

# THE HEALTH EFFECTS OF CELL PHONE USE

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**HEARING**  
BEFORE A  
SUBCOMMITTEE OF THE  
COMMITTEE ON APPROPRIATIONS  
UNITED STATES SENATE  
ONE HUNDRED ELEVENTH CONGRESS  
SECOND SESSION

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**SPECIAL HEARING**  
SEPTEMBER 14, 2009—WASHINGTON, DC

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# THE HEALTH EFFECTS OF CELL PHONE USE

MONDAY, SEPTEMBER 14, 2009

U.S. SENATE,  
SUBCOMMITTEE ON LABOR, HEALTH AND HUMAN  
SERVICES, AND EDUCATION, AND RELATED AGENCIES,  
COMMITTEE ON APPROPRIATIONS,  
*Washington, DC.*

The subcommittee met at 2:05 p.m., in room SD-138, Dirksen Senate Office Building, Hon. Tom Harkin (chairman) presiding.  
Present: Senators Harkin, Pryor, and Specter.

## OPENING STATEMENT OF SENATOR TOM HARKIN

Senator HARKIN. The Appropriations Subcommittee on Labor, Health, Education, and Related Agencies will now come to order.

There are an estimated 270 million cell phone users in the United States and about 4 billion worldwide. I would venture to guess that almost everyone in this room uses a cell phone on a regular basis, and most of us don't give a second thought that it could harm us in any way. However, a growing number of experts think there is cause for concern. The amount of radiation emitted by cell phones is small, billions of times, I'm told, less than an X-ray. But some researchers believe that over the course of many years even this low level of radiation could cause cancers of the brain and central nervous system, as well as a range of other harmful effects.

Indeed, some international studies have suggested that people who use cell phones for more than 10 years are more likely to get tumors on the side of the head where they usually hold their phone. Other studies, meanwhile, have found no correlation at all.

So it is not the intention of this subcommittee to create undue alarm. But one thing that we'll want to discuss today is whether we need more National Institutes of Health (NIH) research in this area and how that research should be conducted. Our expert witnesses will also discuss whether there are precautions we should be taking now to reduce our exposure to cell phone radiation in case these fears turn out to be well founded.

I'm reminded of this Nation's experience with cigarettes. Decades passed between the first warnings about smoking tobacco and the final definitive conclusion that cigarettes cause lung cancer. If more people had heeded those early warnings or if we could have established the link between tobacco and cancer more quickly, many lives would have been saved.

We don't know yet whether cell phone radiation poses a similar danger. I hope today's hearing will begin to address that question.

Before we turn to our first panel, I would yield to Senator Specter, who I would state for the record requested this hearing. It was Senator Specter who came to me and got my attention on this and suggested that we should indeed have a hearing on it. The more I looked at it, the more I think Senator Specter was absolutely right.

Senator Specter.

Senator SPECTER. I had to call Senator Harkin on his cell phone to get him. I was able to get through.

I begin by thanking my distinguished colleague for scheduling this hearing. The subject was brought to my attention by a distinguished doctor who has written extensively on cancer, Dr. David Servan-Schreiber from the University of Pittsburgh Medical Center. He wrote a book on cancer which I found to be very illuminating. I've had a couple of bouts with Hodgkin's and was fascinated to hear Dr. Servan-Schreiber's views about sugar and white flour feeding into cancer. If you've had chemotherapy a couple of times, you look at any conceivable source to minimize the risks.

When he told me about a conference which is being held, which is under way today on the Senate premises, it seemed—well, he requested the hearing, as did Dr. Devra Lee Davis, a professor from the Department of Graduate School of Public Health at the University of Pittsburgh, that this would be a good day.

You have, Mr. Chairman, outlined the issues I think succinctly. I think it is worth in addition noting that there is a \$24 million study under way, which hasn't gotten too far, but is in process, and I think that you are correct that there ought to be a look to see what else needs to be done.

I noted a couple of comments, one from the National Cancer Institute (NCI), which said, quote: "More research is needed to determine what effects, if any, low level radiofrequency has." Well, the question is an open one according to that. The World Health Organization (WHO) said, quote: "There are gaps in knowledge that have been identified for further research to better assess health risks."

I think it is worth noting that Finland, Israel, and France have taken some action in issuing guidelines for the use of cell phones. So it is something which is worth taking a look at, not in an inflammatory or an excited way or with any stark statements, but say it's a serious question and a serious question ought to get a serious analysis. No better place to do it than this subcommittee.

So I thank you for convening the hearing. I thank our distinguished witnesses for coming.

Senator HARKIN. Thank you, Senator Specter. For the last 20 years we've been working together I can honestly say that Senator Specter has always been sort of on the cutting edge of looking at research and asking the tough questions: Should we be doing more research in one area, another area? Especially in the area of cancer, I don't think anyone's been more forthright and had strength of purpose for all these years than Senator Specter in pushing the frontiers on cancer research.

Senator SPECTER. Senator Harkin and I have not only asked the tough questions; we've provided some big answers, like his efforts and mine have had a part, however small, in increasing the NIH

budget from \$12 billion to \$30 billion over a decade, and in the stimulus package our efforts adding \$10 billion more, which has re-awakened a whole research, interest in research scientists, with 15,000 grants we're funding at NIH with level funding, which then resulted in across the board cuts, and inflation having taken \$5.2 billion out of the \$40 billion.

So we have done more than provide questions.

Senator HARKIN. We've pulled together, all right. It was pretty good, thank you.

Thank you, Senator Specter.

We'll turn to our first panel, and I will say for this panel and also to all the witnesses, your statements will be made a part of the record in their entirety. I would hope that you might sum them up in, oh, let's see—I didn't put pencil to paper to figure out our time here, but let's just say 7 or 8 minutes for you to sum it up. We won't have a strict gavel on that, but just try to keep it at 7 minutes or so, your testimony.

Our first witness is Dr. John Bucher, Associate Director of the National Toxicology Program (NTP), a cooperative effort between the National Institute of Environmental Health Sciences (NIEHS), the CDCP, and the FDA to coordinate toxicological testing programs in the Department of Health and Human Services. Dr. Bucher received a master's degree in biochemistry from the University of North Carolina and a Ph.D. in pharmacology from the University of Iowa.

**STATEMENT OF JOHN BUCHER, Ph.D., ASSOCIATE DIRECTOR, NATIONAL TOXICOLOGY PROGRAM, NATIONAL INSTITUTES OF HEALTH, RESEARCH TRIANGLE PARK, NORTH CAROLINA**

Senator HARKIN. Dr. Bucher, welcome to the subcommittee and please proceed.

Dr. BUCHER. Thank you. Mr. Chairman and distinguished members of the subcommittee, I am pleased to appear to discuss research supported by the NIH, NIEHS, and NTP on exposure to radiofrequency (RF) radiation from the use of cellular telephones.

I am John Bucher, Associate Director of the National Toxicology Program. Cellular telephones use RF energy or radiation for mobile communication. Wireless communication devices are used by more than 270 million Americans. With so many users, this could translate into a significant public health problem should their use even slightly increase the risk of adverse health effects.

While the weight of current evidence has not conclusively linked cell phone use with any health problems, we and other scientific organizations believe better data are needed to establish any potential risks to humans from the low-level RF radiation exposures associated with their use.

The Food and Drug Administration (FDA) nominated cell phone RF radiation emissions to the NTP for toxicology and carcinogenicity testing. The nomination was based on the following concerns: There is widespread human exposure; current exposure guidelines are based on protection from acute injury from thermal effects; little is known about potential health effects of long-term exposure; and sufficient data from human studies to clearly answer these questions may not be available for many years.

The NTP is working to provide information that will help clarify any potential health hazards from exposure to cell phone radiation. We're in the initial stages of conducting toxicology and carcinogenicity studies in laboratory animals using specially designed chambers to provide exposures that simulate those of cell phone users in the United States. The rats and mice will be exposed to RF energy from the two technologies, CDMA and GSM, currently used, at 2 frequencies, 900 and 1,900 megahertz.

Because of the complexity of these studies, we are working with experts from the National Institute of Standards and Technology (NIST). NIST scientists have developed a system that provides uniform exposures to RF radiation to unrestrained rodents in the frequency bands used in mobile communications. This design allows for exposures for up to 20 hours per day, in contrast to the most comprehensive rodent cancer studies carried out to date in Europe using restrained animals, where exposures were only to 2 hours per day.

This system consists of 21 chambers assembled in Switzerland and installed in IIT Research Institute laboratories in Chicago. The chambers are essentially shielded rooms with a transmitting antenna radiating RF fields and rotating stirrers to generate statistically uniform fields.

The NTP is conducting studies in three phases: pilot studies to establish field strengths that do not excessively raise body temperature; subchronic toxicology studies where animals are exposed to various sub-thermal field strengths for 1 month; and chronic toxicology and carcinogenicity studies exposing animals for 24 months. The studies include both sexes of rats and mice and pregnant female rats, allowing us to examine potential health effects from exposures starting in gestation and continuing through old age.

The pilot studies are nearly complete. Subchronic studies will begin early next year and the chronic toxicology and carcinogenicity studies will start in late 2010, finish in 2012, with peer review and reporting in the 2013–2014 timeframe.

In addition to the NTP study, research is under way in academic institutions supported through the NIH extramural grants program. The research portfolio of the NCI includes several grants examining possible associations between cell phone use and cancer. Internationally, an NCI-funded grant is exploring possible links between exposure to electromagnetic frequencies and tumors of the brain and central nervous system. In the United States, researchers at five academic centers are undertaking the first efforts to examine environmental and genetic risk factors for meningioma, a tumor that forms in tissues surrounding the brain and spinal cord. Cell phone use is a major environmental risk factor being considered in this study. These grants are expected to conclude in 2011, with findings available shortly thereafter.

The NIEHS is using American Recovery and Reinvestment Act funding to support researchers at UCLA studying whether exposure to cell phones in childhood can affect the central nervous system. The cohort for this study includes more than 100,000 Danish children. The research team will study whether cell phone exposures are related to behavioral and developmental problems, as



well as outcomes such as seizures, migraines, and sleep disturbances.

PREPARED STATEMENT

Thank you for the opportunity to talk about these important studies. The studies I've described represent a significant commitment to determining whether any risks to public health are posed by the use of mobile communication devices. I'll be more than happy to answer any questions you may have.

[The statement follows:]

PREPARED STATEMENT OF JOHN R. BUCHER

Mr. Chairman and distinguished members of the subcommittee: I am pleased to appear before you today to present testimony on research supported by the National Institutes of Health's National Institute of Environmental Health Sciences (NIH/NIEHS), through the National Toxicology Program (NTP), on exposure to radiofrequency (RF) energy from the use of cellular telephones. My name is John Bucher; I am the associate director of the NTP.

Personal (cellular) telecommunications is a rapidly evolving technology that uses RF energy or radiation for mobile communication. Currently, wireless communication devices are used by more than 270 million Americans, or greater than 85 percent of the U.S. population. With so many users, this could translate into a potentially significant public health problem should the use of these devices even slightly increase the risk of adverse health effects.

While the weight of the current scientific evidence has not conclusively linked cell phones with any health problems, we and other scientific organizations evaluating the available studies have concluded that better data are needed to establish any potential risks to humans from the low-level RF radiation exposures associated with their use.

The Food and Drug Administration (FDA) nominated cell phone RF radiation emissions to the NTP for toxicology and carcinogenicity testing. The FDA nomination was based on the following concerns:

- There is widespread human exposure;
- Current exposure guidelines are based on protection from acute injury from thermal effects;
- Little is known about the potential for health effects of long-term exposure; and
- Sufficient data from human studies to definitively answer these questions may not be available for many years.

The NTP is working to provide information that will help clarify any potential health hazards, including cancer risk, from exposure to cell phone radiation and pave the way to better protection for public health. The NTP is in the initial stages of conducting toxicology and carcinogenicity studies in laboratory animals, using specially designed chambers to provide exposures that simulate those of cell phone users in the United States. The rats and mice will be exposed to radiofrequency energy from the two technologies (CDMA and GSM)<sup>1</sup> currently used in the United States at two frequencies (900 and 1900 MHz).

Because of the technical complexity of studying cell phone radiation, NTP staff are working closely with RF radiation experts from the National Institute of Standards and Technology (NIST). Through an interagency agreement, NIST scientists worked to develop an exposure system that would provide uniform exposures to RF radiation in unrestrained rodents in the frequency bands used in mobile communications. This design allows for exposures of up to 20 hours per day, in contrast to the most comprehensive rodent cancer studies carried out to date in Europe using restrained animals, where exposures were only 2 hours per day. The NIST system consists of 21 separate chambers specially assembled in Switzerland and installed in IIT Research Institute laboratories in Chicago. These 21 chambers are essentially shielded rooms with a transmitting antenna radiating RF fields and rotating stirrers to generate a statistically uniform field.

The NTP is conducting studies in three phases: (1) a series of pilot studies to establish field strengths that do not excessively raise body temperature; (2) subchronic toxicology studies where the animals are exposed to various subthermal field

<sup>1</sup> CDMA is Code-Division Multiple Access, and GSM is Global System for Mobile communications.

strengths for 1 month; and (3) chronic toxicology and carcinogenicity studies where the animals will be exposed for 24 months. The studies are being carried out with both sexes of rats and mice and with pregnant female rats. Thus, these studies will examine potential health effects resulting from exposures starting in gestation and continuing through old age.

The projected timeline is that pilot studies should be completed in November 2009. Subchronic toxicology studies then are expected to begin in early 2010, and the chronic toxicology and carcinogenicity studies are expected to start in late 2010, with an anticipated completion in 2012 and subsequent reporting and peer review of the data in 2013–2014.

Collectively, these rodent studies conducted by the NTP will provide critical information regarding the safety of exposure to RF radiation and strengthen the science base for determining any potential health effects in humans. These data could contribute to information used by the Federal Government, including FDA, in making decisions with respect to RF radiation health issues consistent with the protection of public health and safety.

In addition to the NTP study, research is underway in academic institutions supported through the NIH extramural grants program. The research portfolio of the National Cancer Institute (NCI) includes several grants examining possible associations between cellular phone use and cancer. Internationally, an NCI-funded grant is exploring possible links between exposure to electromagnetic frequencies from new communication technologies and tumors of the brain and central nervous system. In the United States, researchers at five academic centers are undertaking the first concentrated effort to examine environmental and genetic risk factors for meningioma, a tumor that forms in the thin layers of tissues protecting the brain and spinal cord. Cellular phone utilization serves as one of the major environmental risk factors being considered in this study. These grants are expected to conclude in 2010 and 2011, respectively, and findings will be made available shortly thereafter.

NIEHS is using American Recovery and Reinvestment Act funding to support researchers at the University of California, Los Angeles, who are studying whether exposure to cellular telephones in childhood can have effects on the central nervous system. The cohort for the study consists of more than 100,000 Danish children born between 1996 and 2007, with data gathered on cell phone use. The research team plans to study whether cell phone exposure might be related to behavioral and developmental problems, as well as other outcomes such as seizures, migraines, and sleep disturbances.

Thank you for the opportunity to talk about these important studies. The NTP/NIH studies I have described represent a significant commitment to determining whether any risks to public health are posed by the current use of these mobile communication devices. I will be happy to answer any questions you may have.

Senator HARKIN. Thank you very much, doctor.

I was asking who is the gentleman with you, but I understand you're here to try to fix up the PowerPoint presentation or something like that?

VOICE. Apparently I'm not good enough at that.

Senator HARKIN. It's not working or something. Well, that's all right.

Did you have something else, Dr. Bucher, that you wanted to—

Dr. BUCHER. Now we have the PowerPoint presentation. We were just going to show some pictures to give you some sense of the magnitude of this operation. These are the chambers that were designed and built in Switzerland and shipped to IIT Research Institute in Chicago. You can see they're large enough to be placed on a crane and dropped through into an underground laboratory facility, where they're obviously being received and moved into place.

Go ahead.

Then here is a picture of the final series of 21 chambers.

Senator HARKIN. I don't understand what the chambers are for.

Dr. BUCHER. These chambers are where the rodent studies are going to be carried out. These are the exposure chambers where the RF radiation will be exposed to the animals.

Senator HARKIN. And you can vary the levels?

Dr. BUCHER. Vary the levels, yes.

Senator HARKIN. Dr. Bucher, the research you described at the NTP involves animals. I can certainly understand, since we, this subcommittee, have been involved with working with researchers for many years, I can understand the value of that sort of research. You can subject these rodents to radiation in ways that you wouldn't want to try on people, I guess and learn a lot about the basic science. But many other countries are doing studies involving humans, more so, it seems, than here in the United States.

We're going to hear later about INTERPHONE, a collaboration involving 13 countries. In fact, practically every study that will be discussed by our second panel of witnesses took place overseas. So I guess kind of a two-part question. Why hasn't more been done here in the United States to look at the epidemiology of brain cancer among cell phone users? And why isn't the United States part of the INTERPHONE collaboration?

Dr. BUCHER. Senator, my understanding is that we do in fact, NCI does support part of the INTERPHONE study. The INTERPHONE study is a large study in 13 different countries that is supported by or is being coordinated by the WHO.

Senator HARKIN. But I don't see the United States? I have a list of them. I don't see the United States listed.

Dr. BUCHER. I have a record that we are in fact supporting one of the principal investigators on the INTERPHONE study. But I could check that certainly and make sure.

[The information follows:]

The National Cancer Institute (NCI) is currently funding 6 grants examining the relationship of cell phone use and brain cancer. Five population-based, case-control studies are underway in Connecticut, Massachusetts, North Carolina, Texas, and California examining intra-cranial meningioma with respect to the genetic and environmental determinants of this disease. The NCI is also providing funding for an analysis of the INTERPHONE multi-country, case-control study cohort, specifically examining information on occupational exposures to electromagnetic radiation, chemicals, and the combination of chemical and electromagnetic radiation exposures with respect to development of gliomas, meningiomas, and parotid gland tumors.

*Grant Title.*—Occupational exposures and brain cancer

*Grant Number.*—R01CA124759

*PI.*—Dr. Elisabeth Cardis

*Institution.*—International Agency for Research on Cancer

*Project Start.*—9/17/2007

*Project End.*—11/30/2010

The International Agency for Research on Cancer (IARC) coordinated a multi-national, case-control study of the possible association between use of cell phones and cancer risk. The INTERPHONE study was conducted in 13 countries using a common core protocol and focused on the risk of tumors originating in tissues most exposed to radiofrequency (RF) radiation from cell phones. The data collection was completed in 2006. A total of 2,613 glioma cases, 2,343 meningioma cases, and 7,557 controls were recruited between 2000 and 2005, making INTERPHONE the largest analytical epidemiological study of brain cancer ever conducted. The questionnaire provided detailed information on history of cell phone use, occupational history, and history of working with selected sources of exposure to electric and magnetic fields (EMF), particularly extremely low frequency (ELF) and RF fields.

While the primary focus of the INTERPHONE questionnaire was the collection of a detailed cell phone history, the information collected in the occupational section of the questionnaire also provides an opportunity to address outstanding questions concerning the risk of brain tumors, such as glioma and meningioma, in relation to occupational exposure to EMF and selected chemicals.

Dr. Cardis' study is using data from INTERPHONE to carry out an assessment of brain cancer risk in relation to occupational exposure to EMF and to selected chemicals. Their study's aims are to use the information on occupational exposures collected through the INTERPHONE study to:

- Evaluate the possible association between occupational exposure to EMF in different frequency bands and tumors of the brain and central nervous system (specifically, glioma, and meningioma); and
- Evaluate the possible association between selected occupational chemical exposures and tumors of the brain and central nervous system (specifically, glioma, and meningioma).

This study includes nine INTERPHONE countries: Australia, Canada, France, Germany, Israel, Italy, New Zealand, Sweden, and United Kingdom (North). Occupational exposure to ELF-EMF, RF-EMF, and selected chemicals is being assessed for more than 10,000 subjects, with nearly 30,000 jobs using validated job-exposure matrices developed through this project. The assessment of EMF exposure is refined by consolidating information obtained from the job-exposure matrix with data on exposure variations related to the specific industry in which a subject worked, to the tasks he or she performed, and to the actual sources of exposure available from the INTERPHONE questionnaire. Analyses of the relationship between brain tumor risk and exposure to EMF and to the chemicals of interest will be carried out.

Historically, the INTERPHONE studies began in Europe in part because of an earlier adoption of cell phone technologies than in the United States, coupled with the availability of centralized health care records. At the time INTERPHONE was launched, the NCI was conducting a hospital-based study on cell phone use and brain tumors (Inskip et al., *N Engl J Med.* 2001 Jan 11;344(2):79–86). Other studies (Muscat et al., *JAMA.* 2000 Dec 20;284(23):3001–3007 and Dryer et al., *JAMA.* 1999 Nov 17;282(19):1814–6) were also underway in the United States, or were just being completed at that time.

The Food and Drug Administration (FDA) provides recommendations on its Web site concerning use of cell phones by children. The FDA recommends limiting use of cell phones by children and using a headset or the speakerphone option. The use of a headset or speakerphone may reduce exposure to the brain since the phone will not be held next to the ear; however, RF radiation exposure will still occur to whatever part of the body is close to the phone. Also, some mobile communication devices emit lower levels of RF radiation than others (<http://www.ewg.org/cellphone-radiation/>). The FDA acknowledges that some groups sponsored by other governments have advised that children be discouraged from using cell phones based on the precautionary principle.

In 2007, the FDA requested that the National Academy of Sciences (NAS) convene a committee of experts to identify research needs relating to potential biological or adverse health effects of wireless communications devices. The committee released its report in 2008 (available at <http://www.nap.edu/catalog/12036.html>).

The committee recommended research in the following areas:

- Characterization of exposure to juveniles, children, pregnant women, and fetuses from personal wireless devices and RF fields from base station antennas.
- Characterization of radiated electromagnetic fields for typical multiple-element base station antennas and exposures to affected individuals.
- Characterization of the dosimetry of evolving antenna configurations for cell phones and text messaging devices.
- Prospective epidemiologic cohort studies of children and pregnant women.
- Epidemiologic case-control studies and childhood cancers, including brain cancer.
- Prospective epidemiologic cohort studies of adults in a general population and retrospective cohorts with medium to high occupational exposures.

With respect to human epidemiology studies of adults, the committee stated, “[a] prospective cohort study will allow for the evaluation of diverse outcomes, but a very large sample size and extended follow-up would be required for rare outcomes or those that occur only with very long latencies. None of the occupational studies to date have been based on an adequate exposure assessment. Much work is needed to identify occupations with potentially high RF exposures and to characterize them.” The study currently being carried out by Elisabeth Cardis (described above) includes an effort to transform occupational history and questionnaire data into meaningful estimates of exposure to electromagnetic fields.

With respect to exposures to children, the committee stated, “[c]hildren are potentially exposed from conception through maternal wireless device use and then postnatally when they themselves become users of mobile phones. Owing to widespread use of mobile phones among children and adolescents and the possibility of relatively high exposures to the brain, investigation of the potential effects of RF fields in the development of childhood brain tumors is warranted.”

The committee also recognized that the pending results of the INTERPHONE study, by far the largest case-control study of head and neck tumors to date, are

likely to have a major influence on the direction and scope of future research concerning the use of cell phones and cancer. As of October 2009, the collected results from the INTERPHONE study have not yet appeared in the peer-reviewed literature.

Concerning the costs of such studies, they will vary depending on the size and availability of appropriate study populations, the ease of access to existing and future information on health status, and the difficulty associated with establishing better measures of total exposures to electromagnetic radiation in the frequency bands used by cell phones.

Huss et al., (*Env. Health Perspect.* 2007 Jan 1;115(1):1–4) carried out a systematic examination of the funding sources of research groups that conducted studies of controlled exposures to RF radiation in relation to a number of health-related outcomes. They reported on 59 studies, 20 percent were funded exclusively by industry, 19 percent by public agencies or charities, 24 percent had mixed funding including industry, and for 37 percent the funding source was not specified. No comparable reports have examined funding of other types of research related to cell phones and health outcomes.

The INTERPHONE study was funded in part by the mobile phone industry through the Mobile Manufacturers Forum and GSM Association. According to the General Accounting Office, studies carried out by the European Commission under its cell phone research program known as the Fifth Framework Programme are funded 40 percent by the European Commission and 60 percent by the mobile phone industry (GAO–01–545, *Research and Regulatory Efforts on Mobile Phone Health Issues*, May 7, 2001).

There is no specific information available concerning the types or extent of studies of health effects related to cell phone use that were not intended to be published in the open literature.

When used in an area where reception is weak, the cell phone will increase the energy level of the emitted RF radiation in an attempt to communicate with the base station. If adverse health effects result from RF radiation, it is speculated that these effects would be produced to a greater extent from an increased level of RF radiation as opposed to a weaker level.

There is little information available concerning the extent to which wireless phones were tested for health effects prior to coming on the market. In 1996, the Federal Communications Commission (FCC) issued regulations that placed a limit on the amount of local tissue heating permitted during the use of wireless communication devices. Manufacturers are responsible for testing their products for compliance with FCC regulations (GAO–01–545).

The World Health Organization (WHO) established the International EMF Program in 1996 to assess the scientific evidence of possible health effects to EMF. As part of this effort, the WHO maintains a database of voluntary submissions of information on research projects that examine effects of EMF on biological systems (in humans, laboratory animals, and cultured cells and artificial systems). The database is searchable for specific frequency ranges and study types, and includes both published studies and ongoing work (<http://www.who.int/peh-emf/research/database/en/index.html>).

The database was last updated in May 2009. It contains listings of 1567 projects. Two hundred and twenty-six projects are coded as epidemiology studies with electromagnetic fields encompassing the frequencies used by cell phones. Most include some type of evaluation of human health effects, although some relate to the use of cell phones while driving. Forty of these studies are listed as ongoing, with the majority in Europe. There are no ongoing studies listed in the United States, although as stated in the testimony, we are aware of at least seven studies supported by funding from the National Institutes of Health, with five of these underway in the United States.

Senator HARKIN. Well, I have 13 countries. I just don't see the United States listed. I'd like to know more about that.

But go ahead, then. So why aren't we doing more on the epidemiology?

Dr. BUCHER. Well, I am not sure I can really answer that question. We have—I've been looking at the grant proposals that have come into the NIH. The one study that I mentioned earlier by Elisabeth Cardis is being funded by the NIH, and that is, as I understood it, looking at least some of the cohorts that are being put together for the INTERPHONE study.

I do know that the FDA has been working and works with an international work group from Japan, Korea, the European Union, Australia, China, and the WHO. The United States participates in this international work group, where they meet every year, I believe, to discuss health effects research on emerging wireless technologies, go over recent biological research developments, and look at standards developments across the countries.

They also do look into the prospects for international collaboration related to the safety of these devices.

Senator HARKIN. One last question, Dr. Bucher. You said—and I underlined here—you said that, while the weight of the current scientific evidence has not conclusively linked cell phones with any health problems, we and the other scientific organizations evaluating the available studies have concluded that better data are needed to establish any potential risks to humans of these low-level RF radiation exposures.

Okay, the key words to me are “the weight of current scientific evidence does not conclusively link cell phones with health problems.” What does that mean? Is the weight 60–40, 55–45, 90–10, 99 to 1? What is the weight on this?

Dr. BUCHER. Well, I specifically said that better data are needed in my testimony. There have been lots of studies on cell phone radiation. There have been human studies. There have been studies in experimental animals. There have been a wide variety of studies where a variety of tissues from animals and cells from animals have been exposed to RF fields to try to determine whether there are biological effects.

I think that each of these areas, with respect to this field, have weaknesses and I think that most people would generally concede that there are weaknesses in each arm of this three-legged stool, I guess, if you would, to provide the weight of evidence. Human epidemiology studies I think may be currently adequate for looking at events that are closely associated in time with the exposure itself. So you can look at behavioral effects while somebody is actually being exposed to cell phone radiation. You can look at effects on the immune system or something of that nature. But the thing that we’re most concerned about is chronic effects, long-term, after long-term use, and things that may take many, many years to develop.

A lot of the epidemiology studies that have been done, the Interphone studies for example, suffer from the weaknesses that all of the participants acknowledge with respect to the fact that they rely on recall of how much one uses a telephone. They recall—they rely on—and this in fact introduces some biases that are inherent in these kinds of retrospective, what are called retrospective case control studies.

The other major problem with epidemiological studies at this point is that there is only, as you mentioned in your opening remarks, there has only been 10 or 12 years of exposure to these agents and it’s increasing dramatically. There have been some hints recently that there is an increase in brain cancers in people who have used these cellular communication devices for a number of years.

Senator HARKIN. Well, thank you very much, Dr. Bucher. I'm going to yield now to Senator Specter.

Senator SPECTER. Thank you, Mr. Chairman.

You had mentioned children. What are the considerations with respect to an additional potential risk for children using cell phones?

Dr. BUCHER. What was the question?

Senator SPECTER. What is the potential additional risk for children using cell phones? I read in a letter, sir, to give you a little help, that brain formation in its early stages may raise an additional susceptibility. Is there something to that?

Dr. BUCHER. I think with respect to many, exposures to many agents, as we study more and more agents and look at different life stages where these agents are being exposed to children or to animals—

Senator SPECTER. Let's not take up animals. How about children? Is there a significant risk there? I've got 5 minutes, Dr. Bucher.

Dr. BUCHER. Children have a configuration of their skull that does allow penetration of cell phone radiation deeper—

Senator SPECTER. Are you saying there's a potentially greater risk?

Dr. BUCHER. I'm saying there potentially is a greater risk—

Senator SPECTER. What limitations, if any—any parents that are watching this on C-SPAN, what should they do?

Dr. BUCHER. I wish I had a good answer to that. I think that—

Senator SPECTER. Well, would there be a precautionary approach? I understand some of the foreign countries are recommending that there be a limitation. Is that true, on the use of cell phones?

Dr. BUCHER. Yes, that is true.

Senator SPECTER. Would you recommend that?

Dr. BUCHER. I don't think we're in a position yet to make that recommendation.

Senator SPECTER. How about the use of ear phones to minimize risk?

Dr. BUCHER. I think that's a good idea.

Senator SPECTER. How would you do that specifically?

Dr. BUCHER. I understand that specific materials, such as the Bluetooth configuration, do reduce the exposure. That's my understanding.

Senator SPECTER. Would you pursue that question and inform the subcommittee so we can inform the public something more precise?

Dr. BUCHER. Yes.

[The information follows:]

The Food and Drug Administration (FDA) provides recommendations on its Web site concerning use of cell phones by children. The FDA recommends limiting use of cell phones by children and using a headset or the speakerphone option. The use of a headset or speakerphone may reduce exposure to the brain since the phone will not be held next to the ear; however, radiofrequency radiation exposure will still occur to whatever part of the "body is close to the phone. Also, some mobile communication devices emit lower levels of radiofrequency radiation than others (<http://www.ewg.org/cellphone-radiation>). The FDA acknowledges that some groups sponsored by other governments have advised that children be discouraged from using cell phones based on the precautionary principle.

Senator SPECTER. Also with respect to the children, something more definitive?

There is a \$24 million study under way. Is that adequate—being conducted by a Federal agency.

Dr. BUCHER. This study is going to address one of the three aspects of the research program and I think from the standpoint of the animal experimental data it will be a state of the art study and it will answer—

Senator SPECTER. Sufficient?

Dr. BUCHER. It will answer the questions to the best of the ability of that technology.

Senator SPECTER. Should there be studies on humans in the United States, as there are elsewhere?

Dr. BUCHER. I certainly would suggest that there should be studies on humans, yes.

Senator SPECTER. That would take extra funding?

Dr. BUCHER. I believe it would.

Senator SPECTER. Would you give the subcommittee a recommendation on what sort of studies you'd recommend for humans and what at cost would be?

Dr. BUCHER. I could do that. I can't do that now. I could do that.

Senator SPECTER. Tomorrow?

I know you can't do that now, but do it as soon as you can?

Dr. BUCHER. Okay.

[The information follows:]

In 2007, the Food and Drug Administration (FDA) requested that the National Academy of Sciences (NAS) convene a committee of experts to identify research needs relating to potential biological or adverse health effects of wireless communications devices. The committee released its report in 2008 (available at <http://www.nap.edu/katalog/12036.html>).

The committee recommended research in the following areas:

- Characterization of exposure to juveniles, children, pregnant women, and fetuses from personal wireless devices and radiofrequency (RF) fields from, base station antennas.
- Characterization of radiated electromagnetic fields for typical multiple-element base station antennas and exposures to affected individuals.
- Characterization of the dosimetry of evolving antenna configurations for cell phones and text messaging devices.
- Prospective epidemiologic cohort studies of children and pregnant women.
- Epidemiologic case-control studies and childhood cancers, including brain cancer.
- Prospective epidemiologic cohort studies of adults in a general population and retrospective cohorts with medium to high occupational exposures.

With respect to human epidemiology studies of adults, the committee stated, “[a] prospective cohort study will allow for the evaluation of diverse outcomes, but a very large sample size and extended follow-up would be required for rare outcomes or those that occur only with very long latencies. None of the occupational studies to date have been based on an adequate exposure assessment. Much work is needed to identify occupations with potentially high RF exposures and to characterize them.” The study currently being carried out by Elisabeth Cardis (described above) includes an effort to transform occupational history and questionnaire data into meaningful estimates of exposure to electromagnetic fields.

With respect to exposures to children, the committee stated, “[c]hildren are potentially exposed from conception through maternal wireless device use and then postnatally when they themselves become users of mobile phones. Owing to widespread use of mobile phones among children and adolescents and the possibility of relatively high exposures to the brain, investigation of the potential effects of RF fields in the development of childhood brain tumors is warranted.”

The committee also recognized that the pending results of the INTERPHONE study, by far the largest case-control study of head and neck tumors to date, are likely to have a major influence on the direction and scope of future research con-



cerning the use of cell phones and cancer. As of October 2009, the collected results from the INTERPHONE study have not yet appeared in the peer-reviewed literature.

Concerning the costs of such studies, they will vary depending on the size and availability of appropriate study populations, the ease of access to existing and future information, on health status, and the difficulty associated with establishing better measures of total exposures to electromagnetic radiation in the frequency bands used by cell phones.

Senator SPECTER. Private companies have made contributions to some of the studies, it's my understanding. Are you aware of that and to what extent the private companies are helping?

Dr. BUCHER. Yes, to some extent. I know there have been some studies that have looked at the literature with respect to who is funding particular investigators. The one study that I recall indicated that about 20 percent of the papers that are published from studies do acknowledge that there is funding from private—

Senator SPECTER. Well, studies which look at the literature don't really go too far. Are there studies which do research beyond the research which has been done to be put in the current literature?

Dr. BUCHER. That's an area that's pretty difficult to answer. I don't know that I can answer that question.

Senator SPECTER. Okay. Could you study that subject and give us a written response?

Dr. BUCHER. I will, Senator.

[The information follows:]

Huss et al., (*Env. Health Perspect.* 2007 Jan 1;115(1):1–4) carried out a systematic examination of the funding sources of research groups that conducted studies of controlled exposures to radiofrequency radiation in relation to a number of health-related outcomes. They reported on 59 studies, 20 percent were funded exclusively by industry, 19 percent by public agencies or charities, 24 percent had mixed funding including industry, and for 37 percent the funding source was not specified. No comparable reports have examined funding of other types of research related to cell phones and health outcomes.

The INTERPHONE study was funded in part by the mobile phone industry through the Mobile Manufacturers Forum and GSM Association. According to the General Accounting Office, studies carried out by the European Commission under its cell phone research, program known as the Fifth Framework Programme are funded 40 percent by the European Commission and 60 percent by the mobile phone industry (GAO-01-545, *Research and Regulatory Efforts on Mobile Phone Health Issues*, May 7, 2001).

There is no specific information available concerning the types or extent of studies of health effects related to cell phone use that were not intended to be published in the open literature.

Senator SPECTER. I note in the briefing materials that cell phones should not be used in areas where reception is weak or blocked, such as in elevators or trains. Is that so? And if so, why?

Dr. BUCHER. I believe that is correct, because the power that's required to reach the cell base station is higher in those situations. Therefore there is more RF radiation transmitted.

Senator SPECTER. Well, in an elevator my phone customarily conks out. Is there more frequency which is imposed when I'm on an elevator with my cell phone.

Dr. BUCHER. I believe that's the case, because the cell phone is still attempting to reach the base station.

Senator SPECTER. Well, the red light went on with our last comments. Would you give us a more definitive answer to that, as to exactly what is involved and why there ought to be extra pre-

cautions under those circumstances in an elevator or similar circumstances?

Dr. BUCHER. I will do that.

[The information follows:]

When used in an area where reception is weak, the cell phone will, increase the energy level, of the emitted radiofrequency radiation in an, attempt to communicate with the base station. If adverse health effects result from radiofrequency radiation, it is speculated that these effects would be produced to a greater extent from an increased level of radiofrequency radiation as opposed to a weaker level.

Senator SPECTER. Thank you, Dr. Bucher.

Thank you, Mr. Chairman.

Senator HARKIN. Thank you, Senator Specter.

Senator Pryor.

Senator PRYOR. Thank you, Mr. Chairman. Thank you for your leadership on this.

Dr. Bucher, let me ask. You may have covered this in your opening statement and I missed it, but how long will it take you to do your analysis?

Dr. BUCHER. For the particular studies that I was describing, the analysis will be taking place in 2013 and we'll be reporting in 2014.

Senator PRYOR. Why does it take so long? Just because it takes that long in the lab to get it together?

Dr. BUCHER. There is about a 3-year time in which the animals will be exposed, and it takes about a year to analyze the study after that.

Senator PRYOR. Will there be any preliminary numbers or do we have to wait until the end to know where it's going?

Dr. BUCHER. It's a three-phase study and there will be information available from the first two stages earlier than that. But they won't be as definitive with respect to outcomes such as cancer.

Senator PRYOR. Do you know if wireless phones were tested by anyone before they came on the market? Do you know the history of that and how much testing was done or not done?

Dr. BUCHER. With respect to health-related testing, I do not know the answer to that. I can find—

Senator PRYOR. I think there would be a lot of people that would be curious about that, to know if anything was done. My sense is that there are people who have very strong suspicions about this, but I think we need to look closely at the science and look at the studies. I appreciate your efforts and what you're trying to do.

[The information follows:]

There is little information available concerning the extent to which wireless phones were tested for health effects prior to coming on, the market. In 1996, the Federal Communications Commission (FCC) issued regulations that placed a limit on the amount of local tissue heating permitted during the use of wireless communication devices. Manufacturers are responsible for testing their products for compliance with FCC regulations (GAO-01-545).

Senator PRYOR. Are there other studies going on, either in this country or around the world, that you're aware of?

Dr. BUCHER. There are many, many studies still going on around the world, yes.

Senator PRYOR. In other words, we'll get—yours won't be the first data that's released? We'll see other things between now and 2013?

Dr. BUCHER. I'm sure you will, yes.

Senator PRYOR. Are most of those going on in the United States or are they going on in other countries, or do you know?

Dr. BUCHER. I don't know the answer to that.

[The information follows:]

The World Health Organization (WHO) established the International EMF Program in 1996 to assess the scientific evidence of possible health effects to EMF. As part of this effort, the WHO maintains a database of voluntary submissions of information on research projects that examine effects of EMF on biological systems (in humans, laboratory animals, and cultured cells and artificial systems). The database is searchable for specific frequency ranges and study types, and includes both published studies and ongoing work (<http://www.who.int/peh-emf/research/database/m/index.html>).

The database was last updated in May 2009. It contains listings of 1,567 projects. Two-hundred and twenty-six projects are coded as epidemiology studies with electromagnetic fields encompassing the frequencies used by cell phones. Most include some type of evaluation of human health effects, although some relate to the use of cell phones while driving. Forty of these studies are listed as ongoing, with the majority in Europe. There are no ongoing studies listed in the United States, although as stated in the testimony, we are aware of at least seven studies supported by funding from the National Institutes of Health, with five of these underway in the United States.

Senator PRYOR. Thank you, Mr. Chairman.

Senator HARKIN. Thank you, Senator Pryor.

Dr. Bucher, I've got one of these. So just from a personal standpoint, we know the science is not quite definitive yet. We know what the weight of it is on that. But if I have a cell phone and I asked your professional opinion on this and I was going to talk on it like this, or if I could use this device here, which I plug into it, and then put this in my ear like this and hold this away from me, and I could talk here in my little microphone here, in your advice which would be best for me to do?

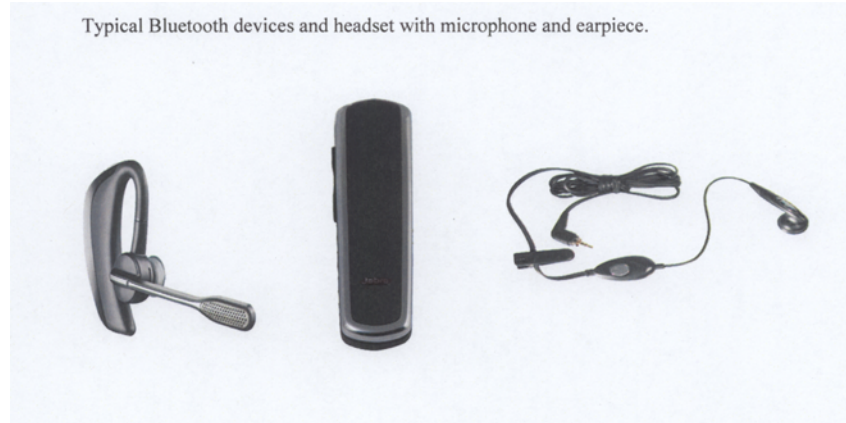
Dr. BUCHER. My understanding is that the position that you're holding the phone now is preferable to up against your head.

Senator HARKIN. Preferable to holding it up to your ear? So you would advise people who might be using a cell phone, as a precaution, because we don't know, that it would be better to have some kind of device like this?

Dr. BUCHER. As I understand it, yes.

Senator HARKIN. As opposed to a Bluetooth? A Bluetooth is an electronic device and it still receives the electromagnetic low frequency radiation, unlike this, which just comes through a line. So would this be better than, say, a Bluetooth-type device?

[The information follows:]



Dr. BUCHER. I must admit, I do not own a Bluetooth. I was under the assumption that the Bluetooth technology was what you were describing, but I'm incorrect.

Senator HARKIN. That's not Bluetooth, no. No, this is wired. This goes through a wire, a copper wire. Bluetooth is something that would receive from this device to a Bluetooth without any connection whatsoever, and therefore you would still get the RF right near your head. Even when you talk into the microphone on a Bluetooth, you're getting the transmission very close to your brain. On this, of course, it's down here, quite a ways away.

Dr. BUCHER. I stand corrected.

Senator HARKIN. But you would say this would be preferable?

Dr. BUCHER. Yes.

Senator HARKIN. To use that kind of device?

Dr. BUCHER. Yes.

Senator HARKIN. I'm going to ask the same question of the other panelists that come up. I'd like to see what they say, too.

Well, thank you very much, Dr. Bucher. We have to move on. Thank you very much for your expert testimony and thank you for the work you do at the National Toxicology Laboratories. Thank you, Dr. Bucher.

Now we'll call our second panel, a big panel. I will introduce them and you can come up and take your seats accordingly: Dr. Dariusz Leszczynski, a research professor at the Radiation and Nuclear Safety Authority in Helsinki, Finland, holds professorships in China and at the University of Helsinki in Finland. He earned his Ph.D. from the University of Helsinki, has lectured on the topic of mobile phones around the world, and has co-chaired two WHO workshops on this issue.

Dr. Siegal Sadetzki—I hope I pronounced that correctly.

Dr. SADETZKI. Not bad.

Senator HARKIN. Not bad? The head of the Clinical Epidemiology Department at Sheba Medical Center and Director of the Cancer and Radiation Epidemiology Unit at the Gertner Institute in Israel, which are affiliated with Tel Aviv University; received her M.D. from the Technion Medical School in Haifa; and a master's in public health from the Hebrew University of Jerusalem. Dr. Sadetzki

wrote the Israeli Ministry of Health guidelines for the use of cell phones in adults and children.

We have Dr. Linda Erdreich. Dr. Erdreich, a Senior Managing Scientist for Exponent, an engineering and scientific consulting firm. She has 30 years of experience in environmental epidemiology and health risk assessment; earned her Ph.D. in epidemiology from the University of Oklahoma and an M.S. in biostatistics and epidemiology.

Dr. Devra Lee Davis is a Professor of Epidemiology at the University of Pittsburgh Graduate School of Public Health. She earned her Ph.D. in science studies at the University of Chicago and an MPH in epidemiology at Johns Hopkins. She has served on numerous governmental and international advisory boards and recently wrote the book “The Secret History of the War on Cancer.”

Last, Dr. Olga Naidenko—did I get that right?

Dr. NAIDENKO. Yes.

Senator HARKIN. Okay. Dr. Olga Naidenko, a Senior Scientist at the Environmental Working Group (EWG), a Washington, DC-based nonprofit organization, received her Ph.D. in molecular biology and immunology from UCLA, was the lead author on the report issued last week by the EWG on the topic of cell phone radiation.

We welcome all of you here. We’ll go Dr. Leszczynski—Is it “Li-CHIN-ski” or “Leh-ZIN-ski?”

**STATEMENT OF DARIUSZ LESZCZYNSKI, Ph.D., D.Sc., RESEARCH PROFESSOR, RADIATION AND NUCLEAR SAFETY AUTHORITY, AND ADJUNCT PROFESSOR, UNIVERSITY OF HELSINKI, HELSINKI, FINLAND**

Dr. LESZCZYNSKI. “Leh-ZIN-ski.”

Senator HARKIN. “Leh-ZIN-ski.” We’ll start with you and then we’ll just go down. Again, I’d ask you if you could—5 to 7 minutes, something like that, if you could summarize it, because I’m sure we’d like to get into a discussion with each of you.

As I said, your statements will be made a part of the record in their entirety.

Dr. Leszczynski, you’re welcome and please proceed.

Dr. LESZCZYNSKI. Thank you. Thank you very much for inviting me to this important hearing on a topic of great concern to all of us. My name is Dr. Dariusz Leszczynski. I am Research Professor at the Radiation and Nuclear Safety Authority in Finland. I am also Guangbiao Professor at the Zhejiang University in China and Adjunct Professor of Biochemistry at the University of Helsinki in Finland.

At this point I would like also to thank Dr. Devra Davis, who made it possible for me to participate in this hearing.

I have been doing basically experimental research in the field of biological and health effects of mobile phones for the past 10 years. The findings of my research group suggest that mobile phone radiation might induce biological responses. However, these findings do not yet prove that there exists a health hazard.

My institution, the Radiation and Nuclear Safety Authority of Finland, has issued two advisories for mobile phone users. The first advisory, in 2004, was a part of the Nordic countries advisory that included Finland, Sweden, Denmark, Norway, and Iceland. The

second advisory, in January 2009, was our own advisory focused on children using mobile phones.

Children are of special concern because of their developing brain. Also, studies from industry and from academia suggest that children's brain is more exposed to mobile phone radiation than the adult brain when using a cell phone.

Both advisories point out the uncertainty of the scientific evidence and the need for precaution in the use of mobile phones. The intention of both advisories is not to discourage people from using the mobile phone technology. However, they remind us that there are still large gaps in the knowledge of the mobile phone radiation effects on humans.

The currently available scientific evidence about the effects of radiation emitted by the mobile phones is contradictory. In each area of investigation, there are both studies showing effects and studies showing no effect. For details on this issue, I would like to refer you to my written statement.

In the present situation of the scientific uncertainty, the statements that the use of mobile phones is safe are premature. If I may repeat it to make it certain, in the present situation of the scientific uncertainty the statements that the use of mobile phones is safe are premature. In my opinion, the current safety standards are not sufficiently supported by science because of the very limited research on human volunteers, on children, and on the effects of long-term exposures in humans.

This situation of uncertainty calls not only for precautionary measures, but also for further research. Apart from the epidemiological, animal, and in vitro laboratory studies, we need a new direction in research. We need international, well-designed, comprehensive, molecular-level human volunteer studies. These studies should be aimed at proving or disproving whether the human body responds to mobile phone radiation. In spite of years of research, we still do not have the answer to this basic question.

#### PREPARED STATEMENT

However, obtaining research funds in this area is a major problem. Continuous assurances that there is no health risk that are coming from standard-setting committees have caused that the funding agencies are reluctant to fund new research. For many years, Europe has led the way in mobile phone research because the funding was available there. The research community is hoping that the United States will again get more involved in this much-needed research by providing necessary funding.

In the meantime, while waiting for this new research, because of the existing scientific uncertainty it is wise to support the use of precautionary measures in everyday use of mobile phones in order to, whenever reasonably possible, limit the body exposure to mobile phone radiation.

Thank you for your attention and I wait for your questions.  
[The statement follows:]

#### PREPARED STATEMENT OF DARIUSZ LESZCZYNSKI

Thank you for inviting me to this important hearing on a topic of a great concern to all of us.

My name is Dariusz Leszczynski and I am a research professor at the Radiation and Nuclear Safety Authority, Helsinki, Finland. I am also Guangbiao professor at the Zhejiang University School of Medicine in Hangzhou, China and adjunct professor of biochemistry at the University of Helsinki in Finland.

I and my research group have worked in the field of biological and health effects of mobile phone radiation for the past 10 years. The basic finding of my group's research is that it appears that mobile phone radiation might induce biological responses in human cells and these responses might alter cell physiology. However, these findings do not yet prove that there exists health hazard.

The currently available scientific evidence about the effects of radiation emitted by the mobile phones is contradictory. In each area of investigation: epidemiology, human volunteer studies, animal studies, laboratory in vitro experiments and biophysical mechanisms there are both positive and negative studies. By the sheer numbers, the negative studies outweigh the positive ones. This argument is used, and often abused, to support the notion that not only there are no proven health effects, but also that such effects are unlikely.

In the present situation of the scientific uncertainty, when there are studies suggesting the existence of health effects of mobile phone radiation, the statements that the use of mobile phones is safe, are premature. In my opinion the current safety standards are not sufficiently supported because of the very limited research on human volunteers, children and on the effects of long-term exposures in humans.

My institution, the Radiation and Nuclear Safety Authority in Finland, has issued two advisories for mobile phone users. In 2004, as part of the Nordic countries advisory, and in 2009 an advisory focused on children using mobile phones. Both advisories point out the uncertainty of the scientific evidence and the need for precaution in the use of mobile phones. The intention of both advisories is not to discourage people from using the mobile phone technology. However, they remind us that there are still large gaps in the knowledge of the mobile phone radiation effects on humans.

In my opinion, to close these gaps we need well designed, comprehensive, molecular level human volunteer studies. Such studies should be executed by consortia of scientists and not by single research groups. These studies should be aimed at proving or disproving whether human body responds to mobile phone radiation and, if so, whether the response is of a sufficient magnitude to alter normal human physiology. In spite of years of research into human health risk of mobile phone radiation, we still do not have the answer to the fundamental question: whether human bodies (tissues, organs) react to mobile phone-emitted microwaves?

However, obtaining research funds in this area is a major problem. Continuous assurances from ICES, International Commission on Non-Ionizing Radiation Protection and the World Health Organization, that the mobile phone radiation does not cause any known health risk and the safety standards protect us all, have caused that the funding agencies are not interested in sponsoring new research.

For many years Europe has led the way in mobile phone research because the funding was available there. The research community is hoping that United States will again get more involved in this much needed research by providing necessary funding.

In the meantime, while waiting for this new research, because of the existing scientific uncertainty, it is wise to support the use of precautionary measures in everyday use of mobile phones in order to, whenever reasonably possible, limit the body exposure to mobile phone radiation.

Thank you for your attention and I look forward to your questions.

Senator HARKIN. Dr. Leszczynski, thank you very much for your testimony.

Dr. Sadetzki, welcome. Please proceed.

**STATEMENT OF SIEGAL SADETZKI, M.D., DIRECTOR, CANCER AND RADIATION EPIDEMIOLOGY UNIT, GERTNER INSTITUTE, CHAIM SHEBA MEDICAL CENTER, TEL-HASHOMER, ISRAEL**

Dr. SADETZKI. Thank you very much. I'm greatly honored to testify at this important hearing on a subject which affects a substantial proportion of the world population and which has great importance for public health. My full résumé appears with my written testimony. I am a physician, board-certified in epidemiology and public health. I am the Director of the Cancer and Radiation Epide-

miology Unit at the Gertner Institute, affiliated at Tel Aviv University.

I am involved in research and I advise the chief director of the Ministry of Health on health policy concerning radiation and cancer. I am currently engaged in collaborative studies of brain cancer funded, among others, by the NIH and the European Community. For more than 10 years I have been participating in research on the risk of tumors associated with cell phones, initially as the principal investigator of the Israeli part of the INTERPHONE study, the largest collaborative study conducted to date on this issue, and currently I lead the Israeli team of another study, also funded by the EU, on cell phones and children, called MOBIKIDS.

In 2008, we published findings from the Israeli findings of the INTERPHONE study suggesting a risk of salivary gland, located right here, salivary gland tumors among people who have used cell phones for relatively long periods, when the phone was usually held on the same side of the head where the tumor developed and when use was relatively heavy.

The Israeli Ministry of Health adopted the precautionary principle that briefly says better safe than sorry. It published recommendations for several simple and low-cost measures—this is really important; the measures are very simple and very low cost—that should be taken to reduce exposure. I believe that the clever engineers that are out there in the industry can very easily find creative solutions for that.

These measures include speakers, earphones, hands-free devices when driving, and, as you said before, reducing the use of cell phones in areas where reception is weak. Special attention was given to children because we have many proofs that the children's population is specifically susceptible to carcinogenic effects. As said here before, guidelines have also been published in other countries, such as France, Finland, Canada, and others.

Now, our findings are in line with some other studies of brain and acoustic neuroma—these are the nerves that control hearing—that demonstrated an increased risk of more than 10 years of use and use on the same side of the head as the tumor. However, there is a debate among scientists, and this is where we are today, whether these observations are true or stem from methodological issues of epidemiological studies in general and those on cell phones specifically.

I also appreciate these methodological issues. I suspect the results, but I respect the results primarily, the results that we have.

I would like to explain one important point which illustrates the limitations of the existing data. I think it's an important point. During a duration of at least 10 years is the minimal time needed for solid cancer studies. In the case of brain tumors, it may reach even 30 to 40 years. For example, the atomic bombs in Hiroshima and Nagasaki occurred in 1945, where the first report demonstrating brain tumors among the survivors was not published until 1994, 50 years later. For leukemia it was published during the 50s and for other solid tumors it began to show in the 60s.

Since widespread cell phone use began only in the mid-90s, the follow-up period in most published studies is only about 10 years,



which is insufficient to detect an effect. Since then, the amount of time people spend on cell phones has increased dramatically.

There is a consensus that additional research is needed. As the United States has always been a leader in medical research, your making this topic a high priority would advance progress in this field. A multi-discipline, multinational effort built on previous research is essential. I think this is very important, not to invent the wheel, but to learn from the past experience.

There are now 4 billion people using this technology, including children. Consequently, even if a small risk for an individual exists, the great number of users could eventually result in great damage. Until definite answers are available, some public health measures, with special emphasis on children, should be instituted. Preventive steps used for other technologies, such as driving, provide a good example. We all use cars, but in order to reduce the risks of accidents legislation was passed concerning the use of seat belts, air bags, speed limits, minimum age of driving, and car tests. I think it's exactly the same thing.

#### PREPARED STATEMENT

I believe that cell phone technology, which has many advantages, is here to stay. However, the question as far as I am concerned, the question that needs to be answered is not whether we should use cell phones, but how we should use them. That's very easy to address, I think.

It is my hope that the issues raised in this hearing will encourage you to promote research and take actions to ensure the safe and responsible use of cell phones.

I would like to thank Dr. Devra Davis, who invited me here, and I would like to thank you for your attention and for raising this issue.

[The statement follows:]

#### PREPARED STATEMENT OF SIEGAL SADETZKI

##### PREFACE

I am greatly honored to participate in such an important forum at the United States Senate, and appreciate the invitation to present my research and the efforts made by the Israeli Ministry of Health to address the issue of cell phones and health. In this written statement, I will offer my opinion on a subject which affects a substantial and growing proportion of the world's population, and which I believe has great significance for public health.

Appended to this statement is my full resume. I studied medicine at the Technion Medical School in Haifa, Israel, where I completed M.Sc. and MD degrees, and received an MPH from the School of Public Health at the Hebrew University of Jerusalem. I am also board certified in epidemiology and public health.

I currently serve as the head of the Clinical Epidemiology Department at the Sheba Medical Center and director of the Cancer and Radiation Epidemiology Unit at the Gertner Institute, Israel, which are affiliated to the Sackler School of Medicine at Tel-Aviv University (where I hold an appointment as a senior lecturer). I also serve as the principal national investigator for tinea capitis (ringworm) research. These studies are conducted in abidance with a law that calls for evaluating health outcomes of treatment with ionizing radiation given for tinea capitis in the 1950s to about 50,000 children (most of them immigrants who came to Israel in the 1950s). The law was established in 1994, to compensate the irradiated population for late radiation outcomes. In accordance with this law, my responsibilities include advising the Ministry of Health regarding compensation for diseases which have been found to be causally related to the irradiation, and developing medical guidelines for follow-up for this unique population.

I am thus actively involved in research and in advising the chief director of the Ministry of Health for determining health policy concerning ionizing and nonionizing radiation and cancer.

I am an official member of several national professional committees established to advise the Ministry of Health: These include, among others, the National Council for Prevention, Diagnosis and Treatment of Cancer, the National Council for Diagnostic Imaging, and the Advisory Committee on Cancer Epidemiology for the Director General. In addition, I have been nominated to participate in several ad hoc committees dealing with specific issues such as guidelines for Pap smear tests in Israel, etc.

In my role as advisor, I authored the Israeli Ministry of Health guidelines for the use of cellular phones in adults and children, as well as the director general's statement concerning the Tinea Capitis Compensation Law (1994), and participated in the drafting of the director general's statements concerning guidelines for imaging procedures using ionizing radiation in children, and risks of radiation in cardiac imaging procedures.

Since 2005, I have been a member of the Brain Tumor Epidemiology Consortium, an open scientific international forum organized to promote studies on brain tumors, for which I served as the European president between the years 2007 and 2009.

I have conducted research on both ionizing and nonionizing radiation in children and adults with colleagues throughout the world, and am currently involved in a number of collaborative studies of brain and other cancers funded by the NIH, United States Army Medical Research Acquisition Activity, the European Community, and other grant institutions. About 85 peer-reviewed articles have been published from these studies.

#### STUDIES ON CELL PHONE USE AND CANCER

For more than a decade, I have been involved in studies of the possible association between the use of cell phones and the risk of malignant and benign brain tumors, tumors of the acoustic (hearing) nerve and tumors of the salivary gland. I served as the principal investigator of the Israeli part of the international collaborative "INTERPHONE" study, the largest epidemiological study conducted to date on this topic.

This study (conducted between the years 2000 and 2005) was coordinated in the International Agency for Research on Cancer with the participation of 13 countries (Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, New Zealand, Norway, Sweden, and the United Kingdom). Several manuscripts on the methodology of this study have been published. While the overall results of the total group have not yet been published, several reports from individual centers, as well as a pooled analysis of five centers, have been published, each presenting their individual results.

I am currently leading the Israeli part of another multi-national collaborative effort to investigate the risk of brain cancer from exposure to RF fields in childhood and adolescence (MOBIKIDS). This study was funded following the European Union's call for proposals within the Seventh Framework Programme. The study, with the participation of 16 centers from several countries in Australia, Canada, Europe, Israel, and New Zealand, will be conducted during the years 2009–2014. The study population will comprise individuals aged 10–24 years, among whom about 1,900 will be cases diagnosed with malignant and benign brain tumors and about 3,900, healthy controls.

It should be noted that in addition to cancer, there are other medical outcomes that also should be explored, including influence on brain activity, behavioral changes, learning patterns, emotional well-being, immunologic pathways, fertility etc. Cultural, social, and other nonmedical outcomes should also be assessed.

#### THE ISRAELI INTERPHONE STUDY—COUNTRY SPECIFIC RESULTS

In February 2008, the Israeli results of the assessment of the association between cell phone use and risk of benign and malignant parotid gland tumors (the major salivary gland located at the anterior border of the external ear, 4–10 mm deep in the skin surface, in the area close to where phones are often held) were published in the *American Journal of Epidemiology*. This nationwide Israeli study followed the core protocol of the INTERPHONE study and was extended to include a larger study population. While, as reported in other studies, no increased risk of these tumors was seen for the total group, consistent elevated risks were shown in complementary analyses restricted to conditions that may yield higher levels of exposure. An elevated risk of salivary gland tumors was seen among people who used cell phones for more than 10 years, especially when the phone was usually held on

the same side of the head where the tumor was found, and when use was relatively heavy.

Our findings of a higher risk with greater exposure (as expressed by laterality of use, more frequent use, and longer duration of use), are consistent with basic public health research criteria for what is referred to as a dose response relationship—the greater the dose or use of cell phone in our study (or exposure), the greater the response (i.e., the risk of developing a tumor). The Israeli population is characterized by exceptionally high levels of cell phone use as expressed by the cumulative number and duration of calls. This situation created an important opportunity for studying the effects of relatively high patterns of use, which did not exist in most other populations.

#### METHODOLOGICAL LIMITATIONS OF CELL PHONE STUDIES

Our findings are in line with several other studies that demonstrated an increase in risk of developing malignant brain tumors and acoustic neurinoma (tumors on the nerve that controls hearing) associated with relatively long-term use (>10 years), and with cell phone use on the same side of the head as the tumor.

However, there is a debate in the scientific community about the interpretation of these findings and whether these observations reflect a true association or stem from the numerous methodological problems that accompany epidemiological studies in general, and those on cell phones specifically.

Epidemiological studies have the advantage of investigating human beings in real life situations. However, considering the complexity of exposures and health conditions in the population, epidemiological studies suffer from a handful of methodological challenges that need to be resolved in order to ensure valid results.

The challenges of investigating a relatively new research topic like cell phones, and a devastating disease such as brain tumor, which can affect cognition and recall, are complex. Many articles and reports have criticized the methodology of the published studies, including that of the INTERPHONE. Unfortunately, I can not cover all of these methodological issues in this testimony; nevertheless, I would like to briefly mention some of them.

Duration of at least 10 years is the minimal time needed for solid cancer studies and, in the case of brain tumors it may reach 30–40 years. To illustrate this point, I would like to use the proven association between ionizing radiation and brain tumors that was assessed in the atomic bomb studies as an example. The A-bomb was dropped on Hiroshima and Nagasaki in August 1945. While an excess risk of leukemia among survivors was observed in the 1950s, and an increased risk of solid tumors was detected in the 1960s, no elevation in risk of brain tumors was noted among survivors for many years. The first report demonstrating brain tumors among the survivors was only published in 1994 (almost 50 years later) and the first quantitative data for all intracranial tumors, in 2002. Consequently, even in the mid-1970s, it was not evident to the scientific community that ionizing radiation can cause brain tumors. Since widespread cell phone use really began only in the mid-1990s, the follow-up period currently available in most published studies is only a little more than 10 years, which is insufficient to detect an effect, if one exists. Moreover, in most studies, the “dose” of the exposure, as expressed by cumulative number of calls and duration of calls was also rather limited during the initial years of use. As current use is characterized by greater levels of exposure it increases the chance of finding an effect.

As exposure to RF from cell phones is localized (98 percent of the energy is absorbed in the brain hemisphere on the side where the phone is used), analysis of cell phone use in relation to location of tumor is necessary for the interpretation of results of these studies.

Valid tools for exposure measurements and assessment are crucial for accuracy of results. However, many difficulties exist in the exposure assessments of cell phones which have to account for laterality of use, period of use, patterns of use, technological aspects of the phones and networks, other exposures to electromagnetic radiation, not to mention the constantly changing technology. Lack of precision in these measurements could lead to errors and biases in the results. The data needed for these studies is usually taken from questionnaires based on self-reporting which are subject to inaccuracies due to problems such as recall. The alternative use of billing records is also limited due to technical problems in abstracting historical records, shared SIM cards, discrepancies between owner and user of the phone, as well as the inability to determine side of use and use of hands-free devices which dramatically lowers the exposure. Novel exposure metrics developed by a multi-disciplinary expert team including epidemiologists, physicists, and indus-

try workers who are familiar with this technology are needed to facilitate accurate measurement of this complicated exposure.

#### FUTURE SCIENTIFIC NEEDS

Despite these difficulties, it is of utmost importance to see that such studies continue, given the broad range of uses and exposures that exist around the world today. I believe I am correct in saying that there is a consensus that the information currently available is insufficient. Therefore, additional extensive research is necessary to clarify this issue. As the United States of America has always been a leader in conducting scientific and medical research, your choice of this topic as a high priority is needed in order to make significant progress in this field. In view of the many challenges that complicate research on cell phones, I am convinced that a multidisciplinary multinational effort conducted in various populations, and benefiting from the experience acquired in previous studies is the optimal road to clarifying the health risks.

It is important to note that the study populations of the research carried out so far were limited to adults. While at the time when cell phone use began, only adults used cell phones, since the beginning of the 21st century, increasing numbers of children have become users and even owners of cell phones. This population requires special attention since children have been found to be more susceptible to developing cancer following exposures to known carcinogens. Furthermore, the brain of a child is not just a smaller version of that of an adult and the radiation absorption in their head is different than adults. The observation of greater susceptibility at younger ages has been consistently shown in numerous studies and for a variety of known carcinogens. In our research as well, on the effects of ionizing radiation used to treat children with tinea capitis, the risk for malignant brain tumors 40 years after treatment was inversely related to age at time of irradiation. Children irradiated under 5 years of age exhibited a risk that was 4.5 times higher than that of children who had not undergone irradiation, while those irradiated at ages 10–15 had a risk that was 1.5 times higher than the nonexposed.

#### PUBLIC HEALTH CONSIDERATIONS

There are now 4 billion people, including children, using cell phone technology. Consequently, even if there is only a small individual risk per person, the great number of users, together with the increasing amount of use, could eventually result in considerable damage. Therefore, until definitive answers are available, some public health measures with special emphasis for children should be instituted. Preventive steps implemented for other technologies associated with risks, such as driving, provide a good example. We all use cars, but in order to reduce the risk of accidents, legislation has been passed concerning the use of seat belts, speed limits, minimum-age requirements for driving licenses, and car tests.

Based on the findings of my work and on reports from scientists in other nations, the Israeli Ministry of Health issued a statement on cell phone use that adopted the precautionary principle (that briefly means: “better safe than sorry”). This approach rests on the important public health concept that: In case of doubt regarding the data, it is far better to prevent harm using simple and low cost measures than to wait for long-term results that confirm a health hazard that has already occurred. Therefore, in such cases, we must be prepared to act before scientific certainty has been achieved (using reasonable and low-cost activities).

The recommendations of the Israeli Ministry of Health, include several simple, low-cost measures that should be taken to minimize exposure, such as using speakers and earphones, hands-free devices when driving, and reducing the use of cell phones in areas where reception is weak. Special attention was given to children, who have been found to be more susceptible to developing cancer following exposures to known carcinogens. The translation of these guidelines is attached.

Guidelines have also been published in other countries. I will not mention all of the existing guidelines, but will give some examples with special emphasis on recommendations for children. It is interesting to mention that the definition of a child varies from country to country. The French Health Ministry has published a warning against excessive use of cell phones, especially among children, and has recommended avoiding calls when reception is weak and while driving, as well as for holding the phone away from sensitive areas of the body by using speakers or hands-free devices. It is also considering the possibility of banning the sale of cell phones designed for children under the age of 6, prohibiting the advertising of mobile phones directed at children less than 12 years of age, and requiring the manufacturers to develop cell phone that allow only sending and receiving messages.

The Finnish Radiation and Nuclear Safety Authority (STUK) has recently suggested restricting the exposure of children to cell phones by encouraging the use of text messages rather than calls and the use of hands-free devices through which the phone is kept away from the body. Additional recommendations include advising parents to limit the number and duration of calls made by their children, and avoiding calls in areas with low reception or in a moving car or train. It is important to note that STUK does not believe that banning cell phone use in children is justified, as cell phones also promote security since they facilitate easy communication with parents.

The Toronto Public Health Department suggested that parents should think twice before giving their children (especially pre-adolescents) cell phones. It also recommended that landlines should be used, whenever possible, while cell phones should be used only when absolutely essential. It was also suggested that the length of cell phone calls be limited, and that headsets or hands-free options be used whenever possible.

In India, the Health Minister has recently suggested that people should not talk on a cell phone continuously for more than 1 hour a day, and that hands-free technology could reduce the side effects of excessive use.

Recommendations have also been published in other countries such as the United Kingdom, Russia, Germany, and Belgium.

The issue of what constitutes appropriate policy in this regard is not, strictly speaking, a scientific matter, but one of judgment. Scientists fulfill their role by providing concrete, independent information on potential hazards, while those charged with policy development have the more difficult job of recommending what to do about the problem, as science continues to evolve.

#### SUMMARY

Advances in technology have improved the quality of our lives in many ways and these changes have been especially dramatic in the area of communication. I believe that cell phone technology, which has many advantages, and can save lives in emergency situations, is here to stay. However, the question that needs to be answered is not if we should use cell phones, but how we should use them?

It is my hope that the issues raised in this forum have enabled the distinguished legislators in this hall to appreciate the need to promote research that will increase our understanding of the potential adverse effects and take actions which will ensure the safe and responsible use of cell phones, while research and technology continue to evolve.

Thank you again for inviting me and for bringing attention to this important issue.

Senator HARKIN. Dr. Sadetzki, thank you very much for coming a great distance and thank you for your testimony.

Now we move to Dr. Linda Erdreich, "ERD-rick?"

**STATEMENT OF LINDA ERDREICH, Ph.D., SENIOR MANAGING SCIENTIST, EXPONENT HEALTH SCIENCES, CENTER FOR EPIDEMIOLOGY, BIostatISTICS, AND COMPUTATIONAL BIOLOGY, NEW YORK, NEW YORK**

Dr. ERDREICH. "ERD-rick."

Senator HARKIN. "ERD-rick," I got it right. Welcome and please proceed with your testimony.

Dr. ERDREICH. Good afternoon.

Senator HARKIN. You still have to punch that button.

Dr. ERDREICH. Thank you.

I have been asked by the CTIA to appear today to provide my independent assessment of the science related to potential health effects from wireless phones. I am a Senior Managing Scientist at Exponent's Health Sciences Center. I have 30 years of experience in environmental epidemiology and health risk assessment. I earned a Ph.D. in epidemiology from the University of Oklahoma and I have a master of science in biostatistics and epidemiology. Much of my work includes assessing epidemiological research and integrating this information with that from other disciplines for de-

termining whether human exposure can present a hazard to human health.

At the Environmental Protection Agency I evaluated research related to chemical contaminants of air and water. These health evaluations were used to develop standards such as ambient water quality standards, exposure limits. I have prepared evaluations for chemicals, for RF energy, for electric and magnetic fields, and I've published in the peer-reviewed literature.

Since 1991, I have been particularly active in updating standards regarding nonionizing radiation, which includes RF energy like that from wireless phones. I've served on advisory committees to government and regulatory organizations regarding health evaluations of chemicals and of electromagnetic fields.

A little bit of background on cellular phones. Mobile phones operate using radio waves. Radio waves, also known as RF energy, is a range on the electromagnetic spectrum that includes broadcast radio, television, and other devices, including cordless phones, baby monitors, radar, and microwave ovens. Visible light is also part of this spectrum, but is at a higher frequency and shorter wavelength than RF. RF energy is not radiation in the same sense as for high frequency X-rays because the energy of RF is lower and unable to change the DNA of cells.

There is a standard scientific approach used to determine whether an exposure source, such as RF energy, poses a health risk. This process first requires that all the published literature be considered, which will include studies that reported effects as well as those that have not. This is the method that I have used for evaluating the RF research and for other assessments throughout my career.

In this process, after the literature is compiled each study is evaluated to assess its strengths and weaknesses, and more emphasis given to studies of better quality because they'll be more reliable. The purpose of this comprehensive review is to be objective. This approach is designed to ensure that we reviewers do not single out studies, consciously or inadvertently, to support a preconceived opinion.

As for any health assessment, the relevant research includes many different methods. As we've heard today, this includes laboratory studies themselves, studies in animals, experimental studies of human volunteers, and epidemiological studies in human populations. Each of these approaches has its own specific strength and limitation, and together the studies provide complementary information, and numerous studies using these different approaches have been conducted over the past 50 years regarding RF and health.

Several scientific organizations—and these include Government agencies as well as professional organizations—have used this procedure to assess the potential for health effects from RF exposure. Some of them have set exposure limits to ensure safety of the public and of workers. These expert groups usually include scientists with different skills to reflect the different research expertise required to answer questions about potential health effects.

While the conclusions vary, all of the agency reports that assess the evidence using a comprehensive approach reach similar conclu-

sions: that the current scientific evidence does not demonstrate that wireless phones cause cancer or other health effects. A few examples follow.

The agencies that have regulatory authority over RF emissions in the United States are the Federal Communications Commission (FCC), and the FDA. They've both reached similar conclusions. The FCC concluded there is no scientific evidence that proves that wireless usage can lead to cancer "or other problems" and the FDA states "the weight of scientific evidence has not linked cell phones with health problems."

The conclusions of these agencies are similar to the conclusions reached by commissions around the world, including for example the Health Council of The Netherlands, which published a report in 2008. The European Commission has a committee called the Scientific Committee on Emerging and Newly Identified Health Risks and they wrote a report on RF. The WHO has an ongoing review process. The Australian Radiation and Nuclear Protection Safety Agency has recently posted statements on its Web site, and the Institute of Electrical and Electronic Engineers, the International Committee on Electromagnetic Safety, reviewed this in 2005 and is in the process of updating its review.

But the most recent one was in 2009. The International Commission of Non-Ionizing Radiation Protection (ICNRP) has reviewed all of the evidence and one of its—one section of its report is an epidemiological study by Dr. Ahlbom in 2009. In his summary he wrote: "In the last few years, the epidemiologic evidence on mobile phone use and risk of brain and other tumors of the head has grown considerably. In our opinion"—this is the ICNRP—"In our opinion, overall the studies published to date do not demonstrate a raised risk within approximately 10 years of use for any tumor of the brain or any head tumor."

#### PREPARED STATEMENT

Based on my review of the epidemiologic studies and consideration of the experimental data, I concur with the conclusions of the scientific organizations. The current evidence does not demonstrate that phones cause cancer or other adverse health effects.

[The statement follows:]

#### PREPARED STATEMENT OF LINDA S. ERDREICH

##### INTRODUCTION

I am a senior managing scientist in Exponent's Health Sciences Center for Epidemiology, Biostatistics, and Computational Biology, and I have 30 years of experience in environmental epidemiology and health risk assessment. I earned a Ph.D. in epidemiology from the University of Oklahoma in 1979, and an MS in biostatistics and epidemiology in 1977. My work includes assessing epidemiological research and integrating this information with that from other disciplines for qualitative and quantitative risk assessments. I have prepared analyses of complex epidemiological evidence for environmental and occupational chemicals, radiofrequency (RF) energy, electric and magnetic fields (EMF), and stray voltage, and have published in the peer-reviewed scientific literature. I have been particularly active in updating standards regarding nonionizing radiation, both low frequencies and RF. I have served on advisory committees to Government, regulatory organizations, and industry regarding health risk assessments of chemicals and EMF.

## BACKGROUND

Mobile phones operate using radio waves. Radio waves, or RF energy, is a range of the electromagnetic spectrum that includes AM and FM broadcast radio, television, and many other devices and technologies including cordless phones, baby monitors, radar, and microwave ovens. Visible light is also part of the electromagnetic spectrum, but is at a higher frequency and shorter wavelength than RF. RF energy is not “radiation” in the same sense as used for high frequency X-rays, because the energy of RF is so much lower and is unable to change the DNA of cells. Although RF energy is sometimes referred to as “EMF” the contemporary usage of EMF refers primarily to the electric and magnetic fields associated with electricity from power lines and all electric devices. Electricity operates in the extremely low frequency (ELF) range, 60 cycles per second (60 Hz), in the United States. To avoid confusion, I will use RF in my discussion of mobile phones.

Standard scientific methods are used to assess possible risks to human health. The standard scientific approach used to determine whether an exposure source, such as to RF energy, poses a health risk, is to look at all of the available research, including both studies that have reported effects, and those that did not. The goal is an objective, comprehensive review, in which the strengths and weaknesses of each study are evaluated, and more weight is given to studies of better quality. This approach is designed to ensure that reviewers do not single out studies, consciously or inadvertently, to support a preconceived opinion. Then, all of the studies are evaluated together to arrive at a conclusion. This is the method that I have used for evaluating the RF research and for other assessments throughout my career.

The relevant research to be considered includes a broad spectrum of scientific research that uses different approaches to study potential effects of RF energy on humans. These different approaches have different strengths and limitations and provide complementary information: laboratory studies in cells and in animals, experimental studies of human volunteers, and epidemiologic studies of human populations. For this reason, scientific organizations convene panels of independent experts from the various areas of expertise (e.g., health physics, engineering, toxicology, clinical medicine, and epidemiology) relevant to the topic. Many scientific organizations consider pertinent studies to be those reports of scientific research or reviews that have been published or accepted for publication in the peer-reviewed scientific literature.

## INDEPENDENT SCIENTIFIC ORGANIZATIONS WORLDWIDE HAVE REVIEWED THE RESEARCH

Independent scientific organizations worldwide have reviewed the research and proposed exposure limits. Many studies have been conducted over the past 50 years to examine whether exposure to RF energy has adverse effects on health, and to determine allowable levels of exposure. Several scientific organizations have reviewed the laboratory and epidemiologic research to assess the potential for health effects from RF exposure, and to set exposure limits to ensure occupational and public safety. These expert groups have included scientists with diverse skills to reflect the different research expertise required to answer questions about RF energy and health. Numerous government agencies and professional organizations have reviewed the science related to potential health effects from using wireless phones. While the specific conclusions vary, all of the reports that assess the evidence using multidisciplinary panels and a comprehensive approach reach similar conclusions; the current scientific evidence does not demonstrate that wireless phones cause cancer or other adverse health effects.

The Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), the agencies with regulatory authority over RF emissions in the United States, have both concluded that the current scientific evidence does not indicate that there are health hazards from using a wireless phone. The FCC’s Web site states that “[t]here is no scientific evidence that proves that wireless phone usage can lead to cancer or a variety of other problems, including headaches, dizziness or memory loss.” The FDA’s Web site similarly states that “[t]he weight of scientific evidence has not linked cell phones with any health problems.”

In September 2008, the National Cancer Institute (NCI), the U.S. Government’s principal agency for cancer research, published a Fact Sheet on Cellular Telephone Use and Cancer Risk that concluded that there is no consistent link between cellular telephone use and cancer.<sup>1</sup> The NCI also stated that “incidence data from the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute have shown no increase between 1987 and 2005 in the age-adjusted

<sup>1</sup>See <http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones>.



incidence of brain or other nervous system cancers despite the dramatic increase in use of cellular telephones.”<sup>2</sup>

The conclusions of these U.S. agencies are similar to the conclusions reached in reports prepared by various commissions and agencies around the world, including for example:

*The Australian Radiation Protection and Nuclear Safety Agency (2009)*

“There is essentially no evidence that microwave exposure from mobile telephones causes cancer, and no clear evidence that such exposure accelerates the growth of an already-existing cancer.”

*Health Canada (2007)*

“There is no convincing scientific evidence that RF exposures have any link to cancer initiation or promotion. The body of peer-reviewed literature in this area overwhelmingly demonstrates a lack of linkage, and where the few reports of linkage effects were found, some may be attributed to factors other than RF energy.”

*The Health Council of the Netherlands (2008)*

“The Committee maintained its conclusion that no causal link has thus far been demonstrated between health problems and exposure to electromagnetic fields generated by mobile phones or base stations for mobile telephony.”

*The Scientific Committee on Emerging and Newly Identified Health Risks of the European Commission (2009)*

“Overall, research indicates that mobile phone use does not increase the risk of cancer, especially when used for less than 10 years.”

*The World Health Organization (2006)*

“Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects.”

The United Kingdom’s Health Protection Agency and New Zealand Ministry of Health’s National Radiation Laboratory also have reached similar conclusions after reviewing the available science.

In September 2009, the International Commission on Non-Ionizing Radiation Protection’s Standing Committee on Epidemiology published a scientific review of all of the available epidemiologic evidence on wireless phones and brain tumors. That review concludes:

“In the last few years, the epidemiologic evidence on mobile phone use and risk of brain and other tumors of the head has grown considerably. In our opinion, overall the studies published to date do not demonstrate a raised risk within approximately 10 years of use for any tumor of the brain or any other head tumor.”

#### CONCLUSION

Based on my review of the epidemiologic studies and consideration of experimental data in animals, I agree with the conclusions of the scientific organizations: The current scientific evidence does not demonstrate that wireless phones cause cancer or other adverse health effects.

Senator HARKIN. Thank you, Dr. Erdreich.

Now we hear from Dr. Devra Lee Davis. Dr. Davis, welcome.

**STATEMENT OF DEVRA LEE DAVIS, Ph.D., MPH, PROFESSOR, DEPARTMENT OF EPIDEMIOLOGY, GRADUATE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF PITTSBURGH, PITTSBURGH, PENNSYLVANIA**

Dr. DAVIS. Good afternoon. It’s an honor to be here today, especially as I haven’t seen the two of you together since my confirmation hearings some time ago to the National Chemical Safety and Hazard Investigation Board.

My background is in the record and my statement is as well. I’m going to speak to you today as a scientist, as a citizen, and as a grandmother. I am deeply concerned about the violation of the

<sup>2</sup>*Id.*

basic human right when it comes to where we are in cell phone research today. Democracy, as you know very well, rests on the right to know, on the freely given consent of the governed to be governed. I would submit that where we lack information about the potential hazards of a widespread technology, our basic right to know is being violated.

We have to ask, why are other Governments issuing the warnings? Why are the Governments of Finland and Israel, which are no strangers to radar or electromagnetic technologies, why are they issuing concerns about this particular issue? I think, as you began your remarks, Senator Harkin, about tobacco, it's important for us to recognize that there is no one in this room today who doubts that we should have acted sooner about tobacco. Now, when we should have acted one can debate. But as I say in my book, we certainly could have acted in the 1950s, and when President Nixon started the war on cancer in 1971, an admirable act, he ignored tobacco, although the Surgeon General had warned about its dangers in 1964.

I think it's fair to say we don't have a level playing field in this issue, and the absence of definitive epidemiologic evidence is not proof that there's not a problem. Rather, it's a reflection of the fact that we do not have a level playing field, that the United States today has not published a new epidemiologic study on brain cancer and cell phones since 2002; that although the NIH budget doubled, under Senator Specter's leadership, in 5 years, the budget for the NIEHS has only recently doubled. It took 11 years, sir, to get there, and that is the Institute that is charged with doing the study.

I would point out the study we heard about from Dr. Bucher was originally proposed in 2002 and now we hear that because of delays, which I think I need not tell you why they occurred, because of those delays the study results will not be available until 2014. We are talking about a technology that affects every single one of us, whether we're users or inadvertently exposed.

Now, Dr. Sadetzki has told you, I think in considerable detail, why epidemiology is difficult. I want to add that the Hiroshima data involved a single exposure to an atom bomb, that took 40 years before you could find an effect. We're talking about cell phones that many of us are using all the time, and children are using at unprecedented levels, and we have never been exposed to this level in our lives.

I want to also tell you, unfortunately, that there has been a history here that I think we need to recognize. When Professors Henry Lai and Singh developed the pioneering new technique for measuring DNA damage, called the common assay, that shows you a tail of DNA when it's damaged, they developed that in 1994. If they'd been more modest, it would have been called the Lai and Singh assay, but it's called the common assay. Professor Lai is with us here today.

When they developed that assay in 1994, they showed that RF exposure to brain cells of the rat could be damaging in terms of the common assay. The industry response, which has been documented and is in my book as well as other places, was this. First, they went to NIH and tried to get their funding revoked. Then they

went to the journal that had accepted the article for publication and tried——

Senator HARKIN. Who are “they?”

Dr. DAVIS. The industry working against seeing this work published. And I have the details and the names of the PR firms, the individuals who wrote the memos, in my book, which I’ll be happy to attach for the record.

Then the same lobbyists tried to get the article unaccepted in a journal where it had been accepted. Finally, they hired other scientists to do advocacy research to try to invalidate the science. When those scientists actually confirmed the work, it was never published.

A similar story can be told today in Europe about a major multi-million dollar EU-supported study called the Reflex program, that was a multi-laboratory study in many countries, that also showed evidence that RF signal at precisely the level of today’s phones could damage DNA, contrary to the assertion that only ionizing radiation can damage DNA. Those researchers were also subject to the same kinds of attack and have recently been exonerated by an independent review by the Medical University of Vienna.

So I think it’s clear the United States needs to catch up. We need to catch up with our European allies and see that we issue warnings for our children as well.

I have a very simple proposal. We definitely need major research on this issue. Unlike tobacco, almost everybody in the world is using a cell phone today. We need research desperately, but how are we going to fund that in this difficult time? I have a simple proposal. We can place a \$1 user fee on a cell phone every year for 3 years. There’s not one parent in this room that wouldn’t like to know what a cell phone will mean for their child’s brain in the future. That \$1 fee should support international and independent research, because, unfortunately, we have not had independent research in this area.

#### PREPARED STATEMENT

Finally, I believe it’s appropriate at this time to ask the FDA and the FCC to review existing standards. Existing standards for cell phones are based on causing heat, avoiding the acute injury of a thermal effect. The way phones are used today, for periods unfortunately in some cases of hours, it’s time for us to move beyond that to a new approach.

I thank you both very, very much for your interest in this. I think you’ve done the world a great service by bringing us together. I want to say, I am not alarmed; I am concerned because the world has changed very rapidly and we have a right to know what that change may mean for our health and that of our grandchildren.

Thank you very much.

[The statement follows:]

#### PREPARED STATEMENT OF DEVRA LEE DAVIS

It is a distinct honor and great privilege to present information before this subcommittee on a matter of tremendous importance to this country and to the world—the relationship of cell phones to our health. This subcommittee is to be commended for bringing public attention to this issue through holding the first Senate hearing on cell phones in about three decades.

My remarks today will draw on my three decades of experience as a public health researcher, teacher, and writer. I was the founding director of the Board on Environmental Studies and Toxicology of the U.S. National Research Council, National Academy of Sciences, where I also served as Scholar in Residence, from 1983–1993. I was confirmed by this body as Presidential appointee to the U.S. Chemical Safety and Hazard Investigation Board from 1994–1999. More recently I founded and directed the Center for Environmental Oncology at the University of Pittsburgh Cancer Institute from 2005 until 2009. I am currently a professor of epidemiology in the Graduate School of Public Health. I have served on numerous governmental and international advisory boards, including the National Toxicology Program Board of Scientific Counselors and the World Health Organization (WHO), health indicators program. I have also advised Governments in China, Mexico, Brazil, Israel, France, the European Union, and local governments throughout the world.

Designated a National Book Award Finalist for my first popular book, *When Smoke Ran Like Water*, in 2002, my recent book, *The Secret History of the War on Cancer*, was a Newsweek must-read pick for the week and has just been released as a paperback. Both works have been translated into Italian and Chinese and the subjects of documentary, television, and public radio coverage.

I have held a number of academic appointments including visiting professor at Carnegie Mellon University's Heinz School, honorary professor at London's School of Hygiene and Tropical Medicine, and expert advisor to the WHO. I have authored more than 190 publications in books and journals ranging from *Scientific American* to the *Journal of the American Medical Association* and the *Lancet*, and the *Annals of the New York Academy of Sciences*, and have also written for the *New York Times*, the *Los Angeles Times*, and other mass media outlets. Recently, I have established the Environmental Health Trust, a nonprofit foundation dedicated to identifying and controlling environmental causes of illness. Among the awards I have received are: The Lisa Zhang Environmental Award of the United Nations 2008, the Artemis Award from the Euro-American Women's Organization and the Greek Ministry of Foreign Affairs in 2009, the Women's Leadership Exchange Compass Award, presented by OPEN: The Small Business Network from American Express, for breaking the paradigms of how women are perceived and the first Rachel Carson Award from the Rachel Carson Homestead in 2008. I was also privileged to be part of the group receiving the Nobel Peace Prize with Al Gore in 2007 for serving as a lead author of the Inter-governmental Panel on Climate Change.

I speak to you today as a scientist, and as a citizen of this great democracy who is also a mother and a grandmother. I am deeply concerned about the absence of a major program of research on cell phones and our health. I want to know, as do the American people, why are other governments acting to warn about the need for safer cell phone use while ours is silent on the matter?

This hearing presents a welcome opportunity to address a subject little discussed in the United States. We know that cell phones have revolutionized our lives for the better. They have radically changed the nature of emergency response and warfare. They have improved our sense of security. But, we must admit that we don't know whether some of their uses place us and our children at risk in the long term and whether there are simple measures to take to reduce those risks. Certainly, we have heard today of growing concerns about the impact on our health from cell phone use from distinguished researchers and national leaders of efforts in Israeli and Finland—countries with great sophistication regarding radar and electronics. We are agreed that additional research is critically needed to clarify the potential hazard of cell phones, which are currently being used by more than half of the world—a great proportion of today's users are under age 30.

We have learned that Dariusz Leszczynski, Ph.D., DSc, who is a research professor at STUK—Radiation and Nuclear Safety Authority, Helsinki, Finland, and Siegal Sadetzki, MD, MPH, head of the Radiation and Epidemiology Unit at Sheba Medical Center, Gertner Institute of Epidemiology, Tel Aviv Medical University and a key advisor to the Israel Radiation Protection Branch, are conducting important research on the question of what cell phones may mean for our health.

In Finland, Israel, China, and the European Union, governments are officially warning citizens about the safer use of cell phones even while that research is still underway. Similar advisories exist in England, France, and some of the states of India and Russia. We have to ask: What do these countries know that we do not?

There is much that we do not know. It will be expensive to resolve many of the issues that must be addressed. But, we do have some information, as the meeting I am chairing in Washington, DC this week makes clear. We know that cell phone radiation, hereinafter referred to as RF, can cause biological impacts in experiments with cell cultures and with laboratory animals at levels that do not produce heat or thermal effects.

We must admit that there is another reason why we in the United States lag behind other nations in addressing these problems. As I have documented in my book, *The Secret History of the War on Cancer*, public discussion in the United States about potential cell phone risks remains obscure because of well-honed efforts by some in the cell phone industry to keep us confused.

The question before this body is what is direct evidence at this time on cell phones and health and what do we do while we wait for science to evolve?

That question is not merely a matter that can be answered by science, but will require leadership and a vision of basic public policy. We must ask what is the downside risk of doing nothing to reduce exposures at this point, compared to the risk of acting as other governments have to issue warnings. We must also consider what sorts of policy options should be used to convey information and whether it is appropriate for this Government to take specific actions at this time that are in line with those taken by others.

Let me stress that the science on this issue is truly complex. It will be expensive to resolve many of the issues that must be addressed. The battleground has been drawn in the realm of both experimental findings and with regard to public health research. Henry Lai has pointed out that if one examines the funding for studies, a simple pattern emerges—studies funded by industry directly are overwhelmingly negative and find no effect of RF in animals or humans. Those studies that are independently funded and have examined people for a decade or longer tend to be positive and find that radiofrequency (RF) is linked with a host of ailments, ranging from cardiac disturbances to fatal brain tumors. The challenge we face is enormous. While science continues to evolve in its understanding of RF signals and our health what do we do while we wait? That question is not merely a question of science, but of basic public policy.

Science is a complicated discipline. When it comes to evaluating potential hazards in the environment, we do not have the luxury of waiting several decades for scientific clarity. We are forced to take precautionary steps while scientific information becomes clearer. The existence of scientific uncertainty should not become an excuse for inaction. In this regard, the decision to take no action, to do nothing, must be understood as a decision to continue the status quo.

As you are well aware the history of regulatory interests makes it clear that in the matters of lead in gasoline and the control of tobacco had we acted sooner to reduce these hazards millions would have been spared damaged brains and lungs. This history tells us that we are obliged to make good sense of what is known at this time about cell phones and our health.

As this chamber knows full well from the sorry history of tobacco, those who do not like particular scientific findings have proven especially adept at treating science as nothing other than a public relations tool. Yet, there is no one reading this testimony who doubts we should have acted sooner to address the hazards of smoking or those of lead in gasoline.

As this body itself determined, the reasons for delays in controlling tobacco had much to do with politics not with science. When President Nixon launched the “War on Cancer” in 1971, he ignored the Surgeon General’s 1964 declaration that tobacco was a cause of poor health. And President Jimmy Carter fired Secretary of Health, Education, and Welfare Joseph Califano in 1979, when Califano had the nerve to declare tobacco public enemy number one. At one point in the 1970s, the National Cancer Institute (NCI) was led by a 4 pack-a-day smoker who spearheaded an effort to spend taxpayer dollars to develop a safe cigarette. The U.S. Government actually spent millions of taxpayer dollars to develop a safe cigarette and continued to subsidize tobacco well into the 1990s. The Government only began to try to restrain this dangerous habit about a decade ago, after the epidemic of smoking-related disease became undeniable and after incontrovertible evidence was revealed of the duplicity of the tobacco industry in manipulating science and regulatory policy on the issue.

As a result of these delays in addressing the dangers of tobacco, the world is now reeling from a massive global epidemic of lung cancer, with more than 1 million cases expected this year in China alone.

What about cell phones? What do we really know about their safety? Consider these undisputed facts.

*Fact.*—Brain tumor rates are increasing in young adults in several nations, including this one. Brain cancer deaths are now the leading cause of cancer deaths in children in this Nation, Sweden, and Australia among others. In truth, we cannot attribute this or the puzzling and sad rise in autism to cell phones. But, clearly this is a matter that requires serious attention.

*Fact.*—The Federal Communications Commission (FCC) sets standards for the amount of RF that can be emitted by a cell phone is based on models of a man’s

head. And not just your average Joe, but also one who ranked at the top 90th percentile of all military personnel in 1988, weighing in at 200 pounds, and who held the phone to his ear for 6 minutes. Also, what few parents know is that RF signals reach much more deeply into children's thinner and smaller heads than ours—a fact established through the pioneering work of Professor Om P. Gandhi, the leader of the University of Utah's electrical engineering department and confirmed recently by studies developed by Niels Kuster and his colleagues in Austria. While these two engineers may differ on the details of their models of the brain, their work makes it clear that children's brains differ in important ways from those of adults. Their skulls are thinner. Their brains contain more fluid. As a result, even if exposures were identical in the depth of the skull that they reach, the potential for doing damage is much greater with the young brain. Whether the elderly face different risks is also an important question to explore.

*Fact.*—The agency that offers recommendations on cell phone emissions in the United States—the FCC doesn't employ a single health expert. The standards the FCC adopts are based on advice given by outside experts, many of whom work directly for the cell phone industry. Unlike with drugs that are tested before being used, the Food and Drug Administration (FDA) lacks the authority to set standards for cell phones and can only act if a phone is shown to release hazardous signals.

What's wrong with this picture? The award-winning Gandhi worries that all the standards used for phones apply to the "big guy" brain. In 2004, standards became looser as a result of a new approach that basically doubled the amount of RF that could reach the brain of an adult and quadrupled that reaching a child's. The brain of a child doubles in the first 2 years of life and keeps on developing until their early 20s. Gandhi no longer works with the cell-phone industry and none of his grandchildren, or mine, uses a cell phone.

*Fact.*—Many of the negative studies on cell phones and human health involve short period of exposure with much older phones. Thus, one of the most widely cited studies of cell phone safety is that of the Danish Cancer Society, which studied close to half a million cell phone users as of the mid-1990s. They excluded all business users from their study—the group most likely to use the phone the most. They found no increased risk in all the others.

Surely, today's phones and the ways we use them are far different from what went on in Denmark a decade ago, when cell phones were as heavy as small briefcases.

Proving harm in science is not a simple matter, especially when it comes to a technology as powerful and widely used as cell phones are today. The science that is implicating cell phones today includes both experimental modeling like that developed by Gandhi and Kuster, as well as the ever-more perplexing studies of epidemiologists. Coming from two Greek words "epi" meaning upon and "demos" the people, epidemiologists look for patterns of disease in time and space to make sense of the real world. Studying brain cancer is one of the toughest jobs in epidemiology. What happens to moms and dads where they live and work and what they eat and drink can have an impact on whether children develop brain cancer. So, we know that men or women who work with some pesticides and solvents tend to have children with much higher rates of brain tumors.

But the disease can take 40 years to develop in adults. Because most adults with brain cancer don't survive, and those who do are often left with problems of speech and recall—either from the disease itself or from the treatment—we often have to interview their remaining family members about their life histories and try to figure out what could have led to the disease. Few of us really know all the good and bad things we've dealt with in our lives, let alone those of our relatives.

When it comes to sorting through the risks of cell phones, we have been assured by widely publicized reports from what appear to be independent scientific reviewers that there is none. Researchers from the Danish Cancer Society reported in the *Journal of the NCI* in 2007 that they found no evidence of risk in several hundred thousand persons who had used cell phones. Headlines around the world boasted of this latest finding from an impeccable source published in a first tier scientific journal.

The press coverage of this study tells us a great deal about what journalists and the rest of us who depend so heavily on these phones would like to believe. These headlines appeared within days of publication:

- "Cell Phones Don't Cause Brain Cancer"—The Toronto Daily News, December 10, 2006;
- "Cell Phones Don't Raise Cancer Risk"—Reuters, December 6, 2006;
- "Big Study Finds No Link Between Cell Phones, Cancer"—San Jose Mercury News, December 6, 2006;

—“Study: Cell Phones Do Not Cause Cancer”—Albuquerque Tribune December 6, 2006;

—“Study: Cell Phones Safe”—Newsday December 7, 2006; and

—“Cell Phones Do Not Cause Cancer”—Techtree.com, India, December 7, 2006.

But let’s look at what the Danish researchers actually studied.

They reviewed health records about brain tumors that occurred up to 2002 of about 421,000 people who had first signed up for private use of cell phones between 1982 and 1995. A “cell phone user” in the study was defined as anyone who made a single phone call a week for 6 months during the period 1981 to 1995. In fact, the study first started out with almost 700,000 people, but the researchers kicked out anyone who was part of a business that used cell phones, including those who had used a cell phone for personal purposes for 8 years. Think of those early clunker phones with their battery packs, cumbersome cords, and hefty monthly fees—those are the phones first examined in this study. Business users are certain to be those with lots of reasons to some lots of time on the phone. Because researchers could not be sure that only one person used a business phone, they threw out all business phones.

This research design raises a lot of questions. Why did the researchers not look at individual business users—those with far more frequent use of cell phones? Why lump all users together, putting those who might have made a single cell phone call a week with those who used the phones more often? Why stop collecting information on brain tumors that had occurred only as of 2002? Use of cell phones has grown more than fourfold since that time in many countries, including many parts of the United States, the United Kingdom, France, and Israel.

When you are looking at a large population to find an effect, generally the more people you study, the better your chance of finding something. But if you include lots of people with little exposure along with those with very high exposure, you basically lower your chances of finding any effect at all. Lumping all these various users together is like looking all over a city for a stolen car when you know it’s within a five-block radius. Perhaps you’ll find what you’re looking for, but the chances are greater that you won’t.

If you want to find out whether cell phone use causes brain cancer, the higher the use or exposure of those you are examining, the better the odds that you will be able to find whether or not it’s made a difference. It’s clear that the early analog phones must be different than the newer digital ones. We hope the difference is big and that those of us using phones today face a lowered risk, but we have no way to know whether this is the case. Some of us believe (and hope) that using speakerphones or earpieces connected by wires—not the hands-free kinds—should reduce our direct exposures, but, again, direct evidence on this is not at hand.

In all circumstances, research works best when we have solid information on the nature of the use or exposure we are looking at. All of us have cell phone bills that provide detailed records of our use, and most of these can be accessed online. These were not used in this Danish study, nor in any study done for or by the industry to date. A gold mine of data lies untapped and so far untappable. Dr. David Servan-Schreiber, a distinguished psychiatrist and medical researcher, and author of the best-selling book, *Anti-Cancer*, and I are working with cell phone companies in France and elsewhere to encourage the release of billing records so that epidemiologists can carry out much more sophisticated studies than have been possible thus far.

The Danish study, as the headlines made clear, found no increase in risk of brain cancer for private users of cell phones. The reason the researchers were looking for brain cancer is straightforward. As the authors noted, cell phone signals do penetrate the brain. “During operation, the antenna of a cellular telephone emits radio frequency electromagnetic fields that can penetrate 4–6 cm into the human brain.”<sup>1</sup>

There is, however, a vibrant debate over what this absorption into the brain means biologically.

We know that the body is electric and that electricity in medicine can be used to heal bones and restart or regularize heart beats. But what about RF signals themselves?

We know that cell phone signals can reach the side of the head where the auditory nerve is located. An earlier Swedish study, compared more than 1,400 people with brain tumors to a similar number without the disease during the time 1997–2000. They found that tumors of the hearing nerve were three times more frequent

<sup>1</sup>Joachim Shüz, et. al., “Cellular Telephone Use and Cancer Risk: Update of a Nationwide Danish Cohort,” *Journal of the National Cancer Institute* 98, no. 23 (2006): 1707–13.

in those who had used cell phones for more than a decade.<sup>2</sup> This difference even passed the demanding scientific test of statistical significance, which essentially shows that the results are not likely to be just some random finding. In 2004, other Swedish researchers found that long-term users also had significantly more tumors on the hearing nerves than nonusers.<sup>3</sup> My colleagues at the University of Pittsburgh Graduate School of Public Health and Medical Center have recently confirmed this result, in work that is attached to this testimony—persons using a cell phone for a decade or longer have significantly elevated risks of acoustic neuromas.

Of course, most of the published work in the field is negative, but it turns out that much of this is inconclusive by design. But, is that really the end of the matter? We know that tumors of the hearing nerve and malignant cancers of the brain can take decades to form. All of these widely publicized negative studies have several things in common. One study that was well publicized in 2000 found no increased risk of brain cancer in cell phone users. There's only one problem with this result—the average cell phone users in this widely publicized study had a phone for less than 3 years.<sup>4</sup> Still, even this limited study found that those who had used phones for this short period of time had twice the risk of a very rare brain tumor—neuroepitheliomatous cancers—the kind that wraps itself around the nerve cells of the lining of the brain—right at the locus that cell signals can reach.

One of the biggest challenges to any study of cell phones and human health is that the problems they are trying to understand are inherently complex. Science works best to study one thing at a time, as we do with drugs in clinical trials carefully meting out specific doses and tracking specific responses. But, the world we live in is much messier and more complicated than the elegant one of clinical research. The problems posed by cell phones in the real world are like huge simultaneous equations—mathematical formulas of relationships between multiple unknowns. How can you determine the role of one factor, such as cell phone exposure to the skull, when all others, like diet, workplace conditions, and local air pollution, are changing at the same time and at different rates? How do you take into account the fact that phones themselves have changed design and that peoples' habits in using phones may also change with reports of concerns growing?

Given how broadly cell signals now penetrate our worlds of the coffee shop, traveling discounted buses, airports, and many downtown areas of major cities, where do we find any truly unexposed groups to compare results against? Because cell phone use has grown so fast and technologies change every year, it is as if we are trying to study the car in which we are driving.

Some of the works done in laboratories at the Medical University of Vienna and elsewhere clearly showed that wireless signals could affect the ways cells talk to one another to stay under control—what is called gap-junction communication. Under healthy conditions, cells send messages through proteins and enzymes that keep things in order and tell badly behaving cells to get in line or die. Wireless signals were shown to throw a monkey wrench into this order. Like teenagers, cells that can't communicate well are prone to grow out of control. In essence, the wireless signals promoted a kind of social breakdown among cells.

As Dr. Sadetzki has told us, the human health component of the study of cell phones remains unfinished, and it may well be unfinishable. A major international study of brain cancer in wireless phone users has been underway for nearly a decade, headquartered at the renowned International Agency for Research on Cancer (IARC) of the WHO in Lyon, France. The large study was designed to combine more than 3,000 cases of brain tumors from around the industrial world and was supposed to release its results in almost 5 years ago.

At the core of the IARC project is a major effort to learn from brain cancer patients whether they used cell phones more frequently than did others. The limits of the work are easy to grasp. The ways to overcome them are not. Still, some German findings published in 2006 are disquieting. Keep in mind that not a single one of these studies is actually using billing records of cell phone use. All of them require people to try to remember their habits more than 10 years or so.

The German study captured information about the daily lives of people in Mainz, Bielefeld, and Heidelberg. What did they have for breakfast regularly? Where did they live? How often did they use the cell phone? For how long? On which ear?

<sup>2</sup>L. Hardell, et al., "Case-control study on the use of cellular and cordless phones and the risk for malignant brain tumours," *International Journal of Radiation Biology* 78, no. 10 (2002): 931–936.

<sup>3</sup>S. Lönn, A. Ahlbom, P. Hall, and M. Feychting, "Mobile phone use and the risk of acoustic neuroma," *Epidemiology* 15, no. 6 (2004): 653–659.

<sup>4</sup>Joshua E. Muscat et. al., "Handheld Cellular Telephone Use and Risk of Brain Cancer", *Journal of the American Medical Association* 284, no. 23 (2000): 3001–3007.



These are the sorts of things epidemiologists like me hope you remember. This work contrasted the life experiences and reported cell phone use of 366 people with deadly tumors of the brain called gliomas and 381 with slow-growing, usually benign tumors of the membranes that cover the spinal cord, against some 1,500 people between the ages of 30 and 69 who had better luck and did not have brain tumors. When asking both groups about their past and current uses of cell phones, they did not find any increased risk in those who used phones for less than a decade. That was not the end of this work, however, but merely the start.

In this same study, those who reported having used cell phones for 10 years or more had twice the risk of coming down with gliomas.<sup>5</sup> This is a tumor that begins in the glial cells of the brain, the nonconducting cells that support the neurons and hold them together. The growth of gliomas can be silent, with symptoms that mimic flu or a headache. But eventually, they become undeniable. People lose speech, sight, movement or hearing, depending on where the tumor starts and where it ends up.

It should be obvious that looking at people with a fatal illness and asking them to try hard to remember what they did up to 40 years ago in some cases is not easy. Doing this the day after brain surgery in the hospital is obviously not an ideal situation for obtaining records.

With all the highly automated information governments now assemble to combat terror, including library and cell phone records, what would it take for authorities to allow expert scientists access to privacy-protected, coded, computerized records of cell phone use so that we could learn whether our use of cell phones places us at risk from a disease that could be averted through better design and technology?

That's not a question likely to get much attention at this moment, but it is well worth thinking about. The studies to date that have not found a general, clear, and consistent risks from cell phones have tended to follow people for short periods of time. Brain tumors can take four decades to become evident. Of necessity, the older studies have for the most part have looked at older technologies over short periods of exposure. With one exception, no researcher has asked about the impact of cell phones on the brains of children and teenagers—one of the fastest growing groups of users in the world today.

Recently, several groups including the Collaborative on EMF Research, the EWG, and the European Union have issued reports concluding that cell phones cause or greatly increase the risk of brain tumors. What is this based on?

The INTERPHONE study, as Dr. Sadetzki just told us, has not reached a clear conclusion. But every single study that is part of INTERPHONE and has studied people who used phones heavily for a decade has found that where persons have used phones heavily for a decade or longer, there is evidence of a significantly increased risk—literally a doubled risk of malignant brain tumors.

The one researcher to have studied young people who began using cell phones as teenagers, Prof. Lennart Hardell of Sweden, has found that those who started to use cell phones heavily before age 20 have four to six times more brain tumors by the time they reach their 30s. This is deeply troubling.

What should we do now?

Representatives of the industry have recently been quoted as saying: “peer-reviewed scientific evidence has overwhelmingly indicated that wireless devices do not pose a public health risk.” To me, the absence of definitive evidence on this issue is not proof there is no harm, but a reflection of two things. First, it is hard to conduct epidemiological studies on cell phone users for obvious reasons, as Dr. Sadetzki has explained. Second, there are powerful interests that have kept us from asking and answering important questions. We have also seen repeatedly that the chances a study will label cell phones safe depends chiefly on who pays for the study. (Lai and Roos.)

What does independent research really show? What do the FDA and ACS really say about the matter? On their Web site, the Center for Devices and Radiological Health of the U.S. FDA, states:

“Available science does not allow us to conclude that mobile phones are absolutely safe, or that they are unsafe. However, the available scientific evidence does not demonstrate any adverse health effects associated with the use of mobile phones.”

The FDA and FCC jointly state that those who are concerned should take simple precautions such as using earpieces and speakerphones, while acknowledging that, quote, “The available scientific evidence does not show that any health problems are

<sup>5</sup>Joachim Schüz et. al., “Cellular Phones, Cordless Phones, and the Risks of Glioma and Meningioma (INTERPHONE Study Group, Germany),” *American Journal of Epidemiology* 163, no. 6 (2006): 512–520.

associated with using wireless phones. There is no proof, however, that wireless phones are absolutely safe.” End quote.

But, the FDA site goes on to say the following:

“The scientific evidence does not show a danger to any users of cell phones from RF exposure, including children and teenagers. The steps adults can take to reduce RF exposure apply to children and teenagers as well.

“—Reduce the amount of time spent on the cell phone.

“—Use speaker mode or a headset to place more distance between the head and the cell phone.

“Some groups sponsored by other national governments have advised that children be discouraged from using cell phones at all. For example, The Stewart Report from the United Kingdom made such a recommendation in December 2000. In this report a group of independent experts noted that no evidence exists that using a cell phone causes brain tumors or other ill effects. Their recommendation to limit cell phone use by children was strictly precautionary; it was not based on scientific evidence that any health hazard exists.”

In 2001, Cancer, a review article in the American Cancer Society Journal, written by Howard Frumkin and Michael Thun, a senior epidemiologist with the American Cancer Society (ACS) in fact took a precautionary approach as well. Noting the absence of clear evidence of harm and the relatively short period of time that studies had been underway, they offered simple advice: “It is impossible to prove that any product or exposure is absolutely safe, especially in the absence of very long-term follow-up.” Accordingly, the following summary from the FDA Center for Devices and Radiological Health offers advice to people concerned about their risk:

“If there is a risk from these products—and at this point we do not know that there is—it is probably very small. But if people are concerned about avoiding even potential risks, there are simple steps they can take to do so. People who must conduct extended conversations in their cars every day could switch to a type of mobile phone that places more distance between their bodies and the source of the RF, since the exposure level drops off dramatically with distance. For example, they could switch to: a mobile phone in which the antenna is located outside the vehicle, a hand-held phone with a built-in antenna connected to a different antenna mounted on the outside of the car or built into a separate package, or a headset with a remote antenna to a mobile phone carried at the waist. Again the scientific data do not demonstrate that mobile phones are harmful. But if people are concerned about the RF energy from these products, taking the simple precautions outlined above can reduce any possible risk.”

In other recent public statements, Thun, who is a vice president of ACS observed that:

“Cellular (cell) phones are a relatively new technology that became widely used in the United States only in the 1990s. Although they have been studied extensively, we don’t yet have information on the potential health effects of very long-term use or usage by children.”

The good news is that manufacturers are beginning to incorporate this advice into information they provide to consumers. The challenge will be to get people to read and act on this information. How many people know that the directions for using Blackberries for the new 4G wireless devices also note that phones should not be kept on the body and that those concerned about children’s exposures should take efforts to reduce that exposure. Those with pacemakers are urged to keep the device at least 20 centimeters, or about 8 inches away from the chest. Warnings with the new Blackberry smartphones and iPhones state that the phone should be kept .98 inch or 25 millimeters or 5/8 inch or 15 millimeters respectively away from the body and that failure to do so could result in excessive exposure. U.K. advisors have urged caution with respect to children.

Recently a number of scientists have confirmed an observation reported by Hungarian and Australian scientists in 2004.

Regularly keeping a cell phone in the pocket produces defects in sperm form and sperm count. Experimental studies have produced similar results, yielding sperm with impeded motility and reduced numbers.

Unfortunately, scientists who have tried to conduct independent research in this area have often found themselves under the gun. Cell phone research became a kind of third rail for many scientists—touch it and you die.

Dr. Om Gandhi, for years, led studies at the University of Utah evaluating emissions from phones for Motorola and all the major cell phone companies. As a pioneer in modeling of cell phone absorption into the brain, he in 1996 published analyses,

which showed that existing models did not protect children's brains. No surprise: he lost all his industry funding. Now, because he's a tenured professor of a certain age, he continues to do the work and has produced further analyses showing he's correct. Recently French Telecom and other industry supported groups have also confirmed what any mother knows—a child's head is much more sensitive thinner, less dense, more fluid, and therefore more vulnerable than that of an adult.

A study by Professors Henry Lai and Singh showed that low levels of RF signals could produce strange defects in DNA in 1994. The industry response? First, they went to the journal where the paper had been accepted and tried to get the paper unaccepted. Then, they hired a PR firm to try to discredit the findings. Then, they gave money to other researchers in an effort to disprove the findings. When this research confirmed their findings that RF could damage DNA, that research was not published. The full story on this can be found at <http://www.washington.edu/alumni/columns/march05/wakeupcall01.html> and is also discussed in my new paperback.

A similar situation is still being resolved in Vienna, where a multi-million dollar, multi-laboratory study of the damaging effect of DNA on RF led by Professor Rudigger and Adlkofer of the Medical University of Vienna was charged with fraud. These charges became headlines around the scientific world. An independent investigation by the university has recently reported that the charges of fraud were not correct. But, the damaging effect of the charges cannot easily be reversed.

I am fortunate that I worked for Ronald B. Herberman at the University of Pittsburgh. In reviewing the evidence provided by the Bioinitiative Report and the European Environment Agency last year, he recognized this issue for what it is—a major chance to promote research while in the meantime preventing harm. The Pittsburgh Advisory and his statement on this issue, along with other background documents can be found at [www.environmentalhealthtrust.org](http://www.environmentalhealthtrust.org).

As we have heard today, scientific and policy leaders in Israel, France, Finland, Russia, and China have since echoed Pittsburgh's precautionary advice.

I would urge the Senate to consider carefully the case for national action. I am encouraged by the fact that the new head of radiological and other devices at the FDA has indicated an interest in examining this issue.

My advice at this point is simple—as a number of groups have recently urged, cell phones should have warning labels stating: Children's brains need special protection; phones should not be kept on the body, and should only be used with ear pieces or speakerphones. Children should be encouraged to text and not use phones next to their heads.

What about the much needed research? Who should do it and where should the money come from? Obviously, the history of cell phones and public relations tells us we must make this research independent. Creating a cabinet level inter-agency group on cell phone research, like that on climate change, seems a good start.

As to funding, I've got a simple idea that many of my colleagues in industry tell me makes sense. Let's put an extra research fee of \$1 on every cell phone for 3 years and use these funds to support the conduct of a major independent research program to address the questions raised by this panel and by the National Academy of Sciences in its 2008 report on the subject.

Given the widespread and important role that cell phones play in our lives today and their invaluable use for many purposes, we can and must do better. Our children and grandchildren will thank us if years from now if they are using safer devices because we took the step at this moment in history to create the solid research program to create an improved technology. I am confident that with this hearing a new day of open dialogue has begun and I thank the Senators for making this possible.

Senator HARKIN. Thank you, Dr. Davis.

Now we turn to Dr. Naidenko, with the EWG. I might just say that we had called this hearing at the suggestion of Senator Specter, as I said earlier, before this study came out last week. I just wanted to make the record clear on that.

Please proceed, Ms. Naidenko.

**STATEMENT OF OLGA V. NAIDENKO, Ph.D., SENIOR SCIENTIST, ENVIRONMENTAL WORKING GROUP, WASHINGTON, DC.**

Dr. NAIDENKO. Mr. Chairman and distinguished members of the subcommittee: My name is Olga Naidenko and I am a Senior Scientist at the EWG, a nonprofit research and advocacy organization

based in Washington, District of Columbia; Ames, Iowa; and Oakland, California.

I thank the subcommittee for holding this important hearing and for the opportunity to testify.

Last week EWG released the results of a 10-month investigation of more than 200 peer-reviewed studies, Government advisories, and industry documents on the safety of cell phone radiation. We found that the studies published during the first two decades of cell phone use produced conflicting results and few definitive conclusions on cell phone safety. But the latest research, in which scientists, are for the first time, able to study people who have used cell phones for many years, suggests the potential for serious safety issues.

The state of the science is provocative and troubling and more research is essential. We at EWG are still using our cell phones, but we also believe that until scientists know much more about cell phone radiation it's smart for consumers to buy phones with the lowest emissions.

We are moving to a mobile society. Cell phones, handheld devices, are now part of everyday life. As of December 2008, U.S. wireless subscribers numbered 270 million, a 30 percent jump in 3 years. As the market for new devices has grown, so has the urgency that cell phone safety be well understood and that cell phone radiation standards be sufficient to protect public health.

EWG advocates that cell phone companies label their product's radiation output so that consumers can make informed choices at the point of sale and that the Government requires this disclosure. Currently most people are given no information at all about radiation emissions when they purchase a phone. To fill this information void, EWG's research team created an interactive online consumer guide to cell phone radiation covering more than 1,200 phones. In the 64 hours following the publication of our science review and cell phone radiation database, 442,000 people accessed our Web site. During those same 3 days, our findings were reported in numerous news articles and broadcast news. This powerful response from the public reflects the consumer's keen interest in the issue of cell phone safety.

Much more research is essential. However, in response to the information already available over the potential health risks of cell phone radiation, Government agencies in six different countries have recommended action to help consumers reduce exposures to cell phone radiation, especially for young children. For example, in 2005 the United Kingdom Department of Health stated in a consumer advisory, quote: "UK chief medical officers strongly advise that where children and young people do use mobile phones, they should be encouraged to: use mobile phones for essential purposes only; keep all calls short—talking for long periods prolongs exposure and should be discouraged."

In contrast, the FDA and the FCC have all but ignored evidence that long-term cell phone use may be risky. The FCC set cell phone radiation standards 17 years ago, when few people used cell phones. The standards failed to provide an adequate margin of safety for cell phone radiation exposure and do not account for risks to children.

Until the science on cell phone risk is settled, EWG recommends a number of simple actions consumers can take to reduce exposures to cell phone radiation, including: use a low-radiation phone; use a head set or speaker phone; choose texting more than talking; and limit children's cell phone use.

PREPARED STATEMENT

In conclusion, EWG strongly believes that the Government should support additional research into this important health question and that the public has a right to know what levels of radiation they may be exposed to, what may be the potential risks, and what precautionary measures consumers can take to protect themselves and their families from any adverse health effects of cell phone radiation.

Thank you for your time. I welcome the opportunity to answer any questions you may have.

[The statement follows:]

PREPARED STATEMENT OF OLGA V. NAIDENKO

Mr. Chairman and distinguished members of the subcommittee: My name is Olga V. Naidenko, and I am a senior scientist at Environmental Working Group (EWG), a nonprofit research and advocacy organization based in Washington, DC; Ames, Iowa; and Oakland, California. I thank the members of the subcommittee for holding this important hearing and for the opportunity to testify.

Last week, EWG released the results of a 10-month investigation of more than 200 peer-reviewed studies, Government advisories, and industry documents on the safety of cell phone radiation. We found that the studies amassed during the first two decades of cell phone use produced conflicting results and few definitive conclusions on cell phone safety. But the latest research, in which scientists are for the first time able to study people who have used cell phones for many years, suggests the potential for serious safety issues.

Studies published over the past several years find significantly higher risks for brain and salivary gland tumors among people using cell phones for 10 years or longer. The state of the science is provocative and troubling, and more research is essential. We at EWG are still using our cell phones, but we also believe that until scientists know much more about cell phone radiation, it's smart for consumers to buy phones with the lowest emissions.

As of December 2008, U.S. wireless subscribers numbered 270.3 million—87 percent of Americans—a 30 percent jump in 3 years. Some 60 percent of the global population—4 billion people—subscribe to wireless services. As the market for new devices has grown, so has the urgency that cell phone safety be well understood, and that cell phone radiation standards be sufficient to protect public health.

In this testimony we highlight five key areas of concern:

- Consumers have a right to know the level of radiation their phones emit;
- The latest science points to potential risks to children's health;
- Federal standards for cell phone radiation need to be modernized;
- What consumers can do to reduce exposures to cell phone radiation; and
- EWG's recommendations to the Government, industry, and the public.

CONSUMERS HAVE A RIGHT TO KNOW THE LEVEL OF RADIATION THEIR PHONES EMIT

EWG advocates that cell phone companies label their products' radiation output so that consumers can make informed choices at the point of sale, and that the Government require this disclosure. Currently, most people are given no information at all about radiation emissions when they purchase a phone.

To fill this information void, EWG's research team created a user-friendly, interactive online guide to cell phone emissions, covering more than 1,200 phones currently on the market. Consumers can use this free online database to make informed decisions about which cell phones to buy. The EWG guide uses easy-to-read graphics to illustrate each phone's radiofrequency emissions, enabling consumers to make quick comparisons of radiation output of various wireless devices.

In the 64 hours following the publication of our science review and cell phone radiation database, 442,000 people accessed these materials on our Web site, collec-

tively viewing 1.4 million online pages. During those same 3 days our findings were reported in 100 news articles and in national and local broadcast news, including the New York Times, NBC Nightly News, WebMD, and USA Today. This powerful response from the public and from news media outlets reflects consumers' keen interest in the issue of cell phone safety. Clearly, people are eager to know if cell phones are safe and how they can protect themselves and their families from potential adverse effects of excessive exposure to cell phone radiation.

#### THE LATEST SCIENCE POINTS TO POTENTIAL RISKS TO CHILDREN'S HEALTH

Prior to 2003, studies of cancer risk and cell phone use produced conflicting results. The Food and Drug Administration (FDA) told consumers that scientists had found no harmful health effects from exposure to cell phone emissions. But FDA's assurances were based on studies of people who had used cell phones for just 3 years, on average, not long enough to develop cancer. At that time, studies had not addressed the risks of longer-term cell phone radiation exposures. The research gap is closing. Recent studies find significantly higher risks for brain and salivary gland tumors among people using cell phones for 10 years or longer. The state of the science is provocative and troubling, especially for the health of children. Among recent findings are the following:

- A joint study by researchers in Denmark, Finland, Norway, Sweden, and the United Kingdom found that people who had used cell phones for more than 10 years had a significantly increased risk of developing glioma, a usually malignant brain tumor, on the side of the head they had favored for cell phone conversations.
- French and German scientists reported an increased risk of glioma for long-term cell phone users. Analysis of all published cell phone-brain tumor studies found that people who had used a cell phone for 10 or more years, the overall risk for developing a glioma on the cell phone side of the head increased by 90 percent.
- Cell phone use for 10 years and longer has been also associated with significantly increased risk of acoustic neuroma, a type of benign brain tumor, on the primary side of cell phone use. An extensive review of published studies of acoustic neuroma found that long-term cell phone users had a 60 percent greater risk of being diagnosed with the disease.
- A study from Israel reported an association between frequent and prolonged mobile phone use and parotid (salivary) gland tumors (Sadetzki 2008). Scientists analyzing data from Sweden and Denmark combined found that people who had used cell phones for at least 10 years ran an increased risk of benign parotid gland tumors.

The National Research Council (NRC) has observed that “with the rapid advances in technologies and communications utilizing [radiation in the range of cell phone frequencies], children are increasingly exposed . . . at earlier ages (starting at age 6 or before)”. Research by France Telecom scientists showed that under standard conditions of use, twice as much cell phone radiation would penetrate a child's thinner, softer skull than an adult's. Children will be exposed to cell phone radiation for more years and therefore in greater total amounts than the current generation of adults.

Children are likely to be more susceptible than adults to effects from cell phone radiation, since the brain of a child is still developing and its nervous tissues absorb a greater portion of incoming radiation compared to that of an adult. Much more research is essential. However, in response to the information already available over the potential health risks of cell phone emissions, government agencies in Germany, Switzerland, Israel, United Kingdom, France, Finland, and the European Parliament have recommended actions to help consumers reduce exposures to cell phone radiation, especially for young children. Among warnings issued by government agencies are the following:

- United Kingdom*.—United Kingdom Department of Health: “UK Chief Medical Officers strongly advise that where children and young people do use mobile phones, they should be encouraged to: use mobile phones for essential purposes only; keep all calls short—talking for long periods prolongs exposure and should be discouraged.”
- Canada*.—City of Toronto Department of Public Health: “Today's children have started to use cell phones at a younger age, therefore their lifetime exposure to cell phone RFs will likely be greater. As a result, the chances that a child could develop harmful health effects from using a cell phone for a long time may be greater. Toronto Public Health is recommending that children, especially pre-adolescent children, use landlines whenever possible, keeping the use of cell

phones for essential purposes only, limiting the length of cell phone calls and using headsets or hands-free options, whenever possible.”

—*Finland.*—Finnish Radiation and Nuclear Safety Authority: “It would be good to restrict children’s use of mobile phones. Precaution is recommended for children as all of the effects are not known . . . Parents are recommended to guide their children to use a hands-free that minimizes the exposure of head significantly. When using a hands-free it is recommended to keep the mobile phone at least a few centimetres away from the body.”

In contrast, the two U.S. Federal agencies that regulate cell phones, the FDA and the Federal Communications Commission (FCC), have all but ignored evidence that long-term cell phone use may be risky.

#### FEDERAL STANDARDS FOR CELL PHONE RADIATION NEED TO BE MODERNIZED

The FCC set cell phone radiation standards 17 years ago, when few people used cell phones. These standards fail to provide an adequate margin of safety for cell phone radiation exposure and do not account for risks to children. The FCC standards closely follow the 1992 recommendations of the Institute of Electrical and Electronics Engineers. The FCC adopted IEEE’s proposal to allow 20 times more radiation to the head than the average amount allowed for the whole body, even though the brain may well be one of the most sensitive parts of human body with respect to RF radiation and should have more protection. EWG’s conclusion: current U.S. cell phone radiation standards are outdated and may not be sufficiently protective. EWG urges the FDA and the FCC to upgrade its standards to take account of the newest scientific evidence and also increasing cell phone use by children.

#### WHAT CONSUMERS CAN DO TO REDUCE EXPOSURES TO CELL PHONE RADIATION

EWG recommends a number of simple actions consumers can take to reduce exposures to cell phone radiation. We recommend these simple precautionary measures until the science on cell phone risks is settled, and until the Federal Government modernizes current radiation limits to reflect the latest research.

—*Use a Low-radiation Phone.*—Consumers can find radiation emissions for their current phone on EWG’s database ([www.ewg.org/cellphone-radiation](http://www.ewg.org/cellphone-radiation)), in their user’s manual, or by contacting the manufacturer. EWG’s database lists alternate, low-radiation phones, allowing people to consider purchasing a phone that emits the lowest radiation possible and still meets their needs.

—*Use a Headset or Speakers.*—Headsets emit much less radiation than phones. Experts are split on whether wireless or wired is safer. Some wireless headsets emit continuous, low-level radiation, so EWG advises removing the headset from the ear between calls. Using a phone in speaker mode also reduces radiation to the head.

—*Listen More, Talk Less.*—Cell phones emit radiation to transmit voice or text messages, but not to receive messages. Listening more and talking less reduces exposures.

—*Hold Phone Away From the Body.*—Holding the phone away from the torso when talking (while using the headset or speaker) reduces radiation exposures. EWG advises against holding the phone against the ear, in a pocket, or on the belt where soft body tissues absorb radiation.

—*Choose Texting More Than Talking.*—Phones use less power (less radiation) to send text than voice. And unlike speaking with the phone at the ear, texting keeps radiation away from the head.

—*Stay off the Phone if the Signal is Poor.* Fewer signal bars on the phone means that it emits more radiation to get the signal to the tower. EWG recommends that people make and take calls when the phone has a strong signal.

—*Limit Children’s Phone Use.*—Young children’s brains absorb twice the cell phone radiation as an adult’s. EWG joins health agencies in at least six countries in recommending limits for children’s phone use, such as for emergency situations only.

—*Skip the “Radiation Shield.”*—Radiation shields such as antenna caps or keypad covers reduce the connection quality and force the phone to transmit at a higher power with higher radiation.

#### RECOMMENDATIONS

The Government should invest in additional research on the health effects of cell phone radiation, with special emphasis on children and teens.

The Government should require industry to make cell phone radiation level information available at the point of sale, so consumers can make informed decisions about the phones they buy.

Given the troubling questions raised by the research thus far, the cell phone industry should not wait for Government action, but instead, offer consumers phones that operate with the least possible radiation, and should offer radiation information at the point of sale.

In the meanwhile, cell phone users can protect themselves and their families by buying low-radiation phones. Cell phone users can also reduce radiation exposures by using their phone in speaker mode or with a headset.

In conclusion, EWG strongly believes that the Government should support additional research into this important health question, and that the public has the right to know what levels of radiation they may be exposed to, what may be the potential risks, and what precautionary measures they can take to protect themselves and their families from any adverse health effects of cell phone radiation.

Thank you for your time. I welcome the opportunity to answer any questions you may have.

Senator HARKIN. Thank you very much, Dr. Naidenko.

I'll just start the first round of questioning here. You can start me at 5. Thank you.

Dr. Naidenko, I was looking at the summary of your working group's study last week. You had a tracking tool that allows visitors to check radiation levels for 1,200 models of cell phones and smartphones. Is that list available? Can I look and see what models would be lowest and what would be highest?

Dr. NAIDENKO. Thank you for that question, Senator. Yes, the full database is available for consumers, for anybody, on the EWG Web site—[www.ewg.org/cellphone-radiation](http://www.ewg.org/cellphone-radiation). It's searchable. Consumers can look for a specific model, look for the phones with highest radiation output, lowest radiation output. So it is a tool that has had immense success over the 4, 5 days since it has been released.

Senator HARKIN. You also say your finding was that texting trumps talking. That was your first tip right here. But texting costs money. It costs more money than talking on the phone.

[Phone rings.]

Senator HARKIN. Right on cue.

So you would say still to text rather than talk, but I just wanted to point out that texting can be very expensive.

It seems to me that you have these studies and I'm getting some curious information here today, Dr. Sadetzki and Dr. Leszczynski, there are some studies that indicate that there are findings that show that some people who have been exposed for long periods of time do in fact have higher levels of certain kinds of brain or head cancers. Is that a fair statement I just made, that there are studies that show that people who have had longer-term usage of cell phones compared to another group have higher incidents of either brain or head type of cancers? No? Yes?

Yes, Dr. Sadetzki.

Dr. SADETZKI. Yes, I think that the statement is correct. I think that when you look at the data you see that indeed in the first 10 years nothing happens. However, when you look at all the individual studies that are out there, you do see something after 10 years with ipsilateral use, meaning, as I said, for holding the phone on the same side where the tumor occurred. Our study also showed increased risk for people who are in the high category of use.

However, what we need to understand is that there are standards for research. These studies are based on very few users, because very few users have been using the phone for more than 10



years. Therefore—you know, I have two hats, public health, as a public health practitioner, and as a researcher. Now, obviously for research these observations are not enough. There is a discussion whether these observations are true or whether they are methodological—stem from methodological problems.

So as a researcher, I do say we have a hint that something is going on. However, we need more research. But as a public health practitioner, I am saying: Wait a minute; this is a red light and we must do something, especially since this something is very easy to implement, because all we need to do is to put the cell phones away from our body.

Senator HARKIN. Dr. Davis, you said in your testimony, again following up on this, you said—you cite Dr. Sadetzki's study and you say that INTERPHONE has studied people who have used phones heavily for a decade and has found that where persons have used phones heavily for a decade or longer, there is evidence of significantly increased risk, nearly a doubled risk of malignant brain tumors. Is that a correct interpretation?

Dr. SADETZKI. I cannot comment on the overall INTERPHONE results, because the overall INTERPHONE results are now under review. They are not published yet. What you said is correct when you look at the individual studies published from the INTERPHONE results, not the overall results.

Senator HARKIN. But again, those are based on—

Dr. SADETZKI. Those are based on people who are long-term users. The term "long-term users" is also not very correct, because we're talking about people who talked for more than 10 years.

Senator HARKIN. Dr. Davis, you said that the one researcher to have studied young people who began using cell phones as teenagers, Professor Lennart Hardell of Sweden, has found that those who started to use cell phones heavily before age 20 have four to six times more brain tumors by the time they reach their 30s.

Can we get some documentation on that study?

Dr. DAVIS. Absolutely. In fact, tomorrow at our international conference that's being held just a few blocks away—I invite your staff to attend—at 8 o'clock in the morning Lennart Hardell will be speaking to us by Skype from Sweden, where he will present not only that result, but additional analyses, unfortunately, of new cases.

You have to understand that in the Scandinavian countries and in Israel they have been using cell phones a lot longer and a lot more heavily than we have. So unfortunately they have some of those data.

I should also add that one of the most troubling findings is a series of studies that have been produced in the United States—this is one study that was done opportunistically at a fertility clinic—and in Hungary and other countries, finding reduced sperm count in young men who keep their phones in their pockets, which unfortunately many young men do, even though if you read the advice that's on the iPhone and the Blackberry it says keep the phone 1 inch away from your body, actually .98 inches in case you want to be precise.

But the reality is very few people do that, and lots of young men keep their phones in their pockets, particularly in the summertime.

The Cleveland Clinic published a peer-reviewed study showing reduced sperm count, and that was not the only such study, but only the most recent one.

Senator HARKIN. Let me ask the question I asked Dr. Bucher. I've got my Blackberry, which we use all the time. Again, just individually, I'll go down the line, Dr. Leszczynski and on down the line: If you were to use a Blackberry, like I do, and you were calling people, if you had the option of putting it up to your ear like this and talking or you could use an earphone like this, with a little speaker down here, which would you do?

Dr. LESZCZYNSKI. I personally and also my institution is advising to use earpiece instead of keeping cell phone to your head. It is a very simple way or a cheap way to reduce exposure of head to cell phone radiation. So I would use earpiece.

Senator HARKIN. Dr. Sadetzki, any difference?

Dr. SADETZKI. Same thing.

Senator HARKIN. Dr. Erdreich.

Dr. ERDREICH. I recognize that use of an earphone would decrease a person's exposure to RF. I don't think—I really can't agree that it reduces the risk because I don't think the total picture of all the studies taken together, with all their complications, I don't think this assessment suggests that there is a risk from using the cell phone.

Senator HARKIN. Dr. Davis.

Dr. DAVIS. I brought my earpiece when you were talking. But I want to go on to read what the FDA and FCC sites say, since Dr. Erdreich suggested to the contrary. The site as of yesterday says:

“The scientific evidence does not show a danger to any users of cell phones from RF exposure, including children and teenagers. The steps adults can take to reduce RF exposure apply to children and teenagers as well.

—Reduce the amount of time spent on the cell phone.

—Use speaker mode or a headset to place more distance between the head and the cell phone.”

I'm continuing to read from their site:

“Some groups, sponsored by other national governments have advised that children be discouraged from using cell phones at all.”

Then it goes on to say:

“For example, in 2000 in the U.K., the Stewart report advised this. Their recommendation to limit cell phone use by children was strictly precautionary. It was not based on scientific evidence that any health risk exists.”

Close quote, from the FDA Web site. It's in my testimony submitted for the record.

The question we have to ask is, What is evidence? Do we insist that the only evidence we will accept is when we have enough sick or dead children? I hope that it is not the case and that we've made some progress as a society in order to take the kinds of precautions that our colleagues in Israel and Finland and many other nations are taking today.

I especially want to thank my colleague Dr. David Servan-Schreiber, who is himself a scientist, a physician, a researcher, and a brain tumor survivor. So his interest in this issue is quite intense and personal.

Senator HARKIN. Thank you very much.

Dr. Naidenko? Dr. Naidenko, the same question: Which would you do?

Dr. NAIDENKO. Thank you for that question, Senator. Based on our very extensive science review, EWG strongly recommends they use a head set, such as the one that you hold in your hand, and I think I have a very similar one.

Senator HARKIN. Any difference between this and Bluetooth?

Dr. NAIDENKO. The Bluetooth is of course itself emitting RF radiation. So when a cell phone is here on the table next to me, the Bluetooth will be transmitting from the ear to the cell phone. The distance is shorter, so the amount of radiation that it would put out would be smaller than a cell phone would put out to a tower way out there. Based on our science review, we found that experts are split. Of course, our distinguished colleagues in Israel are recommending you get a wired earpiece, such as the one that you have. Our colleagues in Switzerland do feel that Bluetooth is a good choice.

Then we have reviewed Government Web sites for many European countries. We have found that some recommend both, some recommend just one. We at EWG feel that either headset would be better than holding the phone to the ear.

Senator HARKIN. My 7 minutes are up, but anything on Bluetooth? Dr. Davis? We'll go back down this way.

Dr. DAVIS. Yes. In fact, if you are using a Bluetooth and you have the phone away from your body and you turn it off when you're not using it, it does give you much less exposure. But the problem is that most people who use a Bluetooth have the phone on their hip, right at their bone marrow, and have it on all the time. That is what we are concerned about.

Senator HARKIN. Dr. Erdreich, the difference between this and Bluetooth?

Dr. ERDREICH. No comment on Bluetooth.

Senator HARKIN. No comment.

Dr. Sadetzki.

Dr. SADETZKI. Usually it's true that the Bluetooth is better than the cell phone itself, but there are situations in which the Bluetooth involves higher emissions than the cell phone itself, such as when the reception is really good, because the Bluetooth is always constant exposure, while the cell phone adapts with the base station all the time. Besides, in Israel we worry that when people wear this Bluetooth it is so comfortable it becomes part of your body, that they will just talk more and more, and therefore the overall exposure will be higher.

Senator HARKIN. Interesting.

And Dr. Leszczynski?

Dr. LESZCZYNSKI. Yes. Of course, Bluetooth is very comfortable because you don't have those wires all the time hanging. However, Bluetooth is emitting radiation continuously and we don't have the slightest idea what this kind of continuous exposure of the area of ear can achieve in due time. Therefore it is much better to use this earpiece.

On the other hand, also it's necessary to remember that, as Dr. Davis mentioned, when people have Bluetooth in their ear they usually keep cell phone somewhere else in the pocket, and then

this area next to cell phone is being exposed, especially if in breast pocket or pocket in trousers. Different areas will be then exposed, not on the head, but somewhere else the radiation goes.

Senator HARKIN. Thank you very, very much.

My time has expired. Senator Specter.

Senator SPECTER. Thank you, Mr. Chairman.

Dr. Davis, what is the strongest evidence you know about an alleged causal connection between use of the cell phone and a brain tumor?

Dr. DAVIS. Well, the strongest evidence does not come from human studies, and that's the problem. When we're looking at public health information, we have to rely on experimental evidence such as that developed by the NIEHS in this country and researchers in Europe in the Reflex Project and others. If we look at experimental studies, we have very strong evidence. If we look at human studies, as Dr. Erdreich has commented—

Senator SPECTER. Tell us about the experimental studies.

Dr. DAVIS. Well, as a matter of fact, here we go. This is a model of the brain and, while the precise information in here has been debated, this is approximately the absorption that gets into the head of a 5-year-old, and this is about the absorption here on the blue line that gets in the head of an adult.

Senator SPECTER. That establishes that there is more absorption.

Dr. DAVIS. Right.

Senator SPECTER. Wait a minute. Just answer the question. That establishes more absorption from a 5-year-old, but that's not my question. My question is what is the strongest evidence you have that exposure to a cell phone causes cancer?

Dr. DAVIS. All right. The process of cancer arises from many different insults to our DNA, the basic building blocks of our genetic material inside ourselves. Researchers have shown that RF signals at exactly the same wavelength of those of the new phones can cause heat shock proteins. Those are proteins that the body forms in response to stress, and those have been shown—

Senator SPECTER. Wait a minute. We don't have time for a treatise. We have 5 minutes.

Dr. DAVIS. Okay, I think I can do it in 5 minutes or less.

Senator SPECTER. No, no. Just answer my question. What is the strongest evidence you have that exposure to a cell phone causes cancer?

Dr. DAVIS. The work that's been done on the common assay that shows double strand breaks in DNA after exposure to cell phone radiation is very strong evidence experimentally. If we tie that with the human studies of Dr. Sadetzki and others that have looked at people who have 10 years of exposure or more, we put them together and we have strong evidence.

Senator SPECTER. Well, Dr. Sadetzki has testified that you see something after 10 years, but she says that there are so few involved that she can't draw a scientific conclusion. Is that an accurate statement, Dr. Sadetzki?

Dr. SADETZKI. Regarding the 10 years, yes. But first of all I would like to say that I'm not sure that there is an association. I cannot be sure based on the current epidemiological data. But what worried me was that in my study I saw consistent positive results

and they always appeared where there is biological plausibility. They did not appear in this group or in that group. They appeared after more than 10 years, they appeared on the same side where the phone was held, they appeared for the heavy users, and they appeared in rural areas compared to urban areas, and this also has biological plausibility because where antennas are more dense then the exposure is lower.

So the act that all of these indications appeared where they should have appeared told me that it was a really red light. But as a scientist, this is not enough, definitely not for causality. But it's an indication that, according to my judgment, is enough in order to advise the precautionary principle.

Senator SPECTER. As a scientist, it's not enough to conclude a causal connection, is that right?

Dr. SADETZKI. Right. For causal association, the criteria are much more strict.

Senator SPECTER. Dr. Erdreich, you've testified that the evidence does not demonstrate a connection between cell phone and cancer. Now, it is much harder to prove a negative, but what would your answer be, does the evidence demonstrate that there is no connection between a cell phone and cancer?

Dr. ERDREICH. You've made an important observation. I think the evidence—

Senator SPECTER. I haven't made an observation. I've asked a question. I'm not having much luck with answers, but that's my question.

Dr. ERDREICH. I think the strongest evidence is not any single study. The strongest evidence is that there is a body of research where we've looked at whether certain studies that showed anything can be replicated, whether we've looked at consistency across studies, and where there have been more than 40 animal studies that used different measures to assess the long-term risks. The evidence doesn't come from any single study. The evidence comes from a careful review, looking at the strengths and weaknesses together, and putting the data together.

This is supported by the fact that the INTERPHONE studies, as Dr. Sadetzki suggests, states, taken together are kind of strongly not showing an association between use and cancer. So the answer—

Senator SPECTER. Do not strongly suggest a showing between the use and cancer?

Dr. ERDREICH. It doesn't show.

Senator SPECTER. But that's not a demonstration that there is no connection.

Dr. ERDREICH. Exactly. What's important is that in the background context of what we know about the nature of the signal, the strength of the signal, how it interacts with cells. There's been research going on with this for more than 50 years, although the research in the last 20 years of course used improved methods and is more definitive.

Senator SPECTER. I was once involved at a hearing which had a similar question. The question was is there evidence that there was no conspiracy on the assassination of President Kennedy. You don't

see the connection? Proof of a negative is very, very different from proof of a positive.

Dr. ERDREICH. Exactly.

Senator SPECTER. And when you boil it all down, what I hear is not a whole lot of disagreement in this panel.

You, Dr. Erdreich, say that there is so little question, in fact there's no issue of risk at all, that you wouldn't take any precaution. I find that—

Dr. ERDREICH. That's—

Senator SPECTER. Well, wait a minute. I'm not finished. When I've finished and give you a question, I'll pause.

But where you end up with all the verbiage, you do not say that the evidence demonstrates there is no connection. Isn't that a fair statement of your testimony?

Dr. ERDREICH. It is a—part of that is a fair statement.

Senator SPECTER. Which part is it?

Dr. ERDREICH. The part that I said there's absolutely no risk whatsoever.

Senator SPECTER. That wasn't part of my question. That was an observation before.

Dr. ERDREICH. Your statement that it's very hard to prove a negative is really on target.

Senator SPECTER. Let's get back to my question. Isn't a fair summary of your testimony that there is no—the evidence does not demonstrate the absence of any connection between exposure and cancer?

Dr. ERDREICH. The evidence does not—excuse me, I have to take just the liberty of rephrasing.

Senator SPECTER. No, no. I'll do that.

Dr. ERDREICH. Please.

Senator SPECTER. The evidence does not demonstrate that there is no connection between the use of a cell phone and cancer?

Dr. ERDREICH. You had said the evidence does not demonstrate that there's no connection. Is that what you meant to say? I'm sorry.

Senator SPECTER. I'll repeat it. A fair statement of your statement is that the evidence does not demonstrate that there is no connection between the use of a cell phone and cancer?

Dr. ERDREICH. The scientific evidence could never demonstrate a total no-connection.

Senator SPECTER. Then I take your answer to be: Correct.

Well, let me tell you where I come out, because this hearing has run very long, but it's been I think very worthwhile. What comes through to me is that we just don't know what the answer is. Dr. Sadetzki raises a lot of red flags, but she says: Well, it's not whether we use cell phones, but how we use them. She's not advocating not using cell phones. Dr. Davis, who drew almost as much applause as Senator Harkin, made the comment that she's not alarmed, but she's concerned.

The issue of the precautions I think comes through to me, with the exception of Dr. Erdreich's testimony, that precautions are worth taking, certainly more worth taking than the precautions I undertake in not eating sugar or white flour out of concern for

feeding into cancer; and that precautions are not a bad idea. They may not be a good idea, but they're not a bad idea.

The issue of children is something we ought to look at a little more closely because of the sensitivity of that issue. We have a duty to do more about protecting children.

The question I think boils down to what additional studies are necessary, because nobody knows, and the question as to whether the people who sell cell phones ought to be undertaking more studies. That's a harder question. What Senator Harkin and I can have some influence on is the appropriations process and to some extent suggesting just what ought to be done. Whether there's enough of a risk here to prompt telephone companies who provide cell phones to people, whoever does that, is another question, and my recommendation would be that they study the testimony here very carefully and that more is to follow.

One final question, Dr. Davis. Does your invitation to appear at your hearing at 8 a.m. tomorrow morning to hear this fellow from overseas extend to everyone?

Dr. DAVIS. Absolutely. We will have it available on the Web. People will have to come and register by 7:30 a.m. if they want to be in by 8 a.m.

Senator SPECTER. So if it's on the Web we can sleep in?

Dr. DAVIS. Yes.

Senator SPECTER. Thank you very much, distinguished panel.

Dr. DAVIS. Yes.

Senator SPECTER. Thank you, Mr. Chairman.

Dr. DAVIS. Thank you.

Senator HARKIN. Thank you, Senator Specter.

Let me follow up on another thing. First of all, I know that we don't have jurisdiction over the FDA here or the FCC.

Senator SPECTER. When has that stopped you, Senator Harkin?

Senator HARKIN. What did you say?

Senator SPECTER. I said, when has that stopped you, Senator Harkin?

Senator HARKIN. Well, you didn't hear my follow-up. Because of my new chairmanship on another subcommittee, I do have jurisdiction over the FDA.

But what I wanted to follow up with was a question that I will pursue beyond this panel with my friends at NIH. That is this. Dr. Erdreich stated, and I made note of this because it's something that I have wondered about for a long time, that RF energy is not radiation in the same sense as used for high frequency X-rays because the energy of RF is so much lower and is unable to change the DNA of cells.

Do you have any definitive proof that this RF energy is unable to change the DNA of cells? Now, Dr. Davis said a study by Professors Henry Lai and Singh showed that low levels of RF signals could produce strange defects in DNA in 1994. So I've got two different things here and, as I said, I will pursue this beyond this panel with NIH to see if we have any definitive answer to that: Is DNA harmed by low level RF frequency?

Did you have any further views on that, Dr. Erdreich?

Dr. ERDREICH. This part of the spectrum is known as nonionizing radiation because it is not known to cause those changes that we've

talked about. There has been mentioned a study. It is not the only study, and the agencies that I've been involved with and that I've read about, that I've reviewed the research, have considered all of the studies on this question and they have not concluded that it's been proven to affect the DNA of cells.

The second part is that the stronger evidence—the strongest evidence you can get is from humans, but there are difficulties in epidemiology studies and in whole animals. Most agencies and authorities that do evaluate health risk think that these studies themselves are important, but it's quite a stretch to say that what happens in cells can happen in human beings or in animals.

Senator HARKIN. Dr. Sadetzki, you have a view on this? And Leszczynski wants to weigh in on this. Yes?

Dr. SADETZKI. I don't want to get into the discussion, do we have a mechanism or not, do we first need to prove the epidemiology and then the mechanism or the other way around. I just wanted to mention very briefly that extremely low frequency (ELF), which is even—has even less energy, was determined by the International Association for Cancer Research, as a possible carcinogen in 2006.

Senator HARKIN. What kind of RF frequency?

Dr. SADETZKI. ELF. Oh, I'm sorry. The IACR is the association of—it's a body of the WHO—

Senator HARKIN. Yes.

Dr. SADETZKI [continuing]. Which classifies carcinogens. And they have different levels of carcinogens, starting from definite carcinogens, such as smoking or ionizing radiation, and ending by probably not a carcinogen. So extremely low frequency, which is also in the spectrum of low energy, was determined by this organization in June 2006 as a possible carcinogen.

Senator HARKIN. Possible?

Dr. SADETZKI. Yes.

Senator HARKIN. Dr. Leszczynski, did you have something you wanted to say about this?

Dr. LESZCZYNSKI. Yes. We don't have precise knowledge whether DNA is damaged by mobile phone radiation. There can be two ways how mobile phone radiation could affect cells that we observe damaged DNA. Either it will be damaged by radiation itself or the radiation could interfere with the process of repair of DNA in cells. In cells normally, all the time DNA damage occurs spontaneously, and this radiation could either interfere with this process of repair, meaning the spontaneously damaged fragments of DNA would not be repaired, or it could damage DNA.

However, as was mentioned earlier, it doesn't have enough energy to directly damage DNA. However, there are indications from some studies that mobile phone radiation can induce production in cells of special molecules which are very chemically active, called free radicals, and those molecules could indirectly damage DNA.

So we have those two options for mechanism. Right now we don't know yet which one of them is the correct one.

As was mentioned earlier, human evidence is the most important, most valuable for us. We cannot get this information, for example, on DNA damage from epidemiological studies. However, that's why I was suggesting a new direction in research, namely making molecular level experiments in human volunteers. This is



possible. It's possible to expose, for example, small areas of skin of people to mobile phone radiation, take a sample of the skin, for example, for DNA damage. We have done these kinds of experiments. We were looking not at DNA; we were looking on behavior of proteins in human skin. But it is feasible. It is possible to do and it is also permitted by ethical parameters of experimentation.

Senator HARKIN. Dr. Naidenko, you and Dr. Sadetzki both had recommendations for cell phone use. I was trying to get through all of these. You recommended, Dr. Naidenko, holding the phone away from the body. We've already gone over the earpiece bit.

Dr. Sadetzki, you said the same thing: a speaker phone or hands-free phone, keeping it away from the body.

Dr. Davis, you said that a cell phone should not be kept any closer than an inch to your body? Is that what you said? I don't know—where does that come from?

Dr. DAVIS. That actually comes from the Blackberry manual, as well as from the iPhone manual. If you read the manuals, which almost none of us does, that is what they say. So by calling for warning labels as I am, I am simply calling to codify what the industry is currently telling us about cell phones.

I would also add that when I was privileged to work with Dr. Ronald Herberman at the University of Pittsburgh Cancer Institute, he looked at the evidence on this issue as one of the world's most distinguished cancer biologists and he concluded that it was appropriate to warn the staff to take these simple precautions, the same precautions that Israel is recommending, the same precautions that Finland, Denmark, Norway, and Sweden have recommended.

Senator HARKIN. Let's face it. Us men—now, my wife has a Blackberry; she keeps it in her purse. Fine. We all have these holsters, right? We all have these. We put them on our belts. Are you telling me that I should not wear a Blackberry that close?

Dr. DAVIS. Well, actually the holster may give you enough distance. That's what Blackberry says. I mean, an inch—take a look at it. An inch, you get some distance there. That's why they recommend that you use their holster. But the reality is we don't know, and as scientists it really shouldn't be my job to tell you what—

Senator HARKIN. That's not an inch. I don't have an inch between my holster and—

Dr. DAVIS. They recommend their holster. I guess this is a question that we ought to ask the appropriate Government agencies and the private sector to resolve. Dr. Servan-Schreiber is working now with senior French officials in the government as well as in the telecom industry, because they are working in the telecom industry, in France at least, to make the kinds of changes which they think are appropriate. I hope that this hearing will lead to a new day of cooperation, because we need the cooperation of industry to solve this problem. We really do.

Senator HARKIN. Also, my last thing is that cell phone technology is changing almost every day. Now, when I first started out a few years ago I had a cell phone. Now you have Blackberries. Now you do everything; they're computing devices. So I don't know, I'm not an expert in this, but I assume that what I do with this and browse

and do everything else emits more RF than what my old cell phone used to, which I just talked to people on. Is that true? No?

Dr. DAVIS. I don't think we know. In fact, not necessarily, because so long as you're holding it out here you actually are going to get less exposure. This is what we are principally concerned about right now, and this is what we need the FDA and the FCC to look into very carefully, because the current standards are based on the standards for a 200-pound man with an 11-pound head talking for 6 minutes, to avoid heat. Now, that's not relevant to my 3-year-old granddaughter who likes to play with a cell phone. That's the problem we have. The current standards are set for a very large, big man and not for me or many other people in the world today. In Brazil, for example, there are 120 cell phone users and one-half of them are under age 20. Thank you. 120 million, thank you.

Senator HARKIN. The last thing I want to say, Dr. Naidenko, I don't have that list. Describe for me just a little bit the testing you went through. You tested 1,200 different phones?

Dr. NAIDENKO. Thank you, Senator. Just to clarify, what we have done, we have conducted a science review of more than 200 publications. These are peer-reviewed studies, Government advisories, and industry documents. That is in our cell phone radiation report.

We have also compiled information on more than 1,200 phones. We did not test the phones. We looked for that information in all publicly open sources. For many of the phones, we did succeed, with a lot of effort, to find their radiation output. For some phones we did not, and the reason for that is the Government does not require disclosure and consumers have to go through a really onerous and time-consuming task to find what their model may emit.

Senator HARKIN. There's no Government agency? The FCC does not put out this kind of information about how much RF frequency is put out by the different phones? The FCC doesn't publish that?

Dr. NAIDENKO. Thank you, Senator. That's a very important point. So the FCC does maintain a database of documents associated with every phone, every phone model that would be identified by FCC ID. But to locate that information, to locate that information, the cell phone user has to know their FCC ID. So the steps are buy the phone, find the FCC ID, go to FCC database. This is not available at the point of sale or in a readily available location.

Senator HARKIN. I want to see that list. I'll have my staff get it. I want to take a look at it. We ought to somehow get it published or somebody ought to at least know what the different ratings for something are.

[The information follows:]

<http://www.fcc.gov/cgb/cellular.html>

Senator HARKIN. Two last things. Senator Specter and I both have to leave. But Dr. Davis.

Dr. DAVIS. You just need to know that the reported SAR, specific absorption rate, can be off by a factor of 2 to 4. There's no routine testing. There's no monitoring. There's no surveillance. The only time the FDA can act is if a hazard has been reported, as happened in the case of the LG flip phone in Canada last year, where a quar-

ter of a million phones were recalled because they were found to be having a higher emission rate.

So even though the SARs may be publicly available, and the EWG is to be commended for compiling them, we have no guarantee that your specific phone is at that SAR or one-half that or double it.

Senator HARKIN. Did you have something you wanted to add to that? I thought you were signaling me.

Dr. SADETZKI. Just two minor points. The first is that in Israel it is obligatory by law to have the specific absorption rate on every one that is in the market.

Senator HARKIN. You're doing that now?

Dr. SADETZKI. Yes, already for 4 years now.

The second thing, I don't think that an inch would be enough. I would like to see the phones be further from the body. You asked how it will be done. This is a very legitimate question. I think that if the companies will need to do it, they have such clever engineers that they will find a solution. It's a technical problem. I see it as a minor problem. I think it can be done very easily with a few clever engineers getting together in a room for half an hour.

Senator HARKIN. Senator Specter, anything you want to add?

Senator SPECTER. Well, I have a final comment. See what the Senate can do on a Monday afternoon if a couple of Senators are in town.

Senator HARKIN. Thank you. Thank you very much, all of you. I found this really very interesting and very challenging, and I can assure you we are going to do some follow-up on this. Thank you all very much.

#### STATEMENT RECEIVED FOR THE RECORD

The subcommittee has received a statement from Robert N. Hoover of the National Cancer Institute, which will be included in the record.

[The statement follows:]

PREPARED STATEMENT OF ROBERT N. HOOVER, MD, SCD, DIRECTOR, EPIDEMIOLOGY AND BIOSTATISTICS PROGRAM, NATIONAL CANCER INSTITUTE, NATIONAL INSTITUTES OF HEALTH, DEPARTMENT OF HEALTH AND HUMAN SERVICES

My name is Dr. Robert N. Hoover. I am the Director of the Epidemiology and Biostatistics Program of the National Cancer Institute (NCI), part of the National Institutes of Health, an agency of the U.S. Department of Health and Human Services. As Director of this program, I have established ongoing programs of research in a variety of areas of cancer epidemiology, including the role of environmental, hormonal, and genetic factors in cancer etiology. I am also responsible for the oversight of the Radiation Epidemiology Branch, which conducts and follows research related to radio-frequency (RF) radiation and low-frequency electromagnetic fields (EMF), as well as ionizing radiation. I have been asked by the subcommittee to prepare written testimony for the record for this hearing on cell phones and health.

The following is a brief summary of the scientific evidence on the topic of cell phones and risk of brain cancer that I presented in September 2008 at a congressional hearing on the subject.

As an epidemiologist my statement will focus on studies of risk in human populations. It is also important to note on the biologic side that the RF radiation from cell phones is billions of times lower than the energy of an X-ray. As such, its effect in the body appears to be insufficient to produce the genetic damage typically associated with developing cancer. To date, no alternative mechanism about how this exposure might result in cancer has been vetted adequately.

In descriptive data from the large networks of population-based registries funded by NCI, there has been no meaningful increase in the incidence of brain or other nervous system cancers from 1987 through 2005, a time period when cell phone use increased tenfold. In the earliest analytic epidemiologic studies, including one conducted by the NCI, self-reported frequency and patterns of cell phone use were compared between patients diagnosed with brain or nervous system tumors (known as cases) and patients (or controls) with other diseases—an investigation known as a case-control study. These studies found no convincing evidence of an association between cell phone use and glioma, a malignant tumor of the brain, or for meningioma or acoustic neuroma, two generally benign (noncancerous) tumors of the nervous system. However, these studies pointed out that future investigation would be needed to evaluate the potential effect of long-term use, as well as changing cell phone technology. As a result, a new generation of cell phone studies is emerging.

Brain cancer is a very difficult disease to study well in an epidemiologic study. Much of the disease can be rapidly fatal, and the tumor, and its treatment can impair cognitive function. Cases may participate at a different rate than controls, and answers to questions may be altered for someone who knows they have a specific condition. Given all of this, it is not surprising that there is a fair amount of inconsistency within and between many of these studies. I will therefore focus on only the larger and better designed of these studies.

Perhaps the most notable of these is a large collaborative project that includes individual studies from 13 different countries, collectively known as INTERPHONE. These case-control studies use a common study protocol to obtain more detailed information over a more recent time period about the frequency and patterns of cell phone use, as well as other measures of RF exposure in a wide variety of countries (Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, New Zealand, Norway, Sweden, and the United Kingdom). Analyses of data from individual centers and those pooled from some, but not all, of the individual countries have been published. These individual studies found no evidence of an overall increase in the risk of any type of brain tumors associated with the first 10 years of cell phone use. No increased risk has been found in relation to several measures of exposure, including time since first use, lifetime years of use, the number of calls, the hours of use, and the use of analog vs. digital phones.

In some studies, a somewhat increased risk has been found for tumors diagnosed on the same side of the head used for speaking on cell phones among those with more than 10 years of cell phone use. However, these findings are based on small numbers (generally less than 5 percent of cases under study) and are not consistently seen across all studies. We anticipate that when published, the combined INTERPHONE analysis, including all the centers in the original study, will provide a much larger number of long-term users; evaluation of different exposure metrics and latency; a formal assessment of the consistency in study-specific results; and more comprehensive and statistically stable risk estimates. This could bring considerable clarity to the current state of the science.

In another noteworthy study, Danish investigators followed up cell phone subscribers over time and found no increased risk of brain tumors among the subscribers. This type of study—called a prospective study—has the advantage of not having to rely on people's ability to remember their past cell phone use, which could be inaccurate or biased.

As for all such investigations, the INTERPHONE study and the Danish prospective study have certain weaknesses as well. However, overall these studies probably provide the highest quality information on the effects of long-term use of cell phones to date.

We know that cell phone use is increasing rapidly among children and adolescents. They are a potentially sensitive group because their small head size could result in higher RF exposure and the young brain may be more sensitive. To date, there are no published studies in the peer-reviewed literature regarding the risk of cancer and cell phone use in children. However, there are ongoing studies in Europe that will soon be able to provide information on the risk from cell phone use among children.

#### SUMMARY

Thus far, brain cancer incidence trends in the United States are unrelated to patterns of cell phone use.

Most analytic studies indicate no overall increased risk of brain tumors within first 10 years of use.

There are no consistent findings of increased risk across many different ways of measuring increased dose.

There are some isolated findings of increased risk in some dose and population subgroups, but larger studies and replication in different study designs are needed to sort out the roles of chance and bias from findings worth pursuing.

Potential risks associated with childhood exposure have not been assessed.

Insight into these last 2 points may come relatively soon from ongoing analyses of the overall INTERPHONE study, and from a European case-control study of childhood cancer.

Thank you for the opportunity to present this information to you.

#### ADDITIONAL COMMITTEE QUESTIONS

Senator HARKIN. If there are any questions they will be submitted for response.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

#### QUESTIONS SUBMITTED BY SENATOR RICHARD C. SHELBY

*Question.* The FCC's Web site states that "there is no scientific evidence that proves that wireless phone usage can lead to cancer or a variety of other problems, including headaches, dizziness or memory loss." Do you agree with the FCC?

*Answer.* Although this statement is correct, it is also true that there is insufficient scientific evidence to prove that wireless phone usage does not lead to cancer or other problems including headaches, dizziness, or memory loss.

*Question.* According to the FCC "All wireless phones sold in the United States meet Government requirements that limit their RF energy to safe levels." Is it your view that wireless phones sold in the United States do not meet Government requirements?

*Answer.* To the best of our knowledge, wireless phones sold in the United States are in compliance with regulations established by the FCC.

*Question.* The FCC, FDA, ICNIRP, American Cancer Society, National Cancer Institute, and World Health Organization have found that there is no evidence that proves health problems with cell phone use. Are you aware of any scientific evidence that these organizations failed to consider?

*Answer.* No.

*Question.* The FDA's Web site states that "the weight of scientific evidence has not linked cell phones with any health problems."<sup>1</sup> Do you agree with the FDA?

*Answer.* The weight of scientific evidence has not linked cell phones with any health problems; however, as alluded to in response to the first question and in the testimony, there are many scientific areas of inquiry where better data would improve our confidence in this statement.

#### CONCLUSION OF HEARING

Senator HARKIN. The subcommittee will stand recessed.

[Whereupon, at 3:51 p.m., Monday, September 14, the hearing was concluded, and the subcommittee was recessed, to reconvene subject to the call of the Chair.]

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<sup>1</sup> See <http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116282.htm>