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Growing Evidence That Cell Phone Radiation Can Affect the Brain

Latest Data from Finnish and German Labs

While public fears about brain cancer remain unresolved, there is now a growing body of evidence that wireless phone radiation can affect the nervous system. Studies from Finland and Germany are the latest to find changes in brain activity.

Some of the new results show subtle behavioral effects, while others involve changes in brain-wave patterns. They do not point to any health risks—in fact, some studies suggest that a cellular phone signal can actually speed up certain mental functions. But while these findings are still tentative, they do call into question the assumption that low-power radiofrequency and microwave (RF/MW) exposures do not cause neurological effects.

In the Finnish study, volunteers exposed to mobile phone signals responded significantly faster on two different tests of reaction times. The amount of time needed for a simple task of mental arithmetic was also decreased. “Our results suggest that GSM cellular telephones may have an effect on cognitive processing,” write Dr. Mika Koivisto and colleagues at the Center for Cognitive Neuroscience at Finland’s University of Turku in the February issue of *NeuroReport*

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EMF Polarization: Ignored Too Long? Study Prompts New Outlook

In the laundry list of variables used to characterize electromagnetic fields (EMFs), polarization is usually an afterthought—if it is mentioned at all. This is mostly because it is neither easy to understand nor simple to describe.

But now, there is new interest in polarization as a possible missing variable that could explain the conflicting results that are the hallmark of EMF biological studies.

The catalyst for the new attention to polarization is a study of melatonin among electric utility workers by Dr. Jim Burch of Colorado State University in Fort Collins. Burch has shown that melatonin levels are more affected by certain EMF environments than others and that the key difference may be the polarization of the magnetic field.

Burch’s study is preliminary and would be much less noteworthy if it did not agree with a series of animal studies by Dr. Masamichi Kato in Japan, which, though well known, have until now been generally ignored in the U.S. and Europe.

If Burch and Kato prove to be right, then their work will focus new atten-

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Suicide Linked to EMF Exposure Among Electrical Workers

EMF exposures increased the risk of death by suicide in a study of male electrical workers by researchers at the University of North Carolina (UNC), Chapel Hill. They note that several studies have linked EMFs to lower melatonin levels, and that low levels of this hormone have in turn been linked to depression.

“We found a dose-response relationship for recent exposure,” Edwin van Wijngaarden told *Microwave News*. “There also seemed to be a higher risk at relatively younger ages.” The study was based on data on 139,000 utility workers, originally collected by Drs. David Savitz and Dana Loomis (see *MWN*, J/F95). The 536 deaths from suicide in that cohort were matched with 5,348 controls.

Workers with the highest EMF exposures in the last year, estimated to average 13 mG or more, were 70% more likely to die by suicide than those who were unexposed at work. There was a clear dose-response gradient: Risk grew as exposure increased, though only the increase for the most-exposed workers was statistically significant.

“Stronger associations, with odds ratios in the range of 2.12-3.62, were found for men less than 50 years of age,” van Wijngaarden, Loomis, Savitz and colleagues write in the April issue of *Occupational and Environmental Medicine* (57, pp.258-263, 2000). They suggest that this may reflect “a difference in the nature of depression and suicide between age groups.” The UNC researchers explain that there are two types of depression, major and minor, and that major depression more often occurs at younger ages. Minor depression, in contrast, is frequently linked to physical illness and “is common and important in later life.”

Van Wijngaarden also looked at suicide in three job titles that have generally high EMF exposures: electricians, linemen and power plant operators. Those who had worked as electricians in the last year were more than twice as likely as other workers to commit suicide, a significant increase. Some significant increases were also seen for linemen, while work as a power plant operator showed a weak negative association with suicide.

The discrepancy in results among these job titles might reflect different patterns of EMF exposure, the UNC team writes. Their paper cites one study that found electricians to have the highest average EMF exposures of these three jobs, and another which reported linemen and electricians to have higher exposures to high-frequency transients than power plant operators.

“Exposure to EMFs may alter melatonin secretion,” according to several studies cited in the paper. Van Wijngaarden and colleagues note that low melatonin levels have been linked to depression, and suggest this as a mechanism through which EMF exposure might lead to suicide.

Past studies of EMFs and depression have had mixed results (see *MWN*, M/J88, J/A92 and M/A96). A small study by Savitz in 1994 found no greater incidence of depression in the broad class of electrical workers, but some evidence for a greater risk among electricians (see *MWN*, M/A94).

A large 1996 study of electric utility workers in Québec showed no clear relationship between suicide and EMF exposure (see *MWN*, M/A96). Van Wijngaarden pointed out, however,

Italy Moves Towards a 2 mG Limit For Schools near Power Lines

The Italian Ministry of the Environment has proposed setting a goal of a maximum magnetic field of 2 mG (0.2 μ T) in new schools, kindergartens and playgrounds built next to power lines. A draft ordinance, released at the end of 1999, favors a 5 mG standard as a “precautionary measure,” but otherwise accepts ICNIRP’s 1 G exposure limit, according to the March issue of *ElektrosmogReport*, published in Berlin.

While this is still only a recommendation, it is “an important step” towards a formal rule, Dr. Paolo Vecchia, the head of the non-ionizing radiation section of the National Institute of Health in Rome, told *Microwave News*.

The 5 mG standard—an annual average—would apply to buildings where people may be expected to stay for four or more hours a day. Exposures could never exceed 20 mG over a tenth of a second.

Meanwhile, a prosecutor has opened a criminal investigation of three employees of Enel, the state electric utility, in connection to health problems associated with a 132 kV power line near a school in a small town near Venice. Agence France-Presse, the news service, reported on February 13 that charges of manslaughter are being considered because some children died of leukemia and other cancers.

that the Québec analysis was based on 49 cases of suicide as compared to over 500 in the UNC study. “Our study has much more power to detect an effect on the order of a 1.7-fold increase,” he said.

The possible connection between EMFs and suicide was first pointed out over twenty years ago by Dr. Stephen Perry, a British physician.

NSA Workers’ Suit Blames Degausser for Brain Tumors

Two employees of the U.S. National Security Agency (NSA) believe they developed brain tumors as a result of using a magnetic tape-erasing machine and are suing its manufacturer. Two other NSA workers who used the degausser also developed brain cancer; all four had benign meningiomas that required surgery. A fifth worker developed another type of cancer.

All five are represented by the firm of Peter Angelos, a powerful Baltimore trial lawyer who has made a fortune on asbestos and tobacco litigation. No decision has been made on how to proceed with the claims of the three who have not yet filed suit.

For each of the four workers with brain cancer, the tumor occurred on the side of the head that was closest to the machine, according to attorney John Pica of Angelos’s law firm.

In an interview with *Microwave News*, Pica said that there might be others who used the degausser and have had health problems. “We’re still in the investigative phase of this lawsuit.” Angelos might try to turn the case into a class action suit.

Degaussers erase magnetic storage media such as audio,

video and computer tapes by applying a powerful magnetic field. (They are also widely used in radio and television studios.) The five NSA staffers sat close to the machine and placed a stream of computer tapes onto a conveyor belt that passed the tapes through a magnetic field of up to 2,500 G.

The original degausser was supplied to the highly secretive intelligence agency in 1967 by Electro-Matic Products Co. of Chicago, and was installed at NSA headquarters in Fort Meade, MD. While that unit was no longer in use, agency technicians surveyed the magnetic fields from a similar degausser in 1997 with an EMDEX High Field meter, which measures frequencies from 40 to 800 Hz.

At the loading position, the magnetic fields were above 900 mG within three feet of the machine. Within a few inches of its sides, the fields were as high as 44 G.

Beginning in the early 1980s, the two plaintiffs, Thomas Van Meter and Tommy Grimes, used the machine for up to three hours a week. Van Meter was diagnosed with a brain tumor in 1986, and Grimes in 1989. Their complaint, filed in a Maryland court in March 1998, states that both have lasting disabilities.

Initially, Grimes and Van Meter were represented by the firm

of Brassel & Baldwin in Annapolis, MD. Last year, however, Jon Brassel determined that his firm had a conflict of interest and the case was taken over by the Angelos firm.

Harold Walter of Tydings & Rosenberg in Baltimore is defending Electro-Matic. The company's degausser "was believed to be safe when it was designed, more than 30 years ago," Walter told *Microwave News*. "Nothing that has been learned since then suggests otherwise." He added that he expects the case to be dismissed. A jury trial is currently scheduled for December.

Starting in the 1960s, Angelos got rich representing thousands of workers in personal injury lawsuits against asbestos manufacturers. In 1993, Angelos led an investment group that bought the Baltimore Orioles baseball team for over \$170 million. As counsel for the state of Maryland in its recently settled lawsuit against tobacco companies, his firm stands to receive up to \$1 billion—though the state may reduce the fee to \$500 million or less.

The NSA has what is widely believed to be the largest computer operation in the world. According to James Bamford, the author of *The Puzzle Palace: A Report on America's Most Secret Agency*, the agency had 11 acres of mainframe computers in the early 1980s.

New Interest in EMF Polarization (continued from p.1)

tion on the relationship between EMF exposure and melatonin, a once-hot topic that has cooled off recently due to inconsistent results.

Polarization refers to the change in direction of the electric or magnetic field. There are two extremes: linear and circular polarization. A linearly polarized magnetic field simply reverses its direction over time. In a circularly polarized field, the direction of the field moves in a circle like the hands of a clock.

Dr. Bill Guy, now retired from the University of Washington, Seattle, explained how this can affect an animal study. "In any position, other than looking right at the source, the rat gets more field exposure from a circularly polarized field," he said. "In a circularly polarized field, there are less peaks and valleys in the induced current as the rat moves around the cage."

To put it even more simply, if you believe that the key EMF effect is to induce a current in the body—the predominant expert view—then a circularly polarized field guarantees the most consistent exposure in an animal experiment. That is why the exposure system Guy designed for long-term RF/MW—animal studies used circularly polarized radiation (see *MWN*, J/A84).

In real-world environments, EMFs are somewhere between linearly and circularly polarized, or more precisely, they are elliptically polarized (see box, p.4).

In a study of 149 utility workers, Burch found that those exposed to fields that were more circularly than linearly polarized had lower levels of melatonin metabolites in their urine. Burch's exposure assessment was crude—he did not make any polarization measurements—but differences in melatonin profiles are apparent.

Subjects who worked for more than two hours a week in environments associated with circularly polarized fields, such as in substations or near 3-phase power lines, excreted significantly less melatonin than those exposed to linearly polarized

Measuring Polarization: Neither Easy, Nor Cheap

Only one meter can measure the polarization of a magnetic field: the Multiwave developed by Electric Research. The System III dosimeter costs \$9,800.

Dr. Joseph Bowman at the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati has four of them. "It's the best way to pursue those characteristics of the field that may be important," he told *Microwave News*. Practically all previous surveys have left out harmonic content, the static field, polarization and spatial orientation, Bowman said. "The Multiwave can capture all these aspects of the field." (See also box, p.4.)

Bill Feero, who designed the Multiwave with Fred Dietrich, explained that, "We have always maintained that polarization could be as important as any other metric." Feero is based in State College, PA, and Dietrich is in Pittsburgh.

fields associated with single-phase power lines and low-voltage electrical wiring.

Writing in the February issue of the *Journal of Occupational and Environmental Medicine* (42, pp.136-142, 2000), Burch calls it a "clear trend," and concludes that his findings "are consistent with the hypothesis that magnetic fields with circular or elliptical polarization are more effective at suppressing melatonin production than linearly polarized fields."

"We are the first to introduce polarization in the context of an epidemiological study," Burch told *Microwave News*.

Kato's experiments with animals show a similar pattern, except that he had the advantage of exposing his rats to pure linearly or circularly polarized fields. Kato found that rats exposed

Polarization at Home, at Work and in the Environment

There have been so few measurements of polarization that it is not obvious where one finds linearly and circularly polarized fields. In fact, outside the lab, most fields are elliptically polarized—that is, somewhere between the two extremes.*

Everyone agrees that very close to 3-phase transmission lines, magnetic fields are nearly circularly polarized and that as you move away, the fields become progressively more linear. There is less agreement about how far from the power line those elliptically polarized fields extend.

In the most detailed set of polarization measurements available, Electric Research found that the “degree of circular polarization in fields within [a 345 kV] substation is comparable to or less than that in residential settings.”† (See also p.3.)

“We were surprised to see as much elliptical polarization as we did in homes,” Fred Dietrich of Electric Research told *Microwave News*. Bill Kaune of EM Factors has pointed out that,

*The skinnier, or taller, an ellipse becomes, the closer it is to being linear. When the ellipse’s two axes are equal, it is a circle.

†Electric Research and Management, *Measurement of Power System Magnetic Fields by Waveform Capture*, Palo Alto, CA: EPRI Report

“Even though [homes] are supplied with single-phase electrical power...the currents in their ground systems are substantially phase-shifted relative to those flowing in the home wiring and appliances.”‡

With respect to commercial settings—office or laboratory spaces—Electric Research found that the degree of polarization was “highly variable from location to location and ranges from near linear to near circular.”†

Many electric motors generate fields that tend to circular polarization. Drs. Joseph Bowman and Mark Methner, both of NIOSH, have made some detailed measurements of polarization and other field variables in six factories, using Electric Research’s Multiwave II system.§ Diverse products, including aluminum, cement and plastics, are manufactured in these facilities. In general they found “a wide diversity of complex magnetic field characteristics and non-sinusoidal waveforms.”

No.TR-100061, February 1992.

‡*Bioelectromagnetics*, 16, p.403, 1995.

§Their data are scheduled to appear in the December 2000 issue of the *Annals of Occupational Hygiene*.

for six weeks to a 14 mG, circularly polarized, 50 Hz field had suppressed melatonin levels in the pineal gland as well as in blood plasma. In contrast, a similar 10 mG field that was linearly polarized had no effect. If the linear field was increased to 50 mG, there was a significant reduction in plasma, though not in pineal, melatonin in the rats.

“In our laboratory, a [linear] magnetic field is not nearly as potent a stimulus at inducing melatonin suppression in rats as is a circularly polarized magnetic field,” Kato concluded in a review paper published in 1997.*

How important a role could polarization play in the EMF–health equation? It is too early to say, but anything that would deepen the understanding of the interaction would be welcomed by many observers. “I’ve always thought that there was something we were not looking at,” said Dr. Paul Gailey of Ohio University, Athens.

Dr. Larry Anderson of Battelle Pacific Northwest Labs in Richland, WA, who has done a large number of EMF animal exposure studies, commented, “My own personal feeling is that I would not be surprised if circularly polarized fields had a differential effect over linearly polarized fields.”

But there is skepticism as to whether polarization can resolve the inconsistent results of past EMF experiments. “I don’t understand how it would explain the discrepancies in the attempts to repeat the work of [Dr. Wolfgang] Löscher and [Dr. Reba] Goodman,” said Dr. Bill Kaune of EM Factors in Richland, WA.

If it turns out that polarization is a key variable, it would mean that the National Institute of Environmental Health Sciences

(NIEHS) made a bad bet in its own multimillion dollar animal exposure studies, as well as those studies the institute funded under the EMF RAPID research program. Practically all used linearly polarized fields.

In the rationale for the animal studies, NIEHS’ Dr. Gary Boorman explained that using linearly polarized fields was simpler and cheaper. (For instance, to generate a circularly polarized field, two sets of coils are needed, while only one set is required for linearly polarized fields.) The fact that the animals would have received a more uniform exposure was not discussed. Boorman’s studies were later interpreted to show few adverse effects and have been cited by those who discount EMF health risks (see *MWN*, J/F98 and M/A98).

In contrast, the New York State Power Lines Project, which ran for most of the 1980s (see *MWN*, F81 and J/A87), required its contractors to use circularly polarized fields in order to mimic the EMF environment near transmission lines (see box, above).

“We didn’t know what the mechanism of interaction was, so we felt we had to emulate a power line field as accurately as we could,” said Dr. Michael Marron of the National Institutes of Health in Bethesda, MD. Marron was a member of the NY project’s Scientific Advisory Panel.

While Kato’s work has essentially been ignored in the design of U.S. experimental studies, it is being taken very seriously in Japan. Battelle’s Anderson visited Japan last November and in a recent interview said that, “Most of the work in Japan—and it is a sizable program—is using circularly polarized fields, a decision driven by Kato’s results.”

Burch believes his work on polarization “definitely needs to be followed up.” But his NIEHS research grant has not been renewed. Nevertheless, he remains cautiously optimistic. “I hope the pendulum will swing back so that we can continue testing this hypothesis,” he said.

* M. Kato and T. Shigemitsu, “Effects of 50 Hz Magnetic Fields on Pineal Function in the Rat,” in *The Melatonin Hypothesis: Breast Cancer and the Use of Electric Power*, edited by R.G. Stevens, B. Wilson and L. Anderson, pp.337-376, Columbus, OH: Battelle Press, 1997.

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PAVE PAWS Radar on Cape Cod At Center of New Controversy

In a stormy meeting on March 13 in Sandwich, MA, Cape Cod residents called for the closing of a large U.S. Air Force radar installation that overlooks the town. Many speakers blasted a state health department report on the facility as tainted by a conflict of interest, and demanded that it be withdrawn.

The PAVE PAWS radar at the Massachusetts Military Reservation is designed to warn of sea-launched missile attacks, as well as to track objects in space. There are also PAVE PAWS radars at Beale Air Force Base in California and at Clear Air Force Station in Alaska. The Cape Cod radar has been a focus of controversy since it was first proposed in the late 1970s, and local opposition has increased in recent years due to reports about Cape Cod's high cancer rates (see *MWN*, M/J87, J/F92 and J/F98).

"We've been part of an experiment that the Air Force has been conducting for more than twenty years," said Sharon Judge of the Cape Cod Coalition to Decommission PAVE PAWS.

The PAVE PAWS beam gives residents "a fraction of the exposure you'd get from a cell phone call" said USAF Captain Joe DellaVedova at the Pentagon in Washington. Still, he told *Microwave News*, the military must address civilians' concerns.

On February 25, the Defense Department released a draft Environmental Impact Statement (EIS) on upgrades to PAVE PAWS needed for a proposed National Missile Defense (NMD), a "Star Wars"-type system intended to protect against a "ballistic missile threat to the U.S. from a rogue nation." The EIS concludes that the upgrades would have "no unavoidable adverse environmental effects."

The EIS contends that the proposed changes would not alter the peak power, average power or operating frequencies of any of the PAVE PAWS radars. Currently, it states, the Cape Cod facility never exposes the public to more than 0.8 $\mu\text{W}/\text{cm}^2$ of radiation, averaged over a 30-minute period. The signal's average power is 146 kW, with a peak power of 582 kW, at 420-450 MHz. A public comment period on this EIS ends on April 17.

When Judge and other activists read the PAVE PAWS EIS, they were outraged to see that Dr. Linda Erdreich of Bailey Research Associates in New York City (see also p.16) was listed as one of its authors. Erdreich chaired a Massachusetts Department of Public Health (MDPH) panel evaluating the public health impact of the Cape Cod radar, which issued a report in late November. The state panel was formed in 1998 in response to public concern about PAVE PAWS, before the Pentagon proposed the NMD upgrade (see *MWN*, N/D98 and N/D99).

In a March 2 letter to the MDPH, Judge denounced Erdreich's work for the Pentagon as a "blatant conflict of interest." She said that the MDPH panel's report was "polluted in [its] entirety" and must be withdrawn.

The MDPH answered that in October, when it learned that Erdreich's firm might work on the PAVE PAWS EIS, it had promptly asked for her resignation. What the agency did not say, however, was that Erdreich did not in fact resign and continued to work on the report. Suzanne Condon, director of MDPH's Bureau of Environmental Health Assessment in Boston, con-

California Proposal: Hands-Free Device with All Mobile Phones

In a couple of years, all cellular phones sold in California would have to come with a hands-free device, if State Senator Tom Hayden's bill becomes law.

Introduced on February 22, SB1699 would require that consumers be given the option to buy an earpiece or headset when they purchase a mobile phone or sign a service contract. In addition, retailers would have to post a notice outlining possible health risks associated with cellular phones.

After January 1, 2002, any mobile phone sold in California would *have* to include a hands-free device, unless the State Department of Health Services determines "that cellular telephones have no adverse health effects."

"Cell phones are a part of our culture now," said Rocky Rushing of Hayden's Los Angeles office. "But the number of users has been expanding at a much more rapid pace than the research on their effects."

The Cellular Carriers Association of California thinks Hayden's bill is unnecessary. "We don't want the state of California to come out and make a statement that would be unnecessarily frightening to our customers," Stephen Carlson, the group's executive director, told *Microwave News*.

Hearings on the bill are scheduled for early April, and Rushing expects a fight. "I anticipate that industry will go into overdrive to see that this legislation is defeated," he said.

Whatever the outcome, the health issue will get attention because of Hayden's high public profile. A former anti-war activist and ex-husband of actress Jane Fonda, Hayden draws more media interest than the average state legislator.

firmed to *Microwave News* that Erdreich remained a member of the panel until its work was finished and it disbanded.

In an interview, Erdreich said that when the MDPH asked her to quit, she responded that she felt "a professional obligation" to finish drafting her section of the report, on epidemiology. After that, Erdreich said, she stepped back from an active role and let the rest of the committee—Drs. Om Gandhi, Henry Lai and Marvin Ziskin—finalize the report. "Basically I stepped down as chair," she explained.

Erdreich stressed that her work on the two projects did not overlap. "I didn't begin the EIS work until around December 1," she said.

"We believe that Erdreich was working on the MDPH report on health and safety impacts of PAVE PAWS at the same time that the Pentagon was deciding whether to give her firm a lucrative contract," said Judge. The coalition had opposed Erdreich's participation from the start, on the grounds that she had testified for the telecom industry on RF/MW health issues.

Condon said that the MDPH would not withdraw the panel's report. "It's important to avoid even the appearance of a conflict of interest," she said. "But even if you'd had a different panel, we think they would have reached the same conclusion: that there is a lack of good environmental data about PAVE PAWS."

The Air Force has agreed in principle to pay for gathering

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exposure data, Condon said, though details have yet to be worked out. She called such measurements an essential next step: "We need better environmental exposure data so we can make better recommendations about health."

The PAVE PAWS EIS can be downloaded from the Web at: <www.acq.osd.mil/bmdo/bmdolink/pdf/uewr.pdf>. The report of the MDPH expert panel is now at a new address: <www.state.ma.us/dph/beha/pavepaws/assess.htm>.

FCC RF/MW Exposure Rules Facing Supreme Court Test

The activists suing to overturn the Federal Communications Commission's (FCC) telecommunications tower-siting policies will ask the U.S. Supreme Court to hear their case.

The move was prompted by a February 18 federal court of appeals ruling that unanimously upheld the FCC's approach to setting rules on public exposures to RF/MW radiation. The court also affirmed the commission's authority to preempt state and local exposure limits.

Writing for a three-judge panel of the Second Circuit appeals court in New York City, Judge John Walker stated that the FCC had correctly relied on the expertise on RF/MW health effects of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE) and the National Council on Radiation Protection and Measurements (NCRP) (see *MWN*, S/O97).

Walker concluded that it was not "arbitrary" for the FCC to opt for limits designed to protect only against thermal injury, since this was consistent with the ANSI/IEEE and NCRP exposure standards (see *MWN*, M/J86 and M/A93). "At most," Walker wrote, new evidence of biological effects at levels below the FCC limits has "established that the existence of nonthermal effects is 'controversial,' and that room for disagreement exists among experts in the field."

Walker similarly found no error in the commission's handling of advice from federal health, environmental and worker safety agencies (see *MWN*, J/F94).

"We believe the court has ignored strong factual evidence which shows that FCC failed to assure public health protection in adopting the current...guidelines," said David Fichtenberg, president of the Ad Hoc Association (AHA), which filed suit against the FCC rules in 1997 and is mounting the high court appeal (see *MWN*, N/D97).

The AHA will be represented by the firm of Landy & Seymour in New York City. Partner Whitney North Seymour Jr. is a former federal prosecutor. James Hobson of the firm of Donelan, Cleary, Wood & Maser in Washington, who argued the AHA's appeals court case, will continue to advise the group.

The FCC also received the court's blessing for preempting state and local RF/MW health and safety rules under the 1996 telecommunications law (see *MWN*, M/A96).

The Cellular Telecommunications Industry Association, the National Association of Broadcasters and AT&T Wireless Services Inc. filed briefs in support of the FCC.

The court assigned costs in the case to the petitioners. This

The Precautionary Principle Comes to Toronto

Toronto, the largest city in Canada, may soon adopt health guidelines for RF/MW radiation from mobile phone base stations. While voluntary, the power density limits would be 100 times lower than those in Canada's national RF/MW exposure standard, Safety Code 6 (SC6) (see *MWN*, N/D99).

The proposal from Toronto Public Health (TPH), now being considered by the City Council, would ask carriers to show that radiation from new 900 MHz antennas does not exceed $6 \mu\text{W}/\text{cm}^2$ (or 5 V/m) in places normally used by the public. At 1800 MHz, the frequency used by PCS phones, the maximum would be $10 \mu\text{W}/\text{cm}^2$ (or 6 V/m). These levels are comparable to those specified by the new RF/MW rules in Switzerland and Italy (see *MWN*, J/F00).

"Due to the uncertainties relating to subtle and long-term effects of RF, it is prudent to keep levels of public exposure below Safety Code 6," TPH head Dr. Sheela Basrur wrote in a report dated November 29, 1999.

Basrur also pointed out that in contrast to SC6, which is based on a 50-fold protection factor, "standards set by regulatory agencies [for] other substances (such as chemicals) often incorporate a 1,000- to 10,000-fold protection factor." Adding a 100-fold margin to SC6, she noted, would bring the overall margin to 5,000, squarely within this range.

TPH proposed the limits last fall after the council asked it to consider a city tower-siting policy based on the precautionary principle (see also p.17). That request "was prompted by reports of adverse health effects at low levels of RF," said Ronald Macfarlane, an environmental health consultant who is working with TPH on the tower-siting issue.

Both Canadian federal officials and wireless industry representatives have voiced concerns about the proposal. Industry Canada argues that the city does not have the authority to regulate RF/MW exposures, but told TPH that it could accept lower limits as long as they are voluntary. The Canadian Wireless Telecommunications Association predicts that carriers would be unable to place multiple transmitters on a single tower or building, resulting in "an undesirable increase in the total number of antenna sites" (see also p.14).

At a public meeting hosted by the council on February 7, Basrur responded that she does not believe the limits would be difficult for industry to meet, pointing out that RF/MW levels "are usually more than 100 times below Safety Code 6 exposure limits" in areas accessible to the public.

The February meeting also featured talks by Dr. Henry Lai of the University of Washington, Seattle, and Mary McBride of the British Columbia Cancer Agency in Vancouver.

The council will consider the proposal in its next session, which begins in June, Macfarlane told *Microwave News*.

practice is "fairly standard" in federal suits and does not include attorneys' fees, Hobson told *Microwave News*. He added that neither the FCC nor any of the intervenors appeared to have submitted a claim for costs before the filing deadline.

The court's decision is available on the Internet at: <www.law.pace.edu/lawlib/legal/us-legal/judiciary/second-circuit.html>.

Motorola Study: No Cancer Risk For RF/MW-Exposed Employees

A study of Motorola's workforce has found no link between exposure to radiofrequency and microwave (RF/MW) radiation and mortality from brain cancer, leukemia or lymphoma.

The study included 196,000 people employed by Motorola between 1976 and 1996 for at least six months, of whom 6,000 died during the study period. Workers with only background-level exposures to RF/MW radiation accounted for 72% of all subjects, while 9% had high or moderate exposures.

Employees with high or moderate RF exposure did not show any increased cancer risk. This was true for usual exposure (the job held longest), for peak exposure (the job with the highest exposure) and for cumulative exposure (estimated in two ways).

"Our findings generally do not support threefold or higher relative risks...due to RF exposure," write Drs. Robert Morgan, Michael Kelsh and colleagues at Exponent Health Group in Menlo Park, CA, in the March issue of *Epidemiology* (11, pp.118-127, 2000). The study did not have enough statistical power, they note, to reliably detect an increase of twofold or less.

Exposure was assessed on the basis of job description, work site and the opinions of experts both inside and outside of Motorola. No measurements were taken. Almost 10,000 job titles were assigned to background, low, moderate or high exposure groups.

"We looked loosely at the sources of RF exposure" in terms of output power, Kelsh told *Microwave News*. "At the bottom was the background group, then above that was people with smaller, transitory exposures," he explained. "The highest group could have been exposed to sources with output power in the neighborhood of 50 W," with the "moderate" group falling in between. All frequencies of RF exposure were combined together.

"We recognize that the exposure assessment was a big limitation," said Kelsh. "We did what we could with job titles, based on many discussions, but it still fell far short of measurements."

Information on use of cellular phones was not included. "We had hoped that there would be a central location for data on company-assigned cell phones," Kelsh said, "but we found that the same phone could be used by different people."

A commentary in the same issue of *Epidemiology* by Dr. Russell Owen of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health in Rockville, MD, points to the lack of data on mobile phone use as a particular shortcoming of the Motorola study. Owen argues that cellular phone use among Motorola employees was probably more widespread and longer-standing than among the general public, and that this would therefore be an "exceptionally informative" group to look at.

Owen reiterates the FDA's long-standing view that there are currently not enough data to conclude whether or not wireless phones pose any health risks (see *MWN*, J/A93 and N/D99). The fact that 80 million people are using mobile phones in the U.S. alone represents "an unprecedented exposure of the population to RF energy," he writes, and even a small increase in risk "would translate into a potentially significant public health problem."

In general, Owen says, "mobile telephones have not been in widespread use long enough for long-term potential health ef-

SAR Search

• All wireless phones must comply with the FCC's 1.6 W/Kg SAR limit by **September 1** or their manufacturers must complete an environmental assessment. This requirement, which was initially announced in 1996, is cited in a public notice issued as a reminder by the commission on February 25. (All FCC licensees, including broadcasters and wireless companies, must meet the FCC's RF/MW rules by September 1.) At present, only phones brought to market after August 1, 1996, have to comply with the SAR standard, and their manufacturers have been required to submit test data to the FCC (see *MWN*, J/A96). In an interview with *Microwave News*, Dr. **Robert Cleveland** of the commission's Office of Engineering and Technology in Washington said that he does not expect the September deadline to cause a deluge of new SAR data. He pointed out that the majority of phones now sold in the U.S. are digital models, in contrast to the analog units that dominated the market four years ago. Cleveland also noted that PCS handsets have been required to meet the SAR guidelines since 1994. In its public notice, the FCC warned that anyone not in compliance after September 1 may be penalized.

fects to have emerged." This may also be true in the Motorola study of other RF sources, writes the Exponent team. "It may be too early to detect a potential RF health effect in this cohort," the paper states, given the relatively young age of employees and "the assumed long latency between exposure and cancer."

Dr. Samuel Milham, an Olympia, WA, consultant who has studied mortality of amateur radio operators (see *MWN*, N/D87 and J/F89), made this point more sharply. "Over half of the Motorola cohort worked for less than five years, and 28% were hired in 1990 or later," Milham said. "A cohort loaded with short-term workers and with workers followed for a short period of time is a formula for finding nothing."

Morgan's preliminary results were first announced at a Motorola press conference on December 17, 1993. The company told reporters that Morgan had found that its employees had a lower-than-expected rate of neurological cancers (see *MWN*, J/F94). The press conference was held the day after Motorola engineer Robert Kane appeared on the CBS program *Eye to Eye with Connie Chung*, to discuss the lawsuit he had filed that month, blaming his brain cancer on exposure to RF radiation during the development and testing of cellular phones.

The Kane suit is slowly progressing through the courts. Motorola spokesperson Norm Sandler, based in Washington, said that the next hearing in the case is scheduled for April 15.

According to Kelsh, the 1993 announcement was based on a proportional mortality study, comparing Motorola employees to the general population. "It was a first, quick look," he said, "to see if we have an epidemic here." Only later did the company decide to fund the cohort study, which did not start until 1995.

The cohort study found "a pronounced healthy worker effect," with a cancer death rate 78% of that for the population as a whole. Kelsh said that this strong effect is "probably because of the higher socioeconomic status of Motorola employees."

Using "Radar" To Detect Breast Cancer

Microwaves may soon be used to detect breast cancer. The new technique promises to miss fewer malignant tumors than X-ray mammography, without exposure to ionizing radiation.

"Microwaves may do it all: improve on X-ray both in sensitivity and in avoiding false positives," said Dr. Susan Hagness of the University of Wisconsin, Madison. In an interview with *Microwave News*, Hagness cautioned, however, that further research is needed to increase the system's accuracy.

X-ray exams, the most widely used tool for breast cancer screening and diagnosis, miss 10-40% of breast cancers, according to the National Cancer Institute. They are also prone to false positives—that is, misidentifying benign tumors as malignant.

Computer simulations indicate that microwaves could distinguish tumors as small as 2 mm in diameter and up to 5 cm below the skin. This sensitivity is "adequate to detect small cancerous tumors usually missed by X-ray[s]," Hagness and colleagues wrote in a paper published last May in *IEEE Transactions on Antennas and Propagation* (47, pp.783-791, 1999).

Hagness developed the imaging system in collaboration with Dr. Allen Taflove of Northwestern University in Evanston, IL, and Jack Bridges of Interstitial Inc. in Park Ridge, IL. (Bridges was formerly at the IIT Research Institute in Chicago.) Previously a student of Taflove's, Hagness is now working on improving the technology with Dr. Fred Kelcz, a radiologist at the

Magnet Therapy Does Not Ease Chronic Low Back Pain

The use of permanent magnets did nothing to reduce low back pain, according to a new study that appeared in the March 8 issue of the *Journal of the American Medical Association* (283, pp.1322-1325, 2000).

"This is the only randomized, double-blind, placebo-controlled study reporting the use of permanent magnets on more than a single occasion and for more than 45 minutes," stated Dr. Edward Collacott of the Veterans Affairs Medical Center in Prescott, AZ, and coworkers.

Twenty patients who had been experiencing low back pain for at least six months were treated either with a sham device or with trapezoidal, bipolar magnets of approximately 300 G for six hours a day, three days a week, for one week. After a one-week hiatus, the sham and real magnets were switched and the treatment was repeated. There were no significant changes in any measures of pain.

Last year, another small study found that magnets could help alleviate foot pain among diabetics (see *MWN*, J/F99). Collacott suggests that the difference in results may be due to the fact that the source of pain in his subjects is deeper than the peripheral nervous system involved in diabetic pain.

University of Wisconsin medical school.

Meanwhile, Interstitial has built a prototype and is testing it with simulated breast tissue, Bridges told *Microwave News*. Bridges, who holds three patents on the technology, hopes to have a microwave imaging device on the market "in a few years."

The system will have to compete with several other techniques. "There are a lot of promising new technologies," said Dr. Sharyl Nass of the Institute of Medicine's National Cancer Policy Board in Washington. In February, the institute hosted a workshop on new approaches to early breast cancer detection, but Nass said that microwave imaging was not discussed.

Indeed, General Electric Co. has received FDA approval for a new digital mammography system. A company spokesperson said that it will bring "a quantum leap" in X-ray image quality, the March 1 *Wall Street Journal* reported.

The microwave system is essentially a "breast tumor radar," according to Taflove. It consists of a computer linked to an array of small antennas that beam 6 GHz pulsed microwaves.

The peak intensity of the pulses is "a few milliwatts," according to Hagness. At this level, she said, patients' exposure to RF/MW radiation is unlikely to be detrimental.

Normal breast tissue is largely transparent to microwave radiation. In contrast, breast tumors contain more water and scatter microwaves back toward their source. The antenna array picks up these reflected signals, which are analyzed to construct a three-dimensional image showing a tumor's location and size.

The new system cannot as yet distinguish between benign and malignant tumors. This means that, like X-rays, it is prone to false positives. Hagness believes the frequency content of reflected pulses could be used to determine malignancy. She and Kelcz are exploring this possibility. Bridges, too, said that he is working to solve the problem of false positives.

The Far Field



The new magnetic back-brace had unforeseen side effects.

European Grants for Health Research on Mobile Phones and EMFs

In early March, the European Commission (EC) announced details of the five projects on the health impacts of mobile phone radiation and EMFs, funded under its Fifth Framework Program (FP5) for research and development (see *MWN*, J/F99).

A short précis of each project, together with the names and affiliations of the coordinator and participants, appears below.

All five projects are now officially under way, according to Dr. Laurent Bontoux, the EC scientific officer responsible for EMF studies under the FP5's environment and health program.

Bontoux and other members of the EC staff hosted the first meeting of the five project coordinators in Brussels on March 20. A similar meeting will be held next year when the first results of the projects begin to appear, Bontoux told *Microwave News*.

The EC funded only one of three projects supported by the Mobile Manufacturers Forum (MMF) (see *MWN*, J/A99). The project, known as PERFORM-A, will carry out a number of animal-cancer studies using 900 MHz and 1800 MHz mobile phone signals. Peter Harrison, the chair of the MMF, told *Microwave News* that the MMF "is working to find the best way to go forward with noncancer studies." Harrison is with Nokia and is based in Camberley, U.K.

Combined Effects of EMFs with Environmental Carcinogens: Molecular Changes and Genetic Susceptibility (CEMFEC)

To study a) Possible combined effects of RF/MW exposure and known mutagenic agents; b) Whether RF/MW fields similar to those emitted by mobile phones enhance tumor development in a carefully selected animal model; c) RF/MW exposure as a possible enhancer of DNA damage *in vivo*; d) *In vitro* the effects of RF/MW fields, alone or in combination with environmental chemicals, on selected cellular processes related to carcinogenesis and non-genotoxic carcinogenesis.

Coordinator: Jukka Juutilainen, University of Kuopio, Finland. **Participants:** Heinrich Ernst, Fraunhofer Institute of Toxicology and Aerosol Research, Hannover, Germany; Lauri Puranen, Center for Radiation and Nuclear Safety, Helsinki, Finland; Maria Scarfi, National Research Council, Naples, Italy; and Luc Verschaeve, VITO, Mol, Belgium.

Risk Evaluation of Potential Environmental Hazards From Low-Energy EMF Exposure Using Sensitive In Vitro Methods (REFLEX)

The objective is to carry out *in vitro* investigations of molecular and functional responses of living cells to EMFs, covering five relevant research areas: a) Genotoxic effects; b) Effects on differentiation and function of embryonic stem cells and tumor cells; c) Effects on gene expression and targeting; d) Effects on the immune system; e) Effects on cell transformation and apoptosis.

Coordinator: Franz Adlkofer, Foundation for Behavior and Environment, Munich, Germany. **Participants:** Ferdinando Bersani, University of Bologna, Italy; Francesco Clementi, University of Milan, Italy; Wolfgang Fichtner, ETH, Zurich, Switzerland; Oswald Jahn, Clinical University for Internal Medicine, Vienna, Austria; Hans-Albert Kolb, University of Hannover, Germany; Isabelle Lagroye, National University of Chemistry and Physics, Talence, France; Jocelyn Leal, Ramon y Cajal Hospital, Madrid, Spain; Dariusz Leszczynski, Center for Radiation and Nuclear Safety, Helsinki, Finland; Rudolf Tauber,

Benjamin Franklin Clinical University, Berlin, Germany; Anna Wobus, Institute for Plant Genetics and Agricultural Research, Gatersleben, Germany.

In Vivo Research on Possible Health Effects Related To Mobile Telephones and Base Stations: Carcinogenicity Studies in Rodents (PERFORM-A)

The objective is to provide research results on possible carcinogenic and cocarcinogenic effects of RF/MW radiation in animal models: a) Two-year bioassays in Wistar rats with 900 MHz GSM and 1800 MHz PCS radiation; b) Two-year bioassays in B6C3F1 mice with 900 MHz GSM and 1800 MHz PCS radiation; c) Replication of DMBA-initiated breast cancer bioassay in female Sprague-Dawley rats with 900 MHz GSM radiation; d) Replication of lymphoma bioassay in *Pim1* transgenic mice with 900 MHz GSM radiation.

Coordinator: Clemens Dasenbrock, Fraunhofer Institute. **Participants:** Antonio Dotti, RCC Ltd., Itingen, Switzerland; Robert Hruby, Austrian Research Center, Seibersdorf, Austria; Niels Kuster, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland; Germano Oberto, RBM Bioscience, Coleretto Giacosa, Italy; and John Sahalos, University of Thessaloniki, Greece.

International Case-Control Study of Cancer in Relation to Mobile Telephone Use

Multicountry epidemiological case-control study of cellular phone use and tumors of the head and neck, including tumors of the acoustic nerve, the parotid gland and parts of the brain (gliomas and meningiomas). This study will also include Australia, Canada, Israel and the U.S., but the grant is for European study participants only.

Coordinator: Elisabeth Cardis, International Agency for Research on Cancer, Lyon, France. **Participants:** Anssi Auvinen, University of Tampere, Finland; Ray Cartwright, University of Leeds, U.K.; Maria Feychting, Karolinska Institute, Stockholm, Sweden; Martine Hours, University Institute of Occupational Medicine, Lyon, France; Christoffer Johansen, Danish Cancer Society, Copenhagen; Susanna Lagorio, National Institute of Health, Rome; Joachim Schüz, University of Mainz, Germany; and Tore Tynes, Norwegian Radiation Protection Authority, Østera, Norway.

Development of Advice to the EC on the Risk to Health of the General Public from the Use of Security and Similar Devices Employing PEMFs

The objective is the production of an advisory document to the European Commission and member states addressing the issue of possible adverse effects on public health from exposure to pulsed electromagnetic fields (PEMFs) associated with electronic security and similar devices.

Coordinator: Jürgen Bernhardt, German Federal Radiation Protection Office, Oberschleissheim, Germany. **Participants:** Anders Ahlbom, Karolinska Institute, Stockholm, Sweden; Jean-Pierre Césarini, Rothschild Foundation, Paris, France; Martino Grandolfo, National Institute of Health, Rome; Frank de Gruijl, Utrecht University Hospital, Utrecht, The Netherlands; Maila Hietanen, Finnish Institute of Occupational Health, Vantaa, Finland; Rüdiger Matthes, German Federal Radiation Protection Office; Alastair McKinlay, National Radiological Protection Board, Chilton, U.K.; Michael Repacholi, World Health Organization, Geneva, Switzerland; and Laszlo Szabo, National Research Institute for Radiobiology and Radiation Hygiene, Budapest, Hungary.

(see box on p.11).

Koivisto's findings are "exciting," Dr. Alan Preece of the U.K.'s University of Bristol writes in a commentary in the same issue of *NeuroReport*. While Preece has also demonstrated that mobile phone radiation can produce a decrease in some reaction times (see *MWN*, M/A99), he told *Microwave News* that, "Koivisto's tests were more precise."

Meanwhile, German government researchers have found that exposure to mobile phone radiation leads to a significant decrease in a type of brain waves known as "slow brain potentials" (SP) during certain cognitive tests. Significant changes in electroencephalogram (EEG) readings were observed in specific areas of the brain, and the effect was repeated in a second experiment.

The team at the Federal Institute for Occupational Safety and Health in Berlin, led by Dr. Gabriele Freude, did not observe any changes in test performance, but the paper notes that SP are thought to play a role in reaction time. The Freude study appears in the January issue of the *European Journal of Applied Physiology* (see box at right).

Impact on Sleep and Headaches

The latest results are part of a growing body of evidence of possible neurological effects from wireless phone radiation. Last year a leading sleep researcher in Switzerland reported that a GSM signal caused EEG changes during sleep, comparable in size to those produced by melatonin (see *MWN*, N/D99). Volunteers exposed overnight also spent significantly less time awake after they first fell asleep. German scientists have observed changes in both EEG readings and sleep patterns (see *MWN*, M/J94 and M/J98). (With other frequencies and power levels, a Swiss-American team has used nonthermal levels of RF/MW radiation to treat insomnia; see *MWN*, M/J96.)

In 1998 a Swedish-Norwegian study pointed to another possible neurological change when it found that headaches increased significantly with the amount of time spent using a mobile phone (see *MWN*, M/J98).

No studies of cellular phones and brain activity have been carried out in the United States.

While findings of mobile phone effects on the nervous system are increasingly common, so far they do not add up to a coherent picture. The Koivisto and Preece experiments, the only two cognitive studies to date, are the most closely related. But they also differ in some important ways.

"Our basic finding, that RF/MW fields may speed up response times, is similar to the finding of Preece," Koivisto told *Microwave News*. He called the effect "rather surprising."

Preece, however, observed the strongest effect with an analog signal, and a much weaker response with a digital one. Koivisto pointed out that this contrasts with his own results, in which a digital GSM signal produced a clear-cut effect. He said that this might be because Preece's digital signal was only half as strong as that in the Finnish experiment—with an average power of 0.125 W as opposed to 0.25 W. (Koivisto did not use an analog phone.) He also noted that the exposure times were shorter in Preece's tests.

Since analog phones use a continuous signal while a digital signal is pulsed, the former generally has a higher average power.

German EEG Study

Dr. Gabriele Freude's experiments were designed to provoke specific types of brain activity. The first experiment used 20 male volunteers while the second used 19, ranging in age from 21 to 30 years.

A GSM phone with a 916 MHz signal was positioned on the left side of the head, touching the ear. Peak power from the antenna was 2.8 W, with an average power of 0.35 W. The signal was pulsed at 217 Hz with a pulse width of 577 μ s. According to staff from Deutsche Telekom in Darmstadt, SARs did not exceed 1.42 W/Kg averaged over one gram of tissue, or 0.882 W/Kg when averaged over ten grams.

The antenna was radiating during half the trials, and the order of real or sham exposure was varied. Subjects were not aware whether the signal was on or off. While researchers were not similarly "blinded," there was no verbal communication with subjects during the tests.

In both the first and second experiments, volunteers performed a complex visual monitoring task (VMT), which involved pressing a button to stop the hand of a clock as close to "12" as possible after the hand made three revolutions. In the second experiment only, two additional tasks were performed: pressing a key at regular intervals, and stopping the clock hand as soon as possible after it began to move.

In both experiments, performance was not altered by exposure to the GSM signal. But brain activity was: In both cases, slow brain potentials in the VMT task were significantly decreased during GSM exposure.

No EEG changes were observed in the two additional tasks in the second experiment.

Freude's results are presented in the January issue of the *European Journal of Applied Physiology* (81, pp.18-27, 2000).

Preece has suggested that this may account for his observation of a stronger effect with an analog phone.

While both studies found faster reaction times in exposed volunteers, they had different results on some of the same tests. Preece saw no changes in the tests of simple reaction time and vigilance, while Koivisto saw faster responses in both (see box, p.11). "I think the effect was probably there in our experiment," said Preece, "but not sufficient to stand out when analyzed alone." When Preece analyzed all "attentional tasks" (simple reaction time, choice reaction time, and vigilance) together, he found a highly significant decrease ($p=0.007$)—a stronger finding than for choice reaction time alone. "If the other results had been negative, then this result would have been weaker," Preece explained.

On the other hand, Preece and Koivisto had different findings in a test of "two-choice" reaction time. In this test, volunteers are asked to press a button to indicate whether the word flashed on a computer screen is "yes" or "no." In two separate experiments, Preece found that the reactions were faster when volunteers were exposed to mobile phone radiation. But when Koivisto performed the same test, he found no difference at all.

Preece states in his commentary that the two experiments

may involve different regions of the brain. His own RF/MW source was a model of an analog phone with an antenna located about 2 cm higher than in the newer digital models, such as the one used by Koivisto. Since the phone's radiation probably only extends about 2 cm into the brain, Preece writes in *NeuroReport*, this difference in location could mean that a different region of the brain is affected, "which could account for differences in the specific cognition responses."

Speaking at a Bioelectromagnetics Society workshop in Washington on February 4, Preece said that the statistical analysis of the data from his own experiments had been checked by a member of the U.K.'s Independent Expert Group on Mobile Phones, Sir David Cox of the University of Oxford, and that Cox agreed with his conclusions (see also p.14).

The Mechanism: Thermal or Nonthermal?

As to a possible mechanism, Preece concludes that "the weight of the evidence so far is for a small thermal response within normal physiological limits." He notes, however, that a nonthermal response is also possible, via proteins that are produced in response to stress. This would have "implications for long-term responses," he writes.

Freude and her team, however, do not believe that their results were caused by heating. "At the low average power of [0.35

W]," they write, "thermal effects at [the] cortical level can probably be excluded." They state that, "It has generally been accepted that fields not exceeding the energy of thermic noise can become [biologically] effective," but note that "knowledge of the underlying biophysical mechanisms is lacking."

Pointing to research on EMF and RF/MW effects on cell membranes—including on calcium flow, neurotransmitters and the blood-brain barrier—Freude and colleagues state that, "Interactions between mechanisms underlying slow brain potential genesis and pulsed [RF/MW] seem to be plausible at least." But they concede that this evidence "does not provide a satisfactory explanation for the findings reported in this study."

The German researchers found significant changes in EEG during a visual monitoring task (VMT)—specifically changes in slow brain potentials (see box, p.10). Six months later, they write, "this effect was replicated in [a] second experiment."

But the effect was observed only in the VMT task, not in two simpler tasks added in the second experiment. Freude notes that SP are involved in the "stage of information processing related to getting ready...for an activity to reach a particular goal." At a physiological level, she adds, SP can be seen "as an index of the allocation of resources to specific networks for the anticipated task performance."

Freude suggests that pulsed RF/MW signals may "exert an excitatory influence" on brain cells, thus "lowering [the] thresholds for neuron excitation." This would enable the same task to be completed with less need for slow brain potentials to prepare the way. This could explain why the effect observed by Freude showed up in tests that made many demands on the brain, but was not apparent in "lower-demanding" tasks such as repetitive movement of a finger.

The GSM signal produced significant changes in EEGs on both the left and right sides of the brain. Curiously, although the antenna was always positioned on the left side of the head, in both experiments there was a "more pronounced effect" on the right. "Execution and control of behavior do not correspond to single cell activity, but to neuron networks," comments Freude.

Although Koivisto did not record EEG data, he makes a similar point in discussing which areas of the brain are likely to be responsible for the effects that he observed: "Changes in any part of the interconnected system supporting attention may affect the function of other components as well."

Freude told *Microwave News* that her results were unlikely to be due to chance. "The effect is very specific," she said, both in its link to a particular task and in the locations where EEG changes are seen.

Koivisto also believes that his own findings are not just random fluctuations. "In our study," he explained, "the significant RF/MW effects were always in the same direction—speeding up responses—and all observed in attention-demanding tasks. Given this pattern of results, it is very unlikely that our results could be due to chance."

However, Koivisto wrote, "the present study does not allow for conclusions about the possible effects of long-term cellular telephone use on cognition or health." Freude also cautioned that conclusions about "human well-being and health" cannot be drawn from her experiments.

Finnish Reaction Time Study

Dr. Mika Koivisto conducted a series of cognitive tests with 48 volunteers, 24 men and 24 women, between 18 and 49 years of age.

A GSM phone was mounted on the left side of the head, with a 902 MHz signal pulsed at a frequency of 217 Hz, a pulse width of 577 μ s, and an average output power of 0.25 W. The phone's antenna was located about 4 cm away from the head, over the rear of the left temporal lobe.

Each subject went through two test sessions lasting about an hour, one with the phone signal on and the other a control session with no exposure. Half had the control session first, while the other half first had the phone turned on; the order of tasks in each test session was also varied. Subjects did not know whether or not the phone was on, although experimenters did.

Significant differences emerged in three out of fourteen measures, including simple reaction time (pressing a button as soon as a "0" appeared on the screen), vigilance (pressing a button whenever L, M or Y were seen in a series of random letters) and the time needed to compute a simple subtraction problem. With the GSM signal on, the average score on these tests was 9 to 29 ms faster. On the vigilance task, there were also significantly fewer "false alarms" (i.e., pressing the button in response to the wrong letter) when the signal was on.

The tests where no effect was seen included several word recognition tasks and tests of "choice reaction time," such as deciding whether or not a picture showed a familiar object.

The study, which was partially funded by Nokia, appears in the February issue of *NeuroReport* (11, pp.413-415, 2000).

FROM THE FIELD

Letter to the Editor

University of Bristol on Release of Henshaw Study

March 10, 2000

To the Editor:

Prof. Nick Day (*MWN*, J/F00) is wrong about a number of matters, not least how the confusion over the UKCCS [U.K. Childhood Cancer Study] arose. The confusion certainly did not arise from the way the Bristol team put their message across in press releases and at the London press conference on Fews et al. in the *International Journal of Radiation Biology*. I chaired that press conference.

Before inviting Prof. Denis Henshaw to present his team's findings, I made a number of points in very simple terms.

These were:

- a) What we had to report was not a scare story (childhood leukemia is a rare disease).
- b) It was a "good news" story (we were going to reveal a plausible "cause and effect" mechanism that would explain epidemiological associations between power lines and cancer. We might be able in future to avoid these causes).
- c) The mechanism involved some fairly standard physics (people have just not realized what was going on around power lines).
- d) The work was robust (many field experiments) and had been internationally refereed.
- e) It has nothing to do with the UKCCS (which was to be published the next day).
- f) I said our understanding was that that survey would be reporting only on the possible effects of *magnetic fields*. I pointed out that our study was about the very different *electric fields*. Prof. Denis Henshaw then gave a simple, straightforward account of the work in which he, *inter alia*, repeated the points made in my introduction.
- g) After his address, and within a matter of minutes of our open-

ing the meeting for questions, we were facing a barrage of misleading, irrelevant and mischievous questions from power industry spokesmen. They came armed with their own press release and they tried to hijack the press conference.

The following day, Nick Day had his press conference for the UKCCS. His press release carried a headline about power lines and cancer (not the main thrust of the UKCCS report) and asserted that the UKCCS had found no connections. Of course, as we now know, one of the tables in the UKCCS did show such connections and it appears the headline appeared without Prof. Day's knowledge or consent.

The text of the press release was drafted by a small group of three persons: A. Trehearne, Sir Richard Doll and Nick Day. We have no quarrel with the text but the headline [MAJOR STUDY FINDS NO LINK BETWEEN OVERHEAD POWER LINES AND CHILDHOOD CANCER] is identical to that on the Electricity Association website [WORLD'S LARGEST STUDY FINDS "NO LINK BETWEEN OVERHEAD POWER LINES AND CHILDHOOD CANCER"], dated the same day we released our results.

We can only speculate how this all happened and why it continues. We can begin to see how journalists, the public and even some professionals became confused and why the necessary distinction between magnetic fields and electric fields became blurred. There is an old Roman saying much used by lawyers. It is: "*Cui bono?*" I ask it now. Who benefited from the confusion? The answer is a matter of public and scientific importance. It cannot be dismissed as Nick Day has tried to do.

Sincerely,

Don Carleton

Consultant, University of Bristol, U.K.

Microwave News offered Dr. Nick Day of the University of Cambridge an opportunity to reply, but he declined, stating that he would let his results, both published and forthcoming, speak for themselves.

Hot New Papers

René de Seze, Sophie Tuffet, Jacques-Marie Moreau and Bernard Veyret, "Effects of 100 mT Time Varying Magnetic Fields on the Growth of Tumors in Mice," *Bioelectromagnetics*, 21, pp.107-111, February 2000.

"Male and female mice (Balb/c, C3H and C57/bl/6 strains) were exposed for 8 h/day from the onset of tumor until death or until the tumor volume reached a predetermined volume. Statistically significant decrease in the rate of tumor growth and increase in survival were observed in all cases....Much more attention has been given to potential effects of 50/60 Hz environmental fields on tumor promotion. It is important to point out that the fields used in the two situations are very different: ambient magnetic fields are sinusoidal and of low strength (typically below 0.1 μ T), while fields used in tumor treatment are stronger (above 1 mT) and with high values of dB/dt (typically greater than 1 T/s)."

J. Isokorpi et al., "Effect of Power Frequency Harmonics on Magnetic Field Measurements," *Radiation and Environmental Biophysics*, 39, pp.67-71, 2000.

"[P]ower frequency harmonics may have a significant effect on magnetic field measurements. The effect depends on the meter, but in this study the effect was higher at higher magnetic field levels. The order (third or fifth) of the harmonic frequency also affects the results: The

effect was higher at the third than at the fifth harmonic frequency. One possible reason for the difference may be the proximity of the lower cut-off frequency at 50 Hz. The frequency response is probably already curved at power frequency, damping measurement results at 50 Hz, or the harmonic frequencies are overamplified. To obtain correct results for measurements from fields containing harmonic frequencies, the meter response to harmonics should be well specified."

Estelle Naumburg et al., "Prenatal Ultrasound Examinations and Risk of Childhood Leukemia: Case-Control Study," *British Medical Journal*, 320, pp.282-283, January 29, 2000.

"[U]ltrasound has been shown to cause membrane changes that could affect embryogenesis and late prenatal and postnatal development. Studies have also shown an association between exposure to ultrasound and an increased frequency of non-righthandedness, indicating that fetal development may be affected by the ultrasonic waves....[W]e performed a nationwide population based case-control study using prospectively assembled data on prenatal exposure to ultrasound....The risk of lymphatic leukemia was not influenced by either the number of ultrasound examinations or when the examination was performed....The risk of myeloid leukemia was not influenced by the number of ultrasound examinations. A slightly higher, but not significant, risk was seen for those

examined during the second trimester (odds ratio 1.42; [95% confidence interval] 0.88 to 2.29)...We could not detect any association between exposure to ultrasound during pregnancy and lymphatic or myeloid leukemia, and the results of the study are therefore reassuring."

Howard Wey, David Conover et al. (including Greg Lotz), "50 Hz Magnetic Field and Calcium Transients in Jurkat Cells: Results of a Research and Public Information Dissemination (RAPID) Program Study," *Environmental Health Perspectives*, 108, pp.135-140, February 2000.

"Although it is virtually impossible to repeat every detail of an experiment, especially when investigator judgment is a factor, we set out to replicate the results of Lindström et al. ["Intracellular Calcium Oscillations in a T-Cell Line by a Weak 50 Hz Magnetic Field," *Journal of Cellular Physiology*, 156, pp.395-398, 1993]. We selected a magnetic field with the frequency (50 Hz) and flux density (1.5 G) that produced maximum results. We attempted to eliminate selection bias by including all cells that qualified for assessment based on the minimum requirements of Lindström et al. We chose a technique that allowed us to evaluate $[Ca^{2+}]_i$ [intracellular free calcium] transients in hundreds of individual cells. Finally, we replicated our own experiments several times using different microscope objectives. In the end, we found no effect of magnetic fields on $[Ca^{2+}]_i$ transients in Jurkat cells nor did we arrive at a satisfactory explanation for why we were unable to replicate the results of Lindström et al."

J.M. Fink et al., "Microwave Emissions from Police Radar," *American Industrial Hygiene Association Journal*, 60, pp.770-776, November/December 1999.

"54 different radar [units] were evaluated. Of the 986 measurements taken, only 4 exceeded the IRPA and NCRP limit of 5 mW/cm², although none exceeded the ACGIH, ANSI, IEEE and OSHA standard of 10 mW/cm². These four measurements were maximum power density readings taken directly in front of the radar (a place where an officer who has been properly trained would never be). Additionally, it should be noted that three of those readings came from the same gun. Of the 812 measurements taken at the officers' seated ocular and testicular positions, none exceeded 0.04 mW/cm²...Until science has reasonably shown that long-term, low-power exposure is not harmful, it is recommended that prudent avoidance be considered."

NCI Power Line Epi Study: The Analysis Continues

Ruth Kleinerman et al., "Are Children Living Near High-Voltage Power Lines at Increased Risk of Acute Lymphoblastic Leukemia?" *American Journal of Epidemiology*, 151, pp.512-515, March 1, 2000.

"In the National Cancer Institute/Children's Cancer Group case-control study of childhood acute lymphoblastic leukemia (1989-1993), living in a home with a high-voltage wire code was not associated with disease risk. To further investigate risk near power lines, the authors analyzed distance to transmission and three-phase primary distribution lines within 40 m of homes and created an exposure index of distance and strength of multiple power lines (408 case-control pairs). Neither distance nor exposure index was related to risk of childhood acute lymphoblastic leukemia, although both were associated with in-home magnetic field measurements. Residence near high-voltage lines did not increase risk."

Elizabeth Hatch et al., "Do Confounding or Selection Factors of Residential Wiring Codes and Magnetic Fields Distort Findings of Electromagnetic Fields Studies?" *Epidemiology*, 11, pp.189-198, March 2000.

"In summary, our analysis found that selection bias and, to a lesser extent, confounding had detectable effects upon the results. Although several variables were strongly related to both wire codes and measurements, it seems unlikely that confounding alone can explain the findings of previous studies. Selection bias, in contrast, led to a slight overestimate of effect in our study, which was magnified when confounding was also considered, and could explain part of the association between wire codes and childhood leukemia reported in past studies."

See also *MWN*, J/A97, N/D97 and M/J98.

New Books: Short Reviews

Rüdiger Matthes, Eric van Rongen and Michael Repacholi, eds., ***Health Effects of Electromagnetic Fields in the Frequency Range 300 Hz to 10 MHz***, 230 pp., \$33.00 (with shipping), Oberschleissheim, Germany: International Commission on Non-Ionizing Radiation Protection (ICNIRP), 2000. Contact: ICNIRP, Fax: (49+89) 31603289, E-mail: <matthes@bfs.de>, Web: <www.icnirp.de>.

The frequency band just above ELF has largely been ignored by health researchers. In June 1999, ICNIRP and the WHO tried to remedy this situation by sponsoring a seminar on this part of the spectrum in Maastricht, The Netherlands. This volume is a collection of papers presented at the workshop. Unfortunately, little can be said about possible health impacts, because as Dr. Jukka Juutilainen and Tuomo Eskelinen, both of Finland, point out: "There are almost no data about the effects of fields from 20 kHz to 10 MHz"—a conclusion repeated by other participants. There are papers detailing sources of exposure, both in industrial and

military environments, and on exposure standards, though one is left to wonder what the limits are based on.

Nick Begich and James Roderick, ***Earth Rising—The Revolution: Toward a Thousand Years of Peace***, 289 pp., \$17.95, Anchorage, AK: Earthpulse Press, 2000. Contact: (888) 690-1277, Fax: (907) 696-1277, Web: <www.earthpulse.com>.

This book, a follow-up to Begich's exposé of the HAARP project (see *MWN*, M/J94), covers a lot of ground—perhaps too much. There are chapters on non-ionizing radiation health effects, non-lethal weapons, mind control, privacy, "strange" new technologies and much more. The authors have done a great deal of research and have 660 footnotes to show for it. Unfortunately, there are too many references to unreliable secondary sources. Begich and Roderick would have better advanced their goal of focusing more attention on the impact of modern technology if they had had a good editor.

Across the Spectrum

I quite understand how the reassurance from public bodies makes you nervous, since they have been wrong so often when it mattered, but this may be a case where they are right.

—Prof. Ernst Andersen in his weekly Q & A column, “Office E-tiquette,” answering a question on the potential hazards of mobile phone radiation, *Sunday Telegraph* (U.K.), February 13, 2000

“The public trusts national government spokesmen about the same as the tabloids.”

—Dr. Alan Preece, University of Bristol, U.K., speaking at *Radiofrequencies and Modulations Applied in Wireless Communication—Biological Effects and Safety Concerns*, Catholic University of America, Washington, February 4, 2000 (see also p.11)

“My interpretation of the research that’s been done is that there’s no proof that it causes cancer. There’s just no proof that it doesn’t. But there’s no proof, I guess, that bubble gum doesn’t cause cancer.”

—Stan Sigman, Chair, Board of Directors, CTIA, Washington, and CEO, SBC Wireless, San Antonio, on wireless phone safety research, quoted by Tom Kridel in “The Hot Seat,” *Wireless Review*, p.26, February 15, 2000

What wimps. That may well be the verdict future historians deliver on the human race at the dawn of the third millennium....The precautionary “principle” is an environmental neologism, invoked to trump scientific evidence and move directly to banning things they don’t like—biotech, wireless technology, hydrocarbon emissions.

—Editorial, “Fear of the Future,” *Wall Street Journal*, p.A18, February 10, 2000 (see also p.6 and p.17)

Dr. George Carlo, chairman of the former Wireless Technology Research LLC, funded primarily by CTIA, just will not go away.

—Allyson Vaughan, “WTR Head Calls for More Wireless Health Research,” *Wireless Week* (a trade magazine with a close relationship with the CTIA), p.10, March 13, 2000

Motorola is finally shedding its nerdy image and appealing more directly to consumers. About three years ago, Motorola executives noticed that cellular-crazy Italians opened and shut their palms when saying goodbye to friends. It was a shorthand for “Call me,” which inspired Motorola’s famous StarTac clamshell phone.

—Gautam Naik, “Motorola Still Is Struggling in Europe,” *Wall Street Journal*, p.A12, February 11, 2000

Even parents of younger children are buying the phones. On a recent day inside the Pentagon City mall, 12-year-old Angela Booker strapped on her Winnie the Pooh backpack, grabbed her mother’s hand and stepped up to the cellular phone stand. Her cheeks popped into a wide smile. She gazed at a line of phones all designed to meet her preteen tastes: black phones dressed in cotton-candy pink and glow-in-the-dark green covers, some even painted with Disney characters—Goofy, Minnie, Donald. “Mom,” she said, pointing to the phone with the deliriously happy, floppy-eared Pluto, “I want that.”

—Emily Wax, “Cellular Children: Safety Phone Takes Social Turn,” *Washington Post*, p.A17, February 17, 2000

“Bunk.”

—Paul Kurtz of the Committee for the Scientific Investigation of Claims of the Paranormal, Amherst, NY, on claims that EMFs pose health risks — #10 on Kurtz’s list of top ten hoaxes; #1 is alien abductions. Quoted by Dyan Machan in “Bah, Humbug!” *Forbes*, p.100, March 6, 2000

On the Internet

Swimming Rats

Last December, the news media put the spotlight on Dr. Henry Lai’s latest findings showing impaired memory among rats exposed to microwave radiation (see *MWN*, J/F00). In Lai’s experiment, rats must maneuver through a water maze. You can now see them doing their paddling on a video clip posted on <www.junkscience.com>. The news story comes from WNBC-TV in New York City; it was originally aired on February 9 and is archived as the “Video of the Day” for February 29. (Note that WNBC mislabels Lai as Dr. Herschel Shosteck, an independent analyst, who in turn is mislabeled as Lai.)

Wireless Connections

Those surfing the Web to learn about mobile phones and health may come across the Wireless Information Resource Center at <www.wirc.org>. It provides “comprehensive, impartial and objective information” about research on health effects of phones and base stations. The center’s aim is to make “a complex issue clearer,” with the assistance of a “team of neutral scientific advisors.” WIRC’s Board of Directors includes Dr. Daniel Krewski of the University of Ottawa and Mary McBride of the British Columbia Cancer Agency in Vancouver (see also p.6). Jim Ferguson of Victoria, BC, looked up the site at Network Solutions,

the Internet registration service, and found out that the site is registered to the Canadian Wireless Telecommunications Association (CWTA) and that Carrie Moussa, listed as the administrative contact, is vice president for association affairs at the CWTA. Visitors to the CWTA Web site, <www.cwta.ca>, will find a link to the WIRC (there is no link in the other direction however). At the bottom of WIRC’s home page, there is an e-mail address for more information. “We would like to hear from you,” the WIRC encourages. When *Microwave News* asked who sponsored the site, there was no response.

FDA and NIEHS/NTP on RF/MW Testing (Redux)

Soon after we noted how to find the FDA’s nomination of RF/MW radiation for testing under the National Toxicology Program (NTP), it disappeared from the National Institute of Environmental Health Sciences’ (NIEHS) Web site (see *MWN*, N/D 99 and J/F00). Apparently, it was posted prematurely and, when discovered, was removed. On March 2, NIEHS made the nomination official with a notice inviting public comment published in the *Federal Register*, <ntp-server.niehs.nih.gov/htdocs/liason/Dec1399ICCECFR.html>. FDA’s nine-page nomination letter is thus now back on the Web, at <ntp-server.niehs.nih.gov/htdocs/Chem_Background/ExSumPdf/Wireless.pdf>. Comments on the desirability of testing are due April 30.

Conference Calendar

See also our last two issues for many more conference listings.

April 26-27: **COST 259 Workshop: The Mobile Terminal and Human Body Interaction**, Bergen, Norway. Contact: May Krosby, Telenor Research and Development, PO Box 83, N-2027 Kjeller, Norway, (47+63) 84-8341, Fax: (47+63) 81-9810, E-mail: <may-elisabeth.krosby@telenor.com>, Web: <www.telenor.no/fou/om/konferanser/cost259>.

June 8-11: **18th Annual International Symposium on Man and His Environment in Health and Disease: Special Focus on the Environmental Aspects of Cardiovascular Disease and EMF**, Omni Richardson Hotel, Dallas, TX. Contact: American Environmental Health Foundation, 8345 Walnut Hill, Dallas, TX 75231, (800) 428-2343, Fax: (214) 361-2534, E-mail: <aehf@aehf.com>, Web: <www.aehf.com/Symposium/2000symp.htm>.

June 15-21: **10th Annual Conference of the International Society for the Study of Subtle Energies and Energy Medicine (ISSSEEM)**, Boulder, CO. Contact: ISSSEEM, 11005 Ralston Rd., Arvada, CO 80004, (303) 425-4625, Fax: (303) 425-4685, E-mail: <issseem@compuserve.com>, Web: <www.issseem.org>.

July 4-7: **International Congress on Weak and Hyperweak Fields and Radiations in Biology and Medicine**, St. Petersburg, Russia. Contact: Congress Administrative Group, (7+812) 394-7885, Fax: (7+812) 394-2563, E-mail: <ata@2russia.com>, Web: <www.congress.spb.ru>.

August 11-14: **7th Annual Michaelson Research Conference**, Inn at Gig Harbor, WA. Contact: Dr. Eleanor Adair, AFRL/HEDR, 8315 Hawks Rd., Bldg. 1162, Brooks AFB, TX 78235, Fax: (210) 536-3977, E-mail: <Eleanor.Adair@he.brooks.af.mil>.

August 22-25: **2000 International Symposium on Antennas and Propagation (ISAP 2000)**, Fukuoka, Japan. Contact: Toshio Ihara, ISAP 2000, CRL/KARC, 588-2 Iwaoka, Nishi-ku, Kobe 651-2401, Japan, (81+78) 969-2115, Fax: (81+78) 969-2119, E-mail: <isap@karc.crl.go.jp>, Web: <www.crl.go.jp/pub/ISAP2000>.

August 27-September 1: **26th International Congress on Occupational Health**, Singapore. Contact: ICOH 2000 Congress Secretariat, Kent Ridge, PO Box 1076, 911103 Singapore, (65) 874-4988, Fax: (65) 779-1489, Web: <www.icoh.org.sg/icoh2000.htm>.

Meeting Notes

- The *International Conference on Cell Tower Siting*, to be held in Salzburg, Austria, June 7-8, has set up a Web site: <www.land-sbg.gv.at/celltower>.

- On Sunday June 11 in Munich, the day before the Bioelectromagnetics Society (BEMS) annual meeting begins, the U.S. Air Force is hosting *A Forum on RFR Standards Development and Harmonization: Point/Counterpoint*. Among the topics to be covered at this all-day session is the relevance of “so called ‘nonthermal’ effects”—as well as the “rationale for including the precautionary principle in science-based exposure guidelines.” For more information, contact Dr. Michael Murphy at Brooks Air Force Base: <michael.murphy@he.brooks.af.mil>. And on the afternoon of the last day of the meeting, Friday June 16, there will be a public forum on recent and ongoing EMF and RF/MW health research. The BEMS program may soon be posted on the BEMS Web site: <www.bioelectromagnetics.org>.

- Dr. Bengt Knave will present a keynote address on “Electromagnetic Radiation and Health” at the *26th International Congress on Occupational Health* in Singapore this summer (see listing at left). In addition, there will be mini-symposia on ELF EMFs and on RF fields and mobile phones.

October 15-18: **2000 IEEE Conference on Electrical Insulation and Dielectric Phenomena**, Empress Hotel, Victoria, BC, Canada. Contact: Soli Bamji, National Research Council of Canada, Rm. 223, Bldg. M-50, 1500 Montreal Rd., Ottawa, K1A 0R6, Canada, (613) 990-4021, Fax: (613) 952-9366, E-mail: <solibamji@nrc.ca>, Web: <www.eeel.nist.gov/ceidp>.

“MICROWAVE NEWS” FLASHBACK

Years 15 Ago

- The FCC requires applicants to consider the hazards of RF/MW exposure from communications facilities.
- Polish researchers see an association between cancer rates among military personnel and their exposure to RF/MW radiation. According to the study, the risk of developing cancer increases with exposure, rising to 5.5 times the expected rate for those in their 20s.
- New tumors are found in rats exposed to microwave radiation by Dr. Bill Guy at the University of Washington, increasing the statistical significance of the results. The revised tumor counts of exposed rats and controls are 18 and 5, respectively.

Years 10 Ago

- Two new epidemiological studies point to an EMF-brain tumor link, bringing the total number of such studies to 12.
- British electric utility National Grid Co. pressures the BBC into dropping an interview with the Central Electricity Generating Board’s

Dr. Robin Cox in which Cox does not deny health risks associated with living near power lines.

- Dr. Stephen Cleary of Virginia Commonwealth University in Richmond finds that RF/MW radiation at SARs of 5 and 25 W/Kg can cause human brain cancer cells to proliferate at abnormally high rates. At higher SARs, however, cell growth is suppressed.

Years 5 Ago

- Eleven families, represented by famed litigator Joe Jamail, sue Houston Lighting & Power Co., claiming that magnetic fields from power lines and building wiring caused their children’s cancers.
- Citing inadequacies in the experiment’s exposure system, the CTIA’s Scientific Advisory Group on Wireless Technology [later WTR] defers the replication of a Lai-Singh study that shows 2.4 GHz radiation to cause DNA breaks in the brains of rats.
- A Bell Atlantic Mobile employee sues Motorola, charging that the company’s cell phones caused or aggravated her brain tumor.

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PEOPLE

Gloria Parsley will become the interim executive director of the Bioelectromagnetics Society (BEMS) when Dr. **William Wisecup** retires later this year. Parsley has worked with Wisecup and the society for as long as most people can remember. Some BEMS board members would like her to take over the job on a permanent basis....Also at BEMS, Motorola's Dr. **Mays Swicord** has been named editor of the society's bimonthly newsletter. He replaces Dr. **Mary Ellen O'Connor**, who died earlier this year. **Janet Lathrop**, formerly with the now-closed electric utility industry newsletter, *EMF Health & Safety Digest*, will assist Swicord as managing editor....At the end of February, **Dr. John Male** retired from his post as project manager on EMF biological interactions at the U.K.'s National Grid Co. He will continue as administrator of the EMF Biological Research Trust, which is funded by the Grid. The trust has a research budget of about £300,000 (US\$470,000) a year and is currently supporting three projects. Drs. **Ian Glover** and **John Swanson** have taken over Male's duties at the Grid. Glover monitors EMF biological research, while Swanson serves as an expert witness....Dr. **William Bailey** has closed Bailey Research Associates of New York City, long active in EMF and RF/MW health issues (see p.5). He and Dr. **Linda Erdreich** have joined the New York office of **Exponent**, a large consulting firm. Dr. **Michael Kelsh** also works at Exponent, in Menlo Park, CA (see p.7)....*Nature* reported in its February 24 issue that budget cuts at the American Physical Society (APS) may lead to the close of Dr. **Robert Park's** weekly tip-sheet, *What's New*, which is distributed by e-mail and on the Internet. No final decisions have yet been made. Park, who is a frequent critic of EMF health concerns, serves as the APS' Washington lobbyist and is on the faculty of the University of Maryland, College Park. He is the author of *Voodoo Science: The Road from Foolishness to Fraud*, to be published by Oxford University Press this spring.

RF/MW HEALTH STANDARDS

Cherry vs. ICNIRP... Three years ago, New Zealand's Dr. Neil Cherry released a detailed review of the RF/MW health literature and made a case for a human exposure limit in the 0.1-0.01 $\mu\text{W}/\text{cm}^2$ range (see *MWN*, M/A97). Now, Cherry has updated and revised his analysis and, while still favoring the same low exposure standards, he is taking aim directly at the ICNIRP guidelines, which he considers to be "flawed." ICNIRP's limits for public exposures are on the order of 10,000-100,000 times less strict than Cherry's recommendation. Cherry, who is at Lincoln University in Canterbury, accuses the commission of "misquoting results and inappropriately dismissing research results." Specifically, he argues that ICNIRP has ignored "the large volume" of epidemiological studies that show adverse health effects. Last year, Standards New Zealand adopted ICNIRP-based exposure guidelines and the ministries of health and environment urged their "strict application" and an end to more stringent local limits (see *MWN*, S/O99). The full text of *Criticism of the Health Assessment in the ICNIRP Guidelines for Radiofrequency and Microwave Radiation* (100 kHz - 300 GHz) has been posted on Roy Beavers's Web site: <www.emfguru.com>. A 155-page

paper copy of the document may be ordered for US\$30.00 from Dr. Neil Cherry, 46B Kilmarnock St., Christchurch 1, New Zealand, Fax: (64+3) 343-3693, E-mail: <neil.cherry@crc.govt.nz>.

TELECOM TOWERS

Precautionary Approach in Scotland...The Scottish Parliament's Transport and Environment Committee has issued a report that endorses "full planning control" of telecom masts. The committee stated that it was "not convinced" that allowing local control "would significantly slow down the roll-out of the telecom network." In its March 29 report, the committee noted that, "There is currently no conclusive scientific evidence on non-thermal effects," but also pointed to widespread public concerns. Noting that, "There is reasonable doubt about health risks," it recommended that, "A precautionary approach should be adopted at a national level allowing for local flexibility." (See also p.6 and p.14.) The committee called for more health research and stated that, "Areas such as schools, nurseries, hospitals and residential areas may be considered sensitive for environmental health reasons." In addition, it endorsed the U.K. Parliament Select Committee on Science and Technology's call for tightening the NRPB exposure standards by a factor of five (see *MWN*, S/O99). A complete copy of *Report on Inquiry into the Proposals To Introduce New Planning Procedures for Telecommunications Developments* is available on the Internet at the parliament's Web site: <www.scottish.parliament.uk/official_report/cttee/trans-00/trr00-03-01.htm>. The report contains the oral and written testimony from industry, citizen and government groups.

VISIBLE LIGHT

Myopia Not Linked to Light at Night...Last year researchers at the University of Pennsylvania reported that children who slept in a fully lighted room before the age of two were over five times more likely to become nearsighted than those who slept in darkness (see *MWN*, M/J99). Children who slept with a night light showed a smaller increase in risk for myopia, indicating a dose-response effect. But this finding is at odds with two new studies that appear in the March 9 issue of *Nature*, the same journal that published the original report. Of the 1,220 children examined by Dr. Karla Zadnik and colleagues at Ohio State University in Columbus, 20% of those who slept in darkness before age two became nearsighted, compared to 22% of those who slept with lights fully on. Only 17% of those who slept with a night light became myopic. But Zadnik found that if parents were nearsighted, they were much more likely to leave a light on in their children's room at night. "We think this may be due to parents' own poor eyesight," she said, and in *Nature* she suggests that the Pennsylvania study should have controlled for parental myopia. "Parents should be reassured by these results and not concern themselves with this unfounded risk," Zadnik said. The second new study, by Dr. Jane Gwiazda of the New England College of Optometry in Boston, comes to a similar conclusion. Gwiazda found a 20% rate of myopia among both children who slept with a night light and children who slept in darkness. There was no nearsightedness among the small number of her 213 subjects who slept with full room lighting. Here again, when both parents were myopic, the use of ambient lighting at night was

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significantly more common. “Based on these results, we question whether parents need to be concerned about causing myopia in their children by lighting their nurseries at night,” Gwiazda’s group concludes. In a reply in the same issue of *Nature*, Dr. Graham Quinn and the rest of the University of Pennsylvania team argue that no one should be too quick to throw out their findings. “There are major differences among the studies,” they write. “Early-onset myopes, who ultimately tend to become more severely affected, are overrepresented in our...[study] population.” They suggest that the absence of darkness during sleep might yet be found to accelerate the onset of nearsightedness, or to provoke it in a subset of more vulnerable children. Quinn also raises the possibility that the two new studies might be affected by reporting bias: “Our findings received widespread publicity, and parents...[might] underreport a behavior they fear could have harmed their children.” Quinn emphasizes the clear evidence that lighting can affect ocular development in animals, and argues, “Rather than offering reassurance to parents at this time,” the differences in these studies should “guid[e] the design of future research.”

CLARIFICATION

In our last issue (“Across the Spectrum,” p.14), we reprinted a quotation from Motorola’s Norm Sandler that originally appeared in the December 3 Los Angeles *Daily News*. On February 27, Sandler wrote *Microwave News* to state that he had been misquoted by the *Daily News*: “I believe the reporter chose to string together three disparate statements.” Sandler expressed concern that “the final product...might be misconstrued.”

Keeping Current: Follow-Up on the News

◆ The Bioelectromagnetics Society has decided not to award its d’Arsonval Award this year. Last year’s winner was Dr. Nancy Wertheimer (see *MWN*, J/F99).

◆ They’re back. If you thought solar power satellites, designed to beam energy down to Earth with microwaves, were the stuff of the 70s and 80s, check out the cover story of the spring issue of the *EPRI Journal*, “Renewed Interest in Space Solar Power.”

◆ Some have blamed phone towers for interfering with the navigation of homing pigeons (see *MWN*, N/D98). Dr. Jonathan Hagstrum of the U.S. Geological Survey in Menlo Park, CA, believes low frequency sound waves from the Concorde SST are responsible. His theory appears in the *Journal of Experimental Biology* (203, pp.1103-1111, 2000).

◆ For many years, Drs. Robert Pearson and Howard Wachtel have argued that air pollution from road traffic is a more important risk factor for childhood cancer than EMFs. Their argument is presented in a new report (No.TR-114231) from EPRI, which has sponsored their work, and in a paper in the February issue of the *Journal of the Air and Waste Management Association* (50, pp.175-180, 2000).

◆ In Israel, at least 18 people were injured in rioting over cellular towers near Haifa, the March 15 *Jerusalem Post* reported.

Protesters, who blame radiation from the towers for increased cancer in the area, clashed with police, attempted to dismantle antennas and threw rocks at Motorola maintenance workers.

◆ Although the Iridium satellite phone system closed down service on March 17, Motorola will not shut down its long-term animal exposure study using the Iridium signal at the Battelle Pacific Northwest Labs in Richland (see *MWN*, N/D98). “It is something that warrants to be taken to conclusion,” Motorola’s Norm Sandler told us, citing the system’s unique frequency and modulation characteristics.

◆ A demonstration will be held on April 8 at the California State Capitol in Sacramento to protest “electromagnetic harassment and torture.” For more information, contact: <lfmontgomery@excite.com>. See also <www.bestnet.org/~raven1>.

◆ A five-member advisory panel completed its report on the possible health and environmental effects of radar radiation from the U.S. Navy’s Surface Warfare Engineering Facility at Port Hueneme, CA, in mid-March, as we go to press. The report, which has been forwarded to the California Coastal Commission and the navy, was prompted by local residents’ concerns (see *MWN*, N/D99). The commission will review it at a meeting scheduled for April 10 in Long Beach.

VIEWS ON THE NEWS

Dow 10,000—Safety Research 0

The evidence is piling up. It is becoming hard to avoid the conclusion that mobile phones can affect the functioning of the brain.

Two things are most striking about the research that points in this direction, described in our cover story. The first is how much we *don't* know about these simple effects: What causes them? Do they change with long-term exposure? Are they bad for you?

The second is how basic these experiments are. The sort of cognitive studies recently conducted in Finland, Germany and the U.K. could have been done any time in the last decade. And you might think that such research would have been one of the first things on anyone's agenda.

After all, when a device is pumping RF/MW energy into a complex electrical system like the brain, it would seem natural to ask if it changes the way that system works.

Instead, no cognitive studies of mobile phones were done until the last couple of years, and none has ever been done in the United States.

The reason for this failure is not lack of money. While research has languished, wireless companies have prospered. Since the end of December 1992, the market value of just four of the largest wireless companies has increased by \$450 billion. This does not include Nokia—now one of the largest corporations in

Market Capitalization in Billions

	12/31/92	3/24/00	Increase
Ericsson	\$5.4	\$201.4	3,650%
Motorola	\$13.4	\$115.1	759%
Nextel	\$1.2	\$51.9	4,335%
Qualcomm	\$0.5	\$103.8	21,084%
Total	\$20.5	\$472.2	2,215%

Europe—or the major service providers.

In the table above, the first column reflects market values *before* news of the Reynard brain cancer lawsuit was featured on *Larry King Live* on January 12, 1993. That interview sent wireless stocks into a nosedive. If we had taken late January 1993 as the starting point, the increase would be much greater.

Total spending on safety research by the entire wireless industry—by Motorola, Nokia, Wireless Technology Research, *everyone*—adds up to less than one hundredth of one percent of the increase in value of just these four companies.

This illustrates something that we already knew: The industry's safety research effort has been many days late, and many dollars short.

Buddy, Can You Spare a Dime?

Everyone agrees we need more research on the safety of mobile phones—but nobody's making it happen.

Not the CTIA. Not the FDA. Not Congress. We need to take health research out of the deep freeze, and here's an idea how: It's time for a tax.

Just one dime a month for each of the 87 million cellular phone subscribers in the U.S. would net \$103 million a year. Once upon a time, a dime would buy you a local call at the corner pay phone. Those days are long gone, but today that dime could buy answers to the festering questions about wireless safety.

Think a dime is too steep? How about a penny? Taxing the industry one cent per user per month would add up to over \$10 million a year. Over five years, that's more than twice what was given to WTR. And that's for the U.S. alone. A similar tax in Europe would bring us answers even quicker.

These numbers help put one fact in sharp relief: Spending on safety research has been ridiculously small, compared to the financial resources of the wireless industry (see item above). It's been less than pocket change: The amount spent on health research has been more like the lint in the industry's pocket.

A tiny, tiny tax on cellular phone service fees would create a dedicated revenue stream for safety research. But it's not just the amount of money that has prevented progress. Experience shows that health research is too important to leave in commercial hands. Industry-sponsored health research seems to move more slowly than anything else in the wireless world. All too often, its pace is

set by lawyers and PR departments.

This has been a problem even with the wireless industry's best safety research program, the one conducted by Motorola. Unlike other companies, Motorola has shown leadership. The problem is that it has a huge amount of money riding on the outcome.

Both conflicts of interest and the appearance of conflict will be a constant issue with any industry-controlled program. That is why the European Union's expert group on mobile phone safety called for a "firewall" between wireless companies and decisions about research (see *MWN*, M/A97).

What we need is a truly independent research program, directed by public health professionals with no ties to the wireless industry. To be independent, that program needs a guaranteed source of research funds. If the word "tax" gives Congress a headache, just call it a "user fee."

The cost is small. The time is right.

Buddy, can you spare a dime?

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