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## Leading Epidemiologists See Childhood Leukemia Risk at 4 mG

A pooled analysis of raw data from nine different electromagnetic field (EMF) studies has found that children exposed to 4 mG or more were twice as likely to develop leukemia. There was no excess risk at lower exposures.

"The level of [statistical] significance that we see for the excess risk at high exposure makes chance an unlikely explanation," an international team of leading epidemiologists writes in the September issue of the *British Journal of Cancer* (83, pp.692-698, 2000).

Led by Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, the study team includes Drs. Nicholas Day of the U.K., Maria Feychting of Sweden, Martha Linet of the U.S., Mary McBride of Canada, Jörg Michaelis of Germany, Jørgen Olsen of Denmark, Tore Tynes of Norway and Pia Verkasalo of Finland, each of whom has led an important study in his or her own country.

The new findings are similar to those announced last year by Dr. Sander Greenland of the University of California, Los Angeles (see *MWN*, S/O99), in an analysis that combined data from many of the same studies. "It's a pretty consistent picture. It's more consistent than one would have any right to expect, given the differences in how these studies were carried out," Greenland told *Microwave News* this September. "The main point is, you don't see anything until you get into the higher categories." Greenland's findings will be published in the November issue of *Epidemiology*.

The Ahlbom and Greenland papers reflect a growing consensus on the apparent association between magnetic fields and childhood leukemia. But there is no consensus on what those data mean. The question of causation—that is, whether EMF exposure is actually responsible for the observed increase—is

(continued on p.11)

### Views on the News

## What 4 Milligauss Means

A consensus is emerging on EMFs and childhood leukemia that is nothing short of remarkable. Not long ago many people, including well-informed researchers, would have characterized the existing epidemiological studies as a muddle—some finding a health risk, others finding nothing at all. But when the data are pulled together, a different picture emerges: a clear and consistent pattern of significant risks for average exposures above 4 mG.

You wouldn't know it from the mass media, but the evidence for an association between magnetic field exposure and childhood leukemia is now stronger than ever. In particular, it is far stronger than it was in the early 1990s, when newspapers covered the story on the front page.

(continued on p.19)

# HIGHLIGHTS

## **Baltimore Doctor Files Cell Phone–Brain Cancer Lawsuit; His Lawyer Plans a Dozen More by December**

Dr. Christopher Newman, a 41-year-old Baltimore neurologist, has filed a lawsuit charging that his brain tumor was caused by use of a cellular phone. The defendants include Motorola, Verizon, Cellular One and the Cellular Telecommunications Industry Association (CTIA).

Newman's suit is the first mobile phone–brain tumor case since several were filed in the early 1990s (see *MWN*, M/J92, J/A93, J/F94, S/O94, N/D94 and M/A95), and it could signal the beginning of a new wave of legal actions. His lawyer says she plans to file 12 more such cases soon.

In a written statement, Motorola argued that, "The claim of a link between wireless phone use and adverse health effects is groundless." CTIA President Tom Wheeler declared, "There is no public health threat from the use of wireless phones." Verizon, a new company formed through the merger of Bell Atlantic and GTE, did not respond to repeated requests for comment.

"The science just doesn't support these claims," said Curt Renner of Watson & Renner in Washington, attorneys for Cellular One's parent company SBC Communications, Inc. In an interview, Renner observed that, "All previous suits of this type have been dismissed or withdrawn" (see *MWN*, M/J96, S/O97, N/D97 and J/A00).

But Newman's attorney, Joanne Suder of Baltimore, thinks his case is different. "As far as medical opinion goes," she told *Microwave News*, "the work that's been released in the last year is much more definitive than anything that came before it." Suder declined, however, to cite specific studies.

Suder pointed out that Newman's brain tumor is a primary cancer, which is unusual: Most brain cancers have metastasized from elsewhere in the body. Suder also emphasized that, "There's no family history of cancer, or any other cause for it." The complaint, which was filed in state court on August 1, states that Newman used a cellular phone regularly from 1992 until his diagnosis with cancer in March 1998.

Suder noted that many of Newman's calls were in areas of poor signal quality, which she said caused his phone to operate at the higher end of its power range. In an August 9 appearance on CNN's *Larry King Live* (see p.6), Newman said he often used his phone "until the phone got hot...and my ear turned red."

The defendants in the case have petitioned the U.S. District Court in Baltimore to move the suit to federal court. In papers filed August 28, they point out that virtually all of the defendants are based outside of Maryland. Suder said she will fight the effort to remove the case from its current venue, Maryland's Circuit Court for Baltimore City.

In a September 6 interview, Suder said that the other brain cancer suits would be filed "in the next 90 days." She added that she does not plan to combine them into a class action: "Right now we're looking at them one case at a time."

One of these plaintiffs will be Michael Murray of Chicago, a former employee at a Motorola production facility who tested cellular phones. Robert Gordon, a consultant to Suder's firm, told *Microwave News* that the 32-year-old Murray tested 40 phones a day over a nine-year period. Another lawsuit is planned by the widow of Scott Muntean, a Baltimore businessman who died recently at the age of 45. Gordon emphasized that Muntean, Murray and Newman all developed tumors of the same type and that all the tumors were located near the phones' antennas.

Baltimore trial lawyer Peter Angelos, who has won hundreds of millions of dollars in suits against the tobacco and asbestos industries, told *Business Week* (August 14) that he has been approached by several mobile phone users who have developed brain cancer. Angelos said he is now looking at the issue "very intensively," but that he will not take these cases unless he felt he was "90% sure" to win. Angelos did not respond to requests for further comment.

Suder's law office is far smaller than the Angelos firm, and she has far less resources than the wireless companies and industry groups she is suing. "Our clients are seeking help with their expenses," she told *Microwave News*, "and all contributions are welcome." While Suder said she had not been actively searching for a legal partner, "we *have* been talking to people who are interested in bringing their cases to us."

In April, Suder won a \$2.5 million judgment against Johns Hopkins Hospital in a case brought by the parents of a college student who died from an overdose of antidepressants.

### **No Money for RF/MW Programs at EPA**

For the last five years, the Environmental Protection Agency (EPA) has not allocated any money for radiofrequency and microwave (RF/MW) radiation programs. The only EPA budgetary expense has been to assign one staff member, Norbert Hankin, to work on RF/MW radiation half time.

The EPA disclosed details of its RF/MW budget to Sen. Joseph Lieberman (D-CT) after the senator wrote to EPA Administrator Carol Browner on May 9 seeking details of the agency's RF/MW activities.

In a July 5 response, Assistant Administrator Dr. Norine Noonan stated that, at present, "EPA has no current or pending research studies on RF radiation health effects."

Five years ago, a Senate panel cut \$350,000 from EPA's budget with instructions that "EPA should not engage in EMF activities" (see *MWN*, S/O95). While the Senate panel appears to have been targeting work on power frequencies, the agency also stopped spending any more money on RF/MW radiation programs. (Staff and financial allocations are treated as separate items in agency budgets.)

"My primary job is to keep the agency's managers and policymakers aware of what's going on with EMF and RF/MW issues," Hankin told *Microwave News*.

Lieberman, who is now a candidate for the U.S. vice presidency, asked the General Accounting Office to investigate the status of mobile phone safety research last October (see *MWN*, N/D99). In 1992, Lieberman chaired a hearing on the health risks of police radar guns (see *MWN*, S/O92).

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## New Tests Show Hands-Free Sets Do Reduce SARs, But U.K. Consumer Group Admits No Error

The use of hands-free sets with mobile phones does in fact lead to much lower radiation exposures in the head, according to tests commissioned by the U.K. Department of Trade and Industry (DTI) and the Australian Consumers' Association (ACA). Hands-free sets "offer very substantial reductions in [specific absorption rate (SAR)] compared to the normal use of a mobile phone held against the ear," concluded SARTest Ltd., in its report\* for the DTI, released in early August.

The new test results are the latest to cast doubt on the well-publicized warning from the U.K. Consumers' Association (CA) that hands-free sets can triple the radiation exposure from a hand-held mobile phone. The CA announced its concerns in the April issue of its magazine, *Which?* (see *MWN*, M/J00).

The ACA assessment,† carried out by EMC Technologies Pty. Ltd. in Melbourne, found that hands-free sets reduce SARs by 92%. Even though its results conflict with those of its U.K. counterpart, the ACA did not say its approach was the correct one. Rather, it emphasized "the need for ongoing study."

The U.K. CA itself is not making any concessions. "We stand by our original test results," said Helen Parker, the editor of *Which?*

Kate Levine of the CA's media office in London pointed out that the CA and the ACA had used different phones, different hands-free kits and different testing methods. "It's not possible to compare like with like," she told *Microwave News*. "It is clear, therefore, that more research is needed to help resolve the differences," she said.

Some observers are speculating that the probes used by ERA Technology Ltd. to measure the electric fields in the CA tests were inappropriate—which led to the erroneous conclusion that hands-free sets magnify radiation exposures. This possibility is now being explored in various U.K. testing labs.

Patricia Hewitt, DTI's Minister for e-Commerce, called for "clear and unambiguous advice" on the use of hands-free sets when she released the SARTest report. But plenty of confusion persisted.

MOBILE PHONES SAFETY MUDDLE blared the *Daily Mail*'s front-page headline on August 8. That same day, the *Guardian*'s science correspondent wrote: "If mobile manufacturers, the Consumers' Association and the government had got together to work out how they could sow the greatest possible confusion in the public's mind about the safety of mobile phones, they could not have done a better job."

And in Germany, the consumer-products testing magazine *Öko-Test* issued its own warning on the use of hands-free sets in August. Without disclosing precisely what had been measured (electric fields or SARs), *Öko-Test* reported that there was enough

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\*The SARTest report, *SAR Tests on Mobile Phones Used With and Without Personal Hands-Free Kits* (No.0083), is available at: <[www.dti.gov.uk/cii/sartest.pdf](http://www.dti.gov.uk/cii/sartest.pdf)>. Similar SARTest reports commissioned by Vodaphone and by One2One are also on the Internet, at <[www.sartest.com](http://www.sartest.com)>.

†The EMC Technologies report, *SAR Measurements on Mobile Phones With Hands-Free Kits* (No.M000515R), is available from the ACA for Aus\$8.25 (approximately US\$4.50). For ordering information, go to <[www.choice.com.au/articles/a100378p1.htm](http://www.choice.com.au/articles/a100378p1.htm)> and click on "Is Hands-Free Safer?"

### Mobile Phone Worn at Waist Can Exceed SAR Limits

Limits for exposures to mobile phone radiation can be exceeded when a hands-free set is used and the phone is worn on the waist, according to measurements done for the Australian Consumers' Association.

A Nokia 252 analog phone had an SAR of 4.42 W/Kg at the waist when measured over 1g of tissue (SAR<sub>1g</sub>) and 2.69 W/Kg when averaged over 10g. These SARs are approximately twice those found in the head if the phone is used without a hands-free set. They exceed the Australian, U.S. FCC and ICNIRP limits.

In its July 14 report to the association, EMC Technologies explains that, "The high SAR values are due to the very close proximity of the phone antenna to the body."

Chris Zombolas, EMC Technologies' technical director, told *Microwave News* that these SARs are worst-case estimates which would be lower if the phone were attached to a belt clip and thus moved away from the body. But, he added, "Even when a belt clip is used, the phone antenna will often be touching the body when the wearer is bending and not upright."

The U.K. report from SARTest recommends that phones be placed with the keypad facing the body to reduce the user's SAR. Dr. Mike Manning of SARTest told *Microwave News* that this orientation would ensure that the antenna is furthest away from the user's body. He noted that in most cases this is true whether the phone has an external or internal antenna.

EMC Technologies also tested two GSM digital phones. An Ericsson A1018s had an SAR<sub>1g</sub> at the waist of 1.56 W/Kg, which was nearly twice as high as when the phone was placed next to the head. A Nokia 5110 had a waist SAR<sub>1g</sub> of 1.38 W/Kg, compared to 1.14 W/Kg in normal use. The uncertainty of the measurement system is ±23.5%.

radiation being channeled into the ear that it would not advise their use.

The CA has asked ERA Technology in Leatherhead, U.K., which did the CA's original measurements, to repeat them. The new tests should be completed soon, according to Thalia Thomas, CA's services manager in London.

CA's Levine said that due to the intense interest in the safety of hands-free sets, the findings will be released to the public as soon as they are ready, even before they are published in *Which?*

In its report, SARTest notes that the SARs can be reduced even further when a ferrite suppressor is clipped onto the hands-free set's cable. Such suppressors are the same as those fitted onto the cords of computer monitors and digital cameras, according to SARTest's Dr. Mike Manning, who did the measurements for DTI with Dr. Camelia Gabriel. SARTest is located in Newdigate, just south of London.

## HIGHLIGHTS

Problems associated with measurement and testing will be addressed at a November 16 conference at Blenheim Palace, organized by the U.K. EMC Test Labs Association and *Approval* magazine. For more information, contact Adrian MacLeod at *Approval*, (44+1732) 746616, Fax: (44+1732) 746617, E-mail: <sar@approval.co.uk>. The program for the meeting will be posted at: <www.approval.co.uk>.

### **Case Reports of Cancer Among Radar-Exposed Workers in Israel**

Six case reports of cancer among radar technicians and radar operators in Israel are presented in the July issue of the *International Journal of Occupational and Environmental Health* (6, pp.187-193, 2000), in a paper by Dr. Elihu Richter and colleagues at Hebrew University in Jerusalem.

Dr. Arthur Upton, former head of the U.S. National Cancer Institute, told *Microwave News* that Richter's case reports "underscore what would appear to be a glaring problem, one that deserves further attention and study." Upton is currently with the Consortium for Risk Evaluation with Stakeholder Participation in New Brunswick, NJ.

Richter writes that, "There was a striking degree of consistency in the preliminary information we received from these in-

dividuals on their high exposures [and] the absence of monitoring and safeguards." Technicians reported working directly in the path of a radar beam "for periods lasting several minutes," or even working directly on top of a radar dish while it was transmitting.

One radar technician examined by Richter who was diagnosed with non-Hodgkin's lymphoma at the age of 26, after eight years of high exposure, told Richter that several other people at the same work site also had cancer. From interviews with this worker and his supervisor, Richter learned that seven out of the 25 workers in this unit had developed cancer. All had been employed there for more than three years; most were younger than 30. Five workers had leukemia or lymphomas. One had brain cancer, as did another who was not included because of incomplete information.

Studies of radar-exposed personnel in the Polish military by Dr. Stanislaw Szmigielski have found significantly higher rates of leukemia and lymphoma (see *MWN*, M/J95). Among young men, these risks were eight times higher than expected. Szmigielski also found a significant increase in the risk of brain cancer, compared to unexposed personnel.

Szmigielski later reported that his data indicate such cancers may "develop faster, with a shorter latency period," as a result of RF/MW exposure (see *MWN*, J/F98). Richter suggests that the same may be true of the cases he describes.

### **On the Newsstand: Recommended Reading**

- Electromog will continue to intensify as engineers find new ways to make more efficient use of the available radio spectrum. In the August 19 *New Scientist* (pp.34-37) Justin Mullins looks at such a system: the use of multiple broadcast antennas and receivers to significantly speed up data transmission in urban areas. For instance, he describes how using a dozen antennas at each end makes it possible to send data up to 20 times faster. The article is titled RADIO BLAST, short for Bell Labs layered space-time.

- Dr. Elaine Scarry is still on the EMI beat. Two years ago, the Harvard literature professor called for an investigation into the possibility that electromagnetic radiation from military sources caused the explosion of TWA 800 (see *MWN*, M/A98). Scarry has now looked into two more jet crashes and sees disquieting parallels with TWA 800. Writing in the September 21 *New York Review of Books*—SWISSAIR 111, TWA 800 AND ELECTROMAGNETIC INTERFERENCE—she lists parallels between the two catastrophes: "(1) they took off from the same airport; (2) they took off on a Wednesday at 8:19; (3) they travelled along the [same] route; (4) they both had their first signs of trouble in the same region of airspace between 12 and 14 minutes into the flight; (5) they both appear to have suffered an electrical catastrophe; (6) they both suffered a catastrophe whose cause remains mysterious, even after years of rigorous inquiry; (7) they both flew during a week when extensive military exercises were being conducted; (8) they both flew when certain specific transmitters (submarines, the Navy P3s) appear to have been in the region." Scarry highlights the little-known fact that Swissair 111 had an un-

plained 13-minute radio blackout at the same time and place as the explosion of TWA 800. In the October 5 issue of the *Review*, Scarry addresses THE FALL OF EGYPTAIR 990 and argues that a number of adverse events, including the disconnection of the autopilot and the plane's steep dive, are "consistent" with EMI. Scarry, who is best known for her book, *The Body in Pain*, presents no evidence of any specific EM signals that could have damaged the electronics of either of the jets. At minimum, Scarry wants a "comprehensive review of the external electromagnetic environment," which she writes, "has still to be carried out for the three planes that have since July 1996 crashed after leaving JFK Airport." The full text of Scarry's two-part series, complete with copious footnotes, is also at <www.nybooks.com/nyrev>.

- *The Economist*, September 9, has an update on the continuing tensions between telecom companies and astronomers over light pollution (GOING, GOING, NEARLY GONE, pp.99-100). The astronomers won a round with the financial death of the Iridium system (see *MWN*, J/A98). The article contains the following startling fact: "A single cell phone on the moon...would broadcast the fourth-strongest signal among all those that are beamed out by astronomical sources."

- With cell phone lawsuits back in the courts, three articles in the summer 2000 *Issues in Science and Technology* on science and the law are of special relevance. Especially informative is EXPERT TESTIMONY: THE SUPREME COURT'S RULES by Margaret Berger, a professor at Brooklyn Law School in New York City, on the *Daubert* ruling and other key decisions. The articles are available online at: <www.nap.edu/issues>.

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## Standards Watch

### Cell Phone Test Protocol Gets Closer

The IEEE subcommittee that has been developing a standard protocol for measuring SARs from wireless phones is coming into the home stretch—or so its members hope. At a meeting at FCC headquarters in Washington, September 25-26, SCC-34/SC-2 worked toward an agreement on a long list of technical issues. The most important debates focused on the correct design for a “phantom head,” within which a probe is moved to take radiation measurements, and on the proper position for phones during testing. “Everyone seemed to be reasonably happy about what came out,” said Kwok Chan of the FCC’s labs in Columbia, MD, “but it all needs to get put down on paper.” The various changes will be combined at an editorial meeting scheduled for October 13-14, with a revised draft protocol sent out for balloting ten days later. Ballots will be due by November 7, and the next full meeting of the subcommittee will be held December 7-8.

### SCC-28/SC-4 Okays Ear as “Extremity”

By a vote of 48-1, with 3 abstentions, subcommittee 4 of SCC-28 has agreed to reclassify the human ear as an “extremity.” This increases the exposure limits for the ear from a mobile phone from 1.6 W/Kg averaged over 1g to 4.0 W/Kg averaged over 10g. The move to change the limit was prompted by measurements showing that, under current definitions, many phones violated the FCC standards (see *MWN*, N/D99). The proposed change must now be approved by the full SCC-28 membership.

### NEMA Wants IEEE-ICNIRP Joint Standard

The U.S. National Electrical Manufacturers Association (NEMA) wants ICNIRP and the IEEE to develop common standards for exposures to EMFs and RF/MW radiation. NEMA representatives spelled out their concerns about the ICNIRP limits at a July 14 meeting with Charles Ludolph, a senior official at the U.S. Department of Commerce, and in “talking points” submitted to Ludolph soon afterwards. Specifically, NEMA contends that ICNIRP’s limits are too stringent. According to its newsletter, *electroindustry* (August 15), NEMA wants the European Union (EU) to support a “standards harmonization collaboration” between ICNIRP and the IEEE and asked Ludolph to present its case during an upcoming visit to Brussels. Noting that the EU’s 1999 recommendation chose ICNIRP’s limits as the basis for a common European standard (see *MWN*, J/A99), NEMA sought a delay in implementing the recommendation “until a harmonized standard can be completed.” The talking points argue that comparable IEEE limits are “significantly less restrictive” than ICNIRP’s, which it warns “will raise trade barriers.” But, in an interview with *Microwave News*, Steinar Dale, one of those who met with Ludolph, downplayed U.S. industry’s problems with the ICNIRP limits. “Our main concern is to harmonize standards,” he said, speaking from his office at ABB Power T&D Co. in Raleigh, NC. Asked whether ICNIRP or the IEEE should give ground to achieve common limits, he replied that, “There will have to be a meeting in the middle somewhere.” Dale

### Belgians Favor Precautionary Limits for Tower Radiation

The regional government of Brussels is moving toward a 3 V/m standard for radiation exposures from telecom towers. This would be even lower than comparable rules in Italy and Switzerland, currently the strictest in Europe (see *MWN*, J/F00).

The Ministry for Health and Environment of Brussels announced a “preliminary draft ordinance” for GSM mobile phone base stations and “similar” sources, including radio and TV transmitters, on July 13. The proposed limit (equivalent to 2.4  $\mu\text{W}/\text{cm}^2$ ) is based on the precautionary principle, according to the ministry’s press release. Officials conceded that it is “extremely strict” and stressed that it is intended to provide a “basis for discussion.”

A week later, the government of Belgium’s Walloon region adopted a 3 V/m limit as part of a “code of good practice” for the siting of GSM antennas.

Initially, the Brussels ordinance was to apply only to mobile phone towers. That changed, however, after officials asked the WHO International EMF Project in Geneva to review the proposal. “It seemed incomplete to single out base stations when they are low-level emitters,” Dr. Michael Repacholi, director of the EMF project, told *Microwave News*. Repacholi has argued against setting standards on the basis of the precautionary principle (see *MWN*, M/J00).

At present, Belgium has no legally binding RF/MW exposure rules. Regional and federal governments are engaged in a “dialogue” to clarify who has regulatory authority, a spokesperson for the Belgian Institute for Postal Services and Telecommunications told *Microwave News*.

heads NEMA’s EMF task force, which decided earlier this year to push for a joint ICNIRP-IEEE standard.

### International Standards Council

Discussions are under way to bring IEEE’s committees SCC-28 and SCC-34 under one umbrella group. They may soon be part of the International Council on Electromagnetic Safety (Standards). Ronald Petersen of Lucent Technologies in Murray Hill, NJ, who plays a major role in each group, told *Microwave News* that this new name would be “more descriptive of the things we do,” but added that the change is still under discussion. Petersen noted that the IEEE Standards Board would have to approve any such changes.

### SCC-28 Closes Meeting to the Press

The leadership of SCC-28 refused to allow *Microwave News* to attend a September working group meeting convened to revise its RF/MW exposure limits. Drs. C.K. Chou of Motorola and John Osepchuk, formerly of Raytheon, argued that, “The presence of the press is detrimental to free discussion.”

« Wireless Notes »

In early 1999, WTR's Dr. **George Carlo** began issuing public warnings about genetic changes from cell phone radiation. Researchers from **Integrated Laboratory Systems (ILS)** in Research Triangle Park, NC, provided details that March at a meeting of the Environmental Mutagen Society, and again at a WTR workshop three months later (see *MWN*, M/A99 and J/A99). A year ago, the **FDA** and the **CTIA** announced that they would work together to follow up these results (see *MWN*, N/D99). In June 2000, a formal FDA-CTIA agreement was signed, and on August 1-2 the **RF Micronucleus Working Group** met to plan further studies (see *MWN*, J/A00). The ILS research has been drawing media attention for over a year and a half and has now become the subject of a legally binding agreement between the wireless industry and the U.S. government—so some eyebrows were raised when ILS' Dr. **Ray Tice** told the FDA-CTIA working group that the first paper on the micronucleus findings had only been submitted for publication "at the end of last week." When asked about the delay, Dr. **Graham Hook**, the paper's lead author, replied that, "Too often experimental data is rushed into publication." Hook noted that, "Appropriate efforts and time must be taken to assure that work that is submitted for publication be of top quality, reproducible and as complete as possible." Hook, formerly with WTR, is now at ILS. It will be some time before the paper is actually available—the paper was submitted to *Bioelectromagnetics*, which is not known for a speedy publication schedule.

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The Food and Drug Administration's (**FDA**) Center for Devices and Radiological Health (**CDRH**) has long been reticent about making public statements on radiation health risks. So it was somewhat surprising that Dr. **David Feigal**, director of the CDRH, agreed to be on **CNN's Larry King Live** to talk about cell phones and brain cancer. (CNN was so eager to have him that the show was delayed from an original July air date until August 9 to accommodate Feigal's schedule.) Dr. Christopher Newman and his attorney, Joanne Suder, were also on the show that night to discuss their lawsuit alleging that cell phones caused Newman's brain tumor (see p.2). But Feigal had insisted that he appear separately and the last ten minutes of the show were devoted to a one-on-one exchange with King. Feigal is no stranger to controversy, having previously headed up FDA's work on antiviral drugs (such as AIDS treatments), and he managed to dodge most of King's questions. For instance, when King asked "Are we spending enough" on health research, Feigal answered, "It's a difficult answer to say what's enough." Feigal said that he used his cell phone about 20 minutes a day, and in closing the interview, King asked: "And you would use yours again for 20 minutes tomorrow?" to which Feigal responded: "I certainly—I need to do that, yes."

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**FDA's** wireless research effort has drawn fire from an unusual source. In an August 14 commentary, *Business Week* called the FDA-CTIA initiative "flawed." The magazine argued that, "It's

**Controversy Before Release of German Cell Tower-Cow Study**

Controversy has flared in Germany over a study of the health of dairy cattle housed near mobile phone antennas.

The study's findings are "explosive," the nationally broadcast TV news magazine *Report Mainz* claimed on August 21. The program said it had obtained partial results which showed that, "There were clearly more deformities and the animals behaved differently" at the farms with antennas nearby than at the other sites. The behavioral effects are similar to those associated with chronic stress, it reported.

The Bavarian state Ministry for Land Development and the Environment, which is in charge of the investigation, responded the next day that the broadcast was "not credible" since the study was not yet complete. The ministry said that it expects to have final results in late October.

A knowledgeable source told *Microwave News* that a confidential draft of the report details behavioral effects similar to those described on TV and that the investigators had found a higher rate of reproductive problems in the exposed herds.

The study, which began in 1998, probed the behavior, milk output and reproductive health of herds at 38 farms, some near wireless base stations and others not (see *MWN*, J/A98). It was projected to cost approximately 700,000 marks (US\$300,000).

Dr. Jutta Brix of the Federal Radiation Protection Office in Oberschleißheim declined to comment to *Microwave News*. A statement on wireless phone systems issued by the office earlier this year maintains that, based on current evidence, there is no danger of negative health effects from exposures within Germany's ICNIRP-based limits.

troubling that the industry is picking up the bill and will choose which projects receive funding" (see *MWN*, J/A00). *Business Week* closed with: "Only well-designed and supervised science will tell us whether and how cell phones affect human cells—and calm consumers' increasingly frayed nerves" (see also p.15). Those frayed nerves were in evidence in Australia, where just a few days earlier, the **Australian Consumers' Association** issued a press release titled MORE RESEARCH NEEDED ON MOBILE PHONE SAFETY (see p.3).

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**California** state Senator **Tom Hayden's** bill calling for a review of research on possible health effects of mobile phones is dead. "It's toe-tag time," Hayden aide Rocky Rushing told *Microwave News*. The bill, SB1699, which passed the Senate in May, was placed on hold by the Appropriations Committee of the Assembly in August. Any further action must now wait until the legislature's next session—but by then, Hayden will no longer be in the Senate. (Under California's term limit law Hayden cannot run again.) SB1699 originally would have required stores to post

health advisories and offer earpieces with phones (see *MWN*, M/A00). When it reached the assembly, however, these provisions had been cut (see *MWN*, M/J00). The California Council on Wireless Technology Impacts is looking for another sponsor for the bill.

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Citizen groups are asking the U.S. **Supreme Court** to restore state and local authority to adopt strict RF/MW exposure standards. They argue that the **1996 Telecom Act's** preemption clause violates the Constitution and should be set aside. "The Tenth Amendment precludes Congress from treating state and local legislative bodies as puppets on a federal string," write **Whitney North Seymour Jr.** and Peter Clines of Landy & Seymour in New York City in a brief filed on September 7. They also ask the court to overturn the FCC's RF/MW exposure limits. Noting the lack of any funding for RF/MW research at the EPA (see p.2), they argue that the federal government has not fulfilled its responsibility to ensure that such limits are based on adequate research. Seymour, formerly a U.S. District Attorney for New York, is representing Citizens for the Appropriate Placement of Telecommunications Facilities. The group (previously known as the Ad Hoc Association) lost its last round in court when an appeals panel upheld federal preemption and the FCC exposure rules (see *MWN*, M/A00). Seymour will be among the speakers at a forum on health questions and zoning issues related to cellu-

### **WHO Director Has a Watchful Eye On International EMF Project**

Dr. Gro Harlem Brundtland, the director-general of the World Health Organization (WHO), is "personally interested" in possible health effects of non-ionizing radiation. That's what Dr. Michael Repacholi, director of the WHO International EMF Project in Geneva, told the Australian Senate in Canberra on August 31 (see also p.15).

At the hearing, Sen. Lyn Allison, chair of an inquiry into possible health effects of mobile phones (see *MWN*, J/F00), suggested that the EMF project had been "premature" in issuing fact sheets on radiation effects. "There remains quite a lot of uncertainty" in this area, Allison said.

Repacholi responded that Brundtland had personally reviewed the fact sheet on mobile phones and base stations released in June (see *MWN*, J/A00) and had approved the statement, but had done so "begrudgingly on some points."

When asked by *Microwave News* about Brundtland's reservations, Repacholi replied that she felt "the EMF project should progress further before issuing the fact sheet" but, in the end, she realized that "governments need to have current information" on possible hazards. Brundtland "is concerned that there may be a problem with EMFs and is keen to see the issue properly resolved," he added.

In his testimony, Repacholi said Brundtland is satisfied that the fact sheet represents "the international consensus" on the question. To date, Brundtland has not made any public statement on non-ionizing radiation, according to a WHO spokesperson.

lar tower siting in Litchfield, CT, on December 2. Others expected to participate include EPA's Dr. **Carl Blackman** and FCC's Dr. **Robert Cleveland**, according to **Blake Levitt**, an author who is helping to organize the event. The target audience is planning and zoning officials; attendance costs \$35.00. For more information on *Cell Towers Forum: State of the Science/State of the Law*, contact the Berkshire-Litchfield Environmental Council at (860) 435-2004.

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Four representatives of the **Australian Mobile Telecommunications Association** (AMTA) appeared before a panel of the Australian Senate when it held a second hearing on September 8. (This is the same committee that heard testimony from Dr. Michael Repacholi on August 31; see box at left.) David Havyatt outlined three recent AMTA initiatives: (1) the creation of a national collocation task force; (2) the release of a "code of conduct" for the siting of wireless towers "to reinforce the precautionary principles that already apply"; and (3) the development of a *Know Your Rights* booklet on tower siting for the public. Alex Gosman, the chair of AMTA's Electromagnetic Energy Committee, said that the association had engaged Dr. **John Moulder** of the Medical College of Wisconsin to present the scientific evidence relating to cancer to the Senate. Moulder played a similar role for the **Federation of the Electronics Industry** (FEI) in the U.K., preparing FEI's submission to the Stewart inquiry on mobile phones (see *MWN*, M/J00). The full transcripts of the August 31 and September 8 hearings are available at: <[www.aph.gov.au/hansard/senate/commtee/s-ecita.htm](http://www.aph.gov.au/hansard/senate/commtee/s-ecita.htm)>.

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Drs. **Bruce Hocking** and **Rod Westerman** have reported that a 72-year-old businessman developed **dysaesthesiae**—a tingling sensation—on his scalp after using a GSM mobile phone. Writing in the July issue of *Occupational Medicine* (50, pp.366-388, 2000), the two Australian physicians argue that the occurrence of this type of neurological abnormality "questions the current view that all health effects of [RF] radiation are due to thermal (heating) effects." They believe this case is "evidence for non-thermal mechanisms of injury in humans." Hocking, an occupational health doctor, was the first to publish a paper on headaches and other types of symptoms among mobile phone users (see *MWN*, N/D98; also p.16). Westerman is a clinical neurophysiologist.

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Dr. **George Carlo** has teamed up with syndicated columnist **Martin Schram** to write what their publisher calls a "gripping narrative of scientific detection that chronicles an unprecedented journey of discovery...into the impact of cell phones on human health." *Cell Phones: Invisible Hazards in the Wireless Age: An Insider's Alarming Discoveries About Cancer and Genetic Damage* is due out in January from Carroll & Graf in New York City. The book will give details of industry's "whispering campaign" that sought to discredit Carlo and of Carlo's "plea that cell phones not be marketed to children." Carroll & Graf promises that Carlo and Schram's opus "is destined to be placed alongside such classics as *Silent Spring*."

## **EMF Exposure May Lead to Dramatic Change in Heart Rate**

Magnetic field exposure during sleep can cause a dramatic decrease in heart rate and changes in heart-rate variability (HRV), according to new experimental results from the Midwest Research Institute (MRI) in Kansas City, MO. The study is the latest to focus on how EMFs may affect the electrical activity of the human heart.

Five hours into the experiment the nine men in the EMF-exposed group had an average heart rate of 50.7 beats per minute, compared to 60.3 beats per minute among the nine controls.

The researchers—Drs. Antonio Sastre, Charles Graham and Mary Cook—have previously linked EMF exposure to significant changes in HRV, which reflects the interaction of reflexes controlling blood pressure, body temperature and breathing (see *MWN*, J/A98). Reductions in HRV are associated with certain types of heart disease, and HRV measurements are used by cardiologists as a diagnostic tool.

The reduction in heart rate is a new observation, which the MRI team attributes to the lower frequency of the field used in this experiment. Their previous work used 60 Hz fields, but in this study they used a 16 Hz magnetic field—a frequency produced by the brain itself, in a band associated with regulation of blood pressure and body temperature.

In a paper detailing the new results, to be published soon in *Clinical Neurophysiology*, Sastre and colleagues write that their data “rule out a direct effect” on the heart itself, and that, “Biophysical calculations of the intensity of the electric fields induced” by magnetic field exposure also “argue for a central nervous system site of action rather than a cardiac one.”

“One thing that’s interesting about our findings at 16 Hz,” Sastre told *Microwave News*, “is that in some parts of Europe, trains run at 16.6 Hz—in Sweden, Norway, Germany, Switzerland and part of Italy. So conductors and other train workers have extremely high exposures to the very fields that we studied.”

The MRI researchers caused a stir two years ago when they predicted, based on their earlier HRV studies, that EMF exposure could increase the risk of certain specific types of heart disease—a prediction that was borne out in a utility worker study by Dr. David Savitz (see *MWN*, J/A98). Almost immediately thereafter, Dr. Jack Sahl began work on a comparable study of workers at Southern California Edison (SCE) (see *MWN*, S/O98). In an interview this September, Sahl said he expects to submit his results for publication soon, but declined to discuss what he had found. Formerly employed by SCE, Sahl is now a consultant based in Upland, CA.

In a paper published in *Environmental Health Perspectives* (108, pp.737-742, 2000), as well as two papers in the September *Bioelectromagnetics* (21, pp.413-421 and 480-482, 2000), the MRI researchers examine some apparent inconsistencies in their past results. They conclude that 60 Hz EMFs only affect HRV when sleep is disturbed.

“We have been telling funding agencies for years that we should do a study during the day,” Sastre told *Microwave News*. The MRI researchers have proposed both a study of workers in

a high-EMF environment, using halter monitors, and a study of people awake but at rest in a laboratory setting. While such research could be especially relevant to epidemiological findings on occupational EMF exposure and cardiac disease, Sastre said that, “So far there’s been interest—but no money.”

## **Stronger ALS–EMF Connection; New Link to Epilepsy Observed**

A new Danish study strengthens the case for a link between EMF exposure and amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig’s disease. The study also presents the first epidemiological evidence of a connection between EMFs and epilepsy.

Dr. Cristoffer Johansen of the Danish Cancer Society in Copenhagen examined the incidence of neurological diseases among all workers in Denmark’s electric power industry employed between 1900 and 1993. He found that motor neuron diseases—mainly ALS—were about twice as common among the 24,850 male utility workers as in the general population. As in previous studies, there were also more cases of senile dementia than expected, Johansen reports in the September issue of *Epidemiology* (11, pp.539-543, 2000).

“This is the first epidemiological study to show that epilepsy may be associated with EMF exposure,” Johansen told *Microwave News*. Male workers with average EMF exposures estimated over 10 mG were twice as likely to develop epilepsy as those with average exposures below 1 mG—a statistically significant difference. The overall incidence of epilepsy among utility workers was lower than in the general population, but Johansen attributes this to a “healthy worker effect.” He writes that, “Most cases of epilepsy are diagnosed during childhood, and this condition is not compatible with employment in electric utilities.”

Johansen also found a greater-than-expected incidence of cerebral palsy and other neurological diseases among the 5,781 women workers in the study, but these estimates are “unstable” because of the small number of cases.

The findings on ALS in male workers confirm Johansen’s earlier study of the same population (see *MWN*, J/A98), as well as another by Dr. David Savitz (see *MWN*, M/J97). But Johansen’s latest study is the first to be based on incidence rather than mortality. “An incidence study, based on nationwide figures, has a very high quality compared to a study based on death certificates,” Johansen said. This is particularly true for rare central nervous system (CNS) disorders, he added, since these will generally not be listed on a death certificate.

Dr. Eugene Sobel, of the University of Southern California in Los Angeles, commented that incidence data on many neurological disorders are not very precise. “Community-based physicians often do not diagnose Alzheimer’s disease or even dementia very well,” he said.

Although Johansen concludes that the rate of Alzheimer’s disease (AD) was “essentially unrelated to exposure to EMFs,” Sobel pointed out that under the classification of different disorders used by Johansen, all of the cases listed as AD were “pre-senile”—that is, they occurred in people younger than 65. “There



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is no reason to suspect that early-onset AD is caused by anything other than genetics," he noted.

On the other hand, Sobel said, "Most of Johansen's senile dementia cases are probably cases of AD." Johansen found that the risk of senile dementia increased with increasing magnetic field exposure. Thus, Sobel argued, Johansen's data are "not inconsistent" with a link between late-onset AD and EMF exposure, which Sobel has observed in several previous studies (see *MWN*, J/A94 and J/F97).

As in his last paper, Johansen states that he could not distin-

guish between the possible effects of EMFs and electric shocks. But he has begun a new study which may shed some light on this question.

Since the early 1900s, Denmark has maintained a national register of electrical accidents. It is mandatory to report not only the person's name, but the current and voltage involved. "The idea," Johansen explained, "is to use this register to evaluate the risk of CNS disorders among survivors after electrical accidents." He expects to begin analyses this fall and submit a paper to a journal by early next year.

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## ***New Support for U.K. Aerosol Hypothesis: More Lung Cancer Found Downwind of Transmission Lines***

Preliminary findings on the distribution of cancer cases around high-voltage power lines lend support to the theory that electrically charged pollutants may be responsible for an excess of lung cancer.

Dr. Alan Preece of the U.K.'s University of Bristol is assessing the relative risk of various cancers for people living within 400 meters of high-voltage transmission lines in southwest England. Initial results show that those who lived near the lines had an elevated risk of lung cancer—but more striking is how that risk was distributed.

"You are likelier to get cancer there, but *only* if you live downwind," Preece told the BBC's Radio Four, on the September 21 broadcast of *Costing the Environment*. Those living downwind were significantly more likely to develop lung cancer, while those who lived upwind of the lines showed no increase in risk. Preece called this "almost proof, or very strong supporting evidence, for the effect of aerosols driven by the wind."

Physicist Dr. Denis Henshaw, also of the University of Bristol, has proposed that a high-voltage line may influence cancer rates by ionizing molecules in the surrounding air (see *MWN*, M/A96, N/D99 and J/F00). "It splits the air up into positive and negative electrical charges, which are blown away from the power line by the wind," Henshaw told the BBC. "They attach themselves to particles of pollution in the air and put an electrical charge on them." The result, he maintains, is that, "When you inhale these small particles, they have a much higher probability of sticking to the lung." Preece undertook his current study as a test of Henshaw's theory.

"If substantiated," Henshaw told *Microwave News*, "these results are bound to have important public health implications, because they involve adult cancers which are far more prevalent" than childhood leukemia. The BBC reported that if Henshaw's hypothesis is correct, the effects of power lines could account for "more than 3,000 premature deaths" a year in the U.K.—comparable to the annual toll from automobile accidents.

"There is a clear case for a moratorium on building houses near high-voltage power lines," Henshaw contends. He added that a policy of placing all lines underground should be considered for the future.

The BBC and U.K. newspapers reported that Preece had found lung cancer rates downwind of the lines to be 29% higher

### ***Tory Leader Backs EMF Studies, Opposes Planned Power Line***

The man who may be the next prime minister of Britain is a long-time supporter of funding EMF health research and has opposed plans to build a 400 kV power line through the area he represents in Parliament.

William Hague, the leader of the Conservative Party and a member of Parliament from Yorkshire, has campaigned for years for more health research, according to the BBC. Last May, Hague called for a government inquiry on power lines similar to the panel on mobile phones headed by Sir William Stewart, reported the *Sunday Express* (May 5).

Hague has voiced concern about a local cancer cluster near an existing transmission line. These cases "make people extremely suspicious" about proposals for new transmission lines, he told the BBC's Radio Four this September. As long ago as 1992 Hague spoke in Parliament against the National Grid's plan for new lines, citing their "environmental cost."

"I've often brought up the health risks" to ministers of both Conservative and Labor governments, Hague told the BBC. "They've always replied...that there's been no evidence so far of any firm link between power lines and cancer. But of course new evidence is coming in all the time," said Hague, "and there's a lot of circumstantial evidence locally."

Britain's Conservative Party is ahead of Labor in recent opinion polls, for the first time since 1992.

than expected. But Preece told *Microwave News* that this figure should not be taken as definitive. He cautioned that it was based on the first of four possible methods of estimating the exposed population. "All I can say at this point," he said, "is that we have now tried all four approaches, and all point to a statistically significant elevation in lung cancer risk."

Preece is currently enlarging the study and taking measurements to check for bias in his method of analysis.

Dr. John Swanson, scientific advisor to the U.K.'s Electricity Association, said that Henshaw "has done some good experiments, which show that the fields power lines produce do affect airborne particles. What he has not done," Swanson told the BBC,

“is show that this has a consequence for health.” These comments were more conciliatory than Swanson’s remarks last December, when he accused Henshaw of engaging in “speculation about the health effects of power lines which is not supported by his data” (see p.15 and *MWN*, J/F00).

The Electricity Supply Board (ESB) in Ireland was more dismissive, calling the Bristol work “highly speculative.” An ESB spokesman told the *Irish Times* (September 21) that Henshaw’s “theories have not been approved by other scientists and fly in

the face of other research in this area.”

Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, commented that a good way to test the Henshaw hypothesis would be to look at cancer rates next to high-voltage DC lines. “Unlike AC power lines, DC lines do not switch polarity 100 or 120 times a second,” he told *Microwave News*. “This means that the ions would be better able to move with the prevailing wind and, if Henshaw is right, you would see even more lung cancer near DC lines.”

## « Power Line Talk »

The idea that power lines may be linked to cancer is one of TWENTY OF THE **GREATEST BLUNDERS** IN SCIENCE IN THE LAST TWENTY YEARS. So says Judith Newman in the October issue of *Discover* magazine, which is published by the Disney Co. “Currents That Don’t Kill” is #9 on the list, which also includes Chernobyl, cold fusion and the Iridium project. Newman states that the Clinton administration “estimates that American taxpayers have paid \$25 billion to determine that power lines don’t do anything more deadly than deliver power” (emphasis added). She explains that, “After several enormous epidemiological studies in Canada, Britain and the United States, the danger was completely discounted” (see p.1). Her source is Dr. **Robert Park**, the physicist-lobbyist, whom she quotes as saying that power frequency fields can’t be associated with cancer because they can’t break chemical bonds and, more generally, that the whole business is “preposterous.”

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*IEEE Spectrum* turns to another physicist, Dr. **Richard Coren**, to quell any fears about the safety of power line EMFs. In the July issue, Dr. **Robert Ashley** expressed his concern that electric fields might present a health risk (see *MWN*, J/A00). In the September issue, Coren of Drexel University in Philadelphia responds that Ashley is all wrong and that there is really nothing to worry about. After giving the reader an introduction to epidemiological research, Coren states: “Today, there is a more definitive consensus [than six years ago] that the statistics, combined with the lack of a credible mechanism, yield no indication of an effect on humans of very low-frequency [EMFs] from power lines. This has been stated unequivocally by several authoritative sources,” such as the provincial government of British Columbia, Canada.

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The inability of different labs to replicate EMF experimental effects has engendered many bitter disputes, often ending with each side alienated from the other. So there is some measure of surprise when two labs jointly publish a paper exploring why they were unable to get similar results. In a series of animal studies carried out in Dr. **Wolfgang Löscher**’s laboratory at the School of Veterinary Medicine in Hannover, **Germany**, Löscher and Dr. **Meike Mevissen** have shown that 50 Hz magnetic fields can increase the growth and development of breast tumors. These experiments were deemed so important by the National Institute of Environmental Health Sciences (NIEHS) that Drs. **Lar-**

**ry Anderson** and **James Morris** of the **Battelle** Pacific Northwest Labs in Richland, WA, were asked to repeat them. They could not (see *MWN*, M/A98). The ensuing controversy often got heated and at times tempers flared (see, for instance, *MWN*, N/D98). In the process, it became clear that NIEHS managers had decided to reject the German data. But the Hannover and Battelle groups continued to work together. As a result, in the September issue of *Environmental Health Perspectives* (*EHP*, 108, pp.797-802), they spell out the numerous differences between the two sets of studies which could explain the lack of agreement. (*EHP* is published by the NIEHS.) Both teams agree that the issue is not closed. “The fact that tumor incidence in MF-exposed groups in the six experiments carried out by the Hannover group...was above controls in five experiments argues against chance as a likely explanation.” They conclude that the EMF-breast cancer risk issue is an “important” one that has yet to be resolved.

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The **Interagency Committee** (IAC) set up to monitor the **EMF RAPID** program may submit a report to Congress after all. Though this report is required by law, work came to a standstill last year as IAC members disagreed over much of its contents (see *MWN*, N/D99). Sources told *Microwave News* that representatives from the eight participating federal agencies on the IAC have now approved the report—which had already gone through four or five drafts by late 1999—and committee staff are finalizing it. The report will then be sent to the White House Office of Science and Technology Policy, prior to being forwarded to Congress. Dr. **Imre Gyuk** of the DOE, the chair of the IAC, did not return calls for comment.

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In the August 4 issue of *FEBS Letters* (p.304), Dr. **Robert Liburdy** officially retracts two figures detailing his experimental results on calcium signaling, which he had published in the journal in 1992. This complies with Liburdy’s agreement with the **Office of Research Integrity** (see *MWN*, J/A99). Nevertheless, Liburdy goes on to state that, “The raw data for these figures are valid and the scientific conclusions stand as published.” Liburdy told *Microwave News* that he is putting the finishing touches on papers detailing his calcium research over the last three years. “My previously published findings are substantiated and these new calcium data fully support my scientific conclusions as originally published,” Liburdy said.

still very much at issue. Ahlbom and colleagues note evidence of selection bias in some of the studies, and conclude only that, "The explanation for the elevated risk estimate is unknown."

"We rule out chance and say that selection bias could explain some of the excess," Ahlbom said in an interview with *Microwave News* (see p.12). "That leaves us with the options of causation or other possible kinds of bias...We may not be able to resolve this in the near future."

The question of causation has important public health implications. While 4 mG is considered unusually high for a residential exposure, present international limits allow for exposures up to 250 times higher. According to a 1998 study by EPRI, between 6 and 12 million Americans live with average exposures above 4 mG (see *MWN*, M/J98).

Day, of Cambridge University, told *Microwave News* that, "Interpretation of the finding of an excess risk above 4 mG has to be cautious." Day headed up the EMF component of last year's U.K. Childhood Cancer Study (UKCCS; see *MWN*, N/D99 and J/F00). "The U.S. study makes a large contribution to this excess, so a lot depends on how one interprets that study," he said.

Linnet, who led the U.S. study, does not think the new combined analysis strengthens the case for an EMF-cancer connection. "All of this increase may be due to bias," she said in an interview. "We've shown in our own study that some of it has to do with who participates and who does not."\* Linnet is at the National Cancer Institute (NCI) in Bethesda, MD, which sponsored her study (see *MWN*, J/A97).

Does bias play this big a role? "You've had this relatively consistent pattern, across different countries and across studies that were conducted in different ways," Greenland said. "It's hard for me to see how selection bias would operate in the same way in all these cases."

Day stands somewhere in between. "Bias and confounding may be the main factors in operation," he said. On the other hand, Day said, "an excess was seen which is very unlikely to be due to chance, and is consistent with a causal role for EMFs at these high levels. It cannot just be dismissed."

The new paper notes that leukemia in children is not well understood, so "one cannot exclude" a potential confounding effect from some as-yet-unidentified risk factor. It does conclude that "mobility, traffic exhaust, type of dwelling and urban/rural residency are not important confounders" in these studies—but Greenland thinks this may be premature.

"Many of these things are not well-measured," Greenland observed. "Traffic exhaust is one of the most controversial. The data on potential confounders is pretty weak, overall."

"It is frustrating that, with all these studies, you can't say all that much yet," commented Greenland. "It's true that bias or confounding might explain the excess risk. But it's also true that

\*The pooled analysis notes that controls were "generally characterized by higher socioeconomic status than cases," particularly in the U.S. study. The UKCCS found some connection between lower status and higher levels of magnetic fields, and an analysis of the NCI data by Linnet and Dr. Elizabeth Hatch found that people with lower socioeconomic status were more reluctant to participate fully, especially as controls (see *MWN*, M/A00). The NCI researchers concluded that selection bias "led to a slight overestimate of effect in our study."

### **Italians Also See Childhood Leukemia Link**

An association between living near power lines and developing childhood leukemia has also been reported in Italy.

Writing in the May-June issue of *Tumori* (86, pp.195-198), a leading Italian cancer journal, a team from northern Italy estimates that children exposed to a calculated magnetic field of more than 1 mG had a 4.5-fold increased risk of leukemia. This result is based on only three cases and three controls and is not statistically significant.

Dr. Nadia Bianchi and coworkers conclude that of the 127 cases of leukemia occurring in the Lombardy region, 6.48 may be attributable to EMFs from power lines.

Dr. Maria Feychting of the Karolinska Institute in Stockholm told *Microwave News* that there were problems with the study's design, selection of controls and exposure assessment. "This study does not change the overall picture of this problem," she said.

it could be a real effect."

In Michaelis's view, "The main problem is that there is so far no plausible explanation of the observed association." In the absence of a specific mechanism, he told *Microwave News*, we cannot conclude that EMF exposure leads to childhood leukemia—even above 4 mG. Michaelis is at the University of Mainz.

Ahlbom sounded a similar theme. "If we had supporting experimental data," he said, "the epidemiology would have been strong enough for a causal interpretation quite some time ago." But without that, "the requirements on epidemiological data become rather strong."

### **"Wire-Code Paradox" Rejected**

The 1996 EMF report from the National Academy of Sciences—National Research Council concluded that childhood leukemia was linked to proximity to power lines—as measured by a system of "wire codes"—but not to measured magnetic fields (see *MWN*, N/D96). Greenland and Ahlbom each conclude, however, that this so-called "wire-code paradox" does not exist.

Both pooled analyses show that at higher levels of exposure, measured field levels are in fact linked to increased risks. Ahlbom and colleagues also question whether the wire-code studies are valid at all: They note that the two North American studies they included—by Linnet and McBride—"show no evidence of increased risk...in high wire-code categories." It is "unclear" why previous wire-code studies found the opposite, they write, but there may have been "considerable potential for bias."

Day takes an even stronger view. "What does emerge clearly," he said, "is that the results of the early studies, from which interest in the [EMF-childhood leukemia] hypothesis developed, were the result of bias." He cited both the NCI data and the pooled analysis led by Ahlbom. "If there is any relationship with magnetic fields," Day argued, "it is not the one put forward on the basis of wire codes."

Greenland disagreed: "That may be true, but we can't conclude that yet." He pointed out that the pooled analysis by Ahl-

bom, Day and colleagues only included “the two most negative of the wire-code studies.” While Greenland’s own analysis found that wire-code studies were less consistent than studies based on measured fields, the data from the eight wire-code studies he examined do show a significant excess risk for children living near “very high-current configuration” power lines.

The original plan for Ahlbom’s pooled analysis (see *MWN*, J/F96 and M/J99) was to include all European studies of EMFs and childhood leukemia that used either calculated fields or 24-

or 48-hour magnetic field measurements. Three others were added later: the NCI study, Dr. Mary McBride’s research from Canada and a New Zealand study by Dr. John Dockerty of the U.K.’s University of Oxford (see *MWN*, M/J99 and N/D99). “We felt that if we could also incorporate new studies from non-European countries, this pooled analysis would be up to date and presumably stay current for several years,” the paper states.

Ahlbom and colleagues analyzed raw data for 3,247 children with leukemia and 10,400 controls. The children’s magnetic field

## **Sweden’s Dr. Anders Ahlbom Talks with Microwave News**

**MWN:** There have been a number of previous meta-analyses of magnetic field exposure and childhood leukemia. What does your new one add to our understanding of this association?

**AA:** I believe this is the first published study based on primary data from the individual studies. Another such study by Sander Greenland, Asher Sheppard and others will be published soon. Using raw data enabled us to make the data across the studies more consistent. For instance, with respect to cutoff points, exposure periods, geometric means. This in turn made it possible for us to investigate higher levels of exposure than had been possible or meaningful in past individual studies. Our combined data set was large enough to look at exposures of 0.4  $\mu\text{T}$  [4 mG] and greater.

**MWN:** Why did you set the cutoff for the high-exposure group at 0.4  $\mu\text{T}$ ?

**AA:** The 0.4  $\mu\text{T}$  level was chosen at an early stage of the study. We were trying to strike a balance between having a “high” exposure level and having a large enough number of subjects above that level.

**MWN:** You conclude that chance is an “unlikely explanation” for the observed doubling of the childhood leukemia risk for exposures of 0.4  $\mu\text{T}$  and greater. How comfortable are you with the idea that such weak magnetic fields could be linked to cancer?

**AA:** Simply stated, the competing explanations are causation, chance and various types of bias. We rule out chance and say that selection bias could explain some of the excess. That leaves us with the options of causation or other possible kinds of bias. I don’t believe there is any way of knowing and I am beginning to suspect that we may not be able to resolve this in the near future.

**MWN:** You do not sound optimistic that epidemiology may have much more to say about the EMF-cancer question. Does this mean that the ongoing Japanese study is not likely to clarify some of the uncertainties?

**AA:** The Japanese study may provide the type of population that is needed. That is, one with a large number of highly exposed subjects. If they can do a study that is not subject to other problems it may be very informative. I do indeed hope this will be the case. There are also other studies in the pipeline: from California, Germany and Italy—so there are still opportunities for new data to resolve the issue.

**MWN:** Does the absence of supporting animal and *in vitro* studies make you suspect that the epidemiological findings are spurious?

**AA:** If we had supporting experimental data, the epidemiology would have been strong enough for a causal interpretation quite some time ago. In the absence of supporting experimental data, the requirements on epidemiological data become rather strong for a firm posi-

tive conclusion.

**MWN:** On the other hand, there are a number of epidemiological studies, and associated meta-analyses, that also show an increased risk of cancer among occupationally exposed workers. How do these fit into the magnetic field risk equation?

**AA:** Since the types of cancer are different I keep these issues somewhat separate and evaluate the childhood leukemia case by itself. At the same time, of course, if there were strong data that some other cancer was caused by EMFs, that would certainly increase the credibility of the hypothesis. That is one reason to focus on childhood leukemia, because that is where the data are strongest.

**MWN:** Does this mean that you do not consider the meta-analyses showing that EMF-exposed workers have higher rates of leukemia and brain cancer to be “strong”?

**AA:** This is certainly of great interest but, in my opinion, these results are weaker than those for childhood leukemia. There are fewer high-quality occupational studies and in addition there are some variations in the specific diagnoses for which the excess risks are seen.

**MWN:** What do you make of the new analyses of the Ontario Hydro occupational data from Canada showing that electric fields can increase leukemia risks by eight-to-ten times the expected rate?

**AA:** This is of interest too, but not backed up by other studies.

**MWN:** In the U.S., many people are now saying that all the attention to EMFs has been a waste of time and money. You have been working on this problem for close to 15 years now. How do you respond to this argument?

**AA:** I believe that we have learned a lot. The bottom-line question may still be unresolved. My understanding, however, is that the possibility of a cancer effect at around 0.2  $\mu\text{T}$  is rather unlikely, while there is still a possibility for an excess risk at higher levels, say 0.4  $\mu\text{T}$ . Only a few people are exposed above 0.4  $\mu\text{T}$ , so this qualification is rather important from a public health perspective. Scientifically it is of course equally interesting with an effect above 0.4  $\mu\text{T}$  as above 0.2  $\mu\text{T}$ .

**MWN:** Long ago, largely based on your and Maria Feychting’s childhood leukemia study, the Swedish government adopted a policy of prudent avoidance. That is, whenever possible, siting power lines away from schools and residential areas. If asked, would you advise the government to continue to practice prudent avoidance?

**AA:** I try to stay away from these issues because so many factors other than science come into play. I do think, however, that in Sweden with all the space and other resources, one should still exercise prudent avoidance.

## Leading Epidemiologists See Childhood Leukemia Risk at 4 mG

exposures were based on in-home measurements. They used geometric means—"because they are less affected by outliers"—to gauge average exposure in the year prior to diagnosis.

Previous EMF-cancer studies "have sometimes been criticized on the grounds that the findings might be a consequence of so-called data dredging," Ahlbom's team writes. To avoid this, "We specified which primary analyses we planned to do and how to do them before we commenced the analysis," doing so "before the results of several of the individual studies were known."

There have been other meta-analyses besides Ahlbom's and Greenland's, but these have not combined the raw data from different studies (see *MWN*, S/O94, J/F99 and J/F00). Ahlbom writes that access to the raw data "gave us two substantial advantages." First, it allowed his team to make the data from different studies "as compatible as possible," especially with respect to the categories for exposure assessment. Second, by analyzing a larger number of cases together, it became "possible to analyze...higher cutoff points than the commonly used 2 mG" for the high-exposure category.

Ahlbom's pooled analysis includes 44 cases and 62 controls with average exposures of 4 mG or more, a far greater number than in any of the individual studies.

Greenland's study does not have data from the UKCCS, and Ahlbom's does not include several of the 15 studies used by Greenland—from Mexico and others from Norway, the U.S. and elsewhere. "But none of this seems to matter much in terms of the results," commented Greenland. "We found in our analysis that the results don't depend much on any one paper." Thus, he said, "it's not surprising that the conclusions of these two pooled analyses came out about the same."

Neither pooled analysis has data from the recent study by Dr. Lois Green of the University of Toronto, which found significant increases in risk, especially among younger children (see *MWN*, J/A99). Ahlbom's paper explains that Green's "exposure information...was not similar enough to justify inclusion," and Greenland said that Green's data were not available in time.

Both Linet and Day emphasized that neither combined analysis showed a risk for most children. "There is no evidence of any appreciable risk below 4 mG," stated Day. "These are the exposure levels of relevance to the great majority of people in this country, and so this confirms the findings from the U.K. study."

"There is no risk for the 99.2% of kids with exposures under 4 mG," said Linet. For this reason, she does not view further EMF studies as a priority.

## FROM THE FIELD

Letter to the Editor

### Litovitz and DiCarlo Respond to FDA on EMFs and Cardiac Protection

September 13, 2000

To the Editor:

Dr. Russell Owen of the Food and Drug Administration (FDA) recently reported to *Microwave News* [J/A00] that his laboratory was unable to replicate the EMF hypoxia studies which we published [see *MWN*, N/D97 and M/J99]. Having read details of the replication experiment undertaken by the FDA laboratory, we feel that our protocol was not precisely followed.

It has been our experience that regardless of the responsiveness of a given flock to EMF exposure, a percentage of the embryo population does not respond to the EMF. We rarely see protection which exceeds 70% survival following hypoxia in field-exposed embryos. If we had allowed, as the FDA did, control survival to be 65%, we would never have seen a significant difference between control and exposed embryos. We state in several of our publications that a survival rate of approximately 35% is targeted.

We believe that FDA's inexperience with the assay led them to discontinue the hypoxia when the control embryo survival rate *appeared* to be 35%. They were likely misled by the phenomenon of myocardial stunning, in which hypoxic eggs without a discernible heartbeat appear dead, when, in fact, heartbeat resumes after re-oxygenation. Our familiarity with this detail allowed us to maintain hypoxic conditions for the appropriate length of time to achieve the targeted 35%.

Dr. Owen also comments that it is "unlikely" that EMF exposures would be protective during myocardial stress. In fact, EMF-induced increases in heat shock proteins (which are known mitigators of myocardial damage) have been shown in several models by five different laboratories.<sup>1-5</sup> Others have directly shown EMF-induced protection against cerebral ischemia<sup>6</sup> and myocardial damage.<sup>7</sup>

We have now studied EMF-induced protection against a number of

stressors in over 30,000 embryos and in three different cell types (rat, mouse and human). Ten researchers in our laboratory have successfully replicated this EMF-induced protection.

Ted Litovitz, PhD and Andrea DiCarlo, PhD  
Catholic University of America, Washington, DC 20064  
(202) 319-5328; E-mail: <litovitz@cua.edu>

*FDA's Dr. Russell Owen declined to respond to Litovitz and DiCarlo's letter, explaining that his group is planning to publish a paper on the attempted replication. A synopsis of FDA's findings can be found in the most recent Office of Science and Technology Annual Report, available on the Internet at: <www.fda.gov/cdrh/ost/reports/fy99>.*

1. R. Goodman and M. Blank, "Magnetic Field Stress Induces Expression of HSP70," *Cell Stress & Chaperones*, 3, pp.79-88, 1998.
2. J.L. Pipkin et al., "Induction of Stress Proteins by Electromagnetic Fields in Cultured HL-60 Cells," *Bioelectromagnetics*, 20, pp.347-357, 1999.
3. B. Junkersdorf, H. Bauer and H.O. Gutzeit, "Electromagnetic Fields Enhance the Stress Response at Elevated Temperatures in the Nematode *Caenorhabditis Elegans*," *Bioelectromagnetics*, 21, pp.100-106, 2000.
4. K.-C. Chow and W.L. Tung, "Magnetic Field Exposure Enhances DNA Repair Through the Induction of DnaK/J Synthesis," *FEBS Letters*, 478, pp.133-136, 2000 [see p.14].
5. G. Tsurita et al., "Effects of Exposure to Repetitive Pulsed Magnetic Stimulation on Cell Proliferation and Expression of Heat Shock Protein 70 in Normal and Malignant Cells," *Biochemical and Biophysical Research Communications*, 261, pp.689-694, August 1999.
6. G. Grant, G. Steinberg and R. Cadossi, "Protection Against Focal Cerebral Ischemia Following Exposure to a Pulsing Electromagnetic Field," in *Electricity and Magnetism in Biology and Medicine*, edited by M. Blank, pp.723-724, San Francisco: San Francisco Press, 1993.
7. A. Albertini et al., "Protective Effect of Low-Frequency Low-Energy Pulsing Electromagnetic Fields on Acute Experimental Myocardial Infarcts in Rats," *Bioelectromagnetics*, 20, pp.372-377, 1999.

## Hot New Papers

**J. Laurence, P. French, R. Lindner and D. McKenzie,** "Biological Effects of Electromagnetic Fields—Mechanisms for the Effects of Pulsed Microwave Radiation on Protein Conformation," *Journal of Theoretical Biology*, 206, pp.291-298, September 2000.

"[S]ignificant temperature transients which could cause protein conformational changes are induced by pulsed microwave exposures in realistic situations. We proposed an explanation for apparent nonlinear dose-response relationships. At some point, the power is sufficient to induce conformational change in some target proteins, but will be insufficient to induce the stress response, so a biological effect could occur unprotected by the stress response. At higher power levels, the conformational change will be great enough to activate the stress response, reducing or nullifying the effect by protecting against further protein unfolding. At still higher power levels irreversible damage will be done to a range of biological systems which the stress response is incapable of preventing."

**King-Chuen Chow and Wai Lin Tung,** "Magnetic Field Exposure Enhances DNA Repair Through the Induction of DnaK/J Synthesis," *FEBS Letters*, 478, pp.133-136, July 28, 2000.

"In contrast to the common impression that exposure to a magnetic field of low frequency causes mutations to organisms, we have demonstrated that a magnetic field can actually enhance the efficiency of DNA repair...The improvement was found to be mediated by the induced overproduction of heat shock proteins DnaK/J (Hsp70/40)."

**Alan Preece, Jeff Hand, Robert Clarke and Alice Stewart,** "Power-Frequency Electromagnetic Fields and Health. Where's the Evidence?" *Physics in Medicine and Biology*, 45, pp.R139-R154, September 2000.

"Further research seems to be required, but mainly in the area of mechanisms. To do this, care is need[ed] to characterize exposure and to define the characteristics of the fields producing the exposure, and until this has been worked out further epidemiological work seems unnecessary."

**Jane Babbitt et al.,** "Hematopoietic Neoplasia in C57BL/6 Mice Exposed to Split-Dose Ionizing Radiation and Circularly Polarized 60 Hz Magnetic Fields," *Carcinogenesis*, 21, pp.1379-1389, July 2000.

"The present study design cannot adequately assess the influence of chronic MF exposure on the initiation of neoplastic lesions. However, another proposed effect of MF exposure has been the acceleration of neoplastic growth and progression. The present study data provide some supporting experimental evidence for this postulate, including the observation that histiocytic sarcomas and [three categories of] lymphomas were found earlier in unirradiated mice exposed to MF, although this comparison was not statistically significant...The observation that the final frequency of combined hematopoietic neoplasms is similar for all experimental groups of both irradiated and unirradiated mice, suggests that treatment within the range of split-dose ionizing radiation used for this experiment promotes the differentiation and growth of specific preneoplastic hematopoietic precursors, rather than initiating lymphomagenesis. The data from this study suggest that tumor development is promoted in those animals which received only ionizing radiation treatment or only MF exposure. The data also suggest an interaction of ionizing radiation treatment effects and MF exposure effects in the development of radiation-induced thymic LB lymphomas. The mechanisms by which these two different levels of radiant energy affect tumor development remain to be determined, as does the mechanism of their interaction. Future studies to elucidate these relationships are warranted."

### Nonlinear Model Can Make Sense Of Inconsistent Data

**Andrew Marino et al.,** "Nonlinear Response of the Immune System to Power-Frequency Magnetic Fields," *American Journal of Physiology—Regulatory, Integrative and Comparative Physiology*, 279, pp.R761-R768, September 2000.

"[I]f the biological effects of EMFs were governed by nonlinear laws, deterministic responses to fields could occur that were both real and inconsistent...The hypothesis of real inconsistent effects due to EMFs was tested by exposing mice to 1 G, 60 Hz for 1-105 days and observing the effect on 20 immune parameters...The data were evaluated by means of a novel statistical procedure that avoided averaging away oppositely directed changes in different animals, which we perceived to be the problem in some of the earlier EMF studies...In three independent experiments involving exposure for 21 or more days, the field altered lymphoid phenotype even though the changes in individual immune parameters were inconsistent. When the data were evaluated using traditional linear statistical methods, no significant difference in any immune parameter was found...We conclude that exposure to power-frequency fields produced changes in the immune system that were both real and inconsistent."

**Paul Lichtenstein et al.,** "Environmental and Heritable Factors in the Causation of Cancer: Analyses of Cohorts of Twins from Sweden, Denmark and Finland," *New England Journal of Medicine*, 343, pp.78-85, July 13, 2000.

"Inherited genetic factors make a minor contribution to susceptibility to most types of neoplasms. This finding indicates that the environment has the principal role in causing sporadic cancer."

**Geraldine Lee et al.,** "The Use of Electric Bed Heaters and the Risk of Clinically Recognized Spontaneous Abortion," *Epidemiology*, 11, pp.406-415, July 2000.

"These findings provide little support for the hypothesis that electric bed heaters increase the risk of spontaneous abortions. The decreased association of electric blankets used at low settings is most likely due to uncontrolled confounding. The initial assumption that electric bed heaters would deliver strong time-weighted average magnetic field levels to the uterus may be wrong (especially for low settings), so that although we can examine the association of electric blankets themselves, electric blankets may not be a strong enough magnetic field source, as generally used by our study population, to examine the relation between time-weighted average magnetic fields and spontaneous abortion."

**Peter Wainwright,** "Thermal Effects of Radiation from Cellular Telephones," *Physics in Medicine and Biology*, 45, pp.2363-2372, August 2000.

"[T]he maximum temperature rise in the brain is likely to be around 0.1°C. This figure is likely to be very sensitive to the individual anatomy...The predicted heating of the brain was greater at 1800 MHz than at 900 MHz...Using a simple finite element model with a continuum heat sink representing the vascular system, the profile of temperature rises within the head can rapidly be estimated for any given SAR distribution...It must be stressed that experimental validation of these results has not been carried out."

## Across the Spectrum

“[Mobile phones constitute] the world’s largest biological experiment ever.”

—Dr. Leif Salford, professor of neurosurgery, University of Lund, Sweden, and long-time researcher on effects of microwaves on the blood-brain barrier, quoted by Norm Alster, “Cell Phones: We Need More Testing,” *Business Week*, p.39, August 14, 2000

Einstein didn’t win the Nobel Prize for the theory of relativity. He won it for showing that you don’t need to worry about radiation from your cell phone.

—Dr. Robert Cahn, senior physicist, Lawrence Berkeley National Laboratory, Berkeley, CA, in “Einstein, Your Cell Phone and You,” *San Francisco Chronicle*, p.A23, August 30, 2000

[T]hese little metallic instruments are this millennium’s cigarette.

—Joel Conarroe, president, John Simon Guggenheim Memorial Foundation, referring to mobile phones in, “Addicted to Talking,” *New York Times*, Op-Ed, p.A15, August 5, 2000

“We think the demand for tower space will increase three or four times over what it is now with the coming of the next generation of wireless data technology for cell phones, the G-3 networks.”

—Phil Foreman, comanager, Evergreen Growth & Income Fund, quoted by Claire Mencke, “Array of Funds Hold Cellular Tower Stocks: Managers Expect Demand Will Grow for Several Years,” *Investor’s Business Daily*, p.B1, August 2, 2000

“[T]he EMF study at WHO is looking only at nonthermal effects. We are not interested in thermal.”

—Dr. Michael Repacholi, director, WHO International EMF Project, Geneva, testifying before an Australian Senate inquiry on mobile phone health risks and RF/MW exposure standards, Canberra, August 31, 2000 (see p.7 and *MWN*, J/F00) (Repacholi’s testimony is available as a PDF file at: <[www.aph.gov.au/hansard/senate/committee/s-ecita.htm](http://www.aph.gov.au/hansard/senate/committee/s-ecita.htm)>.)

“We have never said in a categorical way that power lines are safe, that simply would not be honest. What we say is that when you look at the totality of studies you come to the conclusion that the balance of evidence is that power lines do not have an effect on health.”

—Dr. John Swanson, scientific advisor to the National Grid, U.K., quoted by Paul Brown, “New Cancer Link to Power Lines,” *Guardian* (U.K.), p.2, September 21, 2000 (see p.9)

### On the Internet

#### Petition for Ouster of Repacholi, ICNIRP

In Switzerland, the Association for Representation and Protection of Persons Afflicted by Electromog plans to submit a petition calling for a “worldwide moratorium” on new mobile phone towers to Kofi Annan, the secretary-general of the United Nations. WHO’s Dr. Gro Harlem Brundtland will also receive a copy, Leopoldine Gaigg, the group’s secretary, told *Microwave News*. “Already many people have become seriously ill” through exposure to radiation from cell towers, the association contends. It charges that the WHO, ICNIRP and Dr. Michael Repacholi “failed to fulfill their duty to protect world health” and demands that Repacholi and ICNIRP be replaced. The leader of the association is Hans-Ulrich Jakob, who lives in Schwarzenburg, the site of a former high-power shortwave radio transmitter (see *MWN*, N/D93, J/F96 and S/O96). The petition and letter are available in English and German—along with other material—on the Web at: <[www.gigaherz.ch](http://www.gigaherz.ch)>.

## “MICROWAVE NEWS” FLASHBACK

### Years 15 Ago

- Citing federal budget cuts, Dr. Gordon Heuter, director of EPA’s health research lab in North Carolina, disbands the non-ionizing radiation division and reassigns its 25 members to other parts of the EPA.
- Analysts at the Lawrence Livermore Lab project that radio and TV broadcasters will have to spend \$19.1-45.6 million in order to comply with a possible 100  $\mu\text{W}/\text{cm}^2$  RF/MW exposure standard.
- California radio station KERG–FM shuts down after state officials discover that its signal was exposing forest rangers stationed at a nearby lookout post to RF levels 2-3 times higher than the ANSI limits.

### Years 10 Ago

- Boeing agrees to pay over \$500,000—the largest EMF injury settlement in U.S. history—to Robert Strom, a former employee who claims his leukemia was caused by on-the-job exposure to EMP radiation.

- The National Toxicology Program announces it will spend \$6-10 million to sponsor a series of major animal studies on the reproductive, developmental and carcinogenic effects of 60 Hz EMFs.
- The Swedish National Board for Measurement and Testing (MPR) recommends that VDT manufacturers voluntarily adopt an ELF emission limit of 2.5 mG at 50 cm in front of the terminal.

### Years 5 Ago

- Without explanation, Joe Jamail, a noted Texas trial attorney, unexpectedly withdraws a lawsuit on behalf of 11 families who charged that Houston Lighting & Power Co. power lines caused their children’s cancer.
- The Senate Committee on Appropriations cuts \$350,000 from the EPA’s EMF budget. It states: “The committee believes EPA should not engage in EMF activities” (see p.2).
- Dr. Birgitta Floderus and coworkers at Sweden’s National Institute for Working Life report that men and women have a small, but significant, increased risk of developing a number of different types of cancer if exposed to EMFs on the job.

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### BROADCAST RADIATION & CANCER

**Dispute Over TV Towers & Leukemia...**A sharp debate on broadcast radiation and childhood leukemia has been waged over the last two years in the *Australian and New Zealand Journal of Public Health*. The controversy started after Dr. Bruce Hocking, former chief medical officer for Telecom Australia (now Telstra), found elevated rates of leukemia among children living near TV towers (see *MWN*, N/D95 and J/F97). In 1998 Drs. David McKenzie, a physicist, and Stephen Morrell, an epidemiologist, both of the University of Sydney, challenged this finding in a paper described as "a second look" at the Hocking study (22, pp.360-367, 1998). They argued that one of the three neighborhoods near the antennas, the Lane Cove area, "contributes all the excess," and that the link between the TV tower and childhood leukemia "disappeared when Lane Cove was omitted." McKenzie and Morrell also contended that Hocking's data do not suggest a causal link because there is no clear dose-response pattern. They noted that the incidence of acute lymphoblastic leukemia (ALL) "was highest in Lane Cove during 1972-78 when exposure was lowest, as 24-hour TV transmissions had not commenced until the end" of that period. Hocking, who is now an occupational medicine consultant in Melbourne, responded that the McKenzie and Morrell paper was "based on *post hoc* analyses which are not scientifically justified" (23, pp.104-105, 1999). Hocking wrote that when he began his study years ago, he had no reason to expect a higher leukemia risk in Lane Cove or any other neighborhood, and that statistical tests for heterogeneity provide no basis for singling out Lane Cove in hindsight. He also pointed out that while "24-hour [TV] broadcasting began in 1976...by 1972 the hours broadcast were 18 per day." Overall, Hocking contended, the data in McKenzie and Morrell's paper "confirm our own finding of a modest association, which warrants further study." McKenzie and Morrell shot back with a reply to Hocking's answer (23, pp.553-555, 1999). Emphasizing that another neighborhood near the tower, with similar exposures to Lane Cove, shows no excess leukemia risk, they wrote that this "makes it very difficult to support the TV tower hypothesis." They conclude with the charge that Hocking has published "spuriously alarming results." This prompted Hocking to respond again. In the latest issue of the journal (24, pp.106-107, 2000), he disputes McKenzie and Morrell's analysis on several points and describes one of their criticisms as "bizarre." Hocking suggests that a full-scale study based on careful and detailed radiation measurements "would be the best way of establishing whether there is any association."

### EMFs & SUICIDE

**Utility Worker Study Questioned...**"Magnetic field exposure is unlikely to be either a necessary or sufficient cause of depression or suicide." That assertion is offered in a commentary by Dr. Corinne Peek-Asa of the University of California, Los Angeles, in the August issue of the *Western Journal of Medicine* (173, pp.100-101, 2000). Her remarks accompany a study of suicide among electric utility workers by Edwin van Wijngaarden and Drs. David Savitz and Dana Loomis, all of the University of North Carolina, Chapel Hill (pp.94-100). With some minor corrections, the paper is essentially the same as one they published earlier



this year in *Occupational and Environmental Medicine* (see MWN, M/A00). Their findings, based on data on 139,000 workers, include a statistically significant 70% increase in suicides among the workers with the highest recent EMF exposures. As a possible explanation for the association, they note that EMFs have been linked to lowered melatonin levels and that low levels of this hormone are thought to be connected to depression. Peek-Asa contends that even if this hypothesis is correct, it may not explain the observed increase in suicide rates: "Most cases of depression do not lead to suicide, and other mental illnesses are much more predictive of suicidal behavior." While allowing that EMFs could "exacerbate the effects of existing depression or other risk factors," she concludes that any role of EMFs "is likely to be small." Peek-Asa praises the study as "well-conducted" but points out that it lacks data on known suicide risk factors such as drug use, mental illness and family stresses. These gaps, she writes, "severely limit" the ability to determine whether the elevated risk among the exposed workers is due to such confounders. In an interview, van Wijngaarden agreed that the absence of controls for such factors "could have led to overestimation of associations." But, he stressed, "It is uncertain that these risk factors actually act as confounders, since they may not be highly correlated with EMF exposure."

**MAGLEV**

**Government Assesses Maglev's Impact...**In a few years, Maglev—magnetic levitation—trains could zoom through greater Los Angeles, Washington, Pittsburgh and Las Vegas at speeds up to 240 mph, if pilot projects being planned by the U.S. government and seven states are built. The projects' possible environmental effects are detailed in a draft statement issued by the Federal Railroad Administration. Roughly 20 of the document's 332 pages are devoted to EMFs and EMR, from static and ELF through low-frequency and up to radiofrequencies. Inside the cars of the German Transrapid system chosen for six of the seven projects, ELF magnetic fields would average 50 mG, according to the FRA. Levels along the right-of-way would be "minimal," it states. The document concludes that any adverse health impact due to EMFs would be "insignificant" and stresses that, "No public health risk associated with...Maglev systems has been clearly shown." The comment period for the draft closed September 5 and the FRA expects to release a final version by early November. For a copy of *Draft Programmatic Environmental Impact Statement—Maglev Deployment Program*, go to: <[www.fra.dot.gov/s/env/maglev/MagPEIS.htm](http://www.fra.dot.gov/s/env/maglev/MagPEIS.htm)>.

**MEASUREMENTS**

**Toll-Free Help Line...**Holiday Industries Inc. has set up a help desk to answer questions about measuring non-ionizing radiation. Holiday—of course—sells meters and probes that cover the frequency band from DC to 40GHz. The company has a variety of products: At the low end of the price scale, there is a microwave oven leakage meter that costs \$339 and at the high end you can spend \$10,000 to measure RF/MW electric fields. For more information, call (877) HOLADAY (465-2329), or send an e-mail to <[info@holadayinc.com](mailto:info@holadayinc.com)>.

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## Request for Proposals

The Cellular Telecommunications Industry Association (CTIA) is soliciting proposals for research to be conducted under the Cooperative Research and Development Agreement (CRADA) with the U.S. Food and Drug Administration (FDA) for the first phase of research, specifically on the study of the effects of radiofrequency energy on micronucleus formation.

A copy of the full Request for Proposals (RFP) will be available by September 19, 2000, online through CTIA at <[www.wow.com/rf](http://www.wow.com/rf)> or by calling or e-mailing the CTIA CRADA administrator at (202) 785-0081 or <[crada@ctia.org](mailto:crada@ctia.org)>.

### Stay Ahead with Microwave News

*Microwave News*, May/June 2000

**“Do Hands-Free Kits Triple Radiation Exposure? No Support for Claim by U.K. Consumer Group”**

**“‘Safer’ Phone Kit Critic Said To Be Out of Touch”**

*Financial Times*, August 9, 2000

### As We Go to Press

## USAF Doctor Speaks Out on PAVE PAWS Radiation

Dr. Richard Albanese, a medical research officer employed by the U.S. Air Force (USAF), has called for more studies on the potential health effects of exposures to radiation from the PAVE PAWS radar on Cape Cod, MA. The high-power radar is operated by the USAF.

In a May 23 letter to Suzanne Condon, the director of the Massachusetts Department of Public Health’s Bureau of Environmental Health Assessment in Boston, Albanese warns that the potential effects of the type of radiation emitted by the phased array radar are “completely unexplored.”

“No data exist that are unambiguously relevant to the PAVE PAWS system,” Albanese wrote. The “radiation field of PAVE PAWS is an overlapping set of single pulses,” Albanese noted in his letter, which became public in late September. “In my opinion, controlled animal or human experimentation should be done on an urgent basis to support the claim that the PAVE PAWS radiation is safe for humans,” he advised.

Albanese explained the motivation for his letter: “As a physician, this lack of testing makes me nervous indeed, and thus I report here out of a sense of conscience and concern,” he wrote to Condon. Albanese works at Brooks Air Force Base in San Antonio, the home of the USAF’s RF/MW radiation research labs.

The radar has drawn community opposition since it was first announced in the 1970s. Reports of higher-than-expected cancer rates have led to increasing levels of apprehension among residents. (See, most recently, *MWN*, M/A00.)

“Their concerns are not unwarranted,” Albanese told *Microwave News* in a telephone interview.

In her June 16 reply to Albanese, Condon wrote that, “We do think that public health concerns [over the PAVE PAWS radar] warrant answers.”

Each of the two 102-foot-wide faces of the PAVE PAWS radar is composed of 1,792 individual radiating elements. The system is powerful enough to detect missiles at a distance of 3,000 miles.

## Keeping Current: Follow-Up on the News

◆ A new paper from Dr. James Trosko of Michigan State University in East Lansing and colleagues will add more fuel to the power line health debate. The new *in vitro* experimental results show that a 40 mG, 60 Hz magnetic field can cause effects similar to those of a chemical tumor promoter. The paper will appear in the October *Environmental Health Perspectives*.

◆ The papers presented at last June’s *International Conference on Cell Tower Siting*, held in Salzburg, Austria, are now available (see *MWN*, J/A00). The 240-page proceedings, published in both German and English, cost 28.34 euros (approximately US\$24.65) each. An order form is on the Web at <[www.land-sbg.gv.at/celltower](http://www.land-sbg.gv.at/celltower)>. This site also has a summary of the indi-

vidual presentations, as well as the text of the *Salzburg Resolution on Mobile Telecommunication Base Stations*.

◆ On September 20, the Norwegian National Institute of Occupational Health (STAMI) released its report on the cluster of congenital malformations among children born to sailors who served on the torpedo boat *Kvikk* (see *MWN*, J/F99). The report, which offers no firm conclusions, is at: <[www.stami.no/publ/rapp/pdf/200003.pdf](http://www.stami.no/publ/rapp/pdf/200003.pdf)>. The report is in Norwegian, with an English summary on p.47.

◆ The FCC issued a public notice on August 24 reminding its licensees that they must *all* be in compliance with the commission’s RF/MW rules by September 1 (see *MWN*, J/A96).

Today there is less debate over whether there is an association and more about what it means.

Even if the link is not due to bias, Dr. Martha Linet of the National Cancer Institute favors focusing research on other possible causes. "There is no risk for the 99.2% of kids with exposures under 4 mG," she argues. "There are a lot of other things we could study that would explain more than 0.8% of one type of childhood cancer." Linet is right to emphasize how little we know about children's cancer, but it is wrong to think that this makes the EMF-childhood leukemia connection unimportant.

First, while most children do not live in high-EMF environments, there are millions around the world who do. Second, the idea that there may be a health effect at four milligauss is a scientific bombshell, and this cannot be left unresolved. Third, public opposition to new power lines is an expensive problem for the electric utility industry—and it is not going to go away.

If the risk observed above 4 mG reflects a real health effect, that means that around a million children are at increased risk for leukemia in the U.S. alone (see *MWN*, M/J98). Over a million Americans—including hundreds of thousands of children—have average daily exposures above 10 mG. The percentage of high-exposure homes is larger in North America than in Europe, due to different ways of distributing electricity, but on every continent there are millions of workers with reason to be concerned. If a 4 mG exposure can injure human health, what does that mean for garment workers? Sewing machine operators can easily average 20 or 30 mG for eight hours a day, with their legs exposed to 200 mG or more (see *MWN*, S/O95).

A biological effect from a 4 mG magnetic field is supposed to be impossible. The traditional view of non-ionizing radiation is that such exposure is safe as long as you don't get shocked or cooked. Once unquestioned, that paradigm is now in retreat. There is increasing agreement among biologists that nonthermal biological effects do exist, and there is evidence that some such effects may injure health. Impossible, according to the old theory—but it may be happening every day.

If our scientific understanding of extremely-low-frequency magnetic fields might have been so wrong, what does that mean for higher-frequency RF/MW radiation? From power lines to mobile phones to military radar, our safety standards are on shaky ground. From the IEEE to ICNIRP, it is clear they need an overhaul. It is less clear what should replace them.

Until these scientific and regulatory issues are resolved, we can be sure of one thing: Public concern about EMFs is here to stay. Parents in high-exposure homes have reason to be anxious about their children's health, and the data linking EMFs and childhood leukemia are robust enough that this is not likely to change. That has important implications for the utility industry.

Even with less of a media spotlight on EMFs in recent years, public concern has put a damper on new power line construction. Now rising demand for electricity has converged with deregulation and the decline of conservation measures to produce a loud industry campaign for more plants and more transmission lines.

But anyone who thinks parents are about to welcome high-voltage lines into their backyards is in for a rude surprise. Suburban neighborhoods have sprawled into formerly open land, which

## **IEEE's Health Standards Panel: Major Changes Are Needed**

The IEEE wants the health standards set by its committee on non-ionizing radiation to be recognized around the world. But there is little chance of this happening unless the committee, SCC-28, gets a good dose of reform. As it stands, SCC-28's composition is lopsided and its procedures unfair.

First, each organization should have only one vote, no matter how many of its representatives sit on a panel. At present, the subcommittee that writes RF/MW exposure limits has 64 members, more than 20% of which are from the military. The U.S. Air Force alone has seven votes. Motorola has four votes, the same as all federal health agencies combined.

Second, the committee must recruit more biologists and medical doctors. Should engineers really be in charge of writing health standards? In fact, the whole leadership of the committee should be reconstituted so that it no longer looks like a branch of the military-industrial complex.

Finally, SCC-28 should let in some daylight. Meetings should be open to all interested parties as well as the press. Working documents, including minutes of meetings and drafts of standards, should be posted on the Internet.

Another IEEE panel, the SCC-34 subcommittee that is writing the protocol for measuring cell phone radiation exposures, is already operating in just such a more open and equitable manner. The SCC-34 panel is not run by mobile phone manufacturers, but by the FCC and the FDA. Member organizations are limited to a single vote, and all draft documents and comments are automatically exchanged by e-mail or are posted on the subcommittee's Web site.

If SCC-28 wants to be taken seriously, it must make some serious changes.

makes it more difficult than ever to build new transmission lines without plowing through population centers. The utility industry is on a collision course with the soccer moms, and the moms are not about to get out of the way.

For the sake of public health, the sake of science and the sake of economics, we need better answers about the effects of low-energy radiation. The ubiquity of technology in modern life means that we take a bath in it every day—and we're only going to be spending more time in the tub.

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