



# WAKE-UP

The electromagnetic radiation surrounding us — especially from cell phones — may pose unseen dangers to our health. Learn what you can do to reduce your exposure to EMFs.

BY PAMELA WEINTRAUB

**M**y Brooklyn neighborhood is one of the most historic in New York. Up the block, the F. G. Guido Funeral Home, built circa 1840, was a destination of choice for many a Mafia send-off. The Gothic arches of St. Paul's Church, across the street, have welcomed Episcopalians and music lovers since 1849. Along with hundred-year-old brownstones graced by deep front gardens, these national landmarks are assiduously protected from change. But, one modern feature has silently infiltrated this vintage section of Brooklyn: electromagnetic frequencies, or EMFs for short.

Invisible to the eye, EMFs are powering an ever-expanding thicket of appliances and electric lights, and more recently, a burgeoning network

of cell towers, wireless routers and the ever-present cell phones that gird our lives.

Life without cell phones and other wireless conduits has become nearly unthinkable, but a growing chorus of experts now worries that our near constant immersion in these force fields could be endangering our health.

We are exposed "to as much as 100 million times more electromagnetic radiation than our grandparents were," notes Ann Louise Gittleman, PhD, author of *Zapped: Why Your Cell Phone Shouldn't Be Your Alarm Clock and 1,268 Ways to Outsmart the Hazards of Electronic Pollution* (HarperOne, 2010).

Worry intensified this year after the World Health Organization (WHO) analyzed the data



# CALL

and called cell phones a possible carcinogen. The jury is still out on the range of possible effects, but a raft of studies now links EMFs — especially those from cell phones carried close to our bodies — to brain tumors, damaged DNA, fertility problems and autism.

With cell-phone usage surging from a hundred million people worldwide in 1997 to some 5 billion today, even small increases in risk could pose a serious global threat. A Council of Europe committee has even warned that EMFs might bring about a health crisis comparable to those once spawned by smoking and asbestos.

In an effort to lower risk, some communities are taking action to reduce EMF exposures. The National Library of France, for example,

has dismantled its wireless system. Germany has advised against wireless technologies in residential neighborhoods.

But when it comes to cell phones, initial change might have to come one person at a time.

“Studies show people would rather leave home without their wallet than their cell phone. The cell phone has become an extension of the body,” says Devra Davis, PhD, former researcher for the National Academies of Sciences and president and founder of the Environmental Health Trust, an organization devoted to educating the public about controllable environmental health risks and policy changes needed to reduce them.

Read on to learn more about EMFs and the best ways to reduce your own exposure risks. →

# EMFs ARE EVERYWHERE

What is all the fuss about, anyway? Electromagnetic frequencies — essentially different forms of radiation that vary along what physicists call the “electromagnetic spectrum” (see illustration below) — abound in nature. They build up after thunderstorms and travel through the planet from pole to pole. Light is the most familiar EMF, but modern technology also generates EMFs: x-rays, radio waves and microwaves, to name a few.

What makes one form of electromagnetic radiation fundamentally different from another? In a nutshell: Its wavelength and frequency. Shorter waves have to cycle up and down more frequently to travel a given distance, so they are more energy intensive; some, like x-rays and gamma rays, emit so much energy they can break living tissue apart, a characteristic that has caused experts to label them “ionizing.” By contrast, longer waves, like TV waves, radio waves and microwaves, have to cycle up and down less frequently to travel a given distance. That means they emit less energy; they don’t ionize living tissue and have been widely embraced as safe.

It wasn’t until January 1993, when TV talk-show host Larry King did an interview with a Florida man, that confidence began to erode. King’s guest, David Reynard, had filed a claim against

the cell-phone manufacturer NEC and the carrier GTE Mobilenet. According to Reynard, in 1988 he’d given his wife, Susan, a cell phone for her birthday. Seven months later, he told King, she was diagnosed with a malignant brain tumor that closely resembled the size and shape of the phone’s antenna. A month after Reynard filed the lawsuit, Susan was dead.

Could the cell phone really have been the culprit? Experts like Davis hypothesize that it could have been. The effect on the brain and other vulnerable tissue is much like snapping a rubber band, she explains. “Snap it once, and it stays intact, but snap it constantly and irregularly, and the rubber band falls apart.”

Given how widespread cell-phone usage is, and how quickly Susan Reynard’s cancer (a rare, malignant astrocytoma) developed, lawyers couldn’t prove that her cell phone was to blame. Yet studies and counter-studies have cast an increasingly disturbing — though uncertain — light on the damage that nonionizing wavelengths might cause.

In 1994 University of Washington scientists exposed live rats to cell-phone-like radiation and then examined their brains. DNA from brains of exposed rats was damaged, while DNA from unexposed rat brains remained intact.

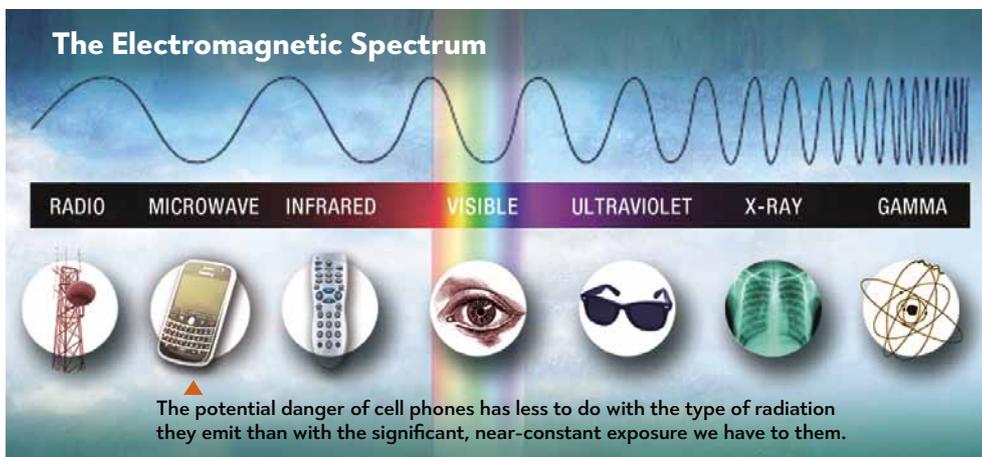
Many consider a series of studies from Lund University in Sweden to be the pivotal evidence to date. By 2003 the Swedish researchers were reporting that cell-phone radiation breached

the blood-brain barrier, the vascular and immune barricade keeping toxins out of the brain. In one study, the Swedish scientists exposed 32 rats to cell-phone radiation for just two hours, varying intensity among the rats in order to reflect the types of exposures human cell-phone users might receive. When the rats were euthanized roughly 50 days after exposure, and their brains studied, scientists found significant blood-vessel leakage and shrunken, damaged neurons. The higher the level of radiation, the more damage was done.

## Studies and counter-studies have cast an increasingly disturbing light on the damage that nonionizing wavelengths might cause.

Ever since the Swedish study, increasing numbers of people have been claiming a link between their brain tumors and their cell phones. Countless studies, most of them small, have shown evidence of harm. But these studies have been countered by just as many studies finding no risk at all.

To help get to the truth, a multinational study called INTERPHONE compared cell-phone usage in brain-tumor patients with usage in a healthy control group without brain tumors. Results, reported in 2010 in the *International*



Radio waves are especially long waves that cycle up and down relatively infrequently. Thus, the energy emitted is low, and danger has long been considered small. Gamma rays cycle rapidly, emitting large quantities of energy and posing significant danger to living tissue. Cell-phone emissions, made of relatively long microwaves, cycle relatively infrequently — but because we carry these devices so regularly, and so close to our bodies, some experts are questioning the risk.

With their thinner skulls and smaller ears, children absorb significantly higher rates of radiation, which can damage neural connections in their developing brains.

*Journal of Epidemiology*, were mixed. According to researchers, risk of getting a brain tumor was higher for those using cell phones the most — 30 minutes a day or more for at least 10 years. On the other hand, people using cell phones for shorter periods of time were reported to have less risk than those using only landlines; for these moderate users, the study implied, cell phones had a *protective* effect.

Writing an editorial on the study in the same issue of the journal, Rodolfo Saracci, MD, of the National Research Council in Pisa, Italy, and Jonathan Samet, MD, of the University of Southern California in Los Angeles, tried to shed some light. Addressing the tepid findings on risk for heavy users only, they commented that, in contrast, “none of today’s established carcinogens, including tobacco, could have been firmly identified as increasing risk in the first 10 years or so since first exposure.”

As for the so-called protective effect, they found no biological mechanism to explain it. Given that, most experts say it probably reflects a flaw in the design of the study — and not a benefit from EMFs.

This year’s critical WHO report labeling EMFs a “possible” carcinogen followed fast on the heels of the INTERPHONE study. According to Samet, who led the WHO working group that reviewed the evidence, the cancer-cell-phone link cannot be dismissed.

“The evidence is credible,” he comments. But Samet also points out that without a known mechanism for how cancer is induced, it’s impossible to elevate the risk label to its next level of concern: from “possible” to “probable.” More research will be required.



## YOUNG BRAINS AND CELL PHONES

Could there be too much of an emphasis being put on brain cancer, which is still a rare diagnosis? “A much larger concern is damage to neural connections in the developing brain and to the reproductive health of men and women,” says Davis.

When it comes to reducing EMF-exposure risks, every millimeter of separation between a cell phone and the brain is protective. With thinner skulls and smaller ears, children are closer to the radiation source. In fact, researchers have long reported significantly higher absorption rates of radiation for children — about twice as much for those under age 8.

When it comes to disruption of neural connections, compelling research published in the *Journal of the American Medical Association* this year shows that

50-minute cell-phone calls increase glucose metabolism in the area of the brain closest to the phone antenna — specifically, the orbitofrontal cortex and temporal pole, regions involved in sensory integration, language, decision making, and social and emotional processing.

Although the study’s lead author, psychiatrist Nora D. Volkow, MD, of the National Institute of Drug Abuse at the National Institutes of Health, does not know whether the metabolic increases can cause damage over time, she does say that, if they do, children and adolescents (because they have the most neuroplastic brains) would be at greatest risk. “As of right now, we don’t know what happens when you get repeated exposures. What happens over the course of 10 or 15 years?” she wonders.

Research presented at a conference held in Istanbul this May underscores Volkow’s concerns. After Turkish researchers exposed adult rats to mobile-phone-like emissions, they found damage to the cerebellum, a part of the brain important for language, attention and motor control. After exposing pregnant rats to similar →

radiation during gestation, the researchers documented cell loss in the newborn rats' hippocampus, a part of the brain pivotal to memory formation.

It appears that cell phones can also threaten fertility. Research from the University of Athens showed that cell-phone radiation could cause DNA fragmentation in the ovarian cells of insects, drastically reducing reproductive capacity.

At the same conference, research was presented from Jawaharlal Nehru University in New Delhi, where researchers exposed rats to two hours of cell-phone radiation a day for 35 days. At the end of that period, exposed rats had high levels of free radicals that resulted in an increased risk of infertility and cancer.

The news is disturbing for humans as well: Research from the Cleveland Clinic in Ohio recently suggested that cell phones may lower sperm count in men — especially those who kept the phone on “talk” mode, and carried it on their body, most often in their pants pocket.

## COMMUNITIES REACT

The most specific findings come from studies of rodents, hardly the highest level of evidence. But right now, that is the best evidence available. Cell-phone technology is new, and definitive human evidence won't emerge until decades of use enable long-term follow-up and the kind of epidemiological evidence true proof demands.

Some communities aren't content to wait those decades for consensus when they can do something now. The San Francisco Commission on the Environment called for a review of cell-phone safety standards, safety warnings at the state and federal levels, and safety information at the point of sale. The mayor and town council of Jackson Hole, Wyo., have voted for a cell-phone safety-awareness campaign for the city and the public schools.

For its part, the cell-phone industry insists on more research before it issues warnings or changes its products in any way. Some compare this to the tobacco industry's resistance to conceding risk and issuing warnings that smoking can cause cancer. “Whilst the vast majority of scientific studies have not shown any adverse health risks, there are some studies that have raised questions that need to be addressed by further research,” according to the Mobile Manufacturers Forum, an international association of telecommunications-equipment manufacturers established in 1998.

Most cancer advocacy organizations insist on better evidence as well. “Studies thus far have not shown a consistent link between cell-phone use and cancers of the brain, nerves, or other tissues of the head or neck. More research is needed because cell-phone technology and how people use cell phones have been changing rapidly,” according to the National Cancer Institute in Washington, D.C.

The furious yin and yang of the debate continues as this article goes to press. In July the *Journal of the National Cancer Institute* published a study comparing

352 Western European children who had brain tumors with 646 without tumors; cell-phone use, the researchers reported, created no increased risk for the disease.

Still, Davis calls those conclusions “astonishing and deeply disturbing.” The research, conducted from 2004 to 2008, couldn't possibly capture the quadrupling of cell-phone use over the last few years, she says. “And how,” she wants to know, “can a study lasting just four years answer questions about tumors that can take a decade to form?”

Although Davis agrees that we have not yet proven harm to the standards that science demands, she says that shouldn't stop us from taking cautionary measures now. “The need for research should not be allowed to become an excuse to carry on as though everything is fine, until we have incontrovertible proof that it is not,” she writes in her book, *Disconnect: The Truth About Cell Phone Radiation, What the Industry Has Done to Hide It, and How to Protect Your Family* (Dutton Adult, 2010). We may not yet have an epidemic of brain tumors in countries that have used cell phones for little over a decade, she points out. “But 10 years after cigarettes began to be heavily smoked, we also did not have an epidemic of lung cancer. Years from now our grandchildren will look back and ask: Did we do the right thing and act to protect them, or did we harm them needlessly, irresponsibly, and permanently, blinded by the addictive delights of our technological age?”

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**Pamela Weintraub** is the author of *Cure Unknown: Inside the Lyme Epidemic* (St. Martin's Press, 2008).

## The Cell-Phone Debate: A Timeline

**1993** Larry King interviews a man who filed claims against his cell-phone manufacturer and carrier after his wife developed a brain tumor in the shape of her phone's antenna.

**1994** University of Washington scientists expose live rats to cell-phone-like radiation and then examined their brains; DNA from brains of exposed rats is damaged.

**2004** Swedish researchers report that cell-phone radiation breaches the blood-brain barrier, which keeps toxins out of the brain.

**2010** The INTERPHONE study reports that those using cell phones the most had significant increases in certain kinds of brain cancer. Results for less heavy users are inconclusive.

### 2011

- The World Health Organization announces that cell phones are a possible carcinogen.
- An international meeting in Istanbul puts forth new evidence for cell-phone-associated DNA damage, infertility and memory loss.
- A study from the National Cancer Institute finds no connection between brain tumors

in children and cell phones, eliciting a backlash from scientists and activists.

- A study from the NIH shows that cell-phone use increases glucose metabolism in the area of the brain closest to the phone antenna — specifically, the orbitofrontal cortex and temporal pole, regions involved in sensory integration, language, decision making, and social and emotional processing.

# 13 WAYS

## TO PROTECT YOURSELF FROM ELECTROMAGNETIC RADIATION



**1.** When talking on your cell phone, your safest bet is speakerphone mode with your phone a hand's length away. Not quite as good (because it still emits some radiation), but better than holding the phone to your head, is a wired headset. A Bluetooth emitter is your third choice. It will deliver lower levels of microwave radiation than your cell phone, but more than the wired headset. Turn your headset off when the phone is not in use.

**2.** Try not to keep your phone turned on next to your body throughout the day. Or, if you must, position the cell phone so that the antenna, which emits radiation, is facing away from you.

**3.** Try to use your phone when you have the maximum number of bars, indicating the best reception. When signal quality is poor, your phone emits more radiation.

**4.** Try not to use your cell phone in elevators, cars, trains or planes. Cell phones draw more power, and emit more radiation, in enclosed metal spaces.

**5.** Text instead of calling whenever possible. The farther your phone is from your body, the better.

**6.** When you are home, use a wired landline. Remember, cordless phones connected to a landline can emit radiation much like cell phones.

**7.** You may be tempted to use one of the many radiation shields on the market, but keep in mind that they may hamper reception, causing your cell phone to churn out more radiation.

**8.** If you have a wireless router in your house or apartment, keep it in a little-used room and out of the bedroom (or turn it off altogether at night). Strive to keep your bedroom as free of electronic radiation as possible. In addition to routers, banish cell phones, wireless phones and computers. Purists will want to unplug electric devices near the bed. If you are worried about "dirty electricity," use a battery-powered alarm clock and make sure that extension cords or power strips do not sit under or around the bed. Avoid electric blankets and wired mattress warmers.

**9.** Connect to the Internet with an Ethernet cord, not a wireless router, whenever possible.

**10.** Disable your computer's wireless connectivity software, including Bluetooth, Airport and the like. Otherwise, your computer will continuously send out electronic "handshakes," exposing you to more EMFs.

**11.** Use a "wired-only" printer, as well as wired computer peripherals like a mouse and keyboard.

**12.** The new generation of wireless baby monitors, often configured to sit right under the bed or the mattress, emit radiation comparable to a cell phone.

**13.** Beware of radio-frequency-based smart meters, increasingly being installed by utilities around the United States to control power consumption within a house. They have come under suspicion as a significant source of electromagnetic radiation. For more information, please see [www.smartmeterdangers.org](http://www.smartmeterdangers.org).