Arthur Firstenberg
PO Box 6216
Santa Fe, NM 87502
phone: (707) 937-3990
email: bearstar@fastmail.fm

Silent Wireless Spring

Silent Wireless Spring

by Arthur Firstenberg

> *The road we have long been traveling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster.*
>
> *– Rachel Carson.*

The autopsies were unambiguous: the laboratory rats that had been exposed to a cell phone—just once, for two hours—had brain damage.

Since they began this line of research in 1988, Dr. Leif Salford and his colleagues at Lund University Hospital in Sweden had exposed over 1,600 experimental animals to low-level microwave radiation. Their results were consistent and worrisome: microwave radiation, including radiation from cell phones, caused the blood-brain barrier—the brain's first line of defense against infections and toxic chemicals—to leak. Researchers in 13 other laboratories in 6 different countries had reported the same effect, but no one had proven whether it would lead to any damage in the long term. Now, in a study published June 2003 in *Environmental Health Perspectives*, Salford's team repeated the experiment on 32 additional animals, but this time waited eight weeks before sacrificing them and examining their brains. In those animals that had been exposed to a cell phone, up to two percent of the neurons in all areas of the brain were shrunken and degenerated.[1]

Salford, chairman of the Department of Neurosurgery at his institution, called the potential implications "terrifying." "We have good reason to believe," he said, "that what happens in rats' brains also happens in humans." Referring to today's teenagers, the study's

---

[1] Salford et al. 2003

authors wrote that “a whole generation of users may suffer negative effects, perhaps as early as in middle age.”

Also in 2003, TNO Physics and Electronics Laboratory in the Netherlands published the results of a study commissioned by three Dutch ministries. In double-blind experiments, in sessions lasting 35 minutes, human volunteers were exposed to radiation mimicking common residential exposure to third generation (UMTS) cell towers. Exposed subjects frequently reported one or more of the following: dizziness and nausea, shortness of breath, numbness and tingling, inability to concentrate, irritability, nervousness, headaches, fatigue, weakness, muscle pains, heart palpitations and chest pain.[2] “The result of the study,” wrote the authors, “is that a statistically significant relation was found between the presence of radiofrequency fields resembling UMTS base station signals and the experience of wellbeing by the subjects.” The researchers thus confirmed, under laboratory conditions, the existence of a microwave syndrome that at least 23 teams of scientists in 16 countries have reported to be widespread in the vicinity of cell towers, and among users of cell phones.

Also in 2003, Spanish ornithologist Alfonso Balmori Martínez published a warning about bird populations. Seeking to explain the decline of so many avian species in his country, he took bird censuses and observed nesting behavior among white storks, house sparrows, starlings, white wagtails, kestrels, rock doves, magpies, collared doves, greenfinches, great tits, serins, wrens, green woodpeckers, short toed treecreepers, and Bonelli’s warblers. He found that breeding failures and population declines were significantly more common within 200 meters of a cell tower, and in areas where measured levels of microwave radiation were high.[3] “It is forgotten,” wrote Balmori, “that not only humans, but also animals who are exposed can suffer

[2] Zwamborn et al. 2003
[3] Balmori 2003

such impediments to their health because of field exposure in the vicinity of transmitting antennas."

The same year, a survey of Austrian beekeepers by medical physicist Ferdinand Ruzicka revealed that those with cell towers near their hives were observing a heightened aggressiveness of their bees, an increased tendency to swarm, and, in 62.5% of such apiaries, a disappearance of colonies. A beekeeper himself, Ruzicka said that "a connection between colony loss and wireless technology is very probable." His findings provided an explanation for the recent worldwide decline of honeybees—and, since honeybees are needed to pollinate food crops, a warning that wireless technology may be threatening the world's food supply.[4]

One can imagine two very different futures. In one, these stories appear on the front pages of *The New York Times* and *The Wall Street Journal*. The Food and Drug Administration suspends cell phone sales, and the Federal Communications Commission shuts down cell towers. Cities stop building Wi-Fi networks. Internet cafes dismantle antennas and install cables. Public service announcements tell people to put wires back on their home phones and computers. Wireless technology takes a place in history beside other mistakes like lead water pipes, asbestos insulation, thalidomide and DDT.

In the other future nothing changes. The news media continue to ignore those stories, and many others like them. Governments issue no warnings, and take no steps to protect the public or the environment.

What consequences does this second scenario hold for our planet? This article is an attempt to explain.

* * *

[4] Ruzicka 2003

When I first began to speak and write about microwave radiation in 1996, the tele-communications industry had just embarked on an ambitious plan to place a cell phone in the hands of every man, woman and child on earth—and to dot our world with so many broadcast antennas that those phones would work in every home and every office, on every street, in every country, on the highest mountain and in the deepest valley, on every lake, in every national park, wilderness area and wildlife refuge, without exception. Fleets of new satellites were also on drawing boards, with the goal of enabling cell phones and wireless computers to work even in mid-ocean and Antarctica. Levels of microwave radiation were going to rise a hundred- to a million-fold, everywhere on earth, virtually overnight.

Sarah Benson wrote to me from Australia urging me to help organize a global opposition. Sarah worked for Lyn Allison, a member of the Australian Senate, and had been instrumental in making electromagnetic radiation a political issue in Australia. She was also a member of our growing network of individuals whose health was already seriously affected by electromagnetic fields (EMFs) from computers, power lines and broadcast towers, and from the chips and digital circuitry that were finding their way into automobiles, telephones, clocks, entertainment centers and virtually everything else in our lives. Previously most of us had been ordinary people working at regular jobs, but a certain kind of pollution had increased, especially in newly computerized workplaces, and like the canaries that were once placed in coal mines, we happened to be the first ones to succumb. Since, officially, EMFs were not thought to cause illnesses, most doctors were of no help, so we banded together and shared information. The prospect of microwave antennas placed every couple of miles throughout the world terrified us. It was going to be like putting the earth *inside* a computer—and there was going to be no escape.

Here in the United States, the Federal Communications Commission issued regulations on August 6, 1996 exempting the telecommunications industry from environmental review, thus giving it the green light for its plans. David Fichtenberg, a biostatistician with the Washington State Department of Social and Health Services, called me from Seattle to ask if I wanted to file an appeal. My city, New York, had just signed lease agreements with three wireless providers— Omnipoint Comunications, Sprint PCS, and Metricom— to place microwave antennas on 3,000 city lampposts; I was about to lose my home. To oppose this, I helped organize the Cellular Phone Task Force, and because no mainstream environmental organizations were addressing the issue, I found myself at the head of a group that was in demand both nationally and internationally. CPTF joined Fichtenberg, 50 other citizens' groups and the Communications Workers of America in submitting appeals to the FCC, and later we all went to court, where I received a belated education in how this country's judicial system does not work, particularly when one of the contending parties is a trillion dollar industry. Some 15,000 pages of scientific studies on the biological and health effects of microwave radiation had been submitted by the public into the record of the FCC's proceedings. But the court was not interested, and did not base its decision on whether the environment would be harmed, but rather on whether the FCC had the legal authority to exempt the industry from environmental oversight. It did, because it had been given that authority by Congress in February 1996.[5] We argued that the law was unconstitutional, but to no avail.

I also learned that on this particular environmental issue, being a liberal or conservative is not a predictor of a politician's position. Suffice it to say that eventually Senators Patrick Leahy (D) and James Jeffords (R), Representatives Bernie Sanders (I) and Tom Tancredo (R), 16 other

[5] Section 704 of the Telecommunications Act of 1996

elected officials, and 69 cities and towns joined in filing an *amicus curiae* brief urging the U.S. Supreme Court to hear our case.

The high court declined.[6]

* * *

Surprisingly, the biological and medical effects of electromagnetic radiation are well documented—more thoroughly, in fact, than the effects of asbestos, DDT, dioxins, or PCBs. But very little of this information ever reaches the news media, the medical community, or elected officials. For all the good it has done, an enormous body of science might as well not exist.

Paul Brodeur, in *The Zapping of America*, warned back in 1977 that proliferating microwave towers and radar facilities were endangering public health. Zory Glaser, now retired from the Food and Drug Administration, labored for the U.S. government throughout the 1970s cataloguing and indexing 5,083 scientific articles and books—including entire medical text-books—on the effects of microwave and radio frequency (RF) radiation on living organisms.[7]

Ophthalmologist Milton Zaret examined the eyes of thousands of military and civilian personnel working at radar installations and published prolifically about the hundreds of cases of microwave-induced cataracts that he encountered. Most of these cataracts were caused by chronic exposure of the eye to radiation at power densities around one milliwatt per square centimeter—a level which is regularly exceeded by each of the two and a half billion cell phones in use today.[8]

---

[6] Cellular Phone Taskforce v. FCC, 205 F.3d 82, 90-92 (2d. Cir. 2000), cert. denied, 531 U.S. 1070 (2001).
[7] Glaser 1984
[8] Birenbaum et al. 1969; Zaret 1971, 1973; Zaret and Snyder 1977

Biologist Allan Frey discovered the blood-brain barrier effect,[9] the line of research that Salford's lab is pursuing today, and he proved that humans and animals can *hear* microwaves[10]—a phenomenon that was well accepted by 1979 but that would be startling news today to millions of people who have been mistakenly diagnosed with "tinnitus." One of the most active microwave researchers during the 1960s and 1970s, Frey caused rats to become docile by irradiating them at a power density of 50 microwatts per square centimeter.[11] He altered specific behaviors at 8 microwatts per square centimeter.[12] He altered the heart rate of live frogs at 3 microwatts per square centimeter.[13] At only 0.6 microwatts per square centimeter, 1600 times less than the current U.S. guideline for public exposure to microwave radiation, he caused isolated frogs' hearts to stop beating by timing the microwave pulses at a precise point during the heart's rhythm.[14]

A team of biologists and engineers at Canada's National Research Council warned that microwave pollution was damaging not only human health but the environment. Experimenting on chickens, pigeons and seagulls, they found that most birds collapsed in distress within seconds of being exposed to microwave radiation of moderate intensity—but not if they were defeathered.[15] The scientists then proved that feathers are efficient receiving aerials for microwave radiation.[16] They predicted that increasing levels of microwave pollution would cause wild birds distress and interfere with their navigation.

---

[9] Frey et al. 1975
[10] Frey 1961
[11] Frey and Spector 1976
[12] Frey and Wesler 1979
[13] Frey 1970
[14] Frey and Seifert 1968. See also Frey 1988 for a review of Frey's research.
[15] Tanner et al. 1967
[16] Bigu de Blanco and Romero-Sierra 1973

These warnings came when virtually all exposure of the public came from outside both home and office.

But then the high-tech industry brought radiation *indoors*.

A few people may remember the 1985 book by Bob DeMatteo, *Terminal Shock: The Health Hazards of Video Display Terminals*. Even earlier, in 1981, then-Representative Al Gore chaired the first of a number of Congressional hearings on the health effects of VDTs. These were held because two editors at *The New York Times*, young men in their 20s and 30s, had developed cataracts; half of all surveyed UPI and AP employees were complaining of visual problems or headaches; an unusual number of babies with birth defects had been born to employees at *The Toronto Star*; and clusters of miscarriages were occurring among female VDT operators all over the U.S. and Canada. The newspaper industry had been the earliest industry to be transformed by computer technology. During the 1981 hearings by the House Committee on Science and Technology, Charles A. Perlik, Jr., president of the Newspaper Guild, testified that had his membership known that VDTs were capable of dangerous emissions, "We would not have quietly permitted the transformation of an essentially benign workplace into a hazardous one."[17]

Although health complaints from VDTs did not vanish, the news media, and Congress, soon stopped paying attention. The medical community began to accept the new, higher rates of cataracts, miscarriages and birth defects as "normal." Most members of the general public were not succumbing to the radiation because they were not in it all the time: they were only being exposed while seated at a desk directly in front of a computer, and only during working hours. Even after computers became part of home life too, the fields were still confined to one location;

[17] *Potential Health Effects of Video Display Terminals and Radio Frequency Heaters and Sealers.* Hearings before the Subcommittee on Investigations and Oversight of the Committee on Science and Technology, U.S. House of Representatives, Ninety-seventh Congress, first session, May 12, 13, 1981.

they did not extend to other rooms of the house, or to the street, the car, or the countryside. A person was not in them at mealtimes or during sleep. The body could recover.

But not everyone's did.

In the mid-1980s, Olle Johansson, a neuroscientist at the world-renowned Karolinska Institute in Stockholm, discovered a new skin disease. Since only people who worked in front of computer screens got it, he named it screen dermatitis. Actually the condition was not new. It had been seen in the early 1970s in the newspaper industry, but no one had studied it. Such patients often complained also of neurological symptoms, including memory loss, fatigue, insomnia, dizziness, nausea and headache, but since Johansson's specialty was skin diseases—he heads the Experimental Dermatology Unit at the Institute—he studied the skin of computer workers. His subjects ranged from those with only redness and itching, to those with severe, disfiguring skin lesions.

Why weren't all computer operators coming down with such problems? Was there something abnormal about those who did? Were they imagining their illnesses? Did they have a rare genetic disorder? Such were the opinions they faced. And so the term "electromagnetic hypersensitivity" was born, serving both to marginalize the injured and to reassure the still-healthy that they need not worry about their own safety.

During the 1990s Johansson methodically analyzed samples of skin from such patients. He discovered, first, that their skin really was damaged, and second, that it presented the same kind of picture usually seen in skin damaged by ultraviolet light or ionizing radiation.[18] He further found that his subjects were *not* different from everyone else. Sitting in front of a computer screen, he found, increases the number of histamine-producing mast cells in the upper layers of the skin of most people.[19] Those who develop frank dermatitis have more severe changes, different in magnitude but not in kind—like the difference between a suntan and a

[18] Gangi and Johansson 1997
[19] Johansson et al. 2001

sunburn. And the reactions are not necessarily confined to the skin, because histamine is involved in allergic responses and in asthma. “It is not in the heavily polluted, less developed countries that asthma is more frequent,” said Johnasson, "but in the highly developed countries of the West with much ‘electro-smog,’ and where almost every other child has some kind of allergy today.”[20] In the United States, deaths from asthma, which had been declining for decades, began to rise for the first time in 1977[21]—the same year Apple marketed its first personal computers—and rates of asthma have risen steadily ever since.[22]

* * *

The high-tech industry was born into an environmental regulatory vacuum. There were not then—*and there are not now*—any mandatory federal standards for exposure of the public or the environment to RF radiation. But in 1978 the Environmental Protection Agency proposed to fill the need. EPA had no enforcement power itself, but was responsible under its charter for developing “guidance for all Federal agencies in the formulation of radiation standards.”

Having spent the previous five years taking measurements throughout the U.S., EPA estimated that public exposure was increasing at a rate of 15% annually. In its laboratories, a full-time staff of 30 were irradiating a variety of animals, from mice to monkeys, and observing resulting immune system damage, birth defects, and behavioral aberrations. The agency announced a target date of April 1979 for the issuance of the first federal guidelines to limit human exposure to RF radiation.[23] But like Sisyphus eternally pushing the rock uphill, EPA tried to birth those guidelines for the next 17 years.

---

[20] Södergren and Johansson 2001
[21] Mannino et al. 1998, figure 10
[22] While it is popularly believed that the use of flat LCD monitors has solved this problem, actual measurements of emissions from a variety of new LCD screens have shown that they do *not* emit less radiation than older CRTs.
[23] United States General Accounting Office 1978

First there was opposition from other federal agencies. The Food and Drug Administration did not want the proposed exposure limits to apply to electronic consumer products such as microwave ovens or VDTs. A number of agencies did not want them to apply to occupational exposures. The Federal Aviation Administration did not want to have to protect the public from air traffic control and weather radars. The Department of Defense did not want military radars to be affected. The CIA, NASA, the Department of Energy, the Coast Guard, and the Voice of America were among the agencies that had to be consulted.[24] A second announced date for completion of EPA's guidelines came and went in 1984.[25]

Finally, in July 1986, EPA published a detailed proposal in the *Federal Register*, titled "Federal Radiation Protection Guidance; Proposed Alternatives for Controlling Public Exposure to Radiofrequency Radiation."[26] But instead of moving the project to its completion, the agency terminated its microwave health effects research program in 1987, and in 1988, suspended the development of exposure guidelines yet again.

In 1992 a new round of Congressional hearings, convened this time by Senator Joseph Lieberman, inquired into an epidemic of testicular cancer in policemen who used traffic radar guns.[27] These hearings resulted in "pressure put on EPA by various Congressmen to go back and finalize the guidance."[28] EPA responded by convening a Radiofrequency Radiation Conference,[29] and three years later the exposure guidelines almost completed their long gestation. In June 1995 E. Ramona Trovato, Director of the Office of Radiation and Indoor Air,

---

[24] See n. 26, p. 27321
[25] Authorizing appropriations for the Office of Research and Development, Environmental Protection Agency, for Fiscal Year 1986, House Report 99-99, p. 11
[26] *Federal Register*, Vol. 51, No. 146, pp. 27318-27339, July 30, 1986
[27] *The Effects of Traffic Radar Guns on Law Enforcement Officers*. Hearing before the Ad Hoc Subcommittee on Consumer and Environmental Issues of the Committee on Governmental Affairs, United States Senate, August 10, 1992.
[28] Margo T. Oge, Opening Remarks. Environmental Protection Agency 1995, p. 7.
[29] Environmental Protection Agency 1995

announced that "the guidelines are substantially complete, and are beginning to enter the review phase…Issuance of the final guidelines should be in early 1996."[30]

This time EPA's efforts were on a collision course with plans for ubiquitous cell phone service. For the new guidelines stated explicitly that they protected only against shocks and burns and the effects of RF heating and did "not apply to chronic, nonthermal exposure situations."[31] EPA further announced that after publication of these interim guidelines, it was ready to proceed to Phase 2 of its regulatory process, which would address chronic exposure and non-thermal effects and take an additional two years.[32] Since the deployment of wireless technologies depended on the premise that there *are* no non-thermal effects, EPA's efforts threatened the very existence of this fledgling industry.

The Electromagnetic Energy Association, an industry lobbying group, sent a delegation to EPA to try to persuade Trovato not to release the new safety guidelines.[33] Then, on September 13, 1995, the Senate Committee on Appropriations stripped the $350,000 that had been budgeted for EPA's EMF work. It also wrote in its report, "The Committee believes EPA should not engage in EMF activities"—thereby ensuring that this regulatory effort would never be resumed.

On October 1, 1995 the leader of EPA's regulatory project, Dennis O'Connor, was reassigned to work on the disposal and cleanup of radioactive waste.[34]

EPA's guidelines were never released. Exposure to RF radiation from a wide variety of devices—including computer monitors, police radar guns, electrocautery devices used in

---

[30] Letter to Richard M. Smith, Office of Engineering and Technology, Federal Communications Commission, June 19, 1995.
[31] Letter to David Fichtenberg from Norbert Hankin, Office of Radiation and Indoor Air, EPA, October 8, 1996.
[32] Development of RF Radiation Exposure Guidelines; Briefing for the Federal Communications Commission. Office of Radiation and Indoor Air, U.S. EPA, March 21, 1995.
[33] *Microwave News*, May/June 1995
[34] *Microwave News*, September/October 1995

surgery, diathermy machines used by physical therapists, and RF heaters and sealers used in dozens of industries—remains unregulated. For communication equipment, the Telecommunications Act of 1996 awarded authority over the environmental effects of RF radiation to the FCC, an agency with no environmental expertise and no biologists on staff, whose stated mission is not environmental protection, but the promotion of communication technology. Section 704(a) of the Act made it illegal for any community to keep FCC-licensed technologies out. It also effectively ended the questioning of their safety in the United States:

> "No state or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions."

On August 6, 1996 the FCC issued regulations exempting virtually all telecommunications facilities, individually and collectively, from environmental assessment. That fall, antennas for the first generation of digital cell phones began appearing on rooftops and towers in cities throughout the US. They were not monitored for their effects on public health, or for their effects on birds, wildlife and forests. No environmental impact study has ever been done on any of the millions of antennas that have been built since then, nor on the FCC's antenna licensing program which has permitted them.

* * *

If a pandemic hits and no health departments are watching, does it still cause suffering?

On November 15 and 16, 1996 I was in Killington, Vermont attending "Unplugged: Health and Policy Implications of the Wireless Revolution," a conference sponsored by the

Vermont Law School. While there I met Stanislaw Szmigielski, physician, epidemiologist, and bioelectromagnetics researcher from Warsaw, Poland; Marija Hughes, Technical Information Specialist for the Occupational Safety and Health Administration and author of *Computer Health Hazards*; Mary Beth Freeman, director of Citizens for the Appropriate Placement of Telecommunication Facilities; Robert F. Cleveland, Jr. of the FCC, whom we would later face in court; and many others. None of us realized how immediately the subject of the conference would disrupt our own lives.

I offer my own experience first:

When I returned home on the 16th, I became dizzy. I assumed one of my neighbors had sprayed something toxic; perhaps the exterminator had been in the building. This would pass, I thought. But within a few days I became nauseous, and I had uncontrollable tremors. I had the first asthma attack of my life. My eyeballs felt like they were bulging out, my throat swelled, my lips felt dry, fat and puffy, I felt pressure in my chest, and the bottoms of my feet hurt. I became so weak I couldn't lift a book. My skin became so sensitive I couldn't bear to be touched. My head was roaring like a freight train. After November 20 I did not sleep, and I could not eat. During the night of November 22, my larynx went into spasm and I couldn't draw a breath in or out. In the morning I grabbed my sleeping bag, got on the Long Island Railroad, and left town.

My relief was immediate.

I learned that on November 14, while I was in Vermont, Omnipoint Communications, New York's first digital cell phone company, had begun selling its service to the public. Thousands of new rooftop broadcast antennas, which the Cellular Phone Task Force had been formed to oppose, were fully operational: New Yorkers were now living inside a computer.

I compared notes with a few friends. Together we compiled a list of symptoms and placed the following classified ad in a local newspaper: “If you have been ill since 11/15/96 with any of the following: eye pain, insomnia, dry lips, swollen throat, pressure or pain in the chest, headaches, dizziness, nausea, shakiness, other aches and pains, or flu that won't go away, you may be a victim of a new microwave system blanketing the city. We need to hear from you.”

And we did hear from them, by the hundreds—men and women, whites, blacks, Hispanics and Asians, office workers, computer operators, stockbrokers, airline employees, teachers, doctors, nurses and lawyers, all of whom had woken up suddenly sometime between mid-November and Thanksgiving, their hearts racing, their heads pounding, thinking they were having a heart attack, a stroke, or a nervous breakdown—now relieved to find out they were not alone.

After weeks or months of exposure to the radiation, a few of them actually did have a stroke or a heart attack. But the illness that hit New York City on November 14 was reported by the Centers for Disease Control to be “influenza,” and the health authorities inquired no further.

Because no health departments anywhere in the world were monitoring the health of populations while these communication systems were being turned on, our informal survey became one of the only sources of information about what they were doing to people. We began to receive urgent pleas for help and sanctuary from individuals, as well as requests for information from organizations, scientists, doctors, and public officials on six continents. CPTF became a repository for information about how the new technologies were affecting public health and the environment. From 1997 to 2002 we published a magazine called *No Place To Hide*, which became the journal of record for the changes that were taking place. Collaboration was international. When the 66 newly launched Iridium satellites began providing global cell

phone coverage on September 23, 1998, we collected consistent reports from around the world of its immediate effects on human health and bird navigation.[35, 36] When EMFacts Consultancy in Australia and Powerwatch in England commissioned three Ukrainian scientists to review the Russian literature on the effects of microwave radiation on the human body, we translated their report from Russian into English and published it in *No Place To Hide*.[37]

* * *

Microwave sickness is the proverbial elephant in the room. The news media, regulatory agencies and health authorities persist in denying its existence. But its widespread impact is documented by a multitude of sources.

The thousands of letters and phone calls that have poured into our office have described when and where the illness hit, what it feels like, and how it has shattered lives. One out of five of our correspondents has been forced to leave home; these people are a new class of environmental refugees. Many remain homeless. Some have killed themselves. Since they often lack both a mailing address and a telephone—and because most are unable to use cell phones or computers—these refugees are difficult to track and more difficult to count.

A second source of information are the associations of affected people that exist in dozens of countries. Some publish regular newsletters and maintain websites. The largest and oldest, Elöverkänsligas Riksförbund, the Swedish organization for the electrosensitive, has become a clearinghouse for authoritative information on the health effects of electromagnetic energy.[38]

---

[35] "Satellites begin worldwide service; health problems coincide." *No Place To Hide* 2(1):3, February 1999.
[36] "Thousands of homing pigeons lose their way." *No Place To Hide* 2(1):3-4, February 1999.
[37] Kositsky et al. 2001
[38] http://www.feb.se

Next are surveys that have been conducted to determine the extent of "self-reported electromagnetic hypersensitivity." Estimates range from 3.1% of the population, reported by the Swedish National Board of Health and Welfare, for Sweden[39]; to 3.2%, reported by the California Department of Health Services, for the state of California[40]; 5%, reported by researchers at the University of Bern, for Switzerland[41]; 6%, reported by the Federal Office of Radiation Protection, for Germany;[42] to 7%, reported by the Marin County Health Department, for Marin County, California.[43] Taking 3% as a minimum figure, at least nine million Americans recognize the effects of electrosmog on their health. If even one-twentieth of these have had to leave their homes, that represents a refugee population of half a million. This is certainly in the right ballpark; the authors of the 1998 California survey concluded that 120,000 affected Californian adults—and by implication one million affected American adults—had had to leave their jobs.

Still, such numbers don't begin to give a true picture of the dimensions of the public health burden. Higher figures are reported by researchers who have asked about *symptoms*, rather than about "sensitivity to EMFs," which most people have never heard of. In France, Santini et al. reported that over half the exposed population was affected. The radiation seemed to hit young adults in their twenties and thirties the hardest; among this age group, 53% of those who lived within 300 meters of a cell tower had disturbed sleep, compared with only 12.5% of those who did not live near a cell tower; 82.4% had fatigue, compared with 25% of those with no tower nearby; 57.6% had headaches, compared with 18.2% of those with no tower nearby.[44]

---

[39] National Board of Health and Welfare 2001
[40] Levallois et al. 2002
[41] Schreier 2006
[42] Schroeder 2002.
[43] *No Place To Hide* 3(3):27, 2002
[44] Santini et al. 2003

Surveys with equally alarming results have been conducted in Poland,[45] Austria,[46] Spain,[47] Germany[48] and Cyprus.[49] Dutch researchers found the same pattern of symptoms in volunteers exposed under laboratory conditions.[50] In Egypt, after the first cell tower in Menoufiya governorate was built, researchers surveyed residents who lived nearby: 28.2% were suffering from memory loss, 23.5% from sleep disturbance, 23.5% from headaches, 21.7% from depression, 18.8% from dizziness, 9.4% from tremors. The numbers from elsewhere in Menoufiya were 5%, 10%, 10%, 8.8%, 5%, and 0% respectively.[51]

As for users of cell phones, a Swedish-Norwegian survey of 15,000 people found that the prevalence of dizziness, discomfort, fatigue, headaches, memory loss, concentration difficulty, tingling, warmth and burning skin increased significantly with the number of calls made per day and the number of minutes per day spent on the phone. Up to 30% of cell phone users experienced one or more of these symptoms.[52] Several years later, Salama et al. in Egypt[53] and Szyjkowska et al. in Poland[54] reported that nearly three-quarters of cell phone users were experiencing symptoms. Similar findings have been made in France,[55] Saudi Arabia,[56] China,[57] and Singapore,[58] and Turkey.[59]

---

[45] Bortkiewicz et al. 2004.
[46] Hutter et al. 2006
[47] Navarro et al. 2003, Oberfeld et al. 2004
[48] Waldmann-Selsam 2005
[49] Preece et al. 2005
[50] Zwamborn et al. 2003
[51] Abdel-Rassoul et al. 2006
[52] Haugsdal et al 1998
[53] Salama et al. 2004
[54] Szykjowska et al. 2005
[55] Santini et al. 2002
[56] Al-Khlaiwi and Meo 2004; Meo and Al-Drees 2005
[57] Cao et al. 2000
[58] Chia et al. 2000
[59] Balikci et al. 2005 ; Balik et al. 2005

Even these numbers, reflecting only the prevalence of symptoms, don't capture the full public health impact. Johansson's group in Sweden, and CPTF in the U.S., have done before-and-after statistical analyses showing the effects of the initial 1996-1997 buildout of cell phone networks on disease and mortality.

In Sweden, antenna towers for 1800 MHz cell phones were built during the latter part of 1997 throughout the country in the space of a few months. The number of Swedish workers on sick leave, which had been declining for a decade, suddenly began to rise in August 1997 and more than doubled during the next five years. During the same period of time, sales of antidepressants doubled. The number of traffic accidents, which had been declining for years, also began to rise. The number of deaths from neurological disease began to rise, and two years later deaths from Alzheimer's disease, which takes time to develop, reversed a declining trend, doubling during the next three years.

Most significantly, and for the first time in history, a burden on public health had a greater impact on the countryside than it did on the cities. Rural areas—despite cleaner air and water, less crowding, and less stress—were suddenly no longer healthier places to live. This analysis, poetically titled "Say to countryside goodbye, when even healthy people die," was done at the Karolinska Institute by Olle Johansson in collaboration with Örjan Hallberg, former environmental manager for telecommunications giant Ericsson.[60, 61] "We would really like to do a [more] detailed study of the connection between ill health and radiation," Johansson said in April 2006, "but we still haven't succeeded in getting funding for it. *Do people perhaps not want to know?*"

[60] Hallberg and Johansson 2004b
[61] Hallberg and Johansson 2004c

With the help of John Goldsmith, professor of epidemiology at Israel's Ben Gurion University of the Negev, I analyzed weekly mortality data for 122 U.S. cities, obtained from the Centers for Disease Control. In each of 19 of the largest cities, a 10-25 percent increase in mortality was recorded, lasting two to three months—as though a disease epidemic had swept through—beginning in the exact week in 1996 or 1997 in which that city's first digital cell phone network began commercial service.

> "The two factors that correlated most closely with mortality were (1) the magnitude and (2) the quickness of the change. The largest markets (New York, Los Angeles, Chicago) and the largest companies (Sprint, PrimeCo) showed the strongest correlations."

Besides a temporary increase in death rate, the CDC statistics showed that long-term variability in the death rate became permanently more erratic. An interpretation was offered:

> "(1) Especially vulnerable or sensitive individuals may die immediately;
>
> "(2) The immune system of the general population becomes on constant alert—less vulnerable to minor stresses but unable to deal with major ones, and therefore subject to larger swings in health and mortality. This is consistent with what is being reported from around the world."[62]

* * *

In fact, the *only* body of evidence supporting the opinion that wireless technology is not dangerous, and is not having widespread effects on human health and the environment, consists of a relatively few studies designed and paid for by the telecommunications industry itself. A recent search of the scientific literature revealed that 68% of all cell phone studies linked cell

[62] Firstenberg 1999.

phones with one or more health effects, a number that rose to 83% when studies funded by the industry were excluded.[63] Yet, perversely, the few negative studies have been parlayed into thousands of authoritative-sounding documents appearing in print and on the internet, and into testimony before standards-setting bodies and Congress, where the opinion of safety has been transformed into public policy.

As long ago as 1982 one scientist, Allan Frey, was perplexed about this irrational process:

"[A] small group of scientists began making public statements in the early 1970s which implied that the bioeffects of nonionizing radiation were reasonably well understood; that no hazard existed; and that there was no biological mechanism by which the living organism could be affected, except by gross heating from high-intensity energy. As time went on, this small group of scientists appointed each other to committees, made public statements that supported their own earlier statements, and supported the testimony of each other. New studies and new information were ignored or unjustly criticized; results of studies from abroad were discounted… The way in which all this happened has little or nothing to do with what was going on in the laboratory."[64]

* * *

After speaking out for more than a decade, I am convinced that Olle Johansson is right: *people don't want to know*.

When I address audiences, I am often confronted with both anger and disbelief. Anger at the suggestion that their acquisition of wireless devices could have been a mistake. Disbelief that anything so harmful could have been allowed to be sold to almost half the world's population.

---

[63] Huss et al. 2006
[64] Frey 1982, p. 197

Disbelief that these technologies are fundamentally different from what preceded them. After all, radio and TV have been around for a century. All those 50,000-watt stations haven't hurt us; why, then, they ask, am I worrying about 200-watt cell towers, 1-watt Wi-Fi antennas or ½-watt cell phones?

And yet Paul Brodeur tried to warn us about radio waves as early as 1977.[65] Russian doctors defined the disease called microwave sickness in 1960.[66] Arsène D'Arsonval, the father of medical diathermy, warned us to be careful back in 1892.[67] Which is to say that not only are the new technologies different, but a cherished belief is wrong: radio broadcasts *always did* affect health and the environment.

I tell my audiences about famous studies—at a shortwave transmitter at Schwarzenberg, Switzerland,[68] a longwave transmitter at Konstantynow, Poland,[69] and a radar station at Skrunda, Latvia[70]—that found that these transmitters stunted trees, broke chromosomes in cows, disturbed human sleep, impaired learning in children, and disrupted bird breeding, for miles around, over periods of decades. Johansson and Hallberg, I add, showed that ordinary FM radio had something to do with the rising rates of certain cancers during the last half of the twentieth century, worldwide.[71]

I next point out to them that because exposure drops off exponentially with distance, the radiation from any radio tower miles away is *much less* than the radiation from a cell tower down the street, a wireless modem in their house, or a cordless phone against their ear. I tell them that

---

[65] Brodeur 1977
[66] Letavet and Gordon 1960
[67] d'Arsonval 1892
[68] Altpeter 1995
[69] Flakiewicz and Cebulska-Wasilewska 1992
[70] Science of the Total Environment 1996
[71] Hallberg and Johansson 2002a, 2002b, 2004a

the reason we appeared to tolerate radio technology for a century is that broadcast towers were (1) few, and (2) distant from most homes—a situation that changed radically ten years ago.

I remind them that all of the new technologies—and almost none of the old—are digital. Digital transmitters emit rat-tat-tat-tat pulsations of energy instead of smooth continuous waves. They are more damaging to cell membranes and capillary walls, more irritating to the nervous system, more destructive of brain cells, and interfere more with the heart's rhythm. The very newest technologies, such as wireless internet (Wi-Fi), are also broadband: they use a much larger chunk of the radio spectrum, therefore their transmissions are likely to include a larger number of biologically important frequencies; at precise frequencies, effects on cell growth and DNA have been shown to occur even at power levels near zero.[72]

But my most important message to my audiences is this: treat radio waves with respect! For 100 years, the average person never had anything but a radio *receiver* (an AM/FM radio) on their person. Placing a radio *transmitter* in the hands of every man and woman on earth—let alone on their lap, next to their brain, or in the hands of their children—is unprecedented.

The majority of the world's population, according to surveys on four continents, are now experiencing some level of the symptoms of microwave sickness, yet people rarely know that everyone else is experiencing the same things. We are bombarded with information about the stress in our lives, and about chemicals in our food, water and air; then told that nothing can be done about our declining health except to take medication to relieve the symptoms of anxiety, depression, insomnia, and so forth. Most people have no idea that they are being irradiated 24 hours a day, or that their health—as those same surveys indicate—would be 80 percent improved without the microwave assault and at least 50 per cent improved without the sources of

[72] Belyaev 1996, Grundler and Kaiser 1992

microwave radiation within their own homes and offices. This means putting wires back on telephones and cables back on computers.

* * *

I wrote my first research paper on this topic, titled “The Effects of Radiant Energy on Living Organisms,” in 1981 while I was in medical school. To my astonishment, thousands of technical books and articles were available on the subject; how was it possible, I wondered, that doctors weren’t being taught any of this?

That question looms even larger today.

Organs that are known to be susceptible to radio waves include the lungs, nervous system, heart, eyes, ears, testes, thyroid gland, and skin. Diseases that have increased remarkably in the last couple of decades—and that there is good reason to connect with the massive increase in radiation—include asthma, sleep disorders, anxiety disorders, attention deficit disorder, autism, multiple sclerosis, ALS, Alzheimer’s disease, epilepsy, fibromyalgia, chronic fatigue syndrome, hearing loss, tinnitus, cataracts, hypothyroidism, diabetes, malignant melanoma, breast cancer, testicular cancer, and heart attacks and strokes in young people. Radiation from microwave towers has been implicated in forest die-off, reproductive failure and population decline in many species of birds, ill health and birth deformities in farm animals, and the worldwide decline of amphibians.

No gadgets will undo the damage. All those pendants, watches, “diodes,” “biochips,” “polarizers,” and “Schumann generators” that are advertised as protection devices are nothing more than modern-day snake oil.

And the effects of microwaves happen quickly. For example, Salford’s team has shown that leakage of the blood-brain barrier—in plain English, leakage of the capillaries in the brain—

occurs after only two minutes of exposure to a cell phone transmitting at a thousandth of its normal power. But just as a fish does not perceive water, most people don't perceive the microwave haze because they haven't been outside of it in a decade.

For the reader who wants to experience the difference, I suggest the following experiment: You, and everyone in your household, turn off your cell phones now. Disconnect your wireless modem or router, and turn off or disable all wireless- or Bluetooth-enabled devices (e.g. computers, headsets, keyboards, speakers, mice, pdas, MP3 players). Unplug the transformers attached to the base units of your cordless phones and remove the batteries from all your portables. Disconnect the wireless baby monitor. Disable the wireless alarm system. Do not use the microwave oven. Then, when you go to sleep tonight, *unplug* your computers and your televisions.

Notice how you sleep tonight and how you feel tomorrow.

Then ask yourself: Environmental organizations are spending millions on global warming, water quality, energy conservation, genetic engineering, chemical pollution, endangered species, and a vast array of other issues. Has any of those problems had as immediate an effect on your sleep and well-being as turning off the microwave radiation? Do any of them have a solution as easy as putting wires back on communication devices? It is illegal to give a child a cigarette or a beer. Which of those destroys brain cells within hours, causes asthma attacks, and makes children hyperactive? Why is society spending billions on problems that it cannot readily solve, while ignoring one that it can? And if microwave radiation is doing this kind of harm to human beings, what is it doing to birds, animals, plants and forests?[73]

As Olle Johansson and Örjan Hallberg have written, "The world may be moving inexorably toward one of those tragic moments that will lead historians to ask: Why did they not

[73] Balmori Martínez 2003a, 2003b, 2006

act in time?" The Sierra Club and the National Resources Defense Council complain that they already have too many other issues on their plates and can't take on this one. Ordinary people complain that their way of doing business has changed: they can't afford to put wires back on their telephones.

Can they afford *not* to?

REFERENCES

Articles

Abdel-Rassoul G, El-Fateh OA, Salem MA, Michael A, Farahat F, El-Batanouny M, Salem E. Neurobehavioral effects among inhabitants around mobile phone base stations. *NeuroToxicology* Aug. 1, 2006 [Epub ahead of print].

Al-Khlaiwi T, Meo SA. Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population. *Saudi Medical Journal* 25(6): 732-736, 2004.

Altpeter ES, Krebs Th, Pfluger DH, von Kanel J, Blattmann R, Emmenegger D, Cloetta B. *Study of Health Effects of Shortwave Transmitter Station of Schwarzenburg, Berne, Switzerland.* Study No. 55, Swiss Federal Office of Energy 1995.

Balik HH, Turgut-Balik D, Balikci K, Ozcan IC. Some ocular symptoms and sensations experienced by long term users of mobile phones. *Pathologie Biologie* 53(2): 88-91, 2005.

Balikci K, Ozcan IC, Turgut-Balik D, Balik HH. A survey study on some neurological symptoms and sensations experienced by long term users of mobile phones. *Pathologie Biologie* 53(1): 30-34, 2005.

Balmori Martínez A. Birds and mobile telephony. Preliminary results of the effects of electromagnetic waves on urban fauna. *El Ecologista* 36: 40–42, 2003. Available online at buergerwelle.de.

Balmori Martínez A. The effects of microwaves on the trees and other plants. Valladolid, Spain, 2003b. Available online at buergerwelle.de

Balmori Martínez A. The incidence of electromagnetic pollution on the amphibian decline: Is this an important piece of the puzzle? *Toxicological and Environmental Chemistry* 88(2): 287-299, 2006.

Belyaev IY, Shcheglov VS, Alipov YD, Polunin VA. Resonance effect of millimeter waves in the power range from 10^{-19} to 3 x10^{-3} W/cm^2 on *Escherichia coli* cells at different concentrations. *Bioelectromagnetics* 17(4):312-321, 1996.

Bigu del Blanco J, Romero-Sierra C. *Bird feathers as dielectric receptors of microwave radiation.* National Research Council, DME Control Systems LTR-CS-89, January 1973.

Birenbaum L, Grosof GM, Rosenthal SW, Zaret MM. Effect of microwaves on the eye. *IEEE Transactions on Biomedical Engineering* 16(1):7-14, 1969.

Bortkiewicz A, Zmyslony M, Szyjkowska A, Gadzicka E. Subjective symptoms reported by people living in the vicinity of cellular phone base stations. *Medycyna Pracy* 55(4): 345-351, 2004, in Polish.

Cao Z, Zhao X, Gao Y, Wan C. Effects of electromagnetic radiation from cellular telephone handsets on symptoms of neurasthenia. *Wei Sheng Yan Jiu* 29(6): 366-368, 2000, in Chinese.

Chia S-I, Chia H-P, Tan J-S. Prevalence of headache among hand-held cellular telephone users in Singapore: a community study. *Environmental Health Perspectives* 108(11): 1059-1062, 2000.

Cox RA, Luxton LM. Cerebral symptoms from mobile telephones. *Ocxcupational and Environmental Medicine* 57(6): 431, 2000.

D'Arsonval A Comparison of the physiological effects of different methods of electrization – New modes of application of electrical energy: sinusoidal voltaization of high frequencies and of high potential. *Bulletin de l'Academie de Médecine* 27: 424-433, 1892, in French.

Environmental Protection Agency. *Summary and Results of the April 26-27, 1993 Radiofrequency Radiation Conference*. 402-R-95-009, Washington, DC 1995.

Firstenberg A. The largest biological experiment ever. *Sun Monthly*, January 2006. Available online at mindfully.org

Firstenberg A. Mortality statistics. *No Place To Hide* 2(2): 11-14, 1999.

Flakiewicz W, Cebulska-Wasilewska A. Biological effects of electromagnetic field on randomly selected human population residing permanently close to the high power, long wave radio transmitter, and Trandescantia plant model system in situ. *International Wroclaw Symposium on Electromagnetic Compatibility 1992*, pp. 72-76.

Frey, Allan H. Auditory system response to radio frequency energy. *Aerospace Medicine* 32: 1140-1142, 1961.

Frey AH, Seifert E. Pulse modulated UHF energy illumination of the heart associated with change in heart rate. *Life Sciences* 7 (Part II): 505-512, 1968.

Frey AH. Cardiac and neural effects of modulated RF energy. *Proceedings of the 23rd Annual Conference on Engineering in Medicine and Biology* 12:175, 1970.

Frey AH, Feld S, Frey B. Neural function and behavior: defining the relationship. *Annals of the New York Academy of Sciences* 247:433-439, 1975.

Frey AH, Spector J. Irritability and aggression in mammals as affected by exposure to electromagnetic energy. *Proceedings of the 1976 Annual Meeting of the International Union of Radio Science, October 15-19, 1976, Amherst, Mass.*

Frey AH, Wesler L. Modification of tail pinch consummatory behavior in microwave energy exposure. *Proceedings of the URSI Annual Meeting, June 18-22, Seattle, WA, 1979.*

Frey AH. From the laboratory to the courtroom: science, scientists, and the regulatory process. In Steneck N, ed., *Risk/Benefit Analysis: The Microwave Case*, San Francisco: San Francisco Press 1982, pp. 197-231.

Frey AH. Evolution and results of biological research with low-intensity nonionizing radiation. In Marino AA, ed., *Modern Bioelectricity*, Dekker, NY, 1988, pp. 785-837.

Gangi S, Johansson O. Skin changes in "screen dermatitis" versus classical UV- and ionizing irradiation-related damage—similarities and differences. Two neuroscientists' speculative review. *Experimental Dermatology* 6: 283-291, 1997.

Glaser Z. *Cumulated index to the Bibliography of reported biological phenomena ("effects") and clinical manifestations attributed to microwave and radio-frequency radiation: report, supplements (no. 1-9), BEMS newsletter (B-1 through B-464), 1971-1981*. Indexed by Julie Moore. Riverside, CA: Julie Moore & Associates, 1984.

Grundler W, Kaiser F. Experimental evidence for coherent excitations correlated with cell growth. *Nanobiology* 1: 163-176, 1992.

Hallberg Ö, Johansson O. Melanoma incidence and frequency modulation (FM) broadcasting. *Archives of Environmental Health* 57: 32-40, 2002a.

Hallberg Ö, Johansson O. Cancer trends during the 20th century. *Journal of the Australasian College of Nutritional and Environmental Medicine* 21: 3-8, 2002b.

Hallberg Ö, Johansson O. Malignant melanoma of the skin – not a sunshine story! *Medical Science Monitor* 10(7): CR 336-340, 2004a.

Hallberg Ö, Johansson O. 1997 – A curious year in Sweden. *European Journal of Cancer Prevention* 13: 535-538, 2004b.

Hallberg Ö, Johansson O. *Say to countryside goodbye, when even healthy people die.* Report no. 6, Experimental Dermatology Unit, Karolinska Institute, Stockholm, 2004c, 41 pp.

Haugsdal B, Hauger E, Mild KH, Oftedal G, Sandstrom M, Wilen J, Tynes T. Comparison of symptoms experienced by users of analogue and digital mobile phones: a Swedish-Norwegian epidemiological study. *Arbetslivsrapport* 23, National Institute for Working Life, Umeå, Sweden, 1998.

Hillert L, Berglind N, Arnetz BB, Bellander T. Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey. *Scandinavian Journal of Work, Environment and Health* 28(1):33-41, 2002.

Hocking B. Preliminary report: symptoms associated with mobile phone use. *Occupational Medicine (London)* 48(6): 357-360, 1998.

Huss A, Egger M, Hug K, Huwiler-Müntener K, Röösli M. Source of funding and results of studies of health effects of mobile phone use: Systematic review of experimental studies. *Environmental Health Perspectives*, Online 15 September 2006, doi:10.1289/ehp.9149 (available at http://dx/doi.org).

Hutter H-P, Moshammer H, Wallner P, Kundi M. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. *Occupational and Environmental Medicine* 63:307–13, 2006.

Johansson O. How shall we cope with the increasing amounts of airborne radiation? *Journal of the Australasian College of Nutrition and Environmental Medicine* 25(3): 5-6, 2006.

Johansson O, Gangi S, Liang Y, Yoshimura K, Jing C, Liu P-Y. Cutaneous mast cells are altered in normal healthy volunteers sitting in front of ordinary TVs/PCs - results from open-field provocation experiments. *Journal of Cutaneous Pathology* 28: 513-519, 2001.

Kositsky NK, Nizhelska AI, Ponezha GV. Influence of high-frequency electromagnetic radiation at non-thermal intensities on the human body (A review of work by Russian and Ukrainian researchers). *No Place To Hide* 3(1) – Supplement, 2001, 32 pages.

Letavet AA, Gordon ZV. *The Biological Action of Ultrahigh Frequencies.* Academy of Medical Sciences, Moscow, 1960. JPRS 12471.

Levallois P, Neutra R, Lee G, Hristova L. Study of self-reported hypersensitivity to electromagnetic fields in California. *Environmental Health Perspectives* 110(suppl 4): 619-23, 2002.

Mannino DM, Homa DM, Pertowski CA, Ashizawa A, Nixon LL, Johnson, CA, Ball LB, Jack E, Kang DS. Surveillance for asthma – United States, 1960-1995. *Surveillance Summaries* 47(SS-1);1-28, Centers for Disease Control, Atlanta, 1998.

Meo SA, Al-Drees, AM. Mobile phone related-hazards and subjective hearing and vision symptoms in the Saudi population. *International Jouranl of Occupational Medicine and Environmental Health* 18(1):53-57, 2005.

National Board of Health and Welfare (Socialstyrelsen). *Environmental Health Report*. Stockholm, Sweden, 2001, in Swedish.

Navarro AE, Segura J, Portoles M Gómez-Perretta C. The microwave syndrome: A preliminary study in Spain. *Electromagnetic Biology and Medicine* 22(2): 161–169, 2003.

Oberfeld G, Navarro AE, Portoles M, Maestu C, Gomez-Perretta C. The microwave syndrome: further aspects of a Spanish study. *Proceedings of the 3rd International Workshop on Biological Effects of Electromagnetic Fields, Kos, Greece, October 4-8, 2004.*

Oftedal G, Wilen J, Sandström M, Mild KH . Symptoms experienced in connection with mobile phone use. *Occupational Medicine (London)* 50:237-245, 2000.

Preece AW, Dunn EJ, Farrow SJ, Georgiou AG. *The Akrotiri Military Antennae Health Survey*. Dept. Of Medical Physics and Oncology, University of Bristol, Final Report, June 2, 2005.

Ruzicka F. Schäden durch elektrosmog. *Bienenwelt* 10: 34-35, 2003.

Salama OE, Abou El Naga RM. Cellular phones : Are they detrimental? *Journal of the Egyptian Public Health Association* 79(3-4): 197-223, 2004.

Salford LG, Brun AE, Eberhardt JL, Malmgren L, Person BRR. Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones. *Environmental Health Perspectives* 111(7): 881-883, 2003.

Sandström M, Wilén J, Oftedal G, Hansson-Mild K. Mobile phone use and subjective symptoms. Comparison of symptoms reported by users of analogue and digital mobile phones. *Occuational Medicine (London)* 51:25–35, 2001.

Santini R, Seigne M, Bonhomme-Faivre L, Bouffet S, Defrasne M, Sage M. Symptoms experienced by users of digital cellular phones: A study of a French engineering school. *Electromagnetic Biology and Medicine* 21:81-88, 2002.

Santini, R., Santini, P., LeRuz, P., Danze, J. M., and Seigne, M.: Survey study of people living in the vicinity of cellular phone base stations. *Electromagnetic Biology and Medicine* 22: 41-49, 2003. Available online at buergerwelle.de

Schreier N, Huss A, Röösli M. The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland. *Sozial- und Präventivmedizin/Social and Preventive Medicine* 51:202-209, 2006.

Schroeder E. *Stakeholder perspectives on amending the 26th Federal Emission Control Ordinance. Results of the nationwide telephone survey ordered by the Federal Office of Radiation Protection.* Schr/bba 04.02.26536.020, Munich, Germany, 2002, in German.

Science of the Total Environment, Volume 180, January 1996 (entire issue). Effects of RF electromagnetic radiation on organisms: A collection of papers presented at the International

Conference on the Effect of Radio Frequency Electromagnetic Radiation on Organisms, Skrunda, Latvia, June 17-21, 1994.

Södergren L, Johansson O. Commentary: Mobile Telephones – Will the Golden Goose Become the Mad Cow? *Journal of the Australasian College of Nutrition and Environmental Medicine* 20(2): 29-30, 2001.

Szyjkowska A, Bortkiewicz A, Szymczak W, Makowiec-Dabrowska T. Subjective symptoms related to mobile phone use – a pilot study. *Polski Merkuriusz Lekarski* 19(112): 529-532, 2005, in Polish.

Tanner JA, Romero-Sierra C, Davie SJ. Non-thermal effects of microwave radiation on birds. *Nature* 216: 1139, 1967.

United States General Accounting Office. *Efforts By The Environmental Protection Agency To Protect The Public From Environmental Nonionizing Radiation Exposures*. CED-78-79, 1978.

Waldmann-Selsam C. The Bamberg Report, 2005. Online at http://www.gigaherz.ch/911.

Wilén J, Sandström M, Hansson-Mild K. Subjective symptoms among mobile phone users – A consequence of absorption of radiofrequency fields? *Bioelectromagnetics* 24(3): 152-159, 2003.

Zaret MM. Hazards of microwave ovens. *JAMA* 217(4):481-2, 1971.

Zaret MM. Microwave cataracts. *Medical Trial Technique Quarterly* 19(3):246-52, 1973.

Zaret MM and Snyder WZ (1977). Cataracts and avionic radiations. *British Journal of Ophthalmology* 61(6): 380-384.

Zwamborn APM, Vossen SHJA, van Leersum BJAM, *et al*. Effects of global communications system radiofrequency fields on well being and cognitive functions of human subjects with and without subjective complaints. TNO report, FEL-03-C148. The Hague, 2003. Available online.

Books

Nordström G. *The Invisible Disease*. Winchester, UK: O Books, 2004.

Brodeur P. *The Zapping of America*. NY: Norton 1977.

Miscellaneous

“Mystery in the Skin,” an October 2001 interview with Olle Johansson, online at http://www.feb.se/ARTICLES/OlleJ.html.

ACKNOWLEDGMENT

This manuscript was edited with the help of Chellis Glendinning.

ABOUT THE AUTHOR

Arthur Firstenberg is the founder and president of the Cellular Phone Task Force and the author of *Microwaving Our Planet: The Environmental Impact of the Wireless Revolution* (Cellular Phone Task Force 1996). From 1997 to 2002, he was the editor of the journal *No Place To Hide*.

Since 1996, the Task Force has provided a global clearinghouse for information about wireless technology's injurious effects, and a national support network for people disabled by this technology. In 1997 the Task Force was the lead litigant in a challenge brought by over 50 citizens groups against the FCC's limits for human exposure to radio frequency radiation.

Articles by Firstenberg or about his work have appeared in *The Ecologist, Earth Island Journal, Vegetarian Times, Village Voice, Utne Reader, Santa Fe New Mexican, San Francisco Chronicle*, and other newspapers and magazines. His work has been translated into Spanish, French, Portuguese, Italian, Danish, Japanese, and Chinese.

After graduating Phi Beta Kappa from Cornell University with a B.A. in mathematics, he attended the University of California, Irvine School of Medicine from 1978 to 1982. Injury by x-ray overdose cut short his medical career. For the past 25 years he has been a researcher, consultant and lecturer on the health and environmental effects of electromagnetic radiation.

SIDEBAR

DEFINITIONS

Electromagnetic field (EMF). A field of force generated by the flow of electric current. EMFs emanate from power lines, electrical wiring, and electrical and electronic equipment.

Electromagnetic radiation (EMR). Electromagnetic fields that travel through space in the form of waves. They include (arranged from highest to lowest frequency): cosmic rays, gamma rays, x-rays, ultraviolet light, visible light, infrared light, radio waves, and ELF (extremely low frequency) waves.

Wavelength. The size of an electromagnetic wave; the distance between successive peaks of the wave.

Frequency. The rate at which a wave oscillates. It is measured in cycles per second, also called hertz. Common abbreviations are kHz (kilohertz, or thousand cycles per second); MHz (megahertz, or million cycles per second); and GHz (gigahertz, or billion cycles per second).

Radio wave. Electromagnetic radiation longer than one millimeter in wavelength. Also called radiofrequency (RF) radiation.

Microwaves. Small radio waves. Electromagnetic radiation between one millimeter and one meter in wavelength; between 300 MHz and 300 GHz in frequency. Cell phone, cordless phone and Wi-Fi systems all operate in the microwave range.