact opposite of what the scientists concluded. In fact, the ACS's chief medical officer at the time, Dr. Otis Brawley, said, "The evidence for an association between cellphones and cancer is weak."

Could the ACS have industry ties? I asked Kathi Di Nicola, director of ACS media relations, for its donor list. "We do not release individual or partner giving, unless required by law," she emailed back. But an ACS site called "Our Partners" lists Goldman Sachs, Bank of America, and JP Morgan, whose clients include the telecom giants; other partners are the giants themselves, such as Microsoft, United Technologies, and World Wide Technology.

For its part, the CDC switched its position about wireless dangers without offering any reasons. Theodora Scarato, executive director of the Wyoming-based nonprofit group the Environmental Health Trust, which works with communities and health professionals to promote research and policies, says that, in June 2014, the CDC website recommended "caution in cellphone use" and noted that "more research is needed . . . before we know for sure if cellphones cause cancer."

Just two months later, most of the message had disappeared and was replaced by one line: "There is no scientific evidence that provides a definite answer to that question [can using a cellphone cause cancer?]." Scarato notes that her nonprofit submitted hundreds of Freedom of Information Act requests to the CDC to determine why; in doing so, it learned that the CDC [had hired Kenneth](#)

[Foster](#), an industry consultant, in 2015, to write that agency's new web pages on the health effects of wireless technology.

The WHO has also straddled both sides. Just one month after its division the International Agency for Research on Cancer defined cellphone radiation as a *possible* human carcinogen in 2011, a WHO fact sheet claimed "no adverse health effects have been established." However, Alasdair Philips notes that many IARC scientists now believe the group should revisit the issue and change the assessment from possible to probable.

Further, the WHO consistently adopts the views of the International Commission on Non-Ionizing Radiation Protection, or ICNIRP, which, since its founding in 1992, has argued that electromagnetic frequency, or EMF, radiation can only cause damage by heating body tissues, which, it says, wireless devices don't do. The WHO also defers to the United States (whose position is articulated by the FDA and the FCC), which, until recently, when President Trump cut U.S. funding, was the WHO's largest contributor.

Dariusz Leszczynski, a University of Helsinki biochemist, says ICNIRP's views haven't changed because its current members only choose new members who share their beliefs. His opinion is confirmed by James Lin, a University of Illinois professor of engineering, physiology, and biophysics, who was an ICNIRP member for 12 years. He told me, "If you look at the group's output, it says the same things industry says."

Moreover, many ICNIRP members have serious [conflicts of interest](#). While they're supposed to list their income on Declaration of Interests forms, they often don't. For example, Michael Repacholi, an Australian biophysicist and ICNIRP's first chair, also founded a WHO project in 1996 to study cellphone radiation effects. But Louis Slesin, editor of *Microwave News*, reported in 2006 that Repacholi admitted the telecom industry had funded half the WHO project's budget. When he left WHO in 2006, Repacholi soon became an industry consultant.

Andrew Wood, who is on the ICNIRP's Scientific Advisory Group, runs a lab at Swinburne University in Australia supported by the Telstra Corporation, which builds and operates digital networks, provides mobile and internet access, and is

that country's largest telecommunications company. Telstra gave Wood's lab some equipment and sent its staff there to test Telstra's products.

Rodney Croft, an ICNIRP member since 2008, told an Australian Broadcasting Corporation news show, "A lot of research . . . has clearly shown there aren't any health effects." However, Croft didn't mention that the research center he directed was created with Telstra funding and lab equipment.

Rene de Seze, in ICNIRP for over a decade, left his Declaration of Interests form completely blank—not listing grants from France Telecom or his work for Motorola.

Even the National Institutes of Health has minimized the radiation hazards. For several years, it sponsored *Healthy Building Roundtable* conferences, the last one in 2018. On July 19 and 20, speakers on the Electro Magnetic Frequency panel [described](#) the dangers of wireless devices, circulated material at the conference, and posted it on the NIH–Healthy Buildings Roundtable website. It said, "Current FCC public radiation exposure guidelines were set decades ago, based on the outdated premise that devices need to emit enough heat to raise the temperature of one's skin to cause harm. There are now [over 25,000 articles published](#), and the majority of non-industry funded studies show great evidence of biological harm at the non-thermal level."

The message still appeared in September, but by early October, it had disappeared. So, too, had any mention of the EMF panel.

The loyal press

Besides the industry's sway with the agencies, its influence on the press and media means that coverage of wireless devices is almost always upbeat. First, the industry buys full-page ads that promote its services and products and now continually tout 5G. Then there are the owners' personal conflicts. For example, *The New York Times'* largest single stockholder is Carlos Slim—the world's richest man in 2013—who holds 17 percent of the newspaper's stock and whose company, America Movil, is Latin America's biggest telecom provider. And Verizon is partnering with the *Times* on a 5G project.

Most press and media repeat the agencies' positions and debunk or ignore studies that describe the dangers. Since *The New York Times* is America's paper of record, its coverage is instructive.

In a May 2019 *Times* story, "your 5g phone wont hurt hurt you. but russia wants you to think so," the journalist William Broad quoted Marvin Ziskin, a Temple University professor of radiology, who claimed, "5G emissions, if anything, should be *safer* [emphasis added] than previous generations' exposure of the body's internal organs." But Ziskin's papers, many co-authored by Kenneth Foster, a professor in the Department of Bioengineering at the University of Pennsylvania, are funded by the Wi-Fi Alliance and the Mobile & Wireless Forum, or MWF, a trade group whose members include Apple, Motorola, Samsung, and Sony. As industry favorites, Foster and Ziskin were invited to chair MWF's 2016 workshop sessions in Belgium, and Foster gave the keynote address.

Broad also quotes David Robert Grimes, whom he identifies as an Oxford University cancer researcher. Besides his statements supporting 5G and wireless devices, Grimes discredits the work of David Carpenter, former dean of SUNY's School of Public Health in Albany who has long warned of cellphone hazards: he claims that "Dr. Carpenter's scariest alarms have been widely dismissed by scientific bodies the world over."

But Grimes isn't a reliable judge. His website has a link to his Oxford work, but the link, when clicked, states, "The page is not found." Grimes's site also notes his work at Queen's University in Belfast, but, as of December 2019, Queen's no longer listed Grimes in its online directory.

Moreover, Grimes's research is on human consumption of oxygen—not cellphone radiation. And although Broad doesn't mention this, Grimes gets industry funds: in one of his papers, Grimes thanks the NVIDIA Corporation for "generous hardware donations" to his research project on radiotherapy (NVIDIA makes parts for smart phones, tablets, and game systems and had an income of \$4 billion in 2018). Grimes also thanks Cancer Research U.K. for its support—an institute that partners with the Francis Crick Research Institute, whose chair is Baron Edmund John Philip Browne, British Petroleum's former head and now chair of Huawei Technologies U.K.

In July 2019, the *Times* ran another story, titled “5G, don’t fear the frequency,” under a huge multicolored drawing of panicked people. Broad writes that Bill Curry, a physicist who warns about radiation dangers, produced “flawed reports” about the damage of microwave radiation, which were adopted by “alarmist websites.” Again, he quotes Grimes, who states, “If phones are linked to cancer, we’d expect to see a marked uptick. Yet we do not.” This assertion contradicts research conducted by Alasdair Philips, who used numbers from the U.K. Cancer Registry to document the increase in aggressive brain tumors.

In fact, Broad’s articles reveal consistent biases. In reviewing two books on global warming in 1998, he said, “[W]e live in a great climate experiment, the outcomes of which, good or bad, no one is likely to forecast with any certitude.” This assurance came nearly 20 years after a National Academy of Sciences report predicted global warming of 2 to 3.5 degrees Celsius (3.6 to 6.3 degrees Fahrenheit)—with greater increases at high latitudes.

In 2007, Broad called Al Gore’s documentary *An Inconvenient Truth* “exaggerated.” To prove his point, he quoted Don Easterbrook, a geologist who saw “a lot of inaccuracies.” But this is the same Easterbrook who told a Washington State Senate Energy, Environment, and Telecommunications Committee that “global warming ended in 1998.”

Broad’s science denials resurfaced in October 2019, when he wrote that plastics, a major source of ocean pollution are “less devastating than usually portrayed.” To support this assertion, he quotes a marine chemist who claims that “sunlight can degrade them in centuries or even decades,” not a timeline that accords with sustainable management of the world’s marine and coastal environments.

Although most press and media support the industry’s position, there are some rare exceptions. For example, the *Chicago Tribune* launched its own study to measure the radiation from Apple, Samsung, and Motorola cellphones. In an August 2019 article, the *Tribune* said the testing laboratory found that many models exceeded the FCC exposure standards, “particularly when tested close to the body.”

The *Baltimore Sun*, covering a May 2016 Pediatric Academic Society annual meeting, quoted physicians who warned parents to limit their children’s

cellphone use. And in October 2005, a *Florida Sentinel* story noted that researchers worried that “radiation enters users’ heads, and over time might pose serious health risks, including cancer.”

Research and retaliation

Industry’s impact on research is also enormous. Henry Lai, the University of Washington bioengineer researcher, reviewed 326 studies on radio-frequency radiation carried out from 1990 to 2005 and found that half showed harmful biological effects, while half did not. When he checked who funded which ones, the numbers diverged dramatically: of those that were independently funded, 70 percent found harmful effects, while among those funded by industry, only 30 percent reported finding them.

For researchers who refute the message, retaliation is certain. A few examples are useful. John Allis, a physical chemist, and Carl Blackman, a biophysicist, were among a group of scientists at the Environmental Protection Agency studying low-intensity EMF radiation from the 1970s until the mid-1980s—to determine its effect on brain tissue. Allis says that although ‘low’ sounds benign, it “penetrates more deeply than X-rays.” Since their research predated cellphones, they studied the radiation from electric power lines and the military’s radar installations.

“We exposed newly hatched chickens’ brains to it and found that this changed their brain tissues. It was a crucial discovery that we wanted to study further, but EPA stopped our funds,” Blackman says. He then got Department of Energy support, but it also ended, and his equipment was thrown away.

Why? Allis says that “in the 1980s, the Reagan administration was pushing ‘Star Wars,’ which was thought to need nonionizing radiation to make it work. The scuttlebutt was that Washington didn’t want to know it had negative effects. So it stopped the funds.”

Lai and his research partner, N.P. Singh, a professor of bioengineering at the University of Washington, exposed rats’ brains to radio-frequency radiation at an intensity the FCC said was safe. But after just two hours, the radiation broke or damaged the DNA in their brain cells—which can lead to mutations and

cancer. When they published their results in a 1995 issue of *Bioelectromagnetics*, Motorola cut their funds and counterattacked: Slesin posted a leaked memo in a 1997 *MicrowaveNews*, which showed (under [Media Strategy](#), p.13) that Motorola wrote to its public relations firm telling how to discredit them.

Lai and Singh then got a Wireless Technology Research grant (under the trade group CTIA) to continue their studies. But Lai says WTR continually tried to “dictate the design of our experiments.” After many confrontations, George Carlo, WTR’s head, wrote the University of Washington president (Richard McCormick), threatening legal action and telling him to fire Lai and Singh. McCormick refused. The scientists still had NIH funds to continue their research on extremely low-frequency fields, and published a paper in 2005. But it was their last.

Om Gandhi, a University of Utah professor emeritus, studied how humans absorbed cellphone radiation and, by the 1990s, was focusing on children because, as he explains, “their skulls are thinner than adult skulls and they absorb much more.” He also found that for every millimeter closer to their heads people hold their phones, the absorption rate is 15 to 30 percent higher. When he published these results, his funders stopped funding. “Without the grants, I had to close my lab,” he said. Some years later, Devra Davis, an epidemiologist who co-founded the Environmental Health Trust, co-wrote a paper with Gandhi. She says that a five-year-old child’s skull absorbs about 10 times as much radiation as an adult’s skull. But when companies test phones, they use a one-size-fits-all model based on the head size of an adult male.

Jerry Phillips (before he went to the University of Colorado) was at the Veterans Affairs Medical Center in Loma Linda, California, where the team with which he worked got Motorola funds to study EMF radiation. The researchers exposed rats in the fetus and newborns to the radiation and found that under certain conditions, the signals affected brain tissues. “Motorola didn’t want to hear this and told us not to present our results. But we did, anyway,” Phillips says.

After this, the company asked the team to study the DNA breaks that Lai and Singh had found, but he said, “Motorola wanted us to reach different conclusions. What we learned was that different exposures

increased *and* decreased DNA damage. Motorola didn't like this, either, since it wanted to hear that there were no effects. It told us to do more research and not publish our data. A friend at Motorola advised me 'give Motorola what it wants, or this could harm your career.'

"Although I knew government funds hadn't been available for such studies for years, I couldn't work with Motorola's restrictions. So I took myself off the project. If I hadn't, Motorola would have. I left California and haven't done this type of research since."

Phillips says Motorola asked several other researchers to disprove what the group at Loma Linda, as well as Lai and Singh, had found about the damage to cells. And some obliged the company. "It's possible to do this, since the way you design studies determines what you'll find."

"This is how industry manages to confuse the public. It stops funding research it doesn't like and promotes the results it likes. It also says the studies cancel each other out." That is, if some find harmful biological effects and others don't, then the former don't count. "This isn't correct," Phillips says.

Lai adds that industry enthusiasts always claim there's a lack of research about the long-term effects, but this isn't true: over 500 epidemiological and animal studies have shown that cellphone radiation causes biological damage. Lai told Slesin, "The industry says half the studies don't show effects. But even if this was true, could the other half all be garbage?"

Reseachers' findings

Brain tumors and blood leaks Several scientists have reported on these health problems. Berkeley's Joel Moskowitz, who writes a blog on electromagnetic radiation, says that in 2017, several journals, such as *Biomedical Research International* and *Neurological Sciences*, published various scientists' reviews of the many studies carried out on brain tumors. They found that "each reported a 'statistically significant' link between heavy cellphone use (of 10 or more years) and brain tumors, especially on the side of the head where people hold their phones (called *ipsilateral* use)."

One review was by Lennart Hardell and Michael Carlberg, whose earlier work on brain tumors is considered the gold standard and was a key reason the International Agency for Research on Cancer classified cellphone radiation as a possible carcinogen. In their review, Hardell and Carlberg found that the highest risk of glioma—brain cancer—occurred among the heaviest users, and they reported in a 2013 issue of the *International Journal of Oncology* that people using cellphones at least 30 minutes a day for nine years “had nearly three times the glioma incidence. If they started as teenagers or earlier, the risk was four times higher.” They also found meningiomas (slow-growing, mostly nonmalignant brain tumors) and acoustic neuromas (tumors on auditory nerves leading from the inner ear to the brain).

Further, a \$25 million Interphone Study, funded by the European Union and others, was carried out by scientists in Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, New Zealand, Japan, Norway, Sweden, and the U.K. They compared approximately 5,000 cases of tumors to a similar-size control group. Many of the researchers said the results were consistent with previous studies that showed increased risks for glioma or acoustic neuroma tumors among the heaviest cellphone users.

Two other studies also found serious risks. The French CERNAT study reported in May 2014 that those using phones 30 minutes a day for five years had a higher risk of brain tumors. And a Chinese study by J. Tang (published in *Brain Research* in 2015) found that rats exposed to cellphone radiation had leakage in the blood-brain barrier and cognitive impairment.

DNA damage Besides the Lai and Singh studies, the reflex study (for which the European Union gave three million Euros to 12 institutions) found that cellphone radiation damaged human cells and DNA. As noted earlier, the NTP study also found DNA damage in rats and mice.

Thyroid tumors Berkeley’s Moskowitz says the incidence of thyroid tumors—especially the papillary type, which is the most sensitive to electromagnetic field radiation—is increasing in many countries. He explains that because of the way phones are designed, much of the radiation is directed toward the neck, where the thyroid gland is located. He says the CDC reported a rapid rise of these tumors among children in the United States, and Hardell and his colleagues

wrote about this in 2016. Finally, he says a 2019 Yale University study found increased thyroid cancer among heavy cellphone users.

Male infertility The Cleveland Clinic Center for Male Fertility found that when men carried phones in their pants pockets, their sperm were weakened and reduced, which can cause infertility.

Hypersensitivity A growing number of physicians and scientists are reporting that some individuals are particularly sensitive to EMF radiation. Their symptoms, which can be quite pronounced, include tinnitus, vertigo, headaches, fatigue, and memory loss.

Insurance companies deny coverage

Interestingly, the risk-averse insurance industry has been reluctant to offer coverage for the companies or those who use the devices. For example, insurance authority Swiss Re classified wireless devices as “high risk,” while Lloyd’s of London underwriters adopted the “Electromagnetic Fields Exclusion Clause”: this means it will not cover “damages or illnesses caused by continuous long-term non-ionizing radiation exposure through mobile phone use.” As journalists Mark Hertsgaard and Mark Dowie noted, in a July 2018 *Guardian* article, they didn’t find a single insurance company that would sell a policy covering cellphone radiation. “Why would we?” one executive told them . . . pointing to over two dozen lawsuits against wireless companies, demanding \$1.9 billion in damages.

Countries’ concerns

Unlike the United States, some countries have tightened their exposure rules. For example, Belgium banned companies from marketing phones specifically designed for children under seven.

Cyprus banned Wi-Fi in nursery schools and kindergartens and launched an advertising campaign to educate parents. Also, it removed Wi-Fi from Archbishop Makarios hospital.

France, which has the world's strictest limits, banned wireless devices in daycare centers for children under three, required Wi-Fi to be turned off in elementary schools when not in use, and ordered towns to map the locations of antennas, measure their radiation levels, and give this data to the public. Also, it required that ads state the various models' exposure levels (with fines of up to 75,000 Euros if they don't comply); further, the ads may not show children using phones or people holding the devices next to their heads.

India reduced the cell tower radiation limit to one-tenth of the cap recommended by ICNIRP, and some states and cities ordered companies to remove their towers that were located near hospitals and schools.

Israel banned Wi-Fi in kindergartens, limited it in first and second grades to three hours a week, required companies to list the phones' radiation levels, and banned ads that show children using phones. Haifa's school district required computers to be hard-wired.

In Poland, Krakow's mayor distributed free meters to its citizens to measure their devices' exposure levels and tightened zoning rules, which limit the areas where towers can be located.

And in Switzerland, Geneva is one of several cities and towns that placed a moratorium on 5G.

States, cities, and scientists fight back

Alarmed about the hazards from wireless devices, 254 scientists from 44 countries have urged the United Nations to toughen the exposure guidelines and "educate the public about the health risks." The U.N. has not replied.

With the advent of 5G, warnings are even stronger: By October 2020, 407 scientists and physicians appealed to the European Commission "to halt the roll-out of 5G . . . which will substantially increase exposure to radiofrequency electromagnetic fields." This has also been ignored.

Many U.S. states, cities, and counties also worry. For example, New Hampshire legislators created a commission of experts to study EMF effects. In their report,

which was released this November, the experts recommended 15 actions: among the most important, they asked the FCC to study the environmental impact of the 5G antennas and towers and locate them further from schools and homes.

Representative Patrick Abrami, who heads the commission, invited Frank Clegg, Microsoft Canada's CEO for 14 years, to meet with them. Clegg told them, "The industry only focuses on getting its products to market but doesn't deal with health and safety issues. It's self-policing, so we're seeing a Wild West scenario regarding the guidelines. I'm not aware of a single study which shows 5G technology is safe."

How did the ex-CEO of Microsoft Canada do such a turnaround? Clegg says, "After I retired in 2005, I talked to scientists and became convinced the devices can harm you. At this point, my wife and I founded Canadians for Safe Technology to raise people's awareness about the dangers and tell them how to use the devices safely."

Louisiana legislators are also concerned. They asked their environmental agency to study the 5G safety issues. The problem, Moskowitz says, is that "there are no health studies" specifically on exposure to 5G.

Richard Blumental, senator from Connecticut, shares their concerns. At a February 2019 Commerce Committee hearing on 5G, he blasted the FCC and FDA for "failing to conduct research into the safety of 5G technology . . . instead, deferring to industry. We're flying blind here."

Dozens of cities, including Huntington Beach, California; Seattle; and Montgomery County, Maryland, sued the FCC, which they claim has usurped local control in order to promote 5G. They argued that local governments should be able to stop companies from installing thousands of 5G antennas and require that environmental impact studies be made before the companies move forward. But the FCC issued an order to "remove these regulatory barriers." And it won.

The Environmental Health Trust also took the FCC to court: "The FCC refused to update U.S. radiation guidelines, ignoring the vast number of studies that found

harm from low-level radiation emitted by wireless devices and cell towers,” the EHT’s Scarato explains.

The FCC fought back, insisting its 1996 regulations were still adequate. It also repeated its mantra, that 5G will unleash “a wave of entrepreneurship and economic opportunity . . . helping ensure the U.S. wins the global race to 5G.” However, in 2019, the District of Columbia Circuit Court of Appeals [said](#) the FCC could not eliminate environmental reviews of 5G small-cell infrastructure. Oral arguments in the EHT case are scheduled for this coming January, but in the meantime, the FCC and telecom companies are forging ahead: the FCC says it can do this—despite local pushback—because the Telecommunications Act of 1996 gives the FCC the sole power to set radiation exposure limits.

Even before the 5G conflict, U.S. cities challenged the industry. In 2010, a San Francisco law required cellphone vendors to warn users about the devices’ radiation and limit their children’s use. CTIA, the trade group, promptly sued, claiming the law violated the sellers’ free speech rights. To flex its economic muscle, CTIA moved its trade show from San Francisco to San Diego. After a three-year fight, the city lost the case in a federal appeals court and backed off—citing the risk of having to pay the industry’s legal fees.

Five years later, Berkeley passed a more limited law that required vendors to educate users about the safety issues. CTIA sued again, arguing it “violated the sellers’ first amendment rights.” At first, the Circuit Court sided with Berkeley and some vendors complied. But CTIA appealed the decision, arguing that the Berkeley ordinance “over-warned the consumer.” Also, the FCC weighed in that Berkeley didn’t have the right to inform the public about safety concerns because the FCC gave the public all the data it needed. This time, [Berkeley lost](#). Scarato [notes](#) that Thomas Johnson Jr., the FCC’s general counsel for the Berkeley case, was previously at the law firm of Gibson, Dunn and Crutcher, which represented the CTIA when it sued Berkeley.

How users can limit their exposure

Since wireless devices are here to stay (5.2 billion people use them globally), scientists and health advocates say the best course is to limit people’s exposure. To this end, California’s Department of Public Health says people should use

headsets but remove them when not talking, since they release small amounts of radiation even when not in use. Also, they should text instead of talk; carry phones away from their bodies (in backpacks, briefcases, handbags, and tote bags); keep them away from their heads when streaming; and download movies (instead of streaming).

Alasdair Philips, the U.K. scientist, says that modern cellphones use less power and thus emit less radiation than cordless phones (also called satellite phones). But he stresses they are still hazardous and should only be used in areas where reception is strong. Just as important, Philips says, “You should download material, rather than stream it, since streaming emits more radiation. And you should not use ear buds, since these fit deeply inside the ear.”

Warnings from industry executives such as Frank Clegg (Microsoft Canada’s former CEO) are rare. So, too, are those from governments, since the industry lavishes huge sums on the lawmakers. According to the Center for Responsive Politics, from 1989 to 2017, the industry gave \$101 million to members of Congress and their PACs. Its favorites were Senator John McCain (R-Ariz.), \$2.5 million; Rep. Ed Markey (D-Mass.), \$1.7 million; Rep. Greg Walden (R-Ore.), \$1.6 million; Rep. Fred Upton (R-Mich.), \$1.6million; and Rep. Steny Hoyer (D-Md.), \$1.4 million. The [three most generous donors](#) were AT&T (\$19.8 million), Comcast (\$14.9 million), and Verizon (\$11.2 million). Moreover, the National Institute on Money in Politics says industry lobbying groups plowed \$93.7 million into local elections in 2018.

As expected, the largesse continues to be rewarded, and a misinformed public continues its love affair with all things wireless.

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