

Submitter Info

Please Do Not Reply To This Email.

Public Comments on Developing an Unified Intercarrier Compensation: =====

Title: Developing an Unified Intercarrier Compensation
FR Document Number: 2011-04399
Legacy Document ID:
RIN:
Publish Date: 3/2/2011 12:00:00 AM

Submitter Info:
First Name: Ari
Last Name: Fitzgerald
Mailing Address: 4702 Clear Ave.
City: Tampa
Country: United States
State or Province: FL
Postal Code: 33629
Organization Name: null

Re: FCC-2011-0078-0001

I was notified of this proposal by a group that brings attention to wireless transmission issues. I was told that the proposed rule aims to eliminate the use of landlines. I'm not sure that the proposed rule does, in fact, do this. But if it does seek to eliminate landlines, I am opposed to it. Internet and telephonic communications that are wired, as opposed to wireless, are, simply put, more secure. With more financial, medical, and other sensitive data being transmitted via telephone and the internet, it doesn't make any sense to eliminate a more secure form of transmission in favor of a less secure one.

Second, I oppose ubiquitous wireless transmissions on the ground that information regarding its negative health effects has been suppressed or ignored. Until such time as the government and providers work together to provide such services responsibly and protect the public, I oppose the rule to the extent it eliminates all wired transmission of communications.

I would appreciate a simple description of the rule's intended purpose. Thank you.

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Publish Date: 3/2/2011 12:00:00 AM

Submitter Info:

First Name: Russell

Last Name: Fieber

Mailing Address: 43300 Little River Airport Rd. #127

City: Little River

Country: United States

State or Province: CA

Postal Code: 95456

Organization Name: None

Please do not take money away from the Universal Service Fund which helps to subsidize Universal Telephone Service land lines- and would instead favor installation of Broadband in Rural Areas. Our community is already awash in multiple wireless technologies that are becoming a public health and safety threat. I am and many other people in our community have already become electrosensitive from the excessive layers of wireless microwave devices already in use in our community- especially the wireless Antenna WiFi Routers combined with Broadband that overreach and crisscross in their individual unlicensed broadcasts of 100 feet each. This which is creating high strength stay electrical MW RF "fields" of increasing intensity which threatens public health and safety. The use of multiple Wireless WiFi Antennas is also a trespass and nuisance in peoples residential homes that is unconstitutional and out-of-control for the homeowner.

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Submitter Info:

First Name: Kathleen

Last Name: Stallmer

Mailing Address: 12 Sycaway Avenue

City: Troy

Country: United States

State or Province: NY

Postal Code: 12180

Organization Name: null

Please not to phase out the switched/analog telephone network.

This phone network is there when you need it.

Digital -- power out, cell needs charge, you're sunk.

Analog, pick up the phone and call.

We need our's, use it, and need it.

Additionally, there are people who are electronically sensitized and cannot use cell phones.

Pls do NOT take the analog telephone network out.

This is America and we have a right to it.

Let's not take away the tried and true and force something else down our throats.

Thank you.

Call me if you need to discuss.

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Submitter Info:

First Name: Stephan

Last Name: Bodian

Mailing Address: 6922 East 3rd St

City: Tucson

Country: United States

State or Province: AZ

Postal Code: 85710

Organization Name: null

I'm very disturbed by the proposal to eliminate telephone landlines in the US. More and more research, especially in Europe, is indicating the extraordinary health dangers of wireless technology, and some of us in the US and worldwide are especially sensitive to EMFs. We demand to have the right to opt out of cellular networks and use the tried-and-true landline technology. Otherwise, we are being forced to compromise our health and being deprived of our freedom to choose!

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Submitter Info:

First Name: Linda

Last Name: Ikeda

Mailing Address: 5000 El Verano Avenue

City: Atascadero

Country: United States

State or Province: CA

Postal Code: 93422

Organization Name: null

The switched telephone network must be maintained!

I will be without basic telephone service if the landlines are torn down. I depend on landlines for my communication needs.

According to the Architectural & Transportation Barriers Compliance Board, the federal agency that administers the Americans with Disabilities Act, about 3% of Americans or almost 10 million of us, have electromagnetic sensitivities and cannot use wireless technology and have difficulty using computers. Eliminating landlines will leave millions of Americans without basic telephone service.

Because of increased exposures to wireless, experts report expected increases in sensitivities to wireless, from 3% to 50%. This translates to pain and poor quality of life to millions.

I do not use wireless and prefer not to use a computer. I warn others not to use wireless and ask all with cell phones to turn them off on my property.

Wireless has no proof of safety. Rather, thousands of studies show adverse effects in addition to European doctors and other professionals raising the alarm. In Europe, the trend is away from wireless and towards wired.

Further, wireless calls are unreliable. Calls are dropped. Additional cell towers/antennas have been proposed, but nobody that knows what's happened in Europe, or to those here living near towers/antennas, wants them near their homes. Landlines are necessary in emergencies. They are dependable during power outages and natural disasters.

Wireless telecom equipment can cause disasters. ABC news confirmed on 4/26/09 that the Malibu California fires were caused by utility poles over-burdened by cell phone gear.

Cell phones and computers are expensive. Seniors and low-income citizens can't afford these.

They are also more complicated to use. One with alzheimers is more likely able to use a corded landline phone than a cell phone or computer.

Cell phones also need to be recharged. Landline corded phones do not.

Landlines are safe, secure, reliable and affordable

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Submitter Info:
First Name: Jenny
Last Name: LAnd
Mailing Address: 3905 Weeburn
City: Dallas
Country: United States
State or Province: TX
Postal Code: 75229
Organization Name: null

It is unbelievable that the FCC would be recommending the phasing out of land lines when emerging studies are raising some troubling questions about the health effects of cellular technology and when there is a need for more extensive studies to determine the scope of these health effects. There are already populations of individuals who are unable to use cell phones because of the health effects they experience from the radiation emitted by them as well as people who choose to not use them to avoid those same health effects. It's absolutely Big Brotherish of the most disturbing order for this agency to actually force American citizens to subject themselves to unnecessary radiation when they should be given a right to use the safer technology of a land line. It's also counterintuitive to the current cultural movement toward greener, slower living. Yes, there is a huge demand for wireless technology, but also a significant demand for greener, safer, healthier alternatives. I myself regularly use my landline to avoid the health effects of cellular phones, something I only keep in my car for emergencies.

Please consider the profound health implications of this decision given the lack of long term studies on cellular use, not to mention the profound divic consequences of an agencies literally dicatating that citizens be required to use less safe technology.

Sincerely,

Jennifer Land

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Submitter Info:

First Name: Linda

Last Name: Nedderman-Eaton

Mailing Address: 50 Argyle St.

City: Cranston

Country: United States

State or Province: RI

Postal Code: 02920

Organization Name: null

The switched telephone network must be maintained. The Architectural and Transportation Barriers Compliance Board ("the Access Board"), is the federal agency that administers the Americans with Disabilities Act. According to the Access Board, an estimated 3% of the population, or almost 10 million Americans, have electromagnetic sensitivities (www.access-board.gov/research/ieq/intro.cfm). They cannot use wireless technology and have difficulty using computers. They depend on the switched telephone network for voice communication. "Universal Service" is not universal if it excludes 10 million people. Eliminating landlines will leave millions of Americans without even basic telephone service. I AM ONE OF THOSE 10 MILLION! I cannot use a cell phone more than a few minutes before having severe reactions and I have limited use of a computer encased within a special filtering box. Without the use of a landline phone I will be without the necessary basic phone service I depend upon for access to the outside world and emergency medical care.

What are you thinking!! Stop this insanity immediately!

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Submitter Info:

First Name: Pamela
Last Name: Morey
Mailing Address: 43300 Little River Airport Rd. #127
City: Little River
Country: United States
State or Province: CA
Postal Code: 95456
Organization Name: None

Dear FCC: I live in a Rural area and I have already become electro sensitive from over exposure to my neighbor's WiFi Router antennas that they use excessively and bombard my home up to 24 hours per day with wireless broadband WiFi Antennas that emit microwave RF strong signals with G router antennas. In addition, I have an electrical transformer on my house lot that puts out excessive EMF's from all of the neighborhood homes that also have individually owned and operated WiFi Router antennas which put additional "dirty electricity" into the shared electrical transformer that exists on my house lot. This electrical transformer also has an additional line too close to the west edge of my home. The neighbors also use fluorescent compact bulbs that also put "dirty electricity" into the shared electrical transformer that is 30-40 years old. The electrical transformer makes excessive noise now with all of the neighborhood creating more and more "dirty electricity." This is now causing electrical outlets in my home and electrical appliances to fail. Other homes in my development now complain of similar electrical problems. We do not want or need any more wireless stray electrical currents from wireless cell phones and Smart Meters now proposed by PG & E!! The massive proliferation of all wireless devices without broadcasting licensing to protect the public from overexposure is now a crisis for health and safety! Please DO NOT add to this problem by doing away with phone land lines in rural areas. Rural areas also have stronger Relay Smart Meter signals that are bad for public health. Please stop this serious health and safety threat of too much use of wireless devices that put out unlicensed stray electricity broadcasts.

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Submitter Info:

First Name: Molly

Last Name: Hauck

Mailing Address: 4004 Dresden St

City: Kensington

Country: United States

State or Province: MD

Postal Code: 20895-3812

Organization Name: null

I am opposed to phasing out landlines. I think that cellphones are bad for many people's health.

First, I am concerned about the radiation in cellphones causing cancer and problems with the parotid gland. Devra Davis, Ph.D., Founder and President of Environmental Health Trust, has researched this thoroughly in her book, Disconnect, and suggests safer ways to use cellphones. Many other people, mostly in other countries have done a great deal of research of the health risks of cellphones.

Second, I am sensitive to electromagnetic frequencies. It causes sleeping problems for me, among other things.

The US government has been almost silent on this issue, probably because of the pressure from the telecommunications industry. We need the FCC to start protecting people's health, rather than the profit of the telecommunications industry.

The switched telephone network must be maintained. The Architectural and Transportation Barriers Compliance Board ("the Access Board"), is the federal agency that administers the Americans with Disabilities Act. According to the Access Board, an estimated 3% of the population, or almost 10 million Americans, have electromagnetic sensitivities (www.access-board.gov/research/ieq/intro.cfm). They cannot use wireless technology and have difficulty using computers. They depend on the switched telephone network for voice communication. "Universal Service" is not universal if it excludes 10 million people. Eliminating landlines will leave millions of Americans without even basic telephone service.

Molly Hauck

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Submitter Info:

First Name: paul

Last Name: howes

Mailing Address: 757 ithaca

City: boulder

Country: United States

State or Province: CO

Postal Code: 80305

Organization Name: null

Do not replace existing landlines with wireless infrastructure until it is proven safe, secure, reliable and affordable!

Landlines are safe.

Children, people with medical implants, people with Radiofrequency Sickness, and people who don't want to increase their risk of cancer can use only landlines.

Research on radiofrequency radiation exposure indicates increased cancer incidence, altered blood glucose levels, weakened blood-brain barrier.

Many in the public cannot use any cordless or wireless phone without developing headaches that are often severe.

Landlines are secure. Cabled phones ensure privacy.

Using mobile phones makes us vulnerable to hackers who commit financial fraud. It makes us vulnerable to terrorists.

Landlines are reliable.

During power outages and natural disasters, landlines are dependable.

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Submitter Info:

First Name: Lois

Last Name: Sachs

Mailing Address: 3004 W Chase

City: Chicago

Country: United States

State or Province: IL

Postal Code: 60645

Organization Name: null

The switched telephone network must be maintained.

My breast cancer has left me with an immune disorder which makes me unable to tolerate exposure to various types of electricity. I live alone although I am not able to use cell phones or computers (my friend is typing this for me) I can still thank God communicate through my land line telephone. My land line telephone IS my life line.

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Submitter Info:

First Name: Brad

Last Name: Stone

Mailing Address: 189-15K 73rd Avenue

City: Fresh Meadows

Country: United States

State or Province: NY

Postal Code: 11366

Organization Name: null

No, I do not want to eliminate wired, land-line phones in the United States. The obvious truth is that reliability and accessibility of land lines cannot be matched by cell phones.

The safety of continued use of cell phones is yet to be determined, with new warnings emerging and debate among experts taking place currently.

The switched telephone network must be maintained. According to the Architectural and Transportation Barriers Compliance Board ("the Access Board"), the agency that administers the Americans with Disabilities Act, an estimated 3% of the population, or almost 10 million Americans, have electromagnetic sensitivities (<http://www.access-board.gov/research/ieq/intro.cfm>). They cannot use wireless technology and have difficulty using computers. They depend on the switched telephone network for voice communication. "Universal Service" is not universal if it excludes 10 million people. Eliminating landlines will leave millions of Americans without even basic telephone service.

Proven reliability, accessibility, and potential ill-effects make this proposal not in the best interest of this country.

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Submitter Info:

First Name: sandra

Last Name: ross

Mailing Address: 76 lee st

City: mill valley

Country: United States

State or Province: CA

Postal Code: 94941

Organization Name: Health & Habitat, Inc.

Do not ever stop supporting landlines for phones. WE need them always. A growing number of people are EMF sensitive and cannot use cell phones - and more will become so. When the electricity goes out, we MUST have landlines.

They are much clearer to hear over - and essential for people with disabilities who cannot hold and function the tiny, slippery cell phones. You will be disenfranchising people with disabilities. And cell phones are more expensive.

Dr Sandra Ross

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Submitter Info:
First Name: Jeraldine
Last Name: Peterson-Mark
Mailing Address: 120 Alamo Drive
City: Santa Fe
Country: United States
State or Province: NM
Postal Code: 87501
Organization Name: NA

I am writing this statement because I am very concerned about losing my Land Line option. I do not use a cell phone for financial reasons and health reasons.

It is much more affordable for me to use a land line for local calls and a calling card for long distance calls.

I found out many years ago, when cell phones first became popular that if I am on a cell phone for longer than 60 seconds I begin to get a severe headache. Now, the 3G and 4G phones are so powerful that I can't even be within a 5 foot radius of someone using one without becoming slightly dizzy, agitated and head-achy. I cannot hold one of these phones without my hand beginning to ache and buzz.

Our home is free of Wi-fi and we had the Smart Meter removed from our house (electronic frequency gas meter system) as it was causing me nausea, insomnia, asthma and mouth ulcers.

Google has the right idea: installing underground fiber optic cable for all communication systems. It is safer, cheaper, more effective and aesthetically pleasing.

I view the land line telecommunication systems in the US as a "public service"; infrastructure like clean drinking water, garbage pick-up and sewage removal, electricity and gas.

If you remove land lines there will literally be millions of citizens who will be unable to communicate with others. And as I recall there have been several major disasters over the years where all cell phone communications failed and only the land lines worked. During preparations leading up to Y2K the government implored people to know where there was a land line in every neighborhood for emergency situations. And let us not forget, that during massive solar flare events, above ground wiring and cell tower communications fail. Buried cables remain functional.

Please leave the land lines alone. In 10 years, when unthinkable numbers of our population are suffering from cell radiation illnesses, you will be glad that there is a still existing infrastructure to fall back upon.

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Submitter Info:

First Name: Carolyn

Last Name: Arnold

Mailing Address: 4827 Brookdale Ave

City: Oakland

Country: United States

State or Province: CA

Postal Code: 94619

Organization Name: same

I appreciate that you are upgrading the telecommunications system and developing fairer ways to charge for the services by including the new technology in the regulations.

However, I request that you KEEP the option of the 'old voice technology' of the current landline. These landlines are safer, more reliable, and more apt to work in an emergency than wireless or other electronic wired services. They are required by my alarm companies. They are safer than having EFT's, or electronic emissions all over the place. I use my cell phone sparingly for that reason. I do not want to have EFTs required for us all to live with. They make many people sick, and they especially should have that option. However, they are just the canaries in the mine - EFTs are possibly on their way to making us all sick, and we need to keep them to a minimum as possible.

For that reason, I would like to have the OPTION of the safe landline phone services, and feel that households, neighborhoods, and cities should have that option. Thank you.

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Submitter Info:

First Name: Galilee

Last Name: Carlisle

Mailing Address: 7816 Libby Rd NE

City: Olympia

Country: United States

State or Province: WA

Postal Code: 98506

Organization Name: null

To the FCC,

I have been studying the health effects of wireless communications for eight years. This has included reading countless international studies on the subject. I have also been carefully observing the ways in which it has changed peoples' social, emotional and spiritual lives. Over the course of my work, I have determined that wireless communication is extremely harmful to us on many levels. I choose not to use it at all and I have helped many people to move towards healthier lives by reducing or eliminating the role of wireless technologies in their lives.

I place a very high value on telephone communication, none-the-less, and use it every day. I use our landline with a corded phone and am exceedingly thankful for the technology we have to do so.

I have recently been informed that you are working on a proposed rule that would eliminate landlines. I am writing to you today to ask you to please do everything you possibly can to keep landlines operational. We think landlines are a crucial part of a vibrant and healthy society -- urban and rural, commercial and residential. It would be a tragedy to dismantle our perfectly-operational system of landlines. Widespread ill-health and less effective communications would be the result of switching to a wireless-only system. I would be more than happy to provide you with more-detailed information as to why I find this to be so crucial. Just ask. Please keep our landlines alive!!! Thank you very much, Galilee Carlisle

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Submitter Info:

First Name: Caroline

Last Name: Dixon

Mailing Address: 229 4th Street

City: Santa Monica

Country: United States

State or Province: CA

Postal Code: 90402

Organization Name: null

Eliminating land lines is a really bad idea.

If the goal of the FCC is a many-fold increase in cancers, dementia, and all types of health-related decline -- then you're on the right track.

Wireless is poison. I live near a cell tower in an upscale neighborhood, and those poor souls living closest to the tower are all grappling with extreme health issues including cancers. (The ages of the persons range from age 6 - 95.) My neighbors die from cancer at an uncanny rate for health-conscious Santa Monica.

The trees near the tower all have diseases. All of them. There is no tree in this pristine part of Santa Monica, that is not ill. Not one.

It will take Americans a long time to figure out what the culprit is... most have no clue.

Please to not move forward with this plan. In fact, take an about face. I know the FCC stands to lose hundreds of billions of dollars if they can't lease every single part of the spectrum. But our lives are worth even more.

Thank you.

Caroline Dixon

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Submitter Info:

First Name: Margaret

Last Name: Glaser

Mailing Address: 2416 W. Greenleaf

City: Chicago

Country: United States

State or Province: IL

Postal Code: 60645

Organization Name: null

See attached file(s)

Please see the attached file for my comment on why I believe phone landlines should continue to be supported.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)	
Connect America Fund)	WC Docket No. 10-90
A National Broadband Plan for Our Future)	GN Docket No. 09-51
Establishing Just and Reasonable Rates for Local Exchange Carriers)	WC Docket No. 07-135
High-Cost Universal Service Support)	WC Docket No. 05-337
Developing an Unified Intercarrier Compensation Regime)	CC Docket No. 01-92
Federal-State Joint Board on Universal Service)	CC Docket No. 96-45
Lifeline and Link-Up)	WC Docket No. 03-109
)	
)	

To: Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Comment Filed by:

Margaret M. Glaser
2416 W. Greenleaf #3
Chicago, IL 60645
e-mail: mm.glaser@yahoo.com

Date filed: April 12, 2011

KEEP WIRED LANDLINE PHONES

I am very concerned about the FCC proposal to eliminate many telephone landlines. It appears to be the next phase of the ongoing, indiscriminate proliferation of wireless

technologies, and the associated radiation to which all are now being subjected involuntarily. There is no way to escape exposure to the ever-increasing levels of this radiation, and elimination of landline phones will greatly exacerbate the problem. This is especially true for those who are particularly sensitive to this biologically active agent.

I don't know how much the members of the FCC actually know about the bioeffects research firsthand. Having tracked it for 11 years, it seems unbelievable to me that an agency so responsible for expanding exposure to the public and environment can avoid seeing the hints of potential harm that are apparent in the great majority of non-industry sponsored research (and in 1/3 of the industry sponsored research). There must be a very strong bias pushing the FCC in the direction it has gone in heretofore. Of course, the most obvious culprit is the close connection with the telecom industry.

A number of senior scientists in the health agencies upon which the FCC purports to rely have expressed serious concerns over the years about the actual safety of wireless radiation at levels currently allowed by FCC guidelines. The European Union's Environmental Agency has expressed concern, as have several individual governments in Europe and elsewhere.

I have personally sat on the IEEE subcommittee, SC4, that recommends RF safety standards to the FCC. It is clear that this is anything but an open-minded group. It is riddled with conflicts of interest, most of its members being positioned to profit from the expansion of wireless telecommunications and other wireless. Complaint was filed with the IEEE Ethics Committee during the development of the standard, but nothing was done to address these problems. This august group representing the mobile manufacturers of the world continually tells the public that "more research is needed," and yet at their meetings, and in personal communications with me, they say that the research needs to stop. This is because they, in their biased wisdom, are certain that no problem exists and that all the research showing bioeffects at low levels is "junk science." Unfortunately, no one overseeing them has looked into the science to see if their position has merit. Meanwhile, their influence on other "authoritative" groups insures the appearance of support, while it is merely the left hand agreeing with the right.

There are many reasons to continue to support landlines in the US. They are more secure, more private, more reliable, more affordable, and easier to use. The overriding reason for me, however, is that we know wired landlines are safe. We do not know that mobile phones are safe, and in fact, there are many studies suggesting they may not be. Taking away the rights of individuals to decide whether they wish expose themselves and their children to this near-field radiation exposure, and risk the bioeffects seen in so many studies, is like requiring them to engage in a habit like cigarette smoking every day of their life. Such a situation would be intolerable.

Something you do not hear much about in the US (and let's face it, you hear very little about this whole issue in this country compared to others) is the problem of hypersensitivity to non-ionizing radiation at levels lower than FCC limits. Several studies have concurred that at least 2% of the population at large is hypersensitive to it.

In recent years, the percentage has doubled in Sweden and Germany where it has been studied. I've met some of these people—a teenager who, to her dismay, noticed that she got bad headaches when she did not use a wired headset with her cell phone; a senior congressional aide who relayed the same thing and who was stymied when he tried to report it to his telecom and found no one was interested or collecting the information; a middle aged woman in an electric wheelchair who said she got nosebleeds whenever she used a cell phone; a businessman who reported that he got face and neck burning on the side of his head where and when he used his cell phone. These were not psych cases. As a professional who does psychological assessments for a living, I have a pretty good sense about who has got their feet on the ground. I believe the FCC would know a great deal more about this hypersensitivity if the Commission actively sought feedback about it from the public. However, the FCC seems more interested in accommodating the wireless industry than in making sure the public is truly protected.

So far, Congress, too, has done more to make the country safe for the wireless industry than to make it safe for people. The Telecommunications Act of 1996 took away the rights of communities to make siting decisions on cell towers that might better protect the environment and the people in it. Animal populations, too, like birds, frogs and bees may be at risk. This seems to be of no consequence to the FCC and the Congress. It appears that decisions were made a long time ago on what was going to be important, and ever since, the truth has been bent to fit the priorities.

I have a wired landline, and I rely on it. I do not have any wish to take the radiation risks associated with using a home cell phone, and I would consider it a violation of my home and my health were I forced into it. For the safety and security of all, please keep the landline system going.

Sincerely,
Margaret M. Glaser

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Submitter Info:

First Name: Dr. Karl

Last Name: Maret

Mailing Address: 430 Cliff Dr

City: Aptos

Country: United States

State or Province: CA

Postal Code: 95003

Organization Name: null

I strongly recommend that you do not remove our choice to have regular telephone land lines. We need them for their emergency reliability since VoIP protocols do not work in power outages. Most importantly, forcing the US population to increasingly use microwave-based cellular services is ill advised. There are numerous non-thermal effects of these devices and the current exposure limits are too high since they only consider thermal effects. The long-term consequences of eliminating land lines would be disastrous to our collective health and increase the already high background microwave radiation levels. As a medical professional and biomedical engineer that has studied this subject in depth, I strongly recommend that you keep the current option of land lines in place.

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Public Comments on Developing an Unified Intercarrier Compensation: =====

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Submitter Info:

First Name: Gilbert L

Last Name: Shepard

Mailing Address: 2665 Pine Knoll Drive #12

City: Walnut Creek, CA

Country: United States

State or Province: CA

Postal Code: 94595

Organization Name: Gil Shepard MFT

I am very much concerned about any attempt to stop landline phones. They are the most secure for my work as a therapist and security and trust are essential for my work.

Landlines operate when and where cell phone connections don't work. In many areas cell phones do not work at all, for example in Grass Valley where two of my adult children live.

Cell phones are risky because of Electro magnetic frequencies which have been demonstrated in various studies (outside of the US mostly, though some are in the US) to be dangerous. They are particularly dangerous to children as they can affect the brain. In adults and in children they cause an increase in cancer rate - I had cancer in the area next to the ear I use to hold a cell phone. That is not good!!!

A lot of information about cell phone effects have been suppressed by cell phone companies, and I hope not by any government agency, but I know these companies are huge and have the power to do so. Verizon has done that with a pediatrician I know who tried to talk in a public hearing about the harmful effects of radiation on health. She was not only threatened, but she was told the law was designed so information about health effects could not even be presented. She had various attempts on her life and harassment.

Gilbert L. Shepard

Please survey the following files:

What is the Real Cancer Threat from Cell Phones?

Posted by: [Dr. Mercola](#) | May 27 2010 | 32,170 views

The U.S. President's Cancer Panel has reported that "the true burden of environmentally induced cancers has been grossly underestimated." The panel pointed to cell phones and other wireless technologies as potential causes of cancer.

In its recommendations, the panel stated:

"Methods for long-term monitoring and quantification of electromagnetic energy exposures related to cell phones and wireless technologies are urgently needed given the escalating use of these devices by larger and younger segments of the population and the higher radiofrequencies newer devices produce."

Dr. Ted Schettler, director of the Science and Environmental Health Network, said

"... Even if cell phones raise the risk of cancer slightly, so many people are exposed that it could be a large public health burden."

Sources:

- » [Electromagnetic Health May 6, 2010](#)
- » [President's Cancer Panel 2008-2009 Annual Report \(PDF\)](#)
- » [New York Times May 6, 2010](#)
- » [World Wire May 7, 2010](#)



Dr. Mercola's Comments:

The President's Cancer Panel report has taken on a momentous issue: how to reduce environmental cancer risks. In 2009, 1.5 million Americans were diagnosed with cancer, and the report suggests that the percentage of these directly caused by environmental factors has been "grossly underestimated."

In its 240 pages, the report touches on more than a handful of environmental carcinogens, each worthy of their own attention. From the 80,000 largely untested and unregulated chemicals used in the U.S. to medical imaging, pharmaceuticals, pesticides, tainted water and air pollution, it seems no stone has been left unturned in the scope of this report.

But there is one issue that really stands out, one that has not received nearly the attention that other carcinogens like bisphenol-A or diesel pollution have, and that is the use of cell phones. This report stands to change that, however, as it clearly notes wireless technology as a formidable force in the fight against environmental cancers.

Cell Phone Use and Wireless Technology is of “Great Concern”

The report states:

“The use of cell phones and other wireless technology is of great concern, particularly since these devices are being used regularly by ever larger and younger segments of the population

... the research on cancer and other disease risk among long-term and heavy users of contemporary wireless devices is extremely limited. Similarly, current and potential harms from extremely low frequency radiation are unclear and require further study.”

The panel members consulted with close to 50 medical experts in writing this report, and clearly they have recognized that one of the main challenges in proving the link between cell phones and cancer is that they have only recently infiltrated the market.

The panel writes:

"It is not known exactly what percentage of all cancers either are initiated or promoted by an environmental trigger ... Some exposures to an environmental hazard occur as a single acute episode, but most often, individual or multiple harmful exposures take place over a period of weeks, months, year, or a lifetime."

For instance, the induction period for brain tumors can be at least 30 years. Cell phones have only been widely used for a decade or so, and usage is only increasing at exponential levels. What this means is that the real effects of regular cell phone usage will not begin to show up for another 10 or more years, but by then it will be too late.

The 10-year-old who starts using a cell phone today may not realize the impact until he's diagnosed with a brain tumor at age 40!

The President's Cancer Panel, realizing this, has urged the usage of the precautionary principle -- not only for cell phones but for all potentially cancer-causing substances bombarding Americans as I write this.

A Precautionary Approach Will Save Countless Lives

You may be surprised to learn that several countries including France, Germany and India have issued recommendations to limit your exposure to electromagnetic fields, including those from cell phones and other wireless technologies.

This includes Toronto's Department of Public Health, which has advised teenagers and young children to [limit their use of cell phones](#) to avoid potential health risks.

What these countries are doing is using the precautionary principle, and taking action *now* to protect their population from a potentially devastating health tragedy.

As the President's Cancer Panel reported:

"The Precautionary Principle asserted in a consensus statement that "when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."

The core tenets of the Precautionary Principle are:

- *Taking preventive action in the face of uncertainty.*
- *Shifting the burden of proof to proponents of an activity.*
- *Exploring a wide range of alternatives to possibly harmful actions.*
- *Including public participation in decision making.*

... when credible evidence exists that there may be a hazard, a precautionary approach should be adopted and alternatives should be sought to remove the potential hazard and still achieve the same social benefit.

Such an approach acknowledges the uncertainty of identifying cancer risks in complex, poorly understood environmental systems."

In the case of cell phones and wireless technologies, there is more than credible evidence that a hazard exists, and immediate steps should be taken to prevent further exposure.

Cancer Risks from Cell Phones are Well Established

The 2009 special EMF issue of the Journal of Pathophysiology contains over a [dozen different studies on the health effects of electromagnetic fields](#) and wireless technology

In addition, a review of 11 long-term epidemiologic studies published in the journal Surgical Neurology revealed that using a cell phone for 10 or more years approximately [doubles the risk of being diagnosed with a brain tumor](#) on the same side of the head where the cell phone is typically held.

Because children have thinner skulls than adults, and their nervous systems are still developing, children are particularly vulnerable to this type of tumor and should not use cell phones at all.

Professor Mild, lead researcher of that particular study, also cautioned that the danger may be even greater than what they found because cancers need a minimum of 10 years to develop. Since children today are using cell phones at an earlier age than any previous generation, their exposure will be far greater over their lifetimes.

[The BioInitiative Report](#) also includes studies showing evidence for exposure to electromagnetic fields and:

- Effects on Gene and Protein Expression (Transcriptomic and Proteomic Research)
- Genotoxic Effects – RFR and ELF DNA Damage
- Stress Response (Stress Proteins)
- Effects on Immune Function
- Effects on Neurology and Behavior
- Brain Tumors, Acoustic Neuromas, and childhood cancers like leukemia

Cell Phone Usage is at an Unprecedented High

The report points out that in 2008, Americans spent *2.2 trillion minutes* on mobile phones, up 100 billion minutes from the year before.

“As the use of cell phones has increased, so has concern about their potential harmful health effects, particularly whether cell phone users are at greater risk for brain cancer,” the report notes.

“Cell phones and related devices become more sophisticated each year, and they are producing energy at increasingly higher radiofrequencies necessary for their expanded functions. The number of cell phone towers also is growing as cellular service providers strive to provide customers a maximally robust network.”

I urge you to take action *now* to protect yourself and your family from the dangerous effects of cell phones and other wireless devices, as if you wait for the next governmental report to come out, it could be too late.

Cell phones will one day be to the 21st century [what cigarettes were to the 20th](#), and you don't want to be among the last to learn the truth.

Australia has already seen an increase in pediatric brain cancers of 21 percent in just one decade. This is consistent with studies showing a 40 percent brain tumor increase across the board in Europe and the U.K. over the last 20 years.

Brain cancer has also now surpassed leukemia as the number one cancer killer in children ... what else are we waiting for to take action?

I suggest you don't wait, and instead begin to minimize your exposure minimize exposure by heeding the following advice:

- **Reduce your overall cell phone use:** Turn your cell phone off more often. Reserve it for emergencies or important matters. As long as your cell phone is on, it emits radiation intermittently, even when you are not actually making a call.
- **[Children Should Not Use Cell Phones:](#)** Barring a life-threatening emergency, children should not use a cell phone, or a wireless device of any type. Children

are far more vulnerable to cell phone radiation than adults because of their thinner skull bones.

- **Use a land line at home and at work:** Although more and more people are switching to using cell phones as their exclusive phone contact, it is a dangerous trend and you can choose to opt out of the madness.
- **Reduce or eliminate your use of other wireless devices:** You would be wise to cut down your use of these devices. Just as with cell phones, it is important to ask yourself whether or not you really need to use them every single time.
- **If you must use a portable home phone, use the older kind that operates at 900 MHz.** They are no safer during calls, but at least many of them do not broadcast constantly even when no call is being made. Alternatively you can use a regular cordless phone if your home is large enough and there are at least three rooms between the base station and where you sleep and spend most of the time in the day.

Note the only way to truly be sure if there is an exposure from your cordless phone is to measure with an electrosmog meter, and it must be one that goes up to the frequency of your portable phone (so old meters will not be of much use). You can find meters at <http://emfsafetystore.com/>.

As a general rule of thumb, you can pretty much be sure your portable phone is a problem if the technology is DECT, or digitally enhanced cordless technology.

- **Use your cell phone only where reception is good:** The weaker the reception, the more power your phone must use to transmit, and the more power it uses, the more radiation it emits, and the deeper the dangerous radio waves penetrate into your body. Ideally, you should only use your phone with full bars and good reception.
- **Don't assume one cell phone is safer than another:** Please understand that despite assurances, there's still [no such thing as a "safe" cell phone](#).
- **Keep your cell phone away from your body when it's on:** The most dangerous place to be, in terms of radiation exposure, is within about six inches of the emitting antenna. You do not want any part of your body within that area (so do not carry your cell phone on your belt, either).
- **Use safer headset technology:** Wired headsets will certainly allow you to keep the cell phone farther away from your body. However, if a wired headset is not well-shielded -- and most of them are not -- the wire itself acts as an antenna attracting ambient information carrying radio waves and transmitting radiation directly to your brain.

Make sure that the wire used to transmit the signal to your ear is shielded.

The best kind of headset to use is a combination shielded wire and air-tube headset. These operate like a stethoscope, transmitting the information to your head as an actual sound wave; although there are wires that still must be shielded, there is no wire that goes all the way up to your head.

I believe this issue is so important I've created an entire web site dedicated to EMF education and information. Feel free to bookmark EMF.mercola.com and check back on occasion for the latest news and updates.

Protect your children from cell phone and WiFi radiation before it's too late

The Canadian Charger

August 25, 2010

Barrie Trower, a physicist and former British Secret Service Microwave Weapons Specialist, said he came out of retirement because microwave technology that was used for weapons is now being used in schools.

Speaking at the University of Toronto recently, Mr. Trower said he refuses all gifts and all money; consequently he tells it “exactly as it is.”

He said there is a lot of proof that microwave radiation – used for cell phones and WiFi - is harmful and governments have known this for many years.

“Your government (Canadian) is one of the world leaders in microwave radiation research. The U.S. joined Canada in conducting research ... The first symptoms of microwave sickness were documented in 1932.”

He added that there are 13 secret code names of microwave radiation research used by Canada, the U.S. and Britain.

Research results show that lung damage, destroyed brain cells and damage to the blood brain barrier are among a litany of ill-effects of prolonged exposure to low levels of microwave radiation; and children are the most susceptible because their cells are close to the size of the microwaves. Mr. Trower said this means children act as antennae for the microwaves.

“Children are not small adults. Their systems have not yet formed. It takes a few years for the blood brain barrier to form. It's like a fish net that surrounds the brain and keeps toxins out (of the brain). Microwave radiation makes the wholes (in the blood brain barrier) bigger so toxins leak into the brain. This can cause psychiatric problems.”

Auditory hallucinations that make people think they're hearing sounds, fatigue, difficulty concentrating, sleeplessness and irritability are among the symptoms of blood brain barrier damage researchers have documented.

Damage to the immune system, which takes 18 years to develop in children, is another effect of exposure to microwave radiation Mr. Trower cites.

He also said we have electric cables in our bodies, formed by mile-long, inch-thick sheets of layers of proteins, that take 22 years to develop in children; and microwave radiation affects the protein synthesis.

Mr. Trower said there isn't a school in the world that hasn't seen an increase in aggression and

other bad behavior when WiFi was introduced.

He cites paranoia, hallucinations, suicidal tendencies and inability to make decisions, among the deleterious effects of exposure to low levels of microwave radiation.

Then he gave an explanation for why little is being done about this issue.

“By 1971 we knew everything that needed to be known. This document (a 1976 summary of U.S. Defense intelligence agencies' research) is the saddest most despicable document ever published in history. Lack of concentration, menstrual disorders, headaches and irritability are some of the effects of exposure to microwaves, listed in this document,” Mr. Trower said, followed by this statement: 'This should be kept secret to preserve industrial profit.' “

He added that as far back as the 1950's profit was deemed what needed protection, not people's health.

“In the 1950's researchers conducted experiments on the effects of microwave radiation. Their report contained this statement: 'If this paper becomes known around the world, it will threaten military and commercial investments.’”

Remarkably, the European Parliament has decided that it can't even trust the World Health Organization's (WHO) guidelines for acceptable levels of microwave radiation.

Mr. Trower said the European Parliament wrote to its 27 countries urging them to ignore WHO guidelines and set exposure limits at lower levels. And what was the WHO's response?

“The WHO said they will not comment on microwave radiation effects on people until 2015, when it will be able to establish effects on human beings. They are watching people to see how many will become sick. We're being experimented upon.”

He added that the WHO only began studying microwave radiation effects on children in 2009 and it said it won't be able to comment until 2020.

Meanwhile, Mr. Trower said Russia is banning any children under 18 from microwave exposure, when possible, and Britain said children under 12 should have no microwave radiation exposure at all.

This is in the wake of reports made to the British parliament detailing the cases of 11 children under 11 years old who have leukemia. Mr. Trower said this is how the government responded:

“The minister said we're within international guidelines and sat down. This happened four times.”

However, as a result of research that documents the harmful effects of microwave radiation on fetuses, the British government said that pregnant women must not be exposed to microwave radiation.

“The head of the fetus has multiple connections going on in the brain of the fetus. Microwave radiation gives the fetus an innumerable amount of electrical shocks. This can cause brain blood barrier damage that can result in severe psychiatric disorders later in life.”

And this is but one of a number of risks to fetus development microwave radiation causes.

“It's a serious thing, even low levels of microwave radiation,” Mr. Trower said. “It affects ovarian follicles and eggs. It can damage genes and eggs and the damage is irreparable. Generations will carry genetic defects. It's threatening the health of future generations, so it must never be put in schools.”

He said there is no known safe level of microwave radiation for a child. “No scientist in the world has published a safe level for a child.”

More data on EMF/cell phones from a friend, one of the authors of *Public Health SOS: The Shadow Side of the Wireless Revolution*.

A scientific study published in the journal *Neurotoxicology* finds that people who live around mobile phone base stations (cell towers) are at risk for developing neuropsychiatric problems and changes in neurobehavioral function.

The prevalence of neuropsychiatric complaints as headache (23.5%), memory changes (28.2%), dizziness (18.8%), tremors (9.4%), depressive symptoms (21.7%), and sleep disturbance (23.5%) were significantly higher among exposed inhabitants than controls: (10%), (5%), (5%), (0%), (8.8%) and (10%), respectively ($P < 0.05$). Exposed inhabitants exhibited a significantly lower performance than controls in one of the tests of attention and short-term auditory memory.

The authors say revision of standard guidelines for public exposure to RER from mobile phone base station antennas around the stations is recommended.

G. Abdel-Rassoul *, O. Abou El-Fateh, M. Abou Salem, A. Michael, F. Farahat, M. El-Batanouny, E. Salem. Neurobehavioral effects among inhabitants around mobile phone base stations. *NeuroToxicology* 28 (2007) 434–440

MOBILE TELEPHONY RADIATION EFFECTS

DPanagopoulos, LMargaritis: Mobile telephony radiation effects on living organisms

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Chapter 3

MOBILE TELEPHONY RADIATION EFFECTS

ON LIVING ORGANISMS

Dimitris J. Panagopoulos and Lukas H. Margaritis*

Department of Cell Biology and Biophysics, Faculty of Biology, University of Athens,

Panepistimiopolis, 15784, Athens, Greece

Abstract

A number of serious non thermal biological effects, ranging from changes in cellular function like proliferation rate changes or gene expression changes to cell death induction, decrease in the rate of melatonin production and changes in electroencephalogram patterns in humans, population declinations of birds and insects, and small but statistically significant increases of certain types of cancer, are attributed in our days to the radiations emitted by mobile telephony antennas of both handsets and base stations. This chapter reviews briefly the most important experimental, clinical and statistical findings and presents more extensively a series of experiments, concerning cell death

induction on a model biological system. Mobile telephony radiation is found to decrease significantly and non thermally insect reproduction by up to 60%, after a few minutes daily exposure for only few days. Both sexes were found to be affected. The effect is due to DNA fragmentation in the gonads caused by both types of digital mobile telephony radiation used in Europe, GSM 900MHz, (Global System for Mobile telecommunications) , and DCS 1800MHz, (Digital Cellular System). GSM was found to be even more bioactive than DCS, due to its higher intensity under equal conditions. The decrease in reproductive capacity seems to be non-linearly depended on radiation intensity, exhibiting a peak for intensities higher than $200 \mu\text{W}/\text{cm}^2$ and an intensity "window" around $10 \mu\text{W}/\text{cm}^2$ where it becomes maximum. In terms of the distance from a mobile phone antenna, the intensity of this "window" corresponds under usual conditions to a distance of 20-30 cm. The importance of different parameters of the radiation like intensity, carrier frequency and pulse repetition frequency, in relation to the recorded effects are discussed. Finally, this chapter describes a plausible biophysical and biochemical mechanism which can explain the recorded effects of mobile telephony radiations on living organisms.

Keywords: mobile telephony radiation, GSM, DCS, RF, ELF, electromagnetic fields, nonionizing

electromagnetic radiation, biological effects, health effects, *Drosophila*, reproductive capacity, cell death, intensity windows.

* E-mail address: dpanagop@biol.uoa.gr. Fax: +30210 7274742, Phone: +30210 7274117.

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Introduction

As mobile telephony becomes more and more a necessary tool in our daily life enabling modern man to communicate easily with everyone at any place and any moment, serious threats arise from the exposure of all living organisms and the environment to a type of radiation unknown until now. Man made electromagnetic fields and radiations differ substantially from natural electromagnetic radiations like natural light, mainly because artificial ones are polarised, able to induce coherent forced vibrations to any electric charge in their space. All living organisms are made of cells and all cellular functions are of electrical nature, involving movements of electrical charges like clouds of free ions or charged macromolecules. Certain movements of certain type of charges within the cells induce or interrupt corresponding cellular functions. Any wrong, synchronized net movement of charge within the cell, would induce a wrong cellular function. The cell as a highly organized unit of life, has protective mechanisms against wrong cellular function, for example by activating

certain genes and consequently producing certain proteins like the "heat shock" ones, made to

protect the cell from excessive heat. But if the cell fails to protect itself from an external disturbance, a malfunction may start which can be transferred to a whole tissue or the whole organism. Electromagnetic fields (EMFs) are perceived by the cells as external disturbances or external stress but the cells don't seem to have special genes to be activated for protection against electromagnetic stress. This might be the reason why in response to electromagnetic stress, cells activate heat shock genes and produce heat shock proteins very rapidly (within minutes) and at a much higher rate than for heat itself, (Weisbrodt et al, 2003). It seems to be for the same reason why electromagnetic stress from mobile telephony radiation induces cell death to the reproductive cells much more than other types of external stress examined before like food deprivation or chemicals, (Panagopoulos et al 2007a). Thus it seems that cells are much more sensitive to man-made electromagnetic fields (EMFs) than to other types of stress previously known. This is probably due to the fact that man-made EMFs constitute a new and perhaps more intense type of external stress, against which, cells have not developed defensive mechanisms. If cells activate heat shock genes to protect themselves from electromagnetic stress and this happens at a much higher rate than for heat itself, this might be dangerous, since repetitive stress leading to continuous expression of heat shock genes may result to cancer induction, (French et al, 2001).

A number of biological effects induced by man-made (EMFs) and radiations of different frequencies including digital mobile telephony and microwave radiations, have already been reported and documented by many research groups. These include changes in intracellular ionic concentrations, changes in the synthesis rate of different biomolecules, changes in cell

proliferation rates, changes in the reproductive capacity of animals, changes in gene expression and even DNA damage and cell death., (Aitken et al 2005; Bawin and Adey 1976; Bawin et al. 1975; 1978; Barteri et al 2005; Belyaev et al 2005; Blackman et al 1980; 1989; Caraglia et al 2005; Diem et al 2005; Dutta et al 1984; Kwee and Raskmark 1998; Velizarov et al 1999; Magras and Xenos 2001; Xenos and Magras 2003; Panagopoulos et al 2004; 2007a; 2007b; Lai and Singh 1995; 1996; 1997; 2004; Remondini et al 2006; Nylund and Leszczynski 2006; Diem et al 2005; Salford et al 2003). At the same time, some epidemiological studies are starting more and more to indicate a connection between the use of cellular mobile phones and certain types of cancer, (Hardell et al 2007a; Hardell et al 2006; Hardell and Hansson-Mild, 2006; Kundi 2004).

In several cases, melatonin, a hormone which controls the daily biological cycle and has an oncostatic action, produced by the epiphysis (pineal gland) in mammals, mainly during the night, is found to reduce the action of EMR exposure, but the synthesis of melatonin itself seems to be reduced by EMR, (Burch et al, 2002; Ozguner et al, 2006; Oktem et al, 2005).

Technical Characteristics of Digital Mobile Telephony Radiation

Both systems of Digital Mobile Telephony Radiation used in Europe, GSM 900 MHz and DCS 1800 MHz and also the system used in USA, GSM 1900 MHz, use different carrier frequencies, (900, 1800, and 1900 MHz respectively) , but the same pulse repetition frequency of 217 Hz, (Hillebrand 2002; Clark 2001; Hyland 2000; Hamnerius and Uddmar 2000; Tisal 1998). As is obvious, the signals of Digital Mobile Telephony Radiation, combine "radio frequencies" (RF) and "extremely low frequencies" (ELF). All three systems use the "Time

Division Multiple Access (TDMA) code to increase the number of people that can simultaneously communicate with a base station. The radiation is emitted in frames of 4.615 msec duration, at a repetition rate of 217 Hz. Each frame consists of eight time slots and each user occupies one of them. Within each time slot the microwave radiation uses a type of phase modulation called Gaussian Minimum Shift Keying modulation (GMSK) to carry the information, (Tisal 1998; Hamnerius and Uddmar 2000). The transmitted frames by both handsets and base stations are grouped into multi-frames of 25 by the absence of every 26th frame. This results to an additional multi-frame repetition frequency of 8.34 Hz. Finally, handsets emit an even lower frequency at 2 Hz whenever the user is not speaking, for energy saving reasons, (non-modulated or non-speaking emission or discontinuous transmission mode - DTX), (Hyland 2000). Of course, when the handsets operate at DTX mode, the average emitted power is much less (about one tenth of the emitted power when they operate at speaking mode, (Panagopoulos et al, 2000a; 2004).

Except of the carrier frequency, another important difference between the three systems of digital mobile telephony radiation is that GSM 900MHz antennas of both mobile phones and base stations operate with double the output power than the corresponding DCS 1800MHz ones or the GSM 1900 MHz ones. GSM 900 MHz handsets operate with 2 W peak power output, while DCS 1800 MHz and GSM 1900 MHz ones operate with 1 W peak power output.

Radiation from base station antennas is almost identical to that from mobile phones of the same system (GSM or DCS), except that it is about 100 times more powerful, or to be more accurate, from several tens up to several hundred times more powerful. Thereby, effects

produced by mobile phones at certain distances, can be extrapolated to represent effects from base station antennas at about 100 times longer distances. Another difference is that handset signals include one pulse per frame occupying one time slot, whereas base station signals include again one pulse per frame but this pulse may occupy 1-8 time slots depending on the number of subscribers each moment. In other words the ratio between pulse peak power and time-averaged power is usually higher for the handset signals compared to the base station signals, (Hillebrand 2002; Clark 2001; Hyland 2000; Hamnerius and Uddmar 2000; Tisal 1998).

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Established Exposure Criteria for Mobile Telephony Radiations

The most stringent international exposure limits in the western world for RF radiation used by digital mobile telephony were set by the International Radiation Protection Association (IRPA) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). These criteria were established to protect biological tissue from temperature increases, (thermal effects).

The ICNIRP exposure limits are given either in terms of Radiation Intensity (Power Density) usually in mW/cm^2 , either in terms of Specific Absorption Rate (SAR) which is defined as the radiation power, absorbed by the unit mass of tissue, in W/kg . Only the radiation intensity in air outside the body can be readily and objectively measured in exposed individuals. The SAR is difficult to be determined for every single tissue as is different for different tissues and radiations. The best way for determining SAR is by computational approximate methods like the Finite Difference Time Domain (FDTP) method, the Finite

Element Method (FEM), or the Method of Moments (MoM), (Meyer and Jacobus, 2003).

According to the ICNIRP exposure criteria, the maximum permitted radiation intensity (in mW/cm²) for the general population exposure, is given according to radiation frequency and it is $f/2$ (f in GHz). Therefore, at 900MHz, the intensity limit according to these criteria is 0.45mW/cm². At 1800 MHz the corresponding limit is 0.9 mW/cm², e.t.c). In terms of SAR the ICNIRP limits for the general population are 0.08 W/Kg (for whole-body average absorbed power) and 2 W/Kg (for the head and trunk). All the above values are to be averaged over any 6min period during the 24-h day. (IRPA 1988; ICNIRP 1998).

For the frequency 25-800 Hz, the IRPA-ICNIRP limits for the general population are for electric field intensity E , the value $250/f$ and for magnetic induction B , the value $50/f$, (E in kV/m, B in G, f in Hz). Therefore, at 217 Hz, (the pulse repetition frequency of digital mobile telephony radiations), the ICNIRP limits are 1.15kV/m and 0.23 G for up to 24h exposure during the day, (IRPA 1990; ICNIRP 1998).

As we shall see, during the years after the establishment of the IRPA-ICNIRP exposure criteria, it has been shown that the vast majority of health effects of digital mobile telephony radiations are non-thermal and a lot of biological effects were recorded at radiation intensities much lower than the values of these criteria. This is the reason why several countries in Europe have established much more stringent national exposure criteria, like Italy, Poland, Russia ($10 \frac{1}{4}$ W/cm²), or Salzburg (Austria), ($0.1 \frac{1}{4}$ W/cm²), (â€œEMF World Wide Standardsâ€).

A Review of Biological, Clinical and Epidemiological Data

There is already a very large number of published studies regarding research on possible

health risks from cellular mobile telephony radiations. While a large and increasing number of studies (biological, clinical and epidemiological) have recorded a variety of nonphysiological changes with increased probabilities for health hazards including several types of cancer, a lot of other studies find no connection between exposure to mobile telephony radiations and health risks. Inconsistencies observed between studies are partly expected since no identical conditions can ever be attained between different studies and different labs, but also they are explained by some authors to be due to biased samples. According to a recent article in which possible secret ties between industries and University researchers are discussed, (Hardell et al, 2007b). Since a large number of studies are funded by companies, a matter arises on how much independent these studies can be.

In the present review we shall emphasize on the studies that indicate different possible effects on living organisms, since we consider that we must take most seriously and focus the most on the possibility that is worse for living organisms and the natural environment. Additionally because of the large number of studies relating RF-microwave radiations in general, we shall concentrate on those that regard to radiations with frequencies and intensities close to those utilized by digital mobile telephony radiations (800-2450 MHz).

A. Biological Effects

Microwaves are found to produce thermally and non-thermally a large number of biological effects, in many cellular and animal studies, (Banik et al, 2003). In the case of radiations emitted by mobile telephony antennas at intensities that people are normally exposed, the effects are non-thermal as verified by different experimenters, (Diem et al, 2005;

Panagopoulos et al, 2004; 2007a; 2007b; Leszczynski et al, 2002; Schirmacher et al, 2000; Velizarov et al, 1999)

Regarding non-thermal effects of RF radiations, it is a must to refer to the pioneer works of Bawin et. al. and Blackman et. al. back in the seventies and eighties although these works were relating lower frequency RF radiations. In those pioneer experiments, RF radiation with carrier frequencies 147 and 450 MHz, modulated by sinusoidal ELF signals 0-40 Hz, was found to decrease Ca²⁺ concentration in chicken brain cells. The effect was found to become maximum at modulation frequencies 6-20 Hz and at intensities 0.6-1 mW/cm², (Bawin et al 1975; 1978). Non-modulated RF signals were not found to be as bioactive as modulated ones by ELFs and additionally, these effects were found to be non-linearly depended on radiation intensity and frequency, exhibiting "windows" within which the phenomena appeared and then disappeared for values outside, (Blackman et al, 1980; 1989).

Repairable DNA damage and increased expression of heat shock protein Hsp 70 without changes in cell proliferation rates was detected in human lens epithelial cells after 2h exposure to 1.8GHz RF field, amplitude modulated at 217 Hz with 3 W/kg SAR. The DNA damage was determined by use of the comet assay, (Lixia et al, 2006).

Increased expression of genes encoding ribosomal proteins and consequently upregulating the cellular metabolism in human cell types, was found after in vitro exposure to 900 and 1800MHz mobile phone radiation, (Remondini et al, 2006). In an other study, gene and protein expression were altered in human endothelial cell lines, after 900 MHz GSM mobile phone radiation exposure at an average SAR of 2.8 W/kg. Genes and proteins were differently affected by the exposure in each of the cell lines, suggesting that cell response to this type of radiation might be genome and proteome- dependent which in turn might explain

to some extent the discrepancies in replication studies between different laboratories, (Nylund and Leszczynski, 2006).

Exposure of human endothelial cells in vitro, to GSM 900 MHz mobile phone radiation for 1h at non-thermal levels, average SAR 2 W/kg, caused transient increase in heat shock protein hsp27 phosphorylation and transient changes in protein expression levels, (Leszczynski et al, 2002).

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Rapid (within minutes) induction of heat shock protein hsp70 synthesis, was found in the insect *Drosophila melanogaster*, after in vivo exposure to GSM 1900 MHz mobile phone radiation, (Weisbrot et al, 2003).

According to a theoretical report, repetitive stress caused by mobile phone radiation, leading to continuous expression of heat shock genes in exposed cells and tissues may result to cancer induction, (French et al, 2001).

Two hours of exposure by a cellular mobile phone, changed the structural and biochemical characteristics of acetylcholinesterase, an important central nervous system enzyme, resulting to a significant alteration of its activity. The enzyme was exposed within an aqueous solution at 5 cm distance from the mobile phone, (Barteri et al, 2004).

Exposure of myoglobin solution to 1.95 MHz microwave radiation for 3h at non-thermal levels was found to affect the folding of the protein and thereby changing its biochemical properties, (Mancinelli et al, 2004).

In vitro exposure for 1h of human skin fibroblasts to GSM radiation, induced alterations in cell morphology and increased the expression of mitogenic signal transduction genes, cell growth inhibitors and genes controlling apoptosis, (Pacini et al, 2002).

In an earlier study, 960 MHz GSM-like signal at SAR 0.021, 0.21 and 2.1 mW/cm² with exposure times 20, 30 and 40 min respectively, was found to decrease the proliferation rate of transformed human epithelial amnion cells. The maximum effect was reached at lower power level with a longer exposure time than at higher power level, (Kwee and Raskmark, 1998).

In another study, in vitro exposure of human peripheral blood lymphocytes to continuous 830 MHz radiation, with average SAR 1.6-8.8 W/kg, was found to produce losses and gains of chromosomes (aneuploidy), a somatic mutation leading to cancer. The effect was found to be activated via a non-thermal pathway, (Mashevich et al, 2003).

Long term exposure of rats to 900 MHz mobile phone radiation produced oxidative stress (increased oxidant products of free radicals) in retinal tissue. Melatonin and caffeic acid phenethyl ester (CAPE)- component of honeybee propolis administered daily to the animals prior to their EMR exposure, caused a significant reduction in the levels of the oxidant products, (Ozguner et al, 2006). In a previous study of the same group, melatonin was found to reverse oxidative tissue injury in rat kidneys, after 10 days exposure-30 min per day, to 900 MHz GSM radiation emitted by mobile phone, (Oktem et al, 2005).

Male mice were exposed to 1800 MHz GSM-like microwaves, 0.1 mW/cm² for two weeks on workdays, 2h per day. Then mice were anesthetized and blood samples were taken for hematology, serum chemistry and serum testosterone determinations. Additionally, testicles, epididymes, adrenals, prostates and pituitary glands were removed for histology. Red blood cell count and serum testosterone level were found to be significantly higher in the exposed groups but no significant alterations were found in the other investigated variables, (Forgacs et al, 2005).

Mice prone to the development of lymphomas, exposed for two 30 min periods per day

for up to 18 months, to 900 MHz pulsed microwave radiation with a 217 Hz pulse repetition frequency at SAR ranging from 0.007 to 4.3 W/kg, developed twice the number of tumors than the unexposed ones, (Repacholi et al, 1997).

Male Wistar 35-day-old rats were exposed to 2.45 GHz radiation for 2 h/day for a period of 35 days at a power density of 0.344 mW/cm², (SAR 0.11 W/kg). After 35 days the rats were sacrificed and whole brain tissue was isolated for protein kinase C (PKC) assay. The study revealed a decrease in PKC activity. Electron microscopy study showed an increase in Mobile Telephony Radiation Effects on Living Organisms 113

the glial cell population in the exposed group. The results indicated that chronic exposures may affect brain growth and development, (Paulraj and Behari, 2006a). In another study of the same group, single strand DNA breaks were measured as tail length of comet. Fifty cells from each slide and two slides per animal were observed. The study showed that chronic exposure to microwave radiation at non-thermal levels (SAR 1 and 2 W/kg) causes statistically significant increase in DNA single strand breaks in rat brain cells, (Paulraj and Behari, 2006b).

In another study mice placed within an RF antenna park were repeatedly mated for five times while they were continuously exposed at very low levels of RF radiation (0.168-1.053 $\hat{1}/4$ W/cm²). A progressive decrease in the number of newborns per maternal mouse was observed after each mating, which ended to irreversible infertility, (Magras and Xenos, 1997).

In a more recent study of the same group, it was found that exposure of pregnant rats to GSM-like 940 MHz radiation at 5 $\hat{1}/4$ W/cm², resulted in aberrant expression of bone morphogenetic proteins (BMP)-(major endocrine and autocrine morphogens known to be involved in renal development) , in the kidneys of newborn rats, (Pyrpasopoulou et al, 2004).

Increase in the number of micronuclei in rat bone marrow erythrocytes, a sign of genotoxicity, was observed after 30 days exposure for 2h daily, to 910 MHz microwave radiation, (Demsia et al, 2004).

In several other mammal studies, no effects were found, in regards to genotoxicity of second generation mobile telephony (GSM, DCS) and third generation, "universal mobile telecommunication system" (UTMS) radiations, (Sommer et al 2007; Oberto et al 2007; Juutilainen et al 2007; Tillmann et al 2007; Gatta et al 2003).

The mortality of chicken embryos was found to increase to 75% from 16% in the control group, after exposure to radiation from a GSM mobile phone, (Grigor^{Me}, 2003). This result is

in agreement with the increased mortality of fertilised chicken eggs that was recorded after irradiation by low power 9.152 GHz pulsed and continuous-wave microwaves, (Xenos and Magras, 2003).

Several studies have reported that microwave exposures increase the permeability of the blood-brain barrier (BBB), an hydrophobic barrier made by endothelial cells to protect the mammalian brain from harmful compounds in the blood. A Swedish group has reported that 915 MHz microwaves at non-thermal intensities causes leakage of albumin into the brain through the BBB in rats, accumulating in the neurons and glial cells which surround the capillaries in the brain, (Salford et al, 1994). The same group reported that GSM mobile phone radiation from a test mobile phone with a programmable constant power output, opens the BBB for albumin, resulting to damage of brain cells in rats. The power density and SAR were within the ICNIRP limits, (Salford et al 2003). These were the first experiments that indicated cell damage caused by mobile phone radiation although this radiation was not a real mobile phone signal. However in an earlier study of the same group, continuous-wave and

pulsed 915 MHz radiation at relatively high intensities, 1 W and 2 W respectively, was not found to damage brain or promote brain tumour development in rats, (Salford et al. 1993). Exposure of an in vitro BBB model, consisted by rat brain cells growing in a culture with pig blood cells, exposed to 1800 MHz microwave radiation pulsed at 217 Hz repetition rate (DCS-like), at SAR 0.3-0.46 W/kg, increased the permeability to sucrose of the BBB twice compared to the control culture. No significant temperature rise was detected during the exposures, (Schirmacher et al, 2000). In a latter study of the same group, in vitro exposure of

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three other BBB models with distinctly higher barrier tightness than the previously used one, did not cause any effect on the permeability of the BBB of the models, (Franke et al, 2005).

In regards to DNA damage or cell death induction due to microwave exposure, in a series of early experiments, rats were exposed to pulsed and continuous-wave 2450 MHz radiation for two hours at an average power density of 2 mW/cm² and their brain cells were

subsequently examined for DNA breaks by "Comet" assay. The authors found a dosedependent

(0.6 and 1.2 W/kg whole body SAR) increase in DNA single-strand and doublestrand breaks, four hours after the exposure to either the pulsed or the continuous-wave radiation, (Lai and Singh 1995; 1996). The same authors found that melatonin and PBN (Ntert-butyl-alpha- phenylnitron) both known free radical scavengers, block the above effect of DNA damage by the microwave radiation, (Lai and Singh 1997). Although these experiments were the first to report DNA damage by microwaves, the radiation intensity (2mW/cm²) was relatively high, exceeding the international exposure limits (ICNIRP 1998) and additionally the radiation frequency was the same as in microwave ovens. This is why the authors of this

review cannot be sure on whether the reported effects were thermal or non-thermal.

In vitro exposure of mouse fibroblasts and human glioblastoma cells to 2450 MHz, (Malyapa et al, 1997a), 835.62 MHz and 847.74 MHz (Malyapa et al, 1997b), radiations at SAR 0.6 W/kg, was not reported to damage DNA as measured by comet assay.

A number of recent studies have reported DNA damage, or cell damage, or cell death, induced by mobile telephony or similar RF radiations at non-thermal intensity levels, (Aitken et al, 2005; Diem et al 2005; Panagopoulos et al 2007; Salford et al, 2003; Markova et al, 2005; Caraglia et al, 2005; Nikolova et al, 2005), while some other studies did not find any such connection, (Hook et al, 2004; Capri et al, 2004a; 2004b; Meltz 2003; Cranfield et al, 2003). Aitken et al 2005, reported damage to mitochondrial genome and the nuclear betaglobin locus in the spermatozoa of mice exposed to 900 MHz, 0.09 W/kg SAR, for 7 days, 12h per day. Diem et al 2005, reported single and double-strand DNA breakage in cultured human and rat cells exposed to 1800 MHz mobile phone-like radiation. Panagopoulos et al 2007a, found DNA fragmentation at a very high degree, caused in the reproductive cells of female *Drosophila* insects only by few min daily exposure to a real mobile phone signal for only few days. These were the first experiments that showed extensive DNA damage and cell death by real digital mobile phone GSM and DCS signals. Previous experiments of the same group had shown a large decrease in the reproductive capacity of the same insect, caused by real mobile phone similar exposures, (Panagopoulos et al, 2004).

B. Clinical Studies on Humans. Effects on EEG, EDA, Melatonin, etc

Mobile telephony radiation is found in several studies to affect electroencephalograms (EEG), electrodermal activity (EDA) and the synthesis rate of hormones like melatonin, in humans.

In a series of early experiments performed by a Finnish group, GSM mobile phone exposure was found to alter the EEG oscillatory activity of healthy adult subjects, in the 6-8 and 8-10 Hz frequency bands during cognitive (visual memory) tasks, (Krause et al, 2000). In more recent experiments of the same group, exposure of 10-14 year old children to mobile phone GSM field while performing an auditory memory task, induced changes in their brain oscillatory EEG responses in the frequencies 4-8 Hz and 15 Hz, (Krause et al, 2006).

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Exposure for 30 min to pulse modulated 900 MHz mobile phones-like EMF, increased waking regional cerebral blood flow (rCBF) and enhanced EEG power in the alpha frequency range (8-12 Hz) prior to sleep onset and during sleep. Exposure to the same field without pulse modulation did not enhance power in waking or sleep EEG, (Huber et al, 2002). In another set of experiments of the same group, 30 min exposure to the same 900 MHz GSMlike field during waking period preceding sleep, increased the spectral power of the EEG in non-rapid eye movement sleep. The maximum increase occurred in the 9.75-11.25 Hz and 12.5-13.25 Hz frequency ranges during the initial part of the sleep. Since exposure during waking, modified the EEG during subsequent sleep, the changes in the brain function induced by mobile telephony radiation are considered to outlast the exposure period, (Huber et al, 2000).

Mobile phone exposure prior to sleep was found to decrease rapid eye movement sleep latency and to increase EEG spectral power in the 11.5-12.5 Hz frequency, during the initial part of sleep following exposure, (Loughran et al, 2005).

Some other studies have failed to find any effects of mobile phone-microwave exposures on EEG during cognitive testing, or to replicate earlier findings, (RÄ¶schke and Mann, 1997;

Wagner et al., 1998).

Mobile phone radiation was found to affect the evoked neuronal activity of the central nervous system (CNN) as represented by EDA, an index of the sympathetic nervous system.

Mobile phone exposure was found to lengthen the latency of EDA (Skin Resistance Response), irrespectively of the head side next to mobile phone, (Esen and Esen, 2006).

Therefore, mobile phone exposure may increase the response time of users with different negative consequences, like for example the increase in the risk of phone-related driving hazards, e.t.c.

A statistically significant increase of chromosomal damage was found in blood lymphocytes of people who used GSM 900 MHz mobile phones, compared to a control group of non-users, matched according to age, sex, health status, drinking and smoking habits, working habits, and professional careers. The increase was even greater for users who were smoker-alcoholic, (Gadhia et al, 2003)

In another type of clinical study, exposures of humans to GSM 900 MHz and DCS 1800 MHz mobile phones fields for 35 min, were not found to change significantly arterial blood pressure or heart rate during or after the exposure, (Tahvanainen et al, 2004).

Prolonged use of mobile phone, (more than 25 min per day), was found to induce a reduction in melatonin production among male users. The effect was enhanced by additional exposure to 60 Hz ELF magnetic field, (Burch et al, 2002).

Two studies about possible immediate- short term effects of GSM and UTMS (third generation of mobile networks)-like exposure on well being and cognitive performance in humans based on questionnaires, found contradictive results. The first (Zwamborn et al, 2003) reported no effects of GSM-like exposure, while the UTMS-like exposure was found to

reduce well-being and cognitive performance. The second, (Regel et al, 2006) reported no effects at all from either type of radiation. The opinion of the authors of this review is that studies based on questionnaires cannot be as much objective as studies based on measurable indexes like EEG or EDA. Besides, it would be unlikely that subjects would report themselves immediate effects on their well-being.

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C. Epidemiological Studies

According to the Swedish Prof. L. Hardell and his research group, the concluding results of up to date epidemiological studies among users for more than ten years use of mobile phones indicate consistently an increased risk for acoustic neuroma and glioma, especially for ipsilateral exposure, (Hardell et al, 2007a). Earlier work of the same research group had found a connection between digital (2nd generation) and analogue (1st generation) mobile phones use and malignant brain tumors, highest for more than ten years latency period, (Hardell et al, 2006).

Another review study of the Austrian Prof. M.Kundi conducted few years ago, states as the resume from several epidemiological and experimental studies, that long term exposure to mobile phone emissions (analogue and digital) constitutes a small to moderate increased risk for developing certain types of cancer, (Kundi, 2004).

Several other studies had not found any association between mobile phone use and cancer, (Inskip et al, 2001; Johansen et al, 2001; Muscat et al, 2002).

A major difficulty in epidemiological studies among mobile phone users is the variation of parameters governing the exposure from hand held mobile phones, i.e. the distance from

the nearest base station which can considerably change the intensity of the radiation emitted by the phone, the actual duration of daily use, e.t.c. Nevertheless, the studies done on habitants living close to base stations are more consistent since the station emits a more constant radiation level on a daily basis and therefore a person residing nearby, receives a measurable radiation at least for several hours per day.

A recent Egyptian study (Abdel-Rassoul et al, 2007) found that inhabitants living nearby mobile telephony base stations may develop a number of neuropsychiatric problems like headaches, memory changes, dizziness, tremors, depression, sleep disturbances, reported also in previous studies as "microwave syndrome" (Navarro et al 2003), plus changes in the performance of neurobehavioral functions. Similar results were found by other studies in different countries like in France, (Santini et al 2003), Poland (Bortkiewicz et al 2004), Spain (Navarro et al 2003), Austria (Hutter et al 2006).

Other epidemiological studies have reported diminishes in the populations of birds around mobile telephony base stations at distances 100-600m from the masts in Belgium, (Everaert and Bauwens 2007) and within 200m from the masts in Spain (Balmori 2005). These studies are in agreement with earlier biological studies which had reported increased mortality of avian embryos, exposed to low levels ($5-120 \mu\text{W}/\text{cm}^2$) of RF antennae radiation, (Xenos and Magras, 2003).

The Design of Bioelectromagnetic Experiments and a Reason for Inconsistencies

As described in the previous paragraphs, there are frequently contradictory results in the bioelectromagnetic experiments performed by different labs. One factor that we have found to

be very important and able to completely change the results of a biological experiment is the influence of the stray electromagnetic fields that exist inside any lab.

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Within a usual room inside a house or laboratory there are 50-60 Hz fields due to the electric wirings and electrical appliances. Close to the walls, near to sockets or close to electrical appliances one can measure electric fields up to 50 V/m and magnetic fields up to 10 mG. Such fields are found to affect biomolecules, cells and whole organisms in different ways and therefore to affect the outcome of any biological experiment, (Goodman E. et al. 1995; Panagopoulos et al. 2002; Weaver and Astumian 1990). Prior to the design of any biological experiment, a careful scanning of stray fields inside the lab is necessary. The experiments should be performed at the place with the minimum stray fields and special care should be taken in having the control under identical conditions with the exposed groups except only for the factor studied. Temperature, light and humidity are additional important factors that should be identical between exposed and control groups.

Before the relatively recent evolution of knowledge in the field of Bioelectromagnetism , ambient electromagnetic fields within the labs were not taken into account in biological experiments. But living organisms are very sensitive to external electromagnetic fields, natural or artificial ones. Rooms or devices used as incubators, are constructed to keep a constant temperature, humidity, e.t.c. in their internal space, but usually are sources of EMFs from their own electrical circuits. A specialized physicist should always be member of any experimental team for taking good care of such factors.

Effects of Mobile Telephony Radiation on a Model Organism

Introduction

In order to study the ability of the electromagnetic signals emitted by cellular mobile telephony antennas to affect the biological function of living organisms, we used a biological model, the reproductive capacity of the insect *Drosophila melanogaster*, a well studied experimental animal with many advantages, including its short life cycle and the good timing of its metamorphic stages and developmental processes, (King 1970). Especially the good timing of this insect's early developmental stages (oogenesis, spermatogenesis, embryogenesis, larval and pupal stages), under certain environmental conditions (i.e. temperature, humidity, food e.t.c.), is a very important feature, on which our experimental protocols were based.

In order to study the effects of mobile telephony radiation on the reproductive capacity, we exposed the insects to real mobile phone signals, emitted by commercially available handsets.

The basic cellular processes are identical in insect and mammalian cells. In addition, insects (particularly *Drosophila*) are much more resistant, at least to ionizing electromagnetic radiation, than mammals, (Koval and Kazmar 1988, Koval et al 1979, 1977, Abrahamson et al 1973). Therefore, a proper experimental protocol relating *Drosophila* can be very useful in assessing the bioactivity of electromagnetic radiation in general, (including non-ionizing radiation and electromagnetic fields).

Our experiments, regarding few minutes daily exposure of this model organism for only few days, to cellular mobile phone signals, have shown a large decrease in the reproductive capacity, affecting both sexes (Panagopoulos et al 2004). Both systems of digital mobile telephony radiation used in Europe, GSM 900 MHz and DCS 1800 MHz were found to

decrease the insect's reproductive capacity, but GSM 900 MHz was found to be even more bioactive than DCS 1800 MHz, mainly due to the higher intensity of GSM 900 MHz antennas compared to DCS 1800 MHz ones, (Panagopoulos et al 2007b; 2007a). The decrease in the reproductive capacity was found to be due to induced cell death (DNA fragmentation) in the gonads, caused by both types of mobile telephony signals, (Panagopoulos et al 2007a).

Unpublished experiments of ours presented here for the first time, show that the bioactivity is strongly and non-linearly dependent on the intensity of the radiation, becoming maximum for intensities higher than 200 mW/cm^2 and within an "intensity window" around 10 mW/cm^2 .

Materials and Methods

Experimental Animal

We used *Drosophila melanogaster* flies, wild-type strain, Oregon R, held in glass bottles with standard food, kept in incubator at $25 \text{ }^\circ\text{C}$, with 12-h periods of light and darkness and 70% relative humidity, cultured according to standard methods, (Panagopoulos et al 2004).

The food consisted of 450ml water, 4g agar, 13g yeast, 32g rice flour, 16g sugar, 25g tomato pulp. The mixture was boiled for over 10min to ensure sterility, which was preserved by the addition of 2ml propionic acid and 2ml ethanol. This food quantity was enough for 25-30 glass vials which were sterilized before the food was added.

In each experiment, we collected newly emerged adult flies from the stock early in the afternoon, anesthetized them lightly with diethyl ether and separated males from females. We divided the collected flies in groups of ten in standard laboratory cylindrical glass vials, with 2.5cm diameter and 10cm height, with standard food, which formed a smooth plane surface,

1cm thick at the bottom of the vials. The vials were closed with cotton plugs.

Exposure System

Before each set of experiments we measured the mean power density of the radiation emitted by the mobile phone handset in the RF range at 900MHz and/or 1800MHz, with the fieldmeter, "RF Radiation Survey Meter, NARDA 8718", with its probe inside a glass vial similar to the ones we used for the insects in our experiments. In addition, we measured in the same way the mean electric and magnetic field intensities at the Extremely Low Frequency (ELF) range, with the field-meter, "Holaday HI-3604, ELF Survey Meter".

The experimenter's position in relation to the mobile phone during the measurements was the same as during the exposures. The mobile phone was held close to the experimenter's head with its antenna facing downward. The exposures and the field measurements, took place in a quiet but not sound-isolated room to simulate the actual conditions to which a user is subjected during a normal conversation on the mobile phone. The room conditions and the positions of all items around the experimental bench were always the same. Exposures and measurements of mobile phone emissions were always conducted at the same place where the mobile phone had full perception of both GSM and DCS signals. The handset was fully charged before each set of exposures or measurements.

In the most new digital cell phone handsets, the antenna is in the back and upper side of the device. This can be easily verified by measuring the emitted radiation holding the probe of the field meter in contact with different parts of the handset's surface.

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The measured exposure values were in general within the established exposure limits,

(ICNIRP 1998).

We used commercially available digital mobile phone handsets in all the sets of our experiments, in order to analyze effects of real mobile telephony exposure conditions. As far as we know, we were the first to use a commercially available mobile phone handset itself in biological experiments, (Panagopoulos et al 2000a). The obvious reason was that these devices are the most powerful RF transmitters in our immediate daily environment. Thus, instead of using simulations of digital mobile telephony signals with constant parameters (frequency, intensity etc), or even "test mobile phones" programmed to emit mobile telephony signals with controllable power or frequency, we used real GSM, DCS signals which are never constant, since there are continuous changes in their intensity and frequency. Electromagnetic fields with changing parameters are found to be more bioactive than fields with constant parameters, (Goodman E.M. et al 1995; Diem et al 2005), probably because it is more difficult for living organisms to get adapted to them. Experiments with constant GSM or DCS signals can be performed, but they do not simulate actual conditions. Later other experimenters also started to use mobile phone handsets as exposure devices apparently for the same reasons, (Weisbrot et al 2003; Barteri et al 2005).

We exposed the flies within the glass vials by placing the antenna of the mobile phone outside of the vials, in contact with or at different distances from the glass wall and parallel to the vial's axis. The total duration of exposure was 6min per day in one dose and we started the exposures on the first day of each experiment (day of eclosion). The exposures took place for a total of 2 to 6 days in each experiment depending on the kind of the experiment, as described below. The daily exposure duration of 6min, was chosen in order to have exposure conditions

that can be compared with the established exposure criteria, (ICNIRP 1998). Besides, early experiments had shown that only few minutes of daily exposure were enough to produce a significant effect on the insects' reproductive capacity (Panagopoulos et al, 2000a).

The experimenter could speak on the mobile phone during connection (this we called, "modulated" or "speaking" emission), or could just stay silent, ("non-modulated" or "non-speaking" emission, or DTX mode). The intensity of the emitted radiation increases about ten times when the user speaks during connection, than when there is no speaking, (Panagopoulos et al, 2000a).

Exposure Procedures

We carried out six sets of experiments: In the first set, we exposed the insects to the mobile phone's GSM 900 MHz field while the mobile phone was operating in non-speaking mode, (non-modulated emission or DTX). In the second set of experiments, the mobile phone was operating in speaking mode, (modulated emission) during the exposures. In the third set of experiments we investigated the effect of the mobile phone signal on the reproductive capacity of each sex separately. In the fourth set of experiments we compared the bioactivity between GSM 900 MHz and DCS 1800 MHz types of mobile telephony signals. In the fifth set of experiments we exposed the insects to different distances (intensities) , from the mobile phone antenna from 0 to 100 cm, for both types of radiation. Finally, in the sixth set of experiments we tested the ability of GSM and DCS fields to induce DNA fragmentation (cell death) in the ovarian cells of the female insects during oogenesis.

In every single experiment we separated the newly emerged collected adult flies to exposed (E) and sham-exposed (SE)/control (C) groups. Each one of the groups consisted

always of ten female and ten male, newly emerged flies. The sham exposed groups had identical treatment as the exposed ones, except that the mobile phone during the 6-min "exposures", was turned off.

Every time before each exposure, the cotton plugs were pushed down in the glass vials in order to confine the flies to a small area of about 1cm height between the cotton and the food so as to provide roughly even exposure to all flies. After the exposure, the cotton plugs were pulled back to the top of the vials, and the vials were put back in the culture room.

In every group of insects in all the sets of experiments, we kept the ten males and the ten females for the first 48h of the experiment in separate glass tubes. At eclosion, adult female flies have already in their ovaries eggs at the first pre-yolk stages and oogenesis has already started. The eggs develop through 14 distinct stages, until they are ready to be fertilized and laid, and the whole process of oogenesis lasts about 48h. By the end of the second day of their adult life, the female flies have in their ovipositors the first fully developed egg chambers of stage 14th, ready to be fertilized and laid, (King 1970; Panagopoulos et al 2004). At the same time, the first mature spermatozoa, (about 6h after eclosion) and the necessary paragonial substances (about 12h after eclosion) in male flies have already been developed (King 1970; Stromnaes and Kvelland 1962; Connolly and Tully 1998). Keeping males separately from females for the first 48h of the experiment ensures that the flies are in complete sexual maturity and ready for immediate mating and laying of fertilized eggs.

After the first 48h of each experiment, the flies were anesthetized very lightly again and males and females of each group were put together (ten pairs) in another glass tube with fresh food, allowed to mate and lay eggs for 72h. During these three days, the daily egg production

of *Drosophila* is at its maximum (from the 3rd to 5th day of its adult life), then stays at a plateau or declines slightly for the next 5 days and diminishes considerably after the 10th day of adult life (Bos and Boerema 1981; Shorrocks 1972; Ramirez et al 1983).

On the sixth day of each experiment in all six sets of experiments, the flies were removed from the glass vials and the vials were maintained in the culture room for six additional days, without further exposure.

After the last six days, most F1 embryos (deriving from the laid eggs) are in the stage of pupation, where they can be clearly seen with bare eyes and easily counted on the walls of the glass tubes, as at the last stages before pupation, the larvae leave the food, crawling up the walls of the glass vials. There may be a few embryos still in the last stages as larvae, which are big enough and ready for pupation (on the surface or already away from the food), so that they can be easily counted. [If the remaining larvae are still many and the counting is imprecise, the experimenter can wait an additional day and recount the pupae]. There may be also already a few newly emerged F1 adult flies, which can also be counted easily.

During the last six days, we inspected the surface of the food within the glass vials under the stereo-microscope for any non-developed laid eggs or dead larvae, something that we did not see in our experiments (empty egg-shells can be seen after hatching). The number of observed exceptions (non-developed eggs or dead larvae), both in exposed and control groups (less than 5%) was within the Standard Deviation of progeny number. [The insignificant percentage of F1 egg and larvae mortality is due to the fact that the paternal-maternal flies were newly emerged during the first 2-5 days of their adult lives]. Therefore the number of pupae in our experiments corresponded to the number of laid eggs (oviposition) . Furthermore, the counting of pupae can be done without any error at all, whereas the counting of laid eggs

under a stereo-microscope is subject to considerable error.

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The oviposition of *Drosophila* is influenced by many factors, like temperature, humidity, prior anesthesia, crowding, food, (King 1970). Special care must be taken to keep all these factors constant. Experience in handling the flies is necessary to prevent accidental deaths.

This number of F1 pupae under the above described conditions, during the insect's three days of highest oviposition, is that we have defined as the Insect's Reproductive Capacity and

this is the biological index we have used to examine the bioactivity of electromagnetic radiation-field.

The temperature during the exposures was monitored within the vials with a mercury thermometer with an accuracy of 0.05°C .

In the sixth set of experiments, after the additional last exposure in the morning of the sixth day from the beginning of each experiment, the flies were removed from the glass vials, and the ovaries of females were dissected into individual ovarioles and fixed for TUNEL assay. The vials were then maintained in the culture room for six additional days, without further exposure, in order to count the F1 pupae as in all the sets of experiments.

TUNEL Assay

A widely used method for identifying cell death is TUNEL assay. By use of this method, fluorescein dUTP is bound through the action of terminal transferase, onto fragmented genomic DNA which then becomes labelled by characteristic fluorescence. The label incorporated at the damaged sites of DNA is visualized by fluorescence microscopy, (Gavrieli

et al, 1992).

Each *Drosophila* ovary consists of 16 to 20 ovarioles. Each ovariole is an individual egg assembly line, with new egg chambers in the anterior moving toward the posterior as they develop, through the 14 successive stages as described, until the mature egg reaches the oviduct.

To determine the ability of GSM and DCS radiation to act as possible stress factors able to induce cell death during early and mid oogenesis, we used TUNEL assay, as follows:

Ovaries were dissected in Ringer's solution and separated into individual ovarioles from which we took away egg chambers of stages 11-14. In egg chambers of stages 11-14 programmed cell death takes place normally in the nurse cells and follicle cells. Thereby we kept and treated ovarioles and individual egg chambers from germarium up to stage 10.

Samples were fixed in PBS solution containing 4% formaldehyde plus 0.1% Triton X-100 (Sigma Chemical Co., Germany) for 30min and then rinsed three times and washed twice in PBS for 5 min each. Then samples were incubated with PBS containing 20 µg/ml proteinase K for 10 minutes and washed three times in PBS for 5 min each. In situ detection of fragmented genomic DNA was performed with Boehringer Mannheim kit containing fluorescein dUTP for 3h at 37°C in the dark. Samples were then washed six times in PBS for 1h and 30 min in the dark and finally mounted in antifading mounting medium (90% glycerol containing 1,4-diazabicyclo (2.2.2) octane (Sigma Chemical Co., Germany) to prevent from fading and viewed under a Nikon Eclipse TE 2000-S fluorescence microscope.

Results and Discussion

In the first two sets of experiments, we separated the insects into two groups: a) the Exposed group (E) and b) the Sham Exposed group (SE). The 6-min daily exposures took place for the

first five days of each experiment.

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In the first three sets of experiments, the exposures were performed by GSM 900 MHz mobile phone radiation-field. Before the exposures, we measured radiation and field intensities, as described above. In the RF range, the measured mean power density for 6min of modulated emission (M), with the antenna of the mobile phone outside of the glass vial in contact with the glass wall and parallel to the vial's axis was $0.436 \hat{\pm} 0.060$ mW/cm². The non-modulated (NM)

corresponding measured mean value, was $0.041 \hat{\pm} 0.006$ mW/cm². In the ELF range, the measured values for modulated field, excluding the ambient electric and magnetic fields of 50Hz, were $6.05 \hat{\pm} 1.62$ V/m electric field intensity and $0.10 \hat{\pm} 0.06$ mG magnetic field intensity.

The corresponding non-modulated values were $3.18 \hat{\pm} 1.10$ V/m and $0.030 \hat{\pm} 0.003$ mG. All given

values are average from eight separate measurements of each kind $\hat{\pm}$ Standard Deviation (SD).

These values are typical for all commonly used GSM 900 MHz mobile phone handsets.

1. Effect of Non-Modulated GSM radiation-field on the Reproductive Capacity

We carried out four experiments (1.1-1.4) with non-modulated field, (non-speaking emission). The exposure parameters in this case simulate the situation when a user listens through the mobile phone during connection.

Results are listed in Table 1.

Table 1 shows the mean number of F1 pupae (corresponding to the number of laid eggs) per maternal fly in the groups E(NM) exposed to Non-Modulated (NM), GSM 900 MHz

mobile phone field and in the corresponding sham exposed (control) groups SE(NM) during the first three days of the insect's maximum oviposition.

The Non-Modulated GSM 900 MHz signals, decreased the insect's reproductive capacity by up to 20% in relation to the unexposed groups with six min daily exposure for five days. No temperature increases were detected within the vials during the exposures.

Table 1. Effect of Non-Modulated GSM field on the Reproductive Capacity of

Drosophila melanogaster

Experiment No Groups Mean Number of F1

Pupae per Maternal Fly

Deviation from

Control

1.1 E(NM) 9.7 -16.38%

SE(NM) 11.6

1.2 E(NM) 10 -15.96%

SE(NM) 11.9

1.3 E(NM) 9.8 -20.16%

SE(NM) 12.4

1.4 E(NM) 10.4 -19.38%

SE(NM) 12.9

Average $\hat{\mu} \pm SD$ E(NM) $9.975 \hat{\mu} \pm 0.31$ -18.24%

SE(NM) $12.2 \hat{\mu} \pm 0.57$

Statistical analysis, (single factor ANOVA test) shows that the probability that mean

oviposition differs between the exposed and the sham exposed groups, owing to random

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variations, is $P < 5 \times 10^{-4}$. Therefore, the decrease in the reproductive capacity is due to the effect of the GSM field.

2. Effect of Modulated GSM Radiation-field on the Reproductive Capacity

We carried out four experiments (2.1-2.4), with modulated emission (the experimenter was speaking close to the mobile phone's microphone, during the exposures). The exposure parameters in this case simulate the situation when a user speaks on the mobile phone during connection. Results are listed in Table 2.

Table 2 shows the mean number of F1 pupae (corresponding to the number of laid eggs) per maternal fly in the groups E, exposed to "Modulated" GSM field and in the corresponding sham exposed groups, SE, during the first three days of the insect's maximum oviposition.

The Modulated GSM 900 MHz signals induced a large decrease in the insect's reproductive capacity up to 60% as compared to the unexposed groups. No temperature increases were detected during the exposures and thus these effects are considered as nonthermal.

Table 2. Effect of Modulated GSM field on the Reproductive Capacity of *Drosophila melanogaster*

Experiment No Groups Mean Number of F1

Pupae per Maternal Fly

Deviation

from Control

2.1 E(M) 6.7 -48.85%

SE (M) (Control) 13.1

2.2 E 5.1 -56.78%

SE (M) (Control) 11.8

2.3 E 5.6 -53.72%

SE (M) (Control) 12.1

2.4 E 6 -53.125%

SE (M) (Control) 12.8

Average $\hat{\mu} \pm SD$ E (M) 5.85 $\hat{\mu} \pm 0.67$ -53.01%

SE (M) (Control) 12.45 $\hat{\mu} \pm 0.6$

The reproductive capacity was much more decreased by modulated emission, (50-60%), than by non-modulated emission, (15-20%). Thus the effect is strongly dependent on radiation-field intensity. At the same time, the intensity of the modulated signal, is about ten times more powerful than the non-modulated signal. Thereby, the effect is not linearly dependent on radiation intensity.

The results from the first two sets of experiments are represented, in Figure 1.

The statistical analysis shows that the probability that mean oviposition differs between the exposed and the sham exposed groups, owing to random variations, is very small, $P < 10^{-5}$. Thus the recorded effect is due to the GSM signal.

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SE(NM) E(NM) SE(M) E(M)

Reproductive Capacity of Exposed and Sham Exposed Groups

Number of F1 pupae per maternal insect

Groups

Figure 1. Reproductive Capacity of the groups exposed to non-modulated and modulated GSM 900

MHz field [E(NM), E(M)] and the corresponding sham exposed, [SE(NM), SE(M)], groups. [The error

bars correspond to Standard Deviation].

3. Effects on the Reproductive Capacity of Each Sex

A third set of experiments (C) was carried out in order to record the effect of the GSM 900 MHz field on the reproductive capacity of each sex separately. The mobile phone was operating in speaking mode during the 6 min exposures, and the insects were separated into four groups (each one consisting again 10 male and 10 female insects): In the first group (E1), both male and female insects were exposed. In the second group (E2), only the females were

exposed. In the third group (E3), we exposed only the males and the fourth group (SE) was sham exposed (control). Therefore in this third set of experiments, the 6-min daily exposures took place only during the first two days of each experiment while the males and females of each group were separated and the total number of exposures in each experiment was 2 instead of 5.

The results from this set of experiments are listed in Table 3 and represented graphically in Figure 2.

The results of this set of experiments show that the GSM field affects the reproductive capacity of both female and male insects. The female insects (E2) were more affected than males (E3) in these experiments. This is expected to be due to the fact that, by the time we started the exposures, spermatogenesis was already almost completed in male flies, while oogenesis had just started, (King 1970; Panagopoulos et al 2004).

Statistical analysis (single factor ANOVA test) shows that the probability that mean oviposition differs between the four groups because of random variations is $P < 10^{-7}$.

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Table 3. Effect of "Modulated" GSM field on the Reproductive Capacity of each sex

Experiment

♂ ♀ Groups Mean Number of F1 Pupae

Per Maternal Fly

Deviation from

Control

3.1 SE(Control) 13.2

E1 8.5 -35.61%

E2 9.4 -28.79%

E3 11.7 -11.36%

3.2 SE (Control) 13.8

E1 7.6 -44.93%

E2 8.9 -35.51%

E3 12.1 -12.32%

3.3 SE (Control) 12.9

E1 7.8 -39.53%

E2 9.3 -27.91%

E3 11 -14.73%

3.4 SE (Control) 13.5

E1 6.9 -48.89%

E2 7.8 -42.22%

E3 12.2 -9.63%

Average $\hat{A} \pm SD$ SE (Control) 13.35 $\hat{A} \pm 0.39$

E1 7.7 $\hat{A} \pm 0.66$ -42.32%

E2 8.85 $\hat{A} \pm 0.73$ -33.71%

E3 11.75 $\hat{A} \pm 0.54$ -11.985%

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SE E1 E2 E3

Effect of GSM field on the Reproductive Capacity of each sex

Number of F1 pupae per maternal insect

Groups

Figure 2. Effect of Modulated GSM field on the reproductive capacity of each sex of *Drosophila melanogaster*. Average mean number of F1 pupae $\hat{\mu} \pm SD$ per maternal insect. SE: sham exposed groups,

E1: groups that both sexes were exposed, E2: groups in which only the females were exposed, E3:

groups in which only the males were exposed.

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In the following fourth, fifth and sixth set of experiments, we used a dual band cellular mobile phone that could be connected to either GSM 900 or DCS 1800 networks simply by changing SIM (Subscriber Identity Module) cards on the same handset. The highest Specific Absorption Rate (SAR), given by the manufacturer for human head, was 0.89 W/Kg. The exposure procedure was the same. The experimenter spoke on the mobile phone's microphone during the exposures. The GSM and DCS fields were thus modulated by the human voice, (speaking emissions or GSM basic).

4. Comparison of Bioactivity between GSM 900 MHz and DCS

1800 MHz

In this set of experiments we separated the insects into four groups: a) the group Exposed to GSM 900MHz field with the mobile phone antenna in contact with the glass vial containing the flies (named as "900"), b) the group exposed to GSM 900MHz field with the antenna of

the mobile phone at 1cm distance from the vial (named as "900A"), c) the group exposed to

DCS 1800MHz field with the mobile phone antenna in contact with the glass vial (named as "1800"), and d) the Sham Exposed (Control) group (named as "SE"). The comparison

between first and third group represents comparison with the usual exposure conditions between GSM 900 and DCS 1800 users, while comparison between second and third group represents comparison between possible effects of the RF frequencies of the two systems under equal radiation intensities. Therefore the second group (900A) was introduced for better comparison of effects between the two types of radiation.

Measured mean power densities in contact with the mobile phone antenna for six min of modulated emission, were $0.407 \hat{\pm} 0.061$ mW/cm² for GSM 900 MHz and $0.283 \hat{\pm} 0.043$ mW/cm² for DCS 1800 MHz. As was expected GSM 900 MHz intensity at the same distance from the antenna and with the same handset was higher than the corresponding DCS 1800 MHz. For the better comparison between the two systems of radiation we measured the GSM power density at different distances from the antenna and found that at 1cm distance, the GSM 900 MHz intensity was $0.286 \hat{\pm} 0.050$ mW/cm², almost equal to DCS 1800 MHz at zero distance. Measured electric and magnetic field intensities in the ELF range for modulated field, excluding the ambient electric and magnetic fields of 50Hz, were $22.3 \hat{\pm} 2.2$ V/m electric

field intensity and $0.50 \hat{\pm} 0.08$ mG magnetic field intensity for GSM at zero distance, $13.9 \hat{\pm} 1.6$ V/m, $0.40 \hat{\pm} 0.07$ mG correspondingly for GSM at 1 cm distance and $14.2 \hat{\pm} 1.7$ V/m, $0.38 \hat{\pm} 0.07$

mG correspondingly for DCS at zero distance. All these values are averaged over ten separate measurements of each kind $\hat{\pm}$ standard deviation (SD).

Except for the power density - field measurements of the mobile phone emissions, we obtained the spectra of both types of radiation, plus the background spectrum in our lab, (Fig. 3). Each one of the two types of radiation gave a unique frequency spectrum. While GSM 900MHz gives a single peak around 900MHz, (Fig. 3b), DCS 1800MHz gives a main peak around 1800MHz and a smaller one around 900MHz, (Fig. 3c). The spectra were obtained by a Hewlett Packard 8595 E, (9 kHz-6.5 GHz), spectrum analyzer (USA).

We carried out ten replicate experiments. Results are listed in Table 4 and represented graphically, in Figure 4.

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The results from this set of experiments show that the reproductive capacity in all the exposed groups is significantly decreased compared to the sham exposed groups. The decrease is maximum in the 900 groups, (48.25% compared to SE) and smaller in the 900A and the 1800 groups, (32.75% and 31.08% respectively), (Table 4). Although the decrease was even smaller in the 1800 groups than in 900A, differences between the 900A and 1800 groups were found to be within the standard deviation, (Table 4, Figure 4).

The statistical analysis shows that the probability that the reproductive capacity differs between groups, owing to random variations, is negligible, $P < 10^{-18}$.

Again, we did not detect any temperature increases, within the glass vials during the

exposures.

The differences in the reproductive capacity between the groups were greater between 900 and 900A (owing to intensity differences between the two types of radiation) and much smaller between 900A and 1800, (owing to frequency differences between GSM and DCS), (Table 4).

This set of experiments shows that there is a difference in the bioactivity between GSM 900 MHz and DCS 1800 MHz and this difference is mainly due to the higher intensity of GSM 900 under the same exposure conditions, (differences between groups 900 and 900A) and not due to the different RF carrier frequencies, (differences between 900A and 1800 groups).

Intensity differences between the two types of cellular mobile telephony radiation depend also on the ability of communication between the antennas of the mobile phone and the corresponding base station. Even if GSM 900 usually has a higher intensity than DCS 1800, this situation can be reversed in certain places if GSM 900 has a much better signal perception between its antennas than DCS 1800, (Tisal 1998). Our results count for equal signal perception conditions between the two types of radiation.

a. Background spectrum.

Figure 3. Continued on next page.

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b. Spectrum of GSM 900 MHz.

c. Spectrum of DCS 1800 MHz.

Figure 3. Background, GSM 900 MHz and DCS 1800 MHz spectra.

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SE 900 900A 1800

Effect of GSM, DCS fields on Reproductive Capacity

Number of F1 pupae per maternal insect

Groups

Figure 4. Reproductive Capacity (mean number of F1 pupae per maternal fly) of exposed (900, 900A,

1800) and sham exposed (SE) groups.

Table 4. Effect of Modulated GSM and DCS fields on the Reproductive Capacity of

Drosophila melanogaster

Experiment No Groups

Mean Number of F1

Pupae per Maternal Fly

Deviation

from Control

1 900 7.7 -42.54%

900A 8.9 -33.58%

1800 9.2 -31.34%

SE (Control) 13.4

2 900 5.8 -51.26%

900A 8.1 -31.93%

1800 7.9 -33.61%

SE (Control) 11.9

3 900 6.8 -46.03%

900A 7.9 -37.30%

1800 8.7 -30.95%

SE (Control) 12.6

4 900 7.4 -47.52%

900A 9.7 -31.21%

1800 9.9 -29.79%

SE (Control) 14.1

5 900 6.2 -52.31%

900A 8.5 -34.62%

1800 8.2 -36.92%

SE (Control) 13

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Table 4. Continued

Experiment No Groups

Mean Number of F1 Pupae

per Maternal Fly

Deviation

from Control

6 900 6.1 -43.52%

900A 8.2 -24.07%

1800 7.8 -27.78%

SE (Control) 10.8

7 900 6.7 -47.66%

900A 8.3 -35.16%

1800 9 -29.69%

SE (Control) 12.8

8 900 6 -48.72%

900A 7.9 -32.48%

1800 8.4 -28.21%

SE (Control) 11.7

9 900 6.7 -49.24%

900A 8.8 -33.33%

1800 9.1 -31.06%

SE (Control) 13.2

10 900 5.7 -53.66%

900A 8.3 -32.52%

1800 8.5 -30.89%

SE (Control) 12.3

Average $\hat{\pm}$ SD 900 6.51 $\hat{\pm}$ 0.67 -48.25%

900A 8.46 $\hat{\pm}$ 0.55 -32.75%

1800 8.67 $\hat{\pm}$ 0.65 -31.08%

SE (Control) 12.58 $\hat{\pm}$ 0.95

5. Radiation Bioactivity According to its Intensity (or According to the Distance from the Antenna)

The aim of this set of experiments was to investigate the dependence of GSM 900 MHz and DCS 1800 MHz bioactivity on their intensity, at different intensity levels that people are exposed to, from mobile phones and base station antennas. The radiation from base station antennas is almost identical to that of corresponding mobile phones but it is about 100 times stronger. Thus distances from mobile phones antennas correspond to about 100 times longer distances from base station antennas of the same type of radiation.

It is difficult to set up experiments regarding exposures from base station antennas since there is no way to have a sham exposed group of experimental animals under identical environmental conditions but without being exposed to the radiation at the same time. Thus we thought that the only way to simulate the reality of the exposure by a base station antenna is to expose the animals at different distances from a mobile phone within the lab.

Biological effects of mobile telephony signals at different intensities- distances from the antenna of a mobile phone handset, resembling effects from base station signals within residential areas, were not performed until now.

In each single experiment of this set, we separated the collected insects into thirteen groups: The first group (named "0") was exposed to GSM 900 MHz or to DCS 1800 MHz

field with the mobile phone antenna in contact with the glass vial containing the flies. The second (named "1"), was exposed to GSM 900 MHz or to DCS 1800 MHz field, at 1 cm distance from the mobile phone antenna. The third group (named "10") was exposed to GSM 900 MHz or to DCS 1800 MHz field at 10 cm distance from the mobile phone antenna. The fourth group (named "20") was exposed to GSM 900 MHz or to DCS 1800 MHz field at 20 cm distance from the mobile phone antenna, etc, the twelfth group (named "100") was exposed to GSM 900 MHz or to DCS 1800 MHz field at 100 cm distance from the mobile phone antenna. Finally, the thirteenth group (named "SE") was the sham exposed. Each group consisted of ten male and ten female insects as previously.

Radiation and field measurements in contact and at different distances from the mobile phone antenna, for six min of modulated emission, for GSM 900 MHz and DCS 1800 MHz in the RF and ELF ranges excluding the background electric and magnetic fields of 50 Hz, are given in Table 5. All the values shown in Table 5, are averaged over ten separate measurements of each kind $\hat{A} \pm$ standard deviation (S.D.).

The measurements reveal that although ELF electric and magnetic fields fall at almost zero levels for distances longer than 50 cm from both GSM 900 and DCS 1800 mobile phone antennas,

the RF components of the signals are still evident for distances up to 100 cm, (Table 5).

The Average mean values of reproductive capacity (number of F1 pupae) from six identical experiments with each kind of radiation are shown in Table 6 and represented in Figures 5, 6. The statistical analysis (single factor Anova test) shows that the probability that

the reproductive capacity differs between groups, owing to random variations, is negligible, $P < 10^{-8}$. Once again there was no temperature increases within the vials during the exposures.

The results show that the effect of mobile telephony radiation is maximum at zero distance (intensities higher than $200 \mu\text{W}/\text{cm}^2$) and then becomes maximum at a distance of 20-30 cm from

the antenna, depending on the intensity of radiation (GSM or DCS). This distance corresponds to an intensity around $10 \mu\text{W}/\text{cm}^2$ for both types of radiation in regards to the RF components.

Table 5. Radiation and Field Intensities in the Microwave and ELF regions

Distance

from

Antenna

(cm)

GSM Radiation

Intensity at 900

MHz, (mW/cm²)

GSM

Electric

Field

Intensity

at 217 Hz,

(V/m)

GSM

Magnetic

Field

Intensity

at 217 Hz,

(mG)

DCS Radiation

Intensity at

1800 MHz,

(mW/cm²)

DCS

Electric

Field

Intensity

at 217 Hz,

(V/m)

GSM

Magnetic

Field

Intensity

at 217 Hz,

(mG)

0 0.380 $\hat{A}\pm 0.058$ 19 $\hat{A}\pm 2.5$ 0.9 $\hat{A}\pm 0.15$ 0.250 $\hat{A}\pm 0.048$ 13 $\hat{A}\pm 2.1$ 0.6 $\hat{A}\pm 0.08$

1 0.260 $\hat{A}\pm 0.047$ 12 $\hat{A}\pm 1.7$ 0.7 $\hat{A}\pm 0.13$ 0.068 $\hat{A}\pm 0.015$ 6 $\hat{A}\pm 0.8$ 0.4 $\hat{A}\pm 0.07$

10 0.062 $\hat{A}\pm 0.020$ 7 $\hat{A}\pm 0.8$ 0.3 $\hat{A}\pm 0.05$ 0.029 $\hat{A}\pm 0.005$ 2.9 $\hat{A}\pm 0.48$ 0.2 $\hat{A}\pm 0.05$

20 0.032 $\hat{A}\pm 0.008$ 2.8 $\hat{A}\pm 0.4$ 0.2 $\hat{A}\pm 0.04$ 0.012 $\hat{A}\pm 0.002$ 0.7 $\hat{A}\pm 0.12$ 0.1 $\hat{A}\pm 0.02$

30 0.010 $\hat{A}\pm 0.002$ 0.6 $\hat{A}\pm 0.09$ 0.1 $\hat{A}\pm 0.02$ 0.007 $\hat{A}\pm 0.001$ 0.3 $\hat{A}\pm 0.06$ 0.06 $\hat{A}\pm 0.01$

40 0.006 $\hat{A}\pm 0.001$ 0.2 $\hat{A}\pm 0.03$ 0.05 $\hat{A}\pm 0.01$ 0.004 $\hat{A}\pm 0.0007$ 0.1 $\hat{A}\pm 0.04$ 0

50 0.003 $\hat{A}\pm 0.0006$ 0.1 $\hat{A}\pm 0.02$ 0 0.002 $\hat{A}\pm 0.0003$ 0 0

60 0.002 $\hat{A}\pm 0.0003$ 0 0 0.0016 $\hat{A}\pm 0.0002$ 0 0

70 0.0017 $\hat{A}\pm 0.0002$ 0 0 0.0014 $\hat{A}\pm 0.0002$ 0 0

80 0.0012 $\hat{A}\pm 0.0002$ 0 0 0.0008 $\hat{A}\pm 0.0002$ 0 0

90 0.0010 $\hat{A}\pm 0.0001$ 0 0 0.0005 $\hat{A}\pm 0.0001$ 0 0

100 0.0004 $\hat{A}\pm 0.0001$ 0 0 0.0002 $\hat{A}\pm 0.0001$ 0 0

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Table 6. Effect of Modulated GSM and DCS radiation-fields on the Reproductive Capacity at different Distances-Intensities from the antenna

Groups

-Distance from

mobile phone

antenna, (cm)

Average Mean

Number

of F1 Pupae

per Maternal Fly,

for GSM 900

MHz

Deviation

from Sham

Exposed Group

Average Mean

Number of F1

Pupae per

Maternal Fly, for

DCS 1800 MHz

Deviation

from Sham

Exposed Group

0 7.45 $\hat{A} \pm 0.72$ -46.01 % 9.26 $\hat{A} \pm 0.68$ -34.00 %
1 9.38 $\hat{A} \pm 0.61$ -32.03 % 11.36 $\hat{A} \pm 0.54$ -19.03 %
10 11.29 $\hat{A} \pm 0.80$ -18.19 % 11.93 $\hat{A} \pm 0.71$ -14.97 %
20 11.52 $\hat{A} \pm 0.79$ -16.52 % 9.19 $\hat{A} \pm 0.62$ -34.50 %
30 7.33 $\hat{A} \pm 0.58$ -46.88 % 13.03 $\hat{A} \pm 0.83$ -7.13 %
40 12.88 $\hat{A} \pm 0.98$ -6.67 % 13.76 $\hat{A} \pm 0.85$ -1.92 %
50 13.48 $\hat{A} \pm 0.81$ -2.32 % 13.85 $\hat{A} \pm 0.74$ -1.28 %
60 13.61 $\hat{A} \pm 0.84$ -1.38 % 14.00 $\hat{A} \pm 0.91$ -0.21 %
70 13.70 $\hat{A} \pm 0.91$ -0.72 % 14.21 $\hat{A} \pm 0.89$ +1.28 %
80 13.97 $\hat{A} \pm 0.77$ +1.23 % 14.07 $\hat{A} \pm 0.79$ +0.29 %
90 13.74 $\hat{A} \pm 0.96$ -0.43 % 14.02 $\hat{A} \pm 1.03$ -0.07 %

100 $14.02 \hat{\pm} 1.01 +1.59 \%$ $14.31 \hat{\pm} 1.08 +2.00 \%$

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Intensity Effect of GSM 900 MHz Radiation

SE 0 1 10 20 30 40 50 60 70 80 90 100

Mean number of F1 pupae per maternal insect

Groups

Figure 5. Reproductive Capacity in relation to the Distance from a GSM 900 MHz mobile phone

antenna. The decrease in reproductive capacity is maximum at zero distance and at 30 cm distance from

the antenna, corresponding to RF intensities $380 \hat{\mu}W/cm^2$ and $10 \hat{\mu}W/cm^2$ (Table 5).

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Intensity Effect of DCS 1800 MHz Radiation

SE 0 1 10 20 30 40 50 60 70 80 90 100

Mean number of F1 pupae per maternal insect

Groups

Figure 6. Reproductive Capacity in relation to the Distance from a DCS 1800 MHz mobile phone antenna. The decrease in reproductive capacity is maximum at zero distance and at 20 cm distance from

the antenna, corresponding to RF intensities $250 \mu\text{W}/\text{cm}^2$ and $12 \mu\text{W}/\text{cm}^2$ (Table 5).

The effect on the reproductive capacity diminishes considerably for distances longer than 50 cm from the mobile phone antenna and disappears for distances longer than 80-90 cm, corresponding to radiation intensities smaller than $1 \mu\text{W}/\text{cm}^2$. For distances longer than 50 cm where the ELF components fall within the background, the decrease in reproductive capacity is within the standard deviation. This might suggest that the ELF components of digital mobile telephony signals, play a key role in their bio-activity, alone or in conjunction with the RF carrier wave.

We have recorded the existence of an "intensity window" around $10 \mu\text{W}/\text{cm}^2$ (in regards to the RF intensity) where the bio-effect becomes even more intense than at intensities higher

than $200 \frac{1}{4} W/cm^2$. This intensity window appears at a distance of 20-30 cm from a mobile phone antenna, which corresponds to a distance of about 20-30 meters from a base station antenna. Since mobile telephony base station antennas are usually located within residential areas, at distances 20-30 m from such antennas there are often houses and work places where people are exposed up to 24 hours per day.

Although intensity windows on the bio-effects of RF radiations have been recorded since many years, (Bawin et al 1975; 1978; Blackman et al, 1980), there is still no widely accepted explanation for their existence.

6. The Decrease in Reproductive Capacity is due to Cell Death in the Gonads

In each experiment of this final sixth set, we separated the collected insects into five groups.

The first four groups were the same just as in the No 4 experiments: The first group (named

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“900”) was exposed to GSM 900 MHz field with the mobile phone antenna in contact with

the glass vial containing the flies. The second (named “900A”), was exposed to GSM 900

MHz at 1cm distance from the mobile phone antenna. The third group (named “1800”) was

exposed to DCS 1800 MHz field with the mobile phone antenna in contact with the glass vial.

The fourth group (named “SE”) was sham-exposed. Finally there was an additional fifth

group (named “C”) which was the control. While sham-exposed animals were treated exactly

as the exposed ones except that the mobile phone was turned off during the “exposures” ,

control animals were never exposed in any way or even taken out of the culture room. Each

group consisted as always of ten male and ten female insects.

In this set of experiments, there was an additional 6 min exposure in the morning of the sixth day, and one hour later female insects from each group were dissected and prepared for TUNEL assay. This additional exposure time was the only difference in the exposure procedure from the previous sets of experiments. Since we were studying the effect on early and mid oogenesis during which the egg chambers develop from one stage to the next within few hours, (King, 1970), an additional exposure, one hour before dissection and fixation of the ovarioles, was proven to be important in recording immediate effects on DNA fragmentation.

The most anterior region of the ovariole is called the germarium. The most sensitive developmental stages during oogenesis for stress-induced apoptosis, are region 2 within the germarium referred to as "germarium checkpoint" and stages 7-8 just before the onset of vitellogenesis, referred to as "mid-oogenesis checkpoint", (Drummond-Barbosa and Spradling, 2001; McCall 2004). The nurse cells (NC) and follicle cells (FC) of both checkpoints, were found to be very sensitive to stress factors like poor nutrition, (Drummond-Barbosa and Spradling, 2001; Smith et al., 2002), or exposure to cytotoxic chemicals like etoposide or staurosporine, (Nezis et al., 2000). Apart from these two check points, egg chambers were not observed before to degenerate during other provitellogenic or vitellogenic stages, (germarium to stage 10), (Drummond-Barbosa and Spradling, 2001; McCall 2004). To determine the ability of GSM and DCS radiation to act as possible stress factors able to induce cell death during early and mid oogenesis, we used TUNEL assay, as described above. The samples from different experimental groups were blindly observed under the fluorescence microscope (i.e. the observer did not know the origin of the sample) and the percentage of egg chambers with TUNEL positive signal was scored in each sample.

Statistical analysis was made by single factor Analysis of Variance test.

In Table 7 the summarised data from 8 separate experiments are listed. The data reveal that both GSM 900 and DCS 1800 mobile telephony radiations strongly induce cell death, (DNA fragmentation) in ovarian egg chambers of the exposed groups, (63.01% in 900, 45.08% in 900A and 39.43% in 1800), while in the SE and C groups the corresponding percentage of cell death was only 7.78% and 7.75% respectively.

Ovarian cell death between the control group and the sham exposed group did not differ significantly, (differences were within standard deviation) and this is why the data from the C group are omitted in Table 7.

Electromagnetic stress from mobile telephony radiations was found in our experiments to be much more bioactive than previously known stress factors like poor nutrition or cytotoxic chemicals, inducing cell death to a higher degree not only to the above check points but to all developmental stages of early and mid oogenesis and moreover to all types of egg chamber cells, i.e. nurse cells, follicle cells and the oocyte (OC), (Panagopoulos et al, 2007a).

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a S8

S4

G S1 S2 S3

c

S8

S1

G

S8

G

2a

2b

OC

NC

FC

S8

S4

S3

S2

G S1

S7

b

c

S4

Figure 7. a) Ovariole of a sham exposed female insect with TUNEL negative egg chambers at all the

developmental stages from germarium (G) to stage 8. b) Ovariole of exposed female insect with

TUNEL positive signal at both check-points, germarium and stage 8 and TUNEL negative signal at the

intermediate stages. c) Ovarioles of exposed female insects with TUNEL positive signals at all the

developmental stages and in all types of egg chamber cells, nurse cells (NC), follicle cells (FC) and the

oocyte (OC).

Table 7. Effect of GSM, DCS fields on Ovarian Cell Death

Groups Dev. Stages

Ratio of TUNEL

Positive to Total

Number of Eggchambers

of each

dev. stage

Sum Ratio of

TUNEL Positive to

Total Number of

Egg-chambers of

all stages

Percentage

of TUNEL

Positive Egg

chambers

Deviation

from

Sham

Exposed

Groups

SE

Germanium

1-6

7-8

9-10

37/186

32/1148

78/364

7/282

154/1980 7.78% 0%

900

Germanium

1-6

7-8

9-10

165/189

675/1252

310/384

165/262

1315/2087 63.01% +55.23%

900A

Germanium

1-6

7-8

9-10

116/184

484/1248

213/374

117/257

930/2063 45.08% +37.30%

1800

Germarium

1-6

7-8

9-10

101/169

388/1202

196/358

91/239

776/1968 39.43% +31.65%

Figure 7a, shows an ovariole from a sham exposed female insect, containing egg chambers from germarium to stage 8, all TUNEL negative. This was the typical picture in the vast majority of ovarioles and separate egg chambers from female insects of the sham exposed and control groups. In the SE groups, only 154 egg chambers (including germaria) out of a total of 1980 in 8 replicate experiments (7.78%), were TUNEL positive (Table 7), a result that is in full agreement with the rate of spontaneously degenerated egg chambers

normally observed during *Drosophila* oogenesis, (Nezis et al., 2000; Baum et al., 2005).

Figure 7b shows an ovariole of exposed female insect (group 900A), with a TUNEL positive signal in the nurse cells at both checkpoints, germarium and stage 8, while egg chambers of intermediate stages are TUNEL negative. Corresponding pictures from 900 and 1800 (data not shown) had identical characteristics. The two checkpoints in all groups (exposed and SE/C) had the highest percentages of cell death compared to the other developmental stages 1-6 and 9-10, (Table 7). While in the SE groups the sum ratio of TUNEL positive to total number of egg chambers was slightly higher in stages 7-8 (78/364) than in the germarium (37/186), in all three exposed groups this ratio was higher in the germarium than in stages 7-8, (Table 7).

Figure 7c, shows ovarioles of exposed female insects (group 900A), with a TUNEL positive signal at all developmental stages from germarium to 7-8 and in all the cell types of the egg chamber, (nurse cells, follicle cells and the oocyte).

Although in most pictures the TUNEL positive signal was most evident in the nurse cells, in the majority of the egg chambers in all the exposed groups, a TUNEL positive signal was detected in all three kinds of egg chamber cells, (figures 1c).

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0,0

0,1

0,2

0,3

0,4

0,5

0,6

0,7

0,8

SE 900 900A 1800

Ovarian Cell Death induced by GSM and DCS Radiations

Number of TUNEL Positive to

Total Number of Egg Chambers

Groups

Figure 8. Mean ratio of Ovarian Cell Death (Number of TUNEL Positive to Total Number of Egg

Chambers), in each experimental group $\hat{\mu} \pm SD$, ($0.078 \hat{\mu} \pm 0.0335$ in SE, $0.630 \hat{\mu} \pm 0.0898$ in 900, $0.451 \hat{\mu} \pm$

0.0574 in 900A and $0.394 \hat{\mu} \pm 0.0777$ in 1800).

In the SE groups the ratio of TUNEL positive egg chambers of stages 9-10 was very small (7/282). In contrast, the corresponding ratio in all three exposed groups was significantly higher, (165/262 in 900, 117/257 in 900A and 91/239 in 1800).

The summarised data of Table 7 are represented in Fig.8.

The statistical analysis, (single factor Analysis of Variance test), showed that the probability that groups differ between them because of random variations, is negligible, $P < 10^{-13}$.

Our experiments and the statistical analysis show that genomic DNA fragmentation of the egg chambers cells is induced by the mobile telephony radiation. Both types of radiation, GSM 900MHz and DCS 1800MHz induce cell death in a large number (up to 55% in relation

to control), of ovarian egg chambers in the exposed insects with only 6 min exposure per day for a limited period of 6 days.

DNA fragmentation is induced in all cases predominantly at the two developmental stages named checkpoints, germarium and stages 7-8. Since the above check points were already known to be the most sensitive stages in response to other stress factors, (Chao and Nagoshi 1999; De Lorenzo et al., 1999; Nezis et al., 2000; Drummond-Barbosa and Spradling 2001; McCall 2004), such an observation could be expected. Our results show that these two checkpoints are the most sensitive stages also in response to electromagnetic stress. However the germarium checkpoint was found to be even more sensitive than stages 7-8 in response to this particular stress. Thereby the two check points are not equally responsive to distinct types of stress and may therefore also respond differentially to other types of stress stimuli. A

possible explanation for the more sensitive germarium stage is that it may be more effective
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in evolutionary terms for the animal to block development of any defective egg chamber at the beginning rather than at later stages, in order to prevent the waste of precious nutrients.

In the sham exposed/control groups, induced DNA fragmentation was observed almost exclusively at the two developmental stages named check-points (37/186 in the germarium and 78/364 in stage 7-8) and only in few cases at the other provitellogenic and vitellogenic stages, 1-6 (32/1148) and 9-10 (7/282), correspondingly. In contrast, ovarian egg chambers of animals from all three exposed groups, were found to be TUNEL positive to a high degree at all developmental stages from germarium to stage 10, (Table 7).

In all cases (both in the sham exposed/control and also in the exposed groups), the TUNEL positive signal was more intense at the two check points, germarium and stages 7-8,

than at the other developmental stages.

There was no detectable temperature increase within the vials during the exposures, therefore the effects are considered as non-thermal.

In this set of experiments, cell death was detected for the first time during all the developmental stages of early and mid oogenesis in *Drosophila*, from germarium to stage 10 and in all types of egg chamber cells, (nurse cells, follicle cells, oocyte). A possible explanation for these effects is that the electromagnetic stress induced in the ovarian cells by the GSM and DCS fields, is a new and probably more intense type of external stress, against which ovarian cells do not have adequate defence mechanisms like they do in the case of poor nutrition or chemical stress.

It is important to emphasize that the recorded effect in the oocyte which undergoes meiosis during the last stages of oogenesis, may result in heritable mutations upon DNA damage induction and repair, if not in cell death.

The results of this set of experiments reveal that the large decrease of reproductive capacity found in the previous sets of experiments is due to elimination of large numbers of egg chambers during early and mid oogenesis, either via stress induced apoptosis or necrosis of their constituent cells, caused by the mobile telephony radiation.

Our present results are in agreement with results of other experimenters reporting DNA damage in other cell types, assessed by different methods than ours, after *in vivo* or *in vitro* exposure to GSM radiation, (Diem et al., 2005; Markova et al., 2005; Salford et al., 2003; Lai and Singh 1995; 1996).

We do not know if the ovarian cell death found in our experiments to be induced by mobile telephony radiation is due to apoptosis, i.e. caused by the organism in response to the

electromagnetic stress, or the result of necrosis caused directly by the electromagnetic radiation. This important issue remains to be uncovered.

A Plausible Mechanism for Mobile Telephony Radiation

Bioeffects

As we have previously reported, (Panagopoulos et al. 2000b; 2002; Panagopoulos and Margaritis 2003b), any external oscillating electromagnetic field can induce a forced vibration on the free ions that exist in large concentrations inside and outside all living cells in biological tissue playing a key role in all cellular functions initiating or accompanying all cellular biochemical processes.

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The forced-vibrational movement of the free ions is described by the equation,

$$m_i$$

$$\frac{d^2 x}{dt^2}$$

$$+ \frac{z q e}{4 \pi \epsilon_0} \frac{1}{r^2} \hat{E} \cos \omega t$$

$$= 0$$

$$\frac{d^2 x}{dt^2} + \frac{z q e}{4 \pi \epsilon_0} \frac{1}{r^2} \hat{E} \cos \omega t = 0$$

$$\frac{d^2 x}{dt^2} + \frac{z q e}{4 \pi \epsilon_0} \frac{1}{r^2} \hat{E} \cos \omega t = 0$$

$$\frac{d^2 x}{dt^2} + \frac{z q e}{4 \pi \epsilon_0} \frac{1}{r^2} \hat{E} \cos \omega t = 0$$

$$\frac{d^2 x}{dt^2} + \frac{z q e}{4 \pi \epsilon_0} \frac{1}{r^2} \hat{E} \cos \omega t = 0$$

$$\frac{d^2 x}{dt^2} + \frac{z q e}{4 \pi \epsilon_0} \frac{1}{r^2} \hat{E} \cos \omega t = 0$$

in the case of an external harmonically oscillating electric field: $\hat{E} = \hat{E}_0 \sin \omega t$ with circular

frequency: $\omega = 2\pi \hat{f}$ (\hat{f} , the frequency), where: z is the ion's valence, $q_e = 1.6 \times 10^{-19}$ Cb, the

electron's charge, $F_2 = -m\ddot{x}$

$2x$, a restoration force proportional to the displacement

distance x of the free ion, m the ion's mass and $\omega = 2\pi f$, with f

the ion's oscillation self -

frequency if the ion were left free after its displacement x . In our case, this restoration force

is found to be very small compared to the other forces and thus does not play any important

role. $F_3 = -\gamma \dot{x}$ is the damping force, where $u =$

dx

dt , is the ion's velocity and γ , is the

attenuation coefficient for the ion's movement, which for the cytoplasm or the extracellular

medium is calculated to be $\gamma \approx \dots 10^{-12}$ Kg/sec, while for ions moving inside channel proteins, is

calculated to have a value: $\gamma \approx \dots 6.4 \times 10^{-12}$ Kg/sec, (in the case of K^+ ions, moving through

open K^+ channels), (Panagopoulos et al 2000b).

We have shown that the general solution of equation [1], is:

$x =$

$\frac{Ezq_0 e}{m\omega^2}$

$\cos \omega t -$

$\frac{Ezq_0 e}{m\omega^2}$

$\cos \omega t$

$\frac{Ezq_0 e}{m\omega^2}$

[2]

Since the second term of [2] is constant, the vibrational movement is described by the

equation:

$$x =$$

$$E z q o e$$

$$\hat{I} \gg \ddot{I} \omega_0$$

$$\cos \ddot{I} \omega_0 t \quad [3]$$

Eq. [3] shows that the forced - vibration is in phase with the external force. The amplitude of the free ions forced vibration is,

$$A =$$

$$E z q o e$$

$$\hat{I} \gg \ddot{I} \omega_0$$

$$[4]$$

Thus, the amplitude is proportional to the intensity and inversely proportional to the frequency of the external oscillating field.

Once this amplitude exceeds some critical value the coherent forces that the ions exert on the voltage sensors of voltage-gated membrane channels can trigger the irregular opening or closing of these channels, thus disrupting cell's electrochemical balance and function.

We have shown that in the most bioactive case of pulsed fields and for double valence cations (i.e. Ca^{+2}) interacting with the channel sensor, the condition for irregular gating of the channel becomes:

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$$\hat{I} \bullet o$$

$$\hat{a} \omega_0 \gg \hat{I}^{1/2} \tilde{A} \sim 0.625 \tilde{A} \sim 10^{-4} \quad [5]$$

($\hat{I}^{1/2}$ in Hz, $\hat{I} \bullet o$ in V/m). Whenever [5] is satisfied, the external field E can irregularly gate the

ion channel.

Relation [5] declares that external ELF electric fields with intensities less than tenths of a mV/m should theoretically be able to disrupt cell function by irregular gating of ion channels (!)

According to this mechanism, lower frequency fields are the most bioactive ones and additionally pulsed fields are shown to be more bioactive than continuous, (uninterrupted) , ones, (Panagopoulos et al., 2002).

Thereby, the ELF components of the mobile telephony signals are certainly within the criteria of this theory and thus able to produce the reported effects on living organisms.

Somebody may wonder, how could be possible that irregular gating of ionic channels on a cell membrane could lead to cell death.

Let us consider the irregular gating of ion channels on a cell's plasma membrane. If the electrochemical balance is destroyed by irregular increase of intracellular ion concentration, then water molecules may enter the cell driven by osmotic forces, proportional to the concentration increase. Such an effect could be able to cause the cell to swell out and the plasma membrane to get ruptured, resulting to cell necrosis.

It is known that perturbations of intracellular Ca^{+2} concentrations are responsible for apoptotic triggering, (Zhou et al., 1998; Sheikh and Huang, 2004; Santini et al. 2005).

Therefore, another scenario of cell death, caused by irregular gating of ion channels, could be that due to altered intracellular Ca^{+2} concentrations, a false signal may be given to initiate apoptosis.

A common event leading to both apoptosis and necrosis is mitochondrial membrane permeabilization, (Armstrong 2006). This can also be done by direct action of an external EMF on mitochondrial membrane Ca^{+2} channels. Apoptosis is connected with increased

mitochondrial concentration of Ca²⁺ ions, released from the endoplasmic reticulum, (Santini et al., 2005). A false uptake of Ca²⁺ ions by mitochondria can be due to irregular opening of mitochondrial Ca²⁺ channels, or due to increased cytosolic Ca²⁺ concentration, caused by irregular release either through the membrane of endoplasmic reticulum or through the plasma membrane. In all cases this could be done by irregular gating of electrosensitive Ca²⁺ channels which exist in all cell membranes.

We have just described few of the many hypothetical but very possible biochemical scenarios which could very explain by means of the above described biophysical theory, the effects of DNA damage recorded in our experiments as well as in other labs experiments, (Diem et al., 2005; Markova et al., 2005; Salford et al., 2003; Lai and Singh 1995; 1996).

Conclusions

As shown by increasing number of biological, clinical and epidemiological studies, the radiations emitted by mobile telephony, at levels that people are daily exposed, are highly bioactive producing a variety of effects on living organisms.

Our studies regarding the effects of mobile telephony radiations on a biological model, the reproductive capacity of the insect *Drosophila melanogaster*, have investigated different

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physical parameters of these radiations, like intensity, carrier frequency, pulse repetition frequency, distance from the antenna, e.t.c.

Our experiments have shown a large decrease in reproductive capacity caused by the GSM and DCS fields-radiation. The recorded effect is due to extensive DNA fragmentation on reproductive cells of the experimental animal, induced by these fields-radiation.

Thus, digital mobile telephony radiations nowadays exert an intense biological action able to kill cells, damage DNA, or decrease dramatically the reproductive capacity of living organisms. Diminishes of bird and insect populations can be explained according to reproduction decreases. Phenomena like headaches, fatigue, sleep disturbances, memory loss e.t.c. reported as "microwave syndrome" can possibly be explained by cell death on a number of brain cells during daily exposures from mobile telephony antennas.

Our experiments show that radiation intensities higher than 1 mW/cm^2 are able to decrease reproduction of living organisms by killing reproductive cells. Our opinion is that the international exposure limits for these radiations should be set not higher than 1 mW/cm^2 . Since short term exposures for few minutes per day are able to produce so intense effects on living organisms, the criteria should not be set according to average values but according to maximum values during the exposure periods.

Our experiments reveal that exposure at a distance of 20-30 cm from a mobile phone can be even more bioactive than exposure in contact with the antenna, due to the existence of an "intensity window" around 10 mW/cm^2 . This intensity, in the case of a usual base station antenna corresponds to a distance of about 20-30 m from the antenna.

Although both types of radiation examined are found to be highly bioactive, GSM 900 MHz seems to be even more bioactive than DCS 1800 MHz, mainly due to higher intensity, but also even when it is emitted at almost the same intensity. Since differences in bioactivity between the two types of radiation under the same intensity are within standard deviation, it seems that RF carrier frequency plays a minimal role in the bioactivity of this radiation, in contrast to the ELF pulse repetition frequencies and the radiation and field intensities that

seem to be of great importance in regards to bioactivity.

The ELF components of the mobile telephony signals, seem to play a key role on their bio-effects, since the recorded effects are considerably diminished at distances that these components fall within the background of stray 50 Hz electric and magnetic fields. This supports that lower frequency fields are more bioactive than higher frequency ones with the same rest characteristics, as it is predicted by our theory, (Panagopoulos et al 2000b; 2002), and supported by other experimental evidence, (Lin Liu and Adey 1982; Penafiel et al 1997).

A plausible explanation of the effects of mobile telephony radiations on living organisms is given by the biophysical mechanism that we have proposed, (Panagopoulos et al. 2000b; 2002; Panagopoulos and Margaritis 2003b). According to this mechanism, altered intracellular ionic concentrations due to irregular gating of ion channels on the cell membranes by an external electromagnetic field can initiate cell death through apoptosis or necrosis.

Similar effects on humans with those recorded in our experiments on insects, are considered to be possible because first, insects are found to be more resistant to radiations than mammals, (Koval and Kazmar 1988, Koval et al 1979, 1977, Abrahamson et al 1973) and second, our results are in agreement with reported effects on mammals, (Lai and Singh 1995; 1996; Aitken et al., 2005; Salford et al., 2003).

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Scientific evidence implies the need of reconsideration of the current exposure criteria to account for non-thermal effects which constitute the large majority of the recorded biological and health effects. Since Mobile Telephony has become part of our daily life, a better design of base station antenna networks towards the least exposure of residential areas and a very

cautious use of mobile phones, is necessary.

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Human populations are increasingly exposed to microwave/radiofrequency (RF) emissions from wireless communication technology, including mobile phones and their base stations. By searching PubMed, we identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone base stations. Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of longterm mobile phone base station exposure are urgently required to more definitively understand its health impact. *Key words:* base stations; electromagnetic field (EMF); epidemiology; health effects; mobile phone; radiofrequency (RF); electromagnetic radiation.

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INTRODUCTION

Mobile phone base stations are now found ubiquitously in communities worldwide. They are frequently found near or on shops, homes, schools, daycare centers, and hospitals (Figure 1). The radiofrequency (RF) electromagnetic radiation from these base stations is regarded as being low power; however, their output is continuous. This raises the question as to whether the health of people residing or working in close proximity to base stations is at any risk.

METHODS

By searching PubMed and using keywords such as base station, mast, electromagnetic field (EMF), radiofrequency (RF), epidemiology, health effects, mobile phone, and cell phone, and by searching the references of primary sources, we were able to find only 10 human population studies from seven countries that examined the health effects of mobile phone base stations. Seven of the studies explored the association between base station proximity and neurobehavioral symptoms via population-based questionnaires; the other three retrospectively explored the association between base station proximity and cancer via medical

records. A meta-analysis based on this literature is not possible due to differences in study design, statistical measures/risk estimates, exposure categories, and endpoints/outcomes. The 10 studies are therefore summarized in chronological order (Table 1).

TABLE 1 Summary of Epidemiological Studies of Mobile Phone Base Station Health Effects

Publication (Year; Country)	Clinical Assessment	Study Design	Base Station Details	Participants	EMF Measured	Key Findings	Strengths	Limitations
Navarro ² (2003; Spain)	Neuro-behavioral	Survey- questionnaire	GSM-DCS 1800 MHz	101	Yes	More symptoms with closer proximity to base station (< 150 m)	Detailed questionnaire, EMF measured, distances studied ^b	Low participation, self-estimated distances, subjects aware ^b
Samitini ² (2003; France)	Neuro-behavioral	Survey- questionnaire	n/s	530	No	More symptoms with closer proximity to base station (< 300 m)	Detailed questionnaire, distances & other EMF exposures assessed	As above, plus no EMF measurements, no base station details
Eger ⁷ (2004; Germany)	Cancer incidence	Retrospective case review	GSM 935 MHz	967	No	3 x risk of cancer after 5 yrs of exposure (< 400 m); early age of cancer diagnosis	Maximum beam intensity calculated, reliable cancer data collection	Other environmental risk factors not assessed; analysis not adjusted for age and sex.
Wolf & Wolf ⁸ (2004; Israel)	Cancer incidence	Retrospective case review	TDMA 850 MHz	1844	Yes	> 4 x risk of cancer after 3-7 yrs exposure (< 350 m); early age of cancer diagnosis	Reliable cancer & demographic data, no other major environmental pollutant identified	Not all environmental risk factors assessed; possible selection bias; no age, sex adjustment.
Gadzicka ⁴ (2006; Poland)	Neuro-behavioral	Survey- questionnaire	n/s	500	No	More headache with proximity < 150 m; nocebo unlikely ^c	Detailed questionnaire, distances & EMF studied, nocebo studied	Subjects aware, no base station details
Huittel ⁵ (2006; Austria)	Neuro-behavioral	Cross-sectional	900 MHz	336	Yes	Headaches & impaired concentration at higher power density; nocebo unlikely	Detailed questionnaire and testing, EMF measured, distances studied, nocebo effect studied	Subjects aware, low participation rate
Meyer ⁹ (2006; Germany)	Cancer incidence	Retrospective case review	n/s	177,428	No	No increased cancer incidence in municipalities with or without base stations	Wide population assessed (Bavaria)	Observation period only 2 years, vague definitions of exposure, exposure onset unknown, distance to base station unknown
Abdel-Rassoul ⁶ (2007; Egypt)	Neuro-behavioral	Cross-sectional	n/s	165	Yes	More symptoms & lower cognitive performance if living under or < 10 m from base station	Detailed questionnaire and testing, EMF measured, distances studied, subjects unaware	Exact base station details n/s, low number of participants
Bletner ¹⁰ (2009; Germany)	Neuro-behavioral	Cross-sectional	n/s	30,047	No	More health complaints closer to base station (< 500 m)	Wide population assessed, detailed survey, nocebo effect assessed	EMF measurements not carried out (see phase II in Berg-Beckhoff et al., 2009; below)
Berg-Beckhoff ¹¹ (2009; Germany)	Neuro-behavioral	Cross-sectional	GSM 900 MHz GSM 1800 MHz UMTS 1920-1980 MHz	1326	Yes	Health effects probably caused by stress and not by RF-EMF	Measured EMF emissions, standardized questionnaires	Low participation, no detailed list of symptoms published, single "spot" measurement in one place in dwelling, no occupational exposure assessed, time lag from assessment of symptoms and EMF measurement

n / s = not specified.

^a"Distance" refers to distance between base station and subjects' households

^b"Subjects aware" refers to study participants being aware of the nature of the study.

^c"Nocebo" effect unlikely because the majority of subjects in the study reported little or no concern for base station proximity.

RESULTS AND DISCUSSION

We found epidemiological studies pertaining to the

health effects of mobile phone base station RF emissions to be quite consistent in pointing to a possible adverse health impact. Eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. The studies by Navarro et al.,² Santini et al.,³ Gadzicka et al.,⁴ and Hutter et al.⁵ reported differences in the distance-dependent prevalence of symptoms such as headache, impaired concentration, and irritability, while Abdel-Rassoul et al.⁶ also found lower cognitive performance in individuals living δ 10 meters from base stations compared with the more distant control group. The studies by Eger et al.⁷ and Wolf and Wolf⁸ reported increased incidence of cancer in persons living for several years < 400 meters from base stations. By contrast, the large retrospective study by Meyer et al.⁹ found no increased incidence of cancer near base stations in Bavaria. Blettner et al.¹⁰ reported in Phase 1 of their study that more health problems were found closer to base stations, but in Phase 2¹¹ concluded that measured EMF emissions were not related to adverse health effects (Table 1). Each of the 10 studies reviewed by us had various strengths and limitations as summarized in Table 1. Per-

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Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations

VINI G. KHURANA, LENNART HARDELL, JORIS EVERAERT, ALICJA BORTKIEWICZ, MICHAEL CARLBERG, MIKKO AHONEN

Received from: Department of Neurosurgery, The Canberra Hospital, The Australian National University Medical School, Garran, Australia (VGK); Department of Oncology, University Hospital, Orebro, Sweden (LH, MC); Research Institute for Nature and Forest [INBO], Brussels, Belgium (JE); Department of Work Physiology and Ergonomics, Nofer Institute of Occupational Medicine, Lodz, Poland (AB); Department of Computer Science, University Hospital, Orebro, Sweden (MA). Send correspondence to: Dr. Vini G. Khurana, Department of Neurosurgery, The Canberra Hospital, PO Box 103, Woden ACT 2606, Australia; email: <vgkhurana@gmail.com>.

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taining to those base station studies in which EMF measurements were not carried out,^{3,4,7,9} it should be noted that distance is not the most suitable classifier for exposure to RF-EMF. Antennae numbers and configurations, as well as the absorption and reflection of their fields by

houses, trees, or other geographic hindrances may influence the exposure level. Further, self-estimation of distance to nearest base station is not the best predictor of exposure since the location of the closest base station is not always known. Such exposure misclassification inevitably biases any association towards null. Multiple testing might also produce spurious results if not adjusted for,^{3,5} as might failure to adjust for participant age and gender.⁷ Latency is also an important consideration in the context of cancer incidence following or during a putative environmental exposure. In this regard, the study by Meyer et al.⁹ found no association between mobile phone base station exposure and cancer incidence, but had a relatively limited observation period of only two years. On the other hand, the studies by Eger et al.⁷ and Wolf and Wolf⁸ found a significant association between mobile phone base station exposure and increased cancer incidence, although the approximate five-year latency between base station exposure and cancer diagnosis appears to be unexpectedly short in both of these studies.

Other problems in several population-based questionnaires are the potential for bias, especially selection⁸ and participation^{2,3,5,6,11} biases, and self-reporting of outcomes in combination with the exposure assessment methods used. For example, regarding limitations in exposure assessment, in a large two-phase base station study from Germany,^{12,13} of the Phase 1 participants (n = 30,047), only 1326 (4.4%) participated with a single “spot” EMF measurement recorded in the bedroom for Phase 2. Further, health effect contributions from all relevant EMF sources and other non-EMF environmental sources need to be taken into account.¹² We acknowledge that participant concern instead of exposure could be the triggering factor of adverse health effects, however this “nocebo effect” does not appear to fully explain the findings.^{4,5} Further, the biological relevance of the overall adverse findings (Table 1) is supported by the fact that some of the symptoms in these base-station studies have also been reported among mobile phone users, such as headaches, concentration difficulties, and sleep disorders.^{13,14} Finally, none of the studies that found adverse health effects of base stations reported RF exposures above accepted international guidelines, the implication being that if such findings continue to be reproduced, current exposure standards are inadequate

in protecting human populations.¹⁵

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Figure 1—Mobile phone base stations ("antennae" or "masts") in Australia. Upper left: Community shop roof showing plethora of flat panel antennae. Upper right: Hospital roof with flat panel antennae painted to blend in. Lower left: Top of a street light pole. Lower center: Mast erected next to a daycare center. Lower right: Antennae mounted on an office block top floor.

CONCLUSIONS

Despite variations in the design, size and quality of these studies as summarized in Table 1, it is the consistency of the base-station epidemiological literature from several countries that we find striking. In particular, the increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations found in 80% of the available studies. It should be pointed out that the overall findings of health problems associated with base stations might be based on methodological weaknesses, especially since exposure to RF electromagnetic radiation was not always measured.

There are some proposed mechanisms via which low-intensity EMF might affect animal and human health,^{16,17} but full comprehensive mechanisms still remain to be determined.^{18,19} Despite this, the accumulating epidemiological literature pertaining to the health effects of mobile phones^{13,20} and their base stations (Table 1) suggests that previous exposure standards based on the thermal effects of EMF should no longer be regarded as tenable. In August 2007, an international working group of scientists, researchers, and public health policy professionals (the BioInitiative Working Group) released its report on EMF and health.²¹ It raised evidence-based concerns about the safety of existing public limits that regulate how much EMF is allowable from power lines, cellular phones, base stations, and many other sources of EMF exposure in daily life. The BioInitiative Report²¹ provided detailed scientific information on health impacts when people were exposed to electromagnetic radiation hundreds or even thousands of times below limits currently established by the FCC and International Commission for Non-Ionizing Radiation Protection in

Europe (ICNIRP). The authors reviewed more than 2000 scientific studies and reviews, and have concluded that: (1) the existing public safety limits are inadequate to protect public health; and (2) from a public health policy standpoint, new public safety limits and limits on further deployment of risky technologies are warranted based on the total weight of evidence.²¹ A precautionary limit of 1 mW/m² (0.1 microW/cm² or 0.614 V/m) was suggested in Section 17 of the BioInitiative Report to be adopted for outdoor, cumulative RF exposure.²¹ This limit is a cautious approximation based on the results of several human RF-EMF studies in which no substantial adverse effects on well being were found at low exposures akin to power densities of less than 0.5 – 1 mW/m².^{2,5,22–26} RF-EMF exposure at distances > 500 m from the types of mobile phone base stations reviewed herein should fall below the precautionary limit of 0.614 V/m.

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Is 'electrosmog' harming our health?
Electrical pollution from cell phones and WiFi may be hazardous

<http://www.msnbc.msn.com/id/34509513/ns/health-cancer//>

By Michael Segell

Prevention

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In 1990, the city of La Quinta, CA, proudly opened the doors of its sparkling new middle school. Gayle Cohen, then a sixth-grade teacher, recalls the sense of excitement everyone felt: "We had been in temporary facilities for 2 years, and the change was exhilarating."

But the glow soon dimmed.

One teacher developed vague symptoms — weakness, dizziness — and didn't return after the Christmas break. A couple of years later, another developed cancer and died; the teacher who took over his classroom was later diagnosed with throat cancer. More instructors continued to fall ill, and then, in 2003, on her 50th birthday, Cohen received her own bad news: breast cancer.

"That's when I sat down with another teacher, and we remarked on all the cancers we'd seen," she says. "We immediately thought of a dozen colleagues who had either gotten sick or passed away."

By 2005, 16 staffers among the 137 who'd worked at the new school had been diagnosed with 18 cancers, a ratio nearly 3 times the expected number. Nor were the children spared: About a dozen cancers have been detected so far among former students. A couple of them have died.

Prior to undergoing her first chemotherapy treatment, Cohen approached the school principal, who eventually went to district officials for an investigation. A local newspaper article about the possible disease cluster caught the attention of Sam Milham, MD, a widely traveled epidemiologist who has investigated hundreds of environmental and occupational illnesses and published dozens of peer-reviewed papers on his findings. For the past 30 years, he has trained much of his focus on the potential hazards of electromagnetic fields (EMFs) — the radiation that surrounds all electrical appliances and devices, power lines, and home wiring and is emitted by communications devices, including cell phones and radio, TV, and WiFi transmitters.

His work has led him, along with an increasingly alarmed army of international scientists, to a controversial conclusion: The "electrosmog" that first began developing with the rollout of the electrical grid a century ago and now envelops every inhabitant of Earth is responsible for many of the diseases that impair — or kill — us.

Milham was especially interested in measuring the ambient levels of a particular kind of EMF, a relatively new suspected carcinogen known as high-frequency voltage transients, or "dirty electricity." Transients are largely by-products of modern energy-efficient electronics and appliances — from computers, refrigerators, and plasma TVs to compact fluorescent light bulbs and dimmer switches — which tamp down the electricity they use. This manipulation of current creates a wildly fluctuating and potentially dangerous electromagnetic field that not only radiates into the immediate environment but also can back up along home or office wiring all the way to the utility, infecting every energy customer in between.

With Cohen's help, Milham entered the school after hours one day to take readings. Astonishingly, in some classrooms he found the surges of transient pollution exceeded his meter's ability to gauge them. His preliminary findings prompted the teachers to file a complaint with the Occupational Safety and Health Administration, which in turn ordered a full investigation by the California Department of Health Care Services.

The final analysis, reported by Milham and his colleague, L. Lloyd Morgan, in 2008 in the *American Journal of Industrial Medicine*: Cumulative exposure to transients in the school increased the likelihood a teacher would develop cancer by 64%. A single year of working in the building raised risk by 21%. The teachers' chances of developing melanoma, thyroid cancer, and uterine cancer were particularly high, as great as 13 times the average. Although not included in the tabulations, the risks for young students were probably even greater.

"In the decades-long debate about whether EMFs are harmful," says Milham, "it looks like transients could be the smoking gun."

The case against EMFs

Cancer and electricity

Could a disease whose cause has long eluded scientists be linked to perhaps the greatest practical discovery of the modern era? For 50 years, researchers who have tried to tie one to the other have been routinely dismissed by a variety of skeptics, from congressional investigators to powerful interest groups — most prominently electric utilities, cell phone manufacturers, and WiFi providers, which have repeatedly cited their own data showing the linkage to be "weak and inconsistent."

Recently, however, in addition to the stunning new investigations into dirty electricity (which we'll return to), several developments have highlighted the growing hazards of EMF pollution — and the crucial need to address them.

The evidence showing harm is overwhelming

In 2007, the Bioinitiative Working Group, an international collaboration of prestigious scientists and public health policy experts from the United States, Sweden, Denmark, Austria, and China, released a 650-page report citing more than 2,000 studies (many very recent) that detail the toxic effects of EMFs from all sources. Chronic exposure to even

low-level radiation (like that from cell phones), the scientists concluded, can cause a variety of cancers, impair immunity, and contribute to Alzheimer's disease and dementia, heart disease, and many other ailments. "We now have a critical mass of evidence, and it gets stronger every day," says David Carpenter, MD, director of the Institute for Health and the Environment at the University at Albany and coauthor of the public-health chapters of the Bioinitiative report.

Fears about the hazards of cell phones seem justified

"Every single study of brain tumors that looks at 10 or more years of use shows an increased risk of brain cancer," says Cindy Sage, MA, coeditor of the report. A recent study from Sweden is particularly frightening, suggesting that if you started using a cell phone as a teen, you have a 5 times greater risk of brain cancer than those who started as an adult. The risk rises even more for people who use the phone on only one side of the head. While defenders of cell phone safety claim no scientist can explain why EMFs may be harmful in humans, a body of reliable and consistent animal research shows that electromagnetic fields, equal to those generated by mobile phones, open the blood-brain barrier, causing blood vessels to leak fluid into the brain and damage neurons. Ironically, that research (by renowned Swedish neuro-oncologist Leif G. Salford, MD, PhD) began with the goal of finding a way to deliver chemotherapy to brain tumors.

Other countries are revising exposure standards

Members of the European Union, which has led the way on EMF investigations, are moving quickly to protect their citizens, particularly children and pregnant women. In the past 2 years alone, France, Germany, and England have dismantled wireless networks in schools and public libraries, and other countries are pressing to follow suit. Israel has banned the placement of cellular antennae on residences, and Russian officials have advised against cell phone use for children under 18.

Electrical hypersensitivity (EHS) is becoming more widespread

Symptoms of EHS, a recently identified condition, include fatigue, facial irritation (resembling rosacea), tinnitus, dizziness, and digestive disturbances, which occur after exposure to visual display units, mobile phones, WiFi equipment, and commonplace appliances. Experts say up to 3% of all people are clinically hypersensitive, as many as one-third of us to a lesser degree.

Electrical pollution is increasing dramatically

"For the first time in our evolutionary history, we have generated an entire secondary, virtual, densely complex environment — an electromagnetic soup — that essentially overlaps the human nervous system," says Michael Persinger, PhD, a neuroscientist at Laurentian University who has studied the effects of EMFs on cancer cells. And it appears that, more than a century after Thomas Edison switched on his first light bulb, the health consequences of that continual overlap are just now beginning to be documented.

A history of harmful effects

Until Edison's harnessing of electricity, humans' only sources of EMF exposure were the

earth's static magnetic field (which causes a compass needle to point north) and cosmic rays from the sun and outer space; over our long evolution, we've adapted to solar EMFs by developing protective pigment. "But we have no protection against other EMF frequencies," says Andrew Marino, PhD, JD, a pioneer in bioelectromagnetics who has done extensive EMF research and a professor in the department of orthopedic surgery at the Louisiana State Health Sciences Center. "How quickly can we adapt our biology to these new exposures? It's the most important environmental health question — and problem — of the 21st century."

Research into the hazards of EMFs has been extensive, controversial — and, at least at the outset, animated by political intrigue. A sampling:

The Russians first noticed during World War II that radar operators (radar operates using radio frequency waves) often came down with symptoms we now attribute to electrical hypersensitivity syndrome. In the 1960s, during the height of the Cold War, they secretly bombarded the US embassy in Moscow with microwave radiation (a higher-frequency RF used to transmit wireless signals), sickening American employees. Radio wave sickness — also called microwave sickness — is now a commonly accepted diagnosis.

When television (also radio wave) was introduced in Australia in 1956, researchers there documented a rapid increase in cancers among people who lived near transmission towers.

In the 1970s, Nancy Wertheimer, PhD, a Denver epidemiologist (since deceased), detected a spike in childhood leukemia (a rare disease) among kids who lived near electric power lines, prompting a rash of studies that arrived at similar conclusions.

In the 1980s, investigators concluded that office workers with high exposure to EMFs from electronics had higher incidences of melanoma — a disease most often associated with sun exposure — than outdoor workers.

In 1998, researchers with the National Cancer Institute reported that childhood leukemia risks were "significantly elevated" in children whose mothers used electric blankets during pregnancy and in children who used hair dryers, video machines in arcades, and video games connected to TVs.

Over the past few years, investigators have examined cancer clusters on Cape Cod, which has a huge US Air Force radar array called PAVE PAWS, and Nantucket, home to a powerful Loran-C antenna. Counties in both areas have the highest incidences of all cancers in the entire state of Massachusetts.

More recently, the new findings on transients — particularly those crawling along utility wiring — are causing some scientists to rethink that part of the EMF debate pertaining to the hazards of power lines. Could they have been focusing on the wrong part of the EMF spectrum?

Transients: the post-modern carcinogen

Some earlier, notable — albeit aborted — research suggests this may be the case. In 1988, Hydro-Québec, a Canadian electric utility, contracted researchers from McGill University to study the health effects of power line EMFs on its employees. Gilles Theriault, MD, DrPH, who led the research and was chair of the department of occupational health at the university, decided to expand his focus to include high-frequency transients and found, even after controlling for smoking, that workers exposed to them had up to a 15-fold risk of developing lung cancer. After the results were published in the *American Journal of Epidemiology*, the utility decided to put an end to the study.

That research commenced at a time when energy-efficient devices — the major generators of transients — were beginning to saturate North American homes and clutter up power lines. A telltale sign of an energy-efficient device is the ballast, or transformer, that you see near the end of a power cord on a laptop computer, printer, or cell phone charger (although not all devices have them). When plugged in, it's warm to the touch, an indication that it's tamping down current and throwing off transient pollution. Two of the worst creators of transient radiation: light dimmer switches and compact fluorescent light bulbs (CFLs). Transients are created when current is repeatedly interrupted. A CFL, for instance, saves energy by turning itself on and off repeatedly, as many as 100,000 times per second.

So how does the human body respond to this pulsing radiation? "Think of a magnet," explains Dave Stetzer, an electrical engineer and power supply expert in Blair, WI. "Opposite charges attract, and like charges repel. When a transient is going positive, the negatively charged electrons in your body move toward that positive charge. When the transient flips to negative, the body's electrons are pushed back. Remember, these positive-negative shifts are occurring many thousands of times per second, so the electrons in your body are oscillating to that tune. Your body becomes charged up because you're basically coupled to the transient's electric field."

Keep in mind that all the cells in your body, whether islets in the pancreas awaiting a signal to manufacture insulin or white blood cells speeding to the site of an injury, use electricity — or "electron change" — to communicate with each other. By overlapping the body's signaling mechanisms, could transients interfere with the secretion of insulin, drown out the call-and-response of the immune system, and cause other physical havoc?

Some preliminary research implies the answer is yes. Over the past 3 years, Magda Havas, PhD, a researcher in the department of environmental and resource studies at Trent University in Ontario, has published several studies that suggest exposure to transients may elevate blood sugar levels among people with diabetes and prediabetes and that people with multiple sclerosis improve their balance and have fewer tremors after just a few days in a transient-free environment. Her work also shows that after schools installed filters to clean up transients, two-thirds of teachers reported improvement in symptoms that had been plaguing them, including headache, dry eye, facial flushing, asthma, skin irritation, and depression.

Transients are particularly insidious because they accumulate and strengthen, their frequency reaching into the dangerous RF range. Because they travel along home and utility wiring, your neighbor's energy choices will affect the electrical pollution in your house. In other words, a CFL illuminating a porch down the block can send nasty transients into your bedroom.

Something else is sending transients into your home: the earth. From your high school science texts, you know that electricity must travel along a complete circuit, always returning to its source (the utility) along a neutral wire. In the early 1990s, says Stetzer, as transients began overloading utility wiring, public service commissions in many states told utilities to drive neutral rods into the ground on every existing pole and every new one they erected. "Today, more than 70% of all current going out on the wires returns to substations via the earth," says Stetzer — encountering along the way all sorts of subterranean conductors, such as water, sewer, and natural-gas pipes, that ferry even more electrical pollution into your home.

A pragmatic proposal

Of course, these small studies — from Milham, Hydro-Québec, and Havas — hardly constitute a blanket indictment of transients. "We're still early in this part of the EMF story," says Carpenter. Does that mean as evidence of their harm accumulates, officials will raise a red flag? Not likely, if past EMF debates are any indication. Power companies have successfully beaten back attempts to modify exposure standards, and the cell phone industry, which has funded at least 87% of the research on the subject, has effectively resisted regulation. One good reason has had to do with latency — how long it takes to develop a particular cancer, often 25 years or more. Cell phones have been around only about that long.

But does that mean we avoid any discussion of their possible dangers? Again, if the past is a guide, the answer appears to be "probably." American scientists worried about the hazards of smoking, the DES (diethylstilbestrol) pill (given to pregnant women, it caused birth defects), asbestos, PCBs (polychlorinated biphenyls) — the list is lengthy — but officially warned about exposure only after they could say with absolute certainty that these things were harmful. As for protecting ourselves from toxic radiation, we have a lax — and laughable — history. In the 1920s, just a few years after medical imaging devices were invented, physicians were known to entertain their guests by X-raying them at garden parties. In the 1930s, scientists often kept radium in open trays on their desks. Shoe stores used X-ray machines in the 1940s to properly fit children's feet, and radioactive wristwatches with glowing hour hands were popular in the 1950s.

All of which means that, absent prudent safety standards from both public officials and manufacturers (adding a protective filter would add 5 cents to the cost of making a CFL and \$5 to the cost of a laptop), you'll have to protect yourself from EMFs. Here's a reasonable proposition: Practice what is known in Europe as the precautionary principle, which is pretty much what it sounds like. Don't expose yourself unnecessarily to EMF hazards. Don't buy a home next to a WiFi tower. Get a corded telephone instead of a

cordless one. Don't let your teenager sleep with a cell phone under her pillow. Don't use your laptop computer in your lap. Treat your EMF-emitting devices with the same cautious respect you do other invaluable modern devices, like your car, which is also dangerous — and can kill. You don't drive in an unnecessarily risky fashion — at high speed or while talking on a cell phone (right?).

The sad truth is that until we have more epidemiologic evidence — whether from disease clusters like the ones at La Quinta and on Cape Cod or from long-term analyses of the health of the world's 4-billion-and-growing cell phone users — we won't know definitively whether electrical pollution is harming us. And even then, we are unlikely to know why or how. "In this country, our research dollars are spent on finding ways to treat disease, not on what causes it — which is to say, how we can prevent it," says Marino. "And that's a tragedy."

But that's also another story.

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Effects of Cell Phone Radiofrequency Signal Exposure on Brain Glucose Metabolism

Preliminary Communication

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1. [Nora D. Volkow](#), MD;
2. [Dardo Tomasi](#), PhD;
3. [Gene-Jack Wang](#), MD;
4. [Paul Vaska](#), PhD;
5. [Joanna S. Fowler](#), PhD;
6. [Frank Telang](#), MD;
7. [Dave Alexoff](#), BSE;
8. [Jean Logan](#), PhD;
9. [Christopher Wong](#), MS

[\[+\]](#) Author Affiliations

1. **Author Affiliations:** *National Institute on Drug Abuse, Bethesda, Maryland (Dr Volkow); National Institute on Alcohol Abuse and Alcoholism, Bethesda (Drs Volkow, Tomasi, and Telang and Mr Wong); and Medical Department, Brookhaven National Laboratory, Upton, New York (Drs Wang, Vaska, Fowler, and Logan and Mr Alexoff).*

Abstract

Context The dramatic increase in use of cellular telephones has generated concern about possible negative effects of radiofrequency signals delivered to the brain. However, whether acute cell phone exposure affects the human brain is unclear.

Objective To evaluate if acute cell phone exposure affects brain glucose metabolism, a marker of brain activity.

Design, Setting, and Participants Randomized crossover study conducted between January 1 and December 31, 2009, at a single US laboratory among 47 healthy participants recruited from the community. Cell phones were placed on the left and right ears and positron emission tomography with (¹⁸F)fluorodeoxyglucose injection was used to measure brain glucose metabolism twice, once with the right cell phone activated (sound muted) for 50 minutes (“on” condition) and once with both cell phones deactivated (“off” condition). Statistical parametric mapping was used to compare metabolism between on and off conditions using paired *t* tests, and Pearson linear correlations were used to verify the association of metabolism and estimated amplitude of radiofrequency-modulated electromagnetic waves emitted by the cell phone. Clusters with at least 1000 voxels (volume >8 cm³) and *P* < .05 (corrected for multiple comparisons) were considered significant.

Main Outcome Measure Brain glucose metabolism computed as absolute metabolism ($\mu\text{mol}/100\text{ g}$ per minute) and as normalized metabolism (region/whole brain).

Results Whole-brain metabolism did not differ between on and off conditions. In contrast, metabolism in the region closest to the antenna (orbitofrontal cortex and temporal pole) was significantly higher for on than off conditions (35.7 vs 33.3 $\mu\text{mol}/100\text{ g}$ per minute; mean difference, 2.4 [95% confidence interval, 0.67-4.2]; $P = .004$). The increases were significantly correlated with the estimated electromagnetic field amplitudes both for absolute metabolism ($R = 0.95$, $P < .001$) and normalized metabolism ($R = 0.89$; $P < .001$).

Conclusions In healthy participants and compared with no exposure, 50-minute cell phone exposure was associated with increased brain glucose metabolism in the region closest to the antenna. This finding is of unknown clinical significance.

More data on EMF/cell phones from a friend, one of the authors of *Public Health SOS: The Shadow Side of the Wireless Revolution*.

A scientific study published in the journal *Neurotoxicology* finds that people who live around mobile phone base stations (cell towers) are at risk for developing neuropsychiatric problems and changes in neurobehavioral function.

The prevalence of neuropsychiatric complaints as headache (23.5%), memory changes (28.2%), dizziness (18.8%), tremors (9.4%), depressive symptoms (21.7%), and sleep disturbance (23.5%) were significantly higher among exposed inhabitants than controls: (10%), (5%), (5%), (0%), (8.8%) and (10%), respectively ($P < 0.05$). Exposed inhabitants exhibited a significantly lower performance than controls in one of the tests of attention and short-term auditory memory.

The authors say revision of standard guidelines for public exposure to RER from mobile phone base station antennas around the stations is recommended.

G. Abdel-Rassoul *, O. Abou El-Fateh, M. Abou Salem, A. Michael, F. Farahat, M. El-Batanouny, E. Salem. Neurobehavioral effects among inhabitants around mobile phone base stations. *NeuroToxicology* 28 (2007) 434–440

Factors that Influence Your Susceptibility to EMF Damage

Researchers have found that there are a number of factors that influence the degree to which you may be affected by EMF's and other types of radiowaves. For example, according to the research by Dr. Dietrich Klinghardt, your physical body, such as your body weight, body-mass index, bone density, and water and electrolyte levels can alter the conductivity and biological reactivity to EMFs.

Heavy metals in your brain also act as micro-antennas, concentrating and increasing reception of EMF radiation. Likewise, any kind of metal implants and/or amalgam tooth fillings will significantly increase reception of microwaves, and the microcurrents from cell phones and other ambient fields.

This is yet another major reason for having your mercury fillings removed by a trained biological dentist.

Your genes can also play a part, as certain genes regulate metal detoxifying enzymes. So depending on your genetic makeup, you may be more or less predisposed to electromagnetic hypersensitivity.

People who suffer from diseases that causes myelin loss, such as muscular sclerosis, Lyme disease, and other autoimmune diseases are also at greater risk of electro-sensitivity.

Unfortunately, EMFs have been found to cause microorganisms to release higher amounts of potent toxins, which can exacerbate infections and autoimmune diseases.

Your overall risk is also dependent on other sources of EMF, such as the synergistic effect from geopathic earth radiation, metallic objects and furnishings in your home or office, electronic appliances, and household wiring.

Mechanism of Action

According to [Dr. Andrew Goldsworthy](#) retired from the Imperial College of London, acute electrohypersensitivity symptoms and diseases stemming from excessive non-thermal radiation exposure could potentially be explained by the effects on the cell wall.

Because as your body absorbs radiation, currents are created that weaken your cells' walls by removing calcium and other divalent ions.

This creates permeability, or "leakage" in your body, and this is known to happen even in non-thermal fields, and, interestingly, only in certain "amplitude windows." Low frequencies can be worse than high frequencies, and pulsed waves are worse than sine waves.

One of the most noticeable effects of this permeability in your body is the effect it can have on your brain function. As explained in the video, programmed flow of calcium ions through your cell membranes is a prerequisite for release of neurotransmitters.

“Unscheduled” leakage of calcium ions increases background calcium which makes membranes hypersensitive and more likely to transmit random signals.

The end result can be clouded mental activity. It can also activate random thoughts, which naturally makes it more difficult to concentrate.

Much of this effect is characteristic of ADHD...

Also, leakage of digestive enzymes from lysosomes can account for damage to DNA, and may offer yet another explanation for cancer rates and the rise in infertility. The resulting DNA fragmentation may also create genetic mutations that could appear in future generations.

Interestingly, and quite believably, the rise in microwave radiation and EMF exposure may be a significant contributing factor to the skyrocketing increase in autism, as electromagnetically induced membrane leakage leads to brain hyperactivity. A summary of a study conducted by Dr. Dietrich Klinghardt, MD, on the EMF level in the bedrooms of pregnant women whose children were autistic, versus EMF levels of mothers who had healthy children, can be found in the "Media Story Leads" section of www.ElectromagneticHealth.org. Body voltage levels in that location were also measured in the study.

The results suggest an urgent need for further research in the autism-EMF area, especially given the official number of children with autism was recently announced to be 1 in 91, compared to 1 in 150 in 2002.

More research is also needed on the mechanisms of action in general. A summary of all currently known mechanisms of action is expected to be published in 2010.

For example, in addition to Dr. Goldsworthy's theories discussed above, other possible mechanisms of action leading to symptoms and diseases include: increased free radical production, and impact on serotonin and melatonin.

In Defending Itself, Your Body Wears Itself Out...

The good news is that your body can, to a degree, defend itself from these types of radiation damage. It does so by pumping surplus calcium out of your cells, and by activating certain enzymes that protect your DNA, and by making heat shock proteins to protect enzymes.

The bad news is that in doing so, your body becomes fatigued, and the more it has to defend itself, the worse your health will fare. Eventually, it can start interfering with your

metabolism; impair your immune system; and lower your resistance to disease and cancer.

Last but not least, EMF exposures have a sensitizing effect, so you will become more and more sensitive over time.

How You Can Help Yourself

Fortunately, you are not completely helpless. There are strategies that can help reduce your exposure and protect your health against the constant onslaught of radiation.

First and foremost, you'll want to reduce your exposure to as many sources as you can.

For my latest list of safety tips and guidelines on how to reduce your exposure, please see this previous [article](#).

In addition to my recommendations, Camilla Rees mentions a few more in her video above, including:

- **Intestinal care** – mainly by making sure you're getting plenty of healthy probiotics. The Paracelsus Clinic in Switzerland discovered that symptoms of electrosensitivity can be reduced by providing gut barrier support. For more information, [listen to the interview with Dr. Rau](#), medical director of the Paracelsus Clinic, available at this [link](#).
- **Regular detoxification programs** – Reducing your toxic burden has become far more important than it ever was before. Not only are you dealing with increasing amounts of toxic chemicals in your environment, your body is full of microorganisms that respond to EMFs by generating increased levels of their own toxins, according to a course for physicians on this subject, taught by [Dr. Dietrich Klinghardt, MD](#).
- **Beware of mold** – Mold, just like other microorganisms, can also react in high EMF environments. One study showed 600 times more neurotoxins generated from mold in a high EMF environment. According to Rees, there are also mold legal cases being reviewed, assessing if problems in buildings infested with mold may have actually been related to nearby antenna infrastructure.

>

Subject: Cell Phones More Dangerous Than Cigarettes and Asbestos

From: NewsMax Media <newsmax@newsmax.sparklist.com>

1. Cell Phones More Dangerous Than Cigarettes and Asbestos

A top Australian neurosurgeon says cell phones may cause more cancer in the near future than smoking or asbestos. Dr. Vini Khurana, who conducted an extensive review of the link between cell phones and brain cancer said using cell phones for at least ten years could more than double the risk of developing deadly brain cancer. Since three times as many people use cell phones as smoke, cell phones will soon emerge as a major killer.

"It is anticipated that this danger has far broader public health ramifications than asbestos and smoking, and directly concerns all of us, particularly the younger generation, including very young children," Dr. Khurana wrote.

Dr. Khurana says there has been an increase in brain tumors in people who have used cell phones heavily for a long time on the same side of the head as their "preferred ear" for making calls. He believes it has been difficult to prove a direct link between cell phone usage and brain tumors because a malignant brain tumor might take between ten and twenty years to develop, and the general public hasn't been using cell phones long enough to effectively study the risk.

That will soon change. "In the years 2008-2012, we will have reached the appropriate length of follow-up time to being to definitely observe the impact of this global technology on brain tumor incidence rates," Khurana says.

Editor's Note:

CELL PHONE HAZARDS - THE EVIDENCE IS IN

By William Thomas

The evidence is in - and it is overwhelming. Even at typical low power, cell phones and wireless technology cause severe biological disturbances in human cells. In August 2007, 26 medical and public health experts their [Bioinitiative Report](#) - available online - reviewing all the literature on the effects of electromagnetic radiation

Cell phone researchers not in the pay of mobile phone corporations agree on three things:

1. Current guidelines based only on the heating effects of cell phones do not address non-heating damage to DNA, nor the effects of frequency modulation used to broadcast information and are completely inadequate to safeguard public health. Specific Absorption Rate (SAR) is should not be used as a basis for a safety standard since it regulates against thermal effects only.

So far cell phone "safety codes" only regulate radiation capable of burning skin. It's like saying cigarettes aren't dangerous unless they burn you.

Cell phone manufacturers insist that "many studies" show their miniature microwave ovens are safe. But when pressed by the *Washington Post* to back up their claim, the cellphone industry could cite no studies showing no adverse impact from cellular telephones on human tissues, nervous systems or organs.

Dr. George Carlo confirms: "The industry had come out and said that there were thousands of studies that proved that wireless phones are safe, and the fact was that there were no studies that were directly relevant."

There are more than 15,000 scientific studies reporting the cell phone health hazards. At least 66 epidemiological studies show that electromagnetic radiation increases brain tumors in human populations. ["Cell Phone Convenience or 21st Century Plague?" by Dr. Nick Begich and James Roderick [earthpulse.com](#)]

A TWO-MINUTE CALL

After only two minutes of cellphone exposure, the blood-brain barrier fails, allowing proteins to enter the brain that can cause nerve damage. "Molecules such as proteins and toxins can pass out of the blood, while the phone is switched on, and enter the brain. We need to bear in mind diseases such as MS and Alzheimer's are linked to proteins being found in the brain." So, adds Leif Salford of Lund University in Sweden, is Parkinson's disease. [Electronics Australia Magazine Feb/00]



STRESS PROTEINS

Cell phone and cell phone tower radiation stress our cells, releasing DNA-damaging free radicals and stress proteins that can migrate through the opened blood-brain barrier and cause degenerative damage in the brain. Dr. Theodore Litovitz, a biophysicist and professor emeritus of physics at Catholic University, explains: "Because stress proteins are involved in the progression of a number of diseases, heavy daily cell-phone usage could lead to great incidence of disorders such as Alzheimer's and cancer." [Reuters Apr 23/08; wirelessconsumers.org Dec03/01]

2. Children through teenage years, and pregnant women should be kept away from cell phones and cell phone radiation.

Alarmed British military scientists have discovered that every cell phone transmission disrupts brain functioning responsible for memory and learning. "Overuse" can cause forgetfulness and sudden confusion, as well as loss of the ability to concentrate, calculate and coordinate.

Children and teens who become hooked on cell phones face a lifetime of learning disabilities, hyperactivity, high risk from driving accidents, greatly increased acute and chronic asthma, hearing loss, vision loss, sleep disorders and cancers - as well as loss of social skills, inability to think and reason clearly, loss of contact with their surroundings. [India Tribune Sept 17/04]

More than 2 billion people - including at least 500 million children - are using cell phones.



At least 87% of 11- to 16-year-olds own cell phones. In the USA, one in three teenagers uses a cell phone. RF/MW signals currently under discussion for inflicting on wireless classrooms throughout North America and the overdeveloped world will operate in the 2.4 GHz frequency range - *two to three times higher than current cell phones*. Plans are already underway to boost classroom radiation levels with "upgraded" technology emitting 5 GHz. [Uncensored (NZ) Nov 9/06; irf.univie.ac.at]

These kids may be difficult to replace, because researchers at University of Szeged in Hungary have discovered that men carrying their cell phones on standby anywhere in their clothing throughout the day produce about a third less sperm than those who do not. Of the remaining sperm, high numbers were found to be swimming erratically - significantly reducing chances of fertilization. [BBC June 27/04]

Put men made infertile by their cell phones together with fashionable beach going women who carry their

cellphones in their bikini bottoms and... We could be looking at an inadvertent cell phone cull. Especially if women are culled by bra-makers encouraging them to carry cell phones in their convenient, already cancer-prone cleavage.

The Spanish Neuro Diagnostic Research Institute in Marbella has found that a call lasting just two minutes can alter the natural electrical activity of a child's brain for up to an hour afterwards. Spanish doctors now fear that disturbed brain activity in children will lead to impaired learning ability, as well as psychiatric and behavioural problems.

Brain scans allowed Dr. Michael Klieseisen's team to see what is happening to the brains of cell phone users. "We never expected to see this continuing activity in the brain," he told the European press in new stories blacked out in the U.S.

Dr. Gerald Hyland finds the results "extremely disturbing." Parents who believe they are enhancing their children's safety and social standing by sending them back to school with cellphones could be impairing their health and ability to learn, Dr. Hyland warns. "The results show that children's brains are affected for long periods even after very short-term use. Their brain wave patterns are abnormal and stay like that for a long period. This could affect their mood and ability to learn in the classroom if they have been using a phone during break time, for instance."

These same altered brain waves "could lead to things like a lack of concentration, memory loss, inability to learn and aggressive behaviour. My advice would be to avoid mobiles." [Mirror Dec 26/01]

Led by Sir William Stewart, the famous British biochemist and president of the British Association for the Advancement of Science biomedical specialists, the Stewart Inquiry report on "Mobile Phones and Health" was released in April 2000. Sir William said he would not allow his grandchildren to use mobile phones. [Journal of the Australasian College of Nutritional & Environmental Medicine Sept /01]

In Sweden cell phones are being marketed to 5-year-olds. Olle Johansson, Associate Professor of Neuroscience at the Karolinska Institute in Stockholm declares: "Parents should take their children away from that technology." [*Dialing Our Cells* by William Thomas]

The Australian government's Commonwealth Scientific and Industrial Research Organisation (CSIRO) described laboratory tests as far back December 1974 showing neurons in the soft skulls of developing fetuses are extremely sensitive to heat during the process of cell division. "The mother's pelvic structure promotes deep RF radiation penetration within the developing embryo or fetus," Dr. Barnett warned. The womb's saline fluid is also highly conductive to Radio Frequencies and microwaves - and the EMF-conductive human body is 65% water-by-weight. Brain functioning may be impaired for life. [CSIRO June 1994; irf.univie.ac.at/emf; EMFacts Consultancy Mar 26/03]

The age of cell phone users continues to drop as fast as their IQ and attention span. In 2007, the average age of first-time "users" was 10. By next year, International Data Corp forecasts the 9-*and-under* market will rack up an additional \$1.6 billion in revenue for cell phone companies - and add another *nine million child zombies* in the United States alone.

According to a Eurobarometer survey of children in 29 countries, most had cellphones after age 9. "We're pretty bullish on increased usage by teenagers," exudes Adam Guy, a senior analyst at the Strategist Group. "Usage penetration is exploding."

Four in 10 people, particularly young adults, make cell phone calls to kill time as well as themselves. [London Telegraph Oct 9/07]

Professor Mild, of Orbero University, Sweden is a Government adviser who led the research says children should not be allowed to use mobile phones. He and others want a revision of the emission standard for mobiles and other sources of radiation, which they describe as "inappropriate" and "not safe". [London Telegraph Oct 9/07]

Dr. Salford says brain neurons that would normally not become senile until people reached their 60's, are doing so now when people reach their 30's because of cell phone exposure. [RFSafe.com Nov26/03]

Cellular One's slogan - "Wherever you go, there we are" - takes on ominous overtones as uninformed people are buying cellphones worldwide at the rate of 25 thousand a day and succumb to PR campaigns like the one that shows a picture of a crib and bears the legend: "No Member of the Family Should Be Without One..." [Independent Mar 30/08]

BEYOND CANCER

It's not just cancer that makes cell phones so dangerous. Lloyd's of London refuses to insure phone manufacturers against the risk of subscribers developing cancer - and early onset Alzheimer's. [Observer Mar11/99]

"Cumulative DNA damage in nerve cells of the brain can lead to Alzheimer's, Huntington's, and Parkinson's diseases." One type of brain cell can become cancerous from these double-strand DNA breaks at lower than the current Specific Absorption Rate exposure-standard (4 watts/kg).

It is not the total energy associated with the EMF that is critical, but rather pulsed oscillations. Many repetitions at the higher frequency close to subtle natural rhythms cause non-thermal threshold to be reached in a shorter time. This makes cellular processes "unusually sensitive to non-thermal ELF frequency fields."

Dr. Henry Lai, a 20-year EMF researcher, and colleague Dr. N.P. Singh confirmed double-strand DNA breaks in test animals exposed for just *two hours* to pulsed, cell phone microwaves. When you talk on your mobile phone at 800 MHz and 1,990 MHz, whipping anything back-and-forth 800 or 1,990 *million times per second* is bound to cause breakage in the double-strand DNA of human cells. [guardian.co.uk]

EM engineer Alasdair Philips of Britain's Powerwatch looked for people under age 40 using cell phones more than four hours a day, and found them already retired as "unfit for future work" due to early onset dementia. [EMFacts Consultancy Mar 26/03]

3. The risk of contracting cancer from cell phones is about 4% of more than 2 billion users - 80 million people and rising at 25,000 new "users" every day. The risk of premature senility and contracting Alzheimer's is extreme. Most kids brought up using cell phones will be functionally senile by the time they are 30.

You only need 2000 hours on a cell - OR A CORDLESS - phone to qualify for a 2 to 4x increased likelihood of a brain (glioma) or ear (acoustic neuroma) tumor.

On a New Zealand news show, Dr. George Carlo called marketing strategies aimed at children, "grotesque" after identifying as many as 50,000 new cases of brain and eye cancer attributable to cell phone use being diagnosed *every year*. (Mobile users who wear metal-frame glasses intensify the exposure to their eyes and heads). Based on current epidemiological studies, that number will reach half a million cell phone cancer cases *annually* within the next two years. [IsraCast Technology News July 29/05]

After heading a \$28 million cell phone study from 1993 through 2001, Dr. Carlos' finding "that RF causes genetic damage" was not welcomed by his cell phone industry sponsors. Ross Adey worked on similar research funded by Motorola in 1991. After he came to similar conclusions, Motorola was adamant that Adey never mention DNA damage and radiofrequency radiation in the same breath. [WSW July 11/02; wirelessconsumers.org Dec03/01]

Cellphones can cause cellular changes, brain damage

HELSINKI A study by scientists in Finland has found that mobile phone radiation can cause changes in human cells that might affect the brain, the leader of the research team said on Wednesday.

But Dariusz Leszczynski, who headed the two-year study and will present findings this week at a conference in Quebec, said more research was needed to determine the seriousness of the changes and their impact on the brain or the body.

The study at Finland's Radiation and Nuclear Safety Authority (STUK) found that exposure to radiation from mobile phones can cause increased activity in hundreds of proteins in human cells grown in a laboratory, he said.

"We know that there is some biological response. We can detect it with our very sensitive approach, but we do not know whether it can have any physiological effects on the human brain or human body," Leszczynski said.

Nonetheless the study, the initial findings of which were published last month in the scientific journal *Intercell*, raises new questions about whether mobile phone radiation can weaken the brain's protective shield against harmful substances.

The study focused on changes in cells that line blood vessels and on whether such changes could weaken the functioning of the blood-brain barrier which prevents potentially harmful substances from entering the brain from the blood stream, Leszczynski said.

The study found that a protein called *hsp27* linked to the functioning of the blood-brain barrier showed increased activity due to irradiation and posed to a possibility that such activity could make the shield more permeable, he said.

"Increased protein activity might cause cells to shrink - not the blood vessels but the



DANGEROUS ... a study has found that exposure to radiation from mobile phones can cause increased activity in hundreds of proteins in human cells. - AFP Photo

cells themselves - and then tiny gaps could appear between those cells through which some molecules could pass," he said.

Leszczynski declined to speculate on what kind of health risks that could pose, but said a French study indicated that headache, fatigue and sleep disorders could result.

"These are not life-threatening problems, but can cause a lot of discomfort," he said, adding that a Swedish group had also suggested a possible link with Alzheimer's disease.

"Where the truth is I do not know," he said.

Leszczynski said that he, his wife and children use mobile phones, and he said that he did not think his study suggested any need for new restrictions on mobile phone use. - Reuters



DRIVE TIME

Stunned by an additional \$4 billion a year in claims for drivers using cell phones, North American insurers discovered that juggling phones while driving is *not* causing a 600% increase in accidents. Cell phones are much worse than merely dangerous driving distractions. Tests conducted by the U.S. Department of Energy found that using a cellphone severely impairs a driver's memory and reaction times by disrupting signals to and within the brain. Hands-free mobile phones cause even more crashes because they typically emit *10-times* more brainwave interference than handheld units.

Phoning from inside a car or truck is a bad call for everyone in the vehicle - especially children - because the surrounding steel structure amplifies cellphone emissions "by up to *10-fold*," the UK House of Commons Science and Technology Committee reports.

University of Toronto investigators report that the heightened probability of cracking up your car persists for up to a half-hour *after* completing a call.

"That's comparable to the risk of crashing while driving dead drunk," exclaims Dr. Chris Runball, chairman of the B.C. Medical Association's emergency medical services committee. Motorists talking on cell phones are actually *more impaired than drunk drivers with blood-alcohol levels exceeding 0.08*. It doesn't matter whether the phone is hand-held or hands free. [Human Factors and Ergonomics Society]

If you put a 20-year-old driver behind the wheel with a cell phone, her reaction times are the same as a 70-year-old driver. But not as wise. [AP Feb 2/05; Human Factors Winter/05]

ELECTRICAL FIELDS AND MAGNETIC FIELDS

"The electricity that comes out of every power socket has associated low frequency electromagnetic fields. Various kinds of higher frequency radiowaves are used to transmit information - whether via TV antennas, radio stations or mobile phone base stations."

"Radio, television, radar and cellular telephone antennas, and microwave ovens are the main sources of RF fields. These fields induce currents within the human body, which if sufficient can produce a range of effects."

"A magnetic field is only produced once a device is switched on and current flows."

Magnetic fields penetrate living tissue "easily."

"Magnetic fields as low as around 2 milligauss or a millionth of a Tesla can produce biological effects. Using a cell phone or a PDA exposes you to magnetic pulses that peak at several tens of microtesla, which is well over the minimum needed to give harmful effects." [Bioeffects Initiative report]

CHILDHOOD LEUKEMIA

"Childhood leukemia is the most frequent childhood malignancy that peaks in the age group of 2 to about 5 years... This peak seems to have been newly evolved in the early quarter of the 20th century and may be due to electrification"... acting as synergistic activators of toxic chemical compounds, I add to the Bioeffects Initiative finding.



MELATONIN, [ALZHEIMER'S](#) AND BREAST CANCER

"Melatonin is found in nearly all organisms... it helps prevent both Alzheimer's disease and breast cancer. Long-term exposure to extremely low frequency (ELF, = 60 Hz) magnetic fields is associated with a decrease in melatonin production."

"Amyloid beta protein is generally considered the primary neurotoxic agent causally associated with Alzheimer's disease. Melatonin can inhibit the development of Alzheimer's disease and, thus, low melatonin may increase the risk of Alzheimer's disease.

"Low melatonin production is a likely risk factor for breast cancer... 11 of the 13 published epidemiologic residential and occupational studies are considered to provide (positive) evidence that high MF exposure can result in decreased melatonin production. (The two negative studies had important deficiencies that may certainly have biased the results.)"

"Some modulation patterns are more bioactive than others, for example, frequencies are similar to those found in brain wave patterns. Current public safety limits do not take modulation into account and thus are no longer sufficiently protective of public health where chronic exposure to pulsed or pulse-modulated signal is involved, and where sub-populations of more susceptible individuals may be at risk from such exposures." [Bioeffects Initiative report]

LOW POWER IS VERY DANGEROUS

Cell phone researcher Dr. Peter Franch says unequivocally that brain and other "cells are permanently damaged by cellular phone frequencies." This cellular damage, Franch notes, is maximized at low power. [guardian.co.uk]

Much like taking repeated blows to the head, rapidly pulsing cell phones signal permanent brain damage. And the high frequency range used in today's digital cell phones is also very close to the resonant frequency of human DNA, as well as the resonant frequency of the human skull case.

As the Bioeffects Initiative report points out: "Published laboratory studies have provided evidence for more than 40 years on bioeffects at much lower intensities than cited in the various widely publicized guidelines for limits to prevent harmful effects. Many of these reports show EMF-caused changes in processes associated with cell growth control, differentiation and proliferation which are the molecular and cellular basis of cancer."

"Windows of intensity align across different carrier frequencies." [Bioeffects Initiative report]

COLTAN

A tiny piece of mineral used in your phone called coltan is causing a frenzied rush for its extraction in strip mines across the Congo - exploiting children, razing pristine forests, wiping out up to 90% of all mountain gorillas, and has already led to the rape of more than 250,000 women as old as 75 and girls as young as three.

Since consumers don't have any idea where the coltan in their phones comes from, please stop buying them until guidelines guaranteeing the provenance of cell phone and wireless laptop computers come in.

CONCLUSIONS OF THE BIOEFFECTS INITIATIVE REPORT

"The conclusion that, if health effects of commonly encountered RF exposures exist, they must be small, is wrong. The evidence points to a quite substantial hazard. Scientific research has shown that the public is not being protected from potential damage that can be caused by exposure to EMF, both power frequency (ELF) and radio frequency (RF)."

"There is a need for a biological standard to replace the thermal standard and to also protect against cumulative effects across the EM spectrum."

One main conclusion from the worldwide NATO meetings in 2005: "Worldwide harmonization of standards have to be based on biological responses."

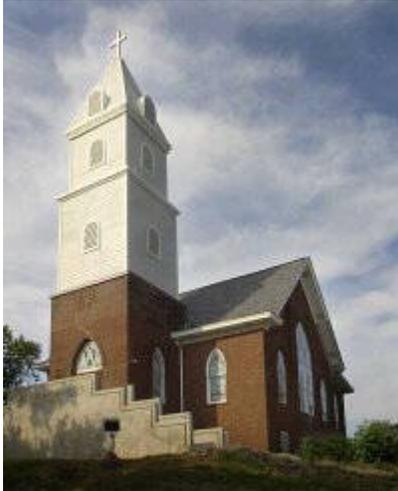
"DNA damage (strand breaks), a cause of cancer, occurs at levels of ELF and RF that are below the safety limits. Also, there is no protection against cumulative effects stimulated by different parts of the EM spectrum."

"ELF limits for public exposure should be revised to reflect increased risk of breast cancer at environmental levels possibly as low as 2 milliGauss or 3 mG."

"There is substantial scientific evidence that some modulated fields (pulsed or repeated signals) are bioactive, which increases the likelihood that they could have health impacts with chronic exposure even at very low exposure levels. Modulation signals may interfere with normal, nonlinear biological processes."

"Current standards have ignored modulation as a factor in human health impacts, and thus are inadequate in the protection of the public in terms of chronic exposure to some forms of ELFmodulated RF signals... The collective papers on modulation appear to be omitted from consideration."





IT'S NOT JUST THE CELL PHONES!

What about all these cell phone relay towers springing up everywhere?

Our bodies - and each one of our trillions of cells - are exquisitely sensitive receiving antennas.

There are currently over 210,000 cell towers, providing 81% wireless penetration in America alone, and one would be hard-pressed to find an inhabitable place on Earth that is not within range of cell frequency transmissions. [CTIA The Wireless Association June/07]

The work of researchers like Dr. Henry Lai, Dr. Ross Adey and Dr. Jerry Phillips show that such effects as DNA strand breaks are produced not only by short-term exposure at high intensity, but also by long-term, chronic exposure to low intensities - like that increasingly experienced by growing numbers of people from cell phone towers and microwave communication facilities.

Henry Lai found Radio Frequency Radiation like that from cell phone towers penetrates further into a child's small, growing skull.

As my friend Chris Anderson points out, "This is continuous exposure, and it is not optional."

Sydney Australia first city to go wireless say a significant jump in allergies and deaths.

By 2005, more than 500 cell tower disputes around the country ended up in court. But federal law

prohibits towns from rejecting a transmission tower on the grounds that it poses health concerns. [New York Times May 1/05]

Now, cell phones small enough to fit inside a cigarette case have decreased reception so base stations must boost their microwave transmissions 15% to 20%. [New York Times Mar 10/03]

Findings by the Associated Bioelectromagnetics Technologists show that RF exposure from cell phones and cell phone relay towers "is wholly correlated with the repeatedly documented increased incidence of autism - now reported by at least some researchers as greater than 1 per 100 newborn."



A COMING CULL?

Professor Khurana has placed his considerable reputation behind warning: "Unless the industry and governments take immediate and decisive steps, the incidence of malignant brain tumours and associated death rate will be observed to rise globally within a decade from now - by which time it may be much too late to medically intervene." [Independent Mar 30/08]

"Dr. George Carlo predicts surefire disaster, and the complete destruction of the health care system from electromagnetic radiation alone." Right now, the Bioeffects Initiative report indicates that as many as one in 10 people suffer debilitating effects from electromagnetic sensitivities. EMR expert Chris Anderson predicts, "In the next 5 to 10 years, fully half the developed world's population could suffer disability from EMR. [Chris Anderson EMR expert - correspondence with the author.]

After carefully reviewing more than 100 clinical studies showing that using "hands free" and regular cell phones for 10 years or more can double the risk of brain cancer, PhD Vini Khurana - who has received 14 awards while publishing more than three dozen scientific papers - predicts that cell phones will kill far more people than either smoking or asbestos. Smoking continues to cull some five million people worldwide every year, while asbestos exposure in England continues to claim as many corpses as road accidents. [Independent Mar 30/08]

In September 2007, the EU's European Environment Agency (EEA) and the country of Germany both issued warnings to their citizens advising them to avoid the use of WiFi and cell phones until further long term studies are conducted, citing fears that the ubiquitous use of wireless technology has the potential to become the next public health disaster on the level of tobacco smoking, asbestos, and lead in automobile gas. [naturalnews.com]

Dr. Vini Khurana urges everyone to stop using cell phones immediately. [Independent Mar 30/08]

GUARANTEED CELL PHONE PROTECTION

Dr. Gro Harlem Brundtland, director general of the World Health Organisation, former Norwegian prime minister and licensed physician emphasized: *Making shorter calls does not help*, [Microwave News Mar-Apr/02; Dagbladet Norge Mar 9/02]

The only way to ensure complete protection against being turned into a zombie by cell phones is to avoid using them except in emergencies when no other voice communication is available - at the max, experts suggest, one or two minutes per month.



SEVEN THINGS YOU CAN DO

1. Do not use a cell phone for longer than one minute twice a month.
2. Do not live within two miles or five kilometers from a cell phone tower. Get the tower removed. Or move.
3. In your home, *unplug* all electrical appliances when not in use. (Switching TVs and similar devices "off" does *not* turn them off. Intersecting electrical fields result.)
4. Avoid using wireless routers and portable phones.
5. Keep your bedroom free of electrical appliances, especially near your head while you sleep. Use a battery-operated alarm clock - never a plug-in clock radio! Unplug lamps when not in use.
6. Replace dimmer switches with regular switches to eliminate high-frequency radiation - the "dirty electricity" hidden in your home's most likely improperly grounded electrical wiring. (Even if done to Code.)
7. Take the best quality daily vitamin and mineral supplements program you can get your hands on.



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BREAKING! [Scientists Launch Urgent Appeal against Cell Phones](#)

February 22, 2011, 4:21 pm

Cellphone Use Tied to Changes in Brain Activity

By [TARA PARKER-POPE](#)

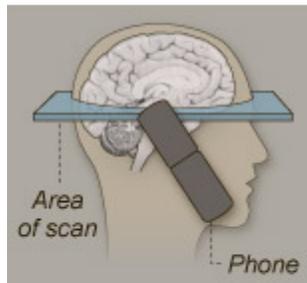
Researchers from the National Institutes of Health have found that less than an hour of cellphone use can speed up brain activity in the area closest to the phone antenna, raising new questions about the health effects of low levels of radiation emitted from cellphones.

The researchers, led by Dr. Nora D. Volkow, director of the [National Institute on Drug Abuse](#), urged caution in interpreting the findings because it is not known whether the changes, which were seen in brain scans, have any meaningful effect on a person's overall health.

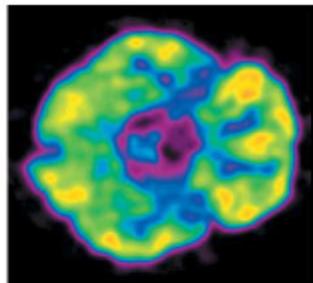
But the study, [published Wednesday in The Journal of the American Medical Association](#), is among the first and largest to document that the weak radio-frequency signals from cellphones have the potential to alter brain activity.

CELLPHONES AND THE BRAIN Researchers tested 47 people by placing a cellphone at each ear. Both phones were off in one test, and in the other test the right phone was on a muted call. After 50 minutes, brain scans showed increased consumption of glucose, or sugar, in areas of the brain near the activated phone.

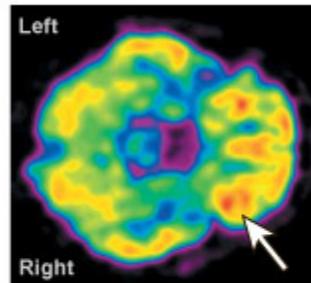
BRAIN SCAN



BOTH CELLPHONES OFF



RIGHT CELLPHONE ON



Rate of brain glucose metabolism LOW  HIGH

Source: JAMA Note: images are from a single participant. THE NEW YORK TIMES; IMAGES BY JAMA

“The study is important because it documents that the human brain is sensitive to the electromagnetic radiation that is emitted by cellphones,” Dr. Volkow said. “It also highlights the importance of doing studies to address the question of whether there are — or are not — long-lasting consequences of repeated stimulation, of getting exposed over five, 10 or 15 years.”

Although preliminary, the findings are certain to reignite a debate about the safety of cellphones. A few observational studies have suggested a link between heavy cellphone use and rare brain tumors, but the bulk of the available scientific evidence shows no added risk. Major medical

groups have said that cellphones are safe, but some top doctors, including the former director of the [University of Pittsburgh Cancer Center](#) and prominent neurosurgeons, have urged the use of headsets as a precaution.

Dr. Volkow said that the latest research is preliminary and does not address questions about cancer or other health issues, but it does raise new questions about potential areas of research to better understand the health implications of increased brain activity resulting from cellphone use.

“Unfortunately this particular study does not enlighten us in terms of whether this is detrimental or if it could even be beneficial,” Dr. Volkow said. “It just tells us that even though these are weak signals, the human brain is activated by them.”

Most major medical groups, including the [American Cancer Society](#), the [National Cancer Institute](#) and the [Food and Drug Administration](#), have said the existing data on cellphones and health has been reassuring, particularly a [major European study](#) released last year by the [World Health Organization](#) that found no increased risk of rare brain tumors among cellphone users.

When asked to comment on the latest study, the leading industry trade group, [CTIA – The Wireless Association](#), released a statement emphasizing recent studies that have shown no elevated cancer risk associated with cellphone use.

“The peer-reviewed scientific evidence has overwhelmingly indicated that wireless devices, within the limits established by the [F.C.C.](#), do not pose a public health risk or cause any adverse health effects,” said John Walls, vice president of public affairs for the trade group, adding that leading global health groups “all have concurred that wireless devices are not a public health risk.”

But the new research differed from the large observational studies that have been conducted to study cellphone use. In Dr. Volkow’s study, the researchers used brain scans to directly measure how the electromagnetic radiation emitted from cellphones affected brain activity..

The randomized study, conducted in 2009, asked 47 participants to undergo positron emission tomography — or PET — scans, which measure brain glucose metabolism, a marker of brain activity. Each study subject was fitted with a cellphone on each ear and then underwent two 50-minute scans.

During one scan, the cellphones were turned off, but during the other scan, the phone on the right ear was activated to receive a call from a recorded message, although the sound was turned off to avoid auditory stimulation.

Whether the phone was on or off did not affect the overall metabolism of the brain, but the scans did show a 7 percent increase in activity in the part of the brain closest to the antenna. The finding was highly statistically significant, the researchers said. They said the activity was unlikely to be associated with heat from the phone because it occurred near the antenna rather than where the phone touched the head.

In the past, any concerns about the health effects of cellphones have been largely dismissed because the radiofrequency waves emitted from the devices are believed to be benign. Cellphones emit nonionizing radiation, waves of energy that are too weak to break chemical bonds or to set off the DNA damage known to cause cancers. Scientists have said repeatedly that there is no known biological mechanism to explain how nonionizing radiation might lead to cancer or other health problems.

But the new study opens up an entirely new potential area of research. Although an increase in brain glucose metabolism happens during normal brain function, the question is whether repeated artificial stimulation as a result of exposure to electromagnetic radiation might have a detrimental effect.

Although speculative, one theory about how an artificial increase in brain glucose metabolism could be harmful is that it could potentially lead to the creation of molecules called free radicals, which in excess can damage healthy cells. Or it may be that repeated stimulation by electromagnetic radiation could set off an inflammatory response, which studies suggest is associated with a number of health problems, including cancer.

Among cancer researchers and others interested in the health effects of cellphones, the study, listed in the medical journal under the heading “Preliminary Communications,” was met with enthusiasm because of the credibility of the researchers behind it and the careful methods used.

“It’s a high-quality team, well regarded, and if nothing else they’re showing that radiation is doing something in the brain,” said Louis Slesin, editor of [Microwave News](#), a newsletter on the health effects of electromagnetic radiation. “The dogma in the cellphone community says that it doesn’t do anything. What she’s shown is that it does do something, and the next thing to find out is what it’s doing and whether it’s causing harm.”

Dr. Ronald B. Herberman, former director of the Pittsburgh Cancer Institute and now chief medical officer for the [Intrexon Corporation](#), a biotechnology company in Germantown, Md., said, “I think it’s a very well-designed study, and they have clearly shown that there is biologic activity being induced in the nerve cells in the region where the antenna is the closest.” Dr. Herberman said skeptics about the risks of cellphones have focused on the fact that the type of radiation they emit is too weak to break chemical bonds and cannot plausibly be implicated in cancer. However, the new research suggests a potentially different pathway for cancer and other health problems to develop.

“I think it’s an important new direction to go in for biologists to start delving deeper into sorting out what might be going on,” Dr. Herberman said.

In [an editorial accompanying the Journal article](#), Henry C. Lai, a University of Washington professor of bioengineering who has long raised concerns about cellphone safety, said he hoped the data would broaden the focus of cellphone research and health.

“The bottom line is that it adds to the concern that cellphone use could be a health hazard,” said Dr. Lai. “Everybody is worried about brain cancer, and the jury is still out on that question.”

There are actually quite a lot of studies showing cellphone radiation associated with other events, like sleep disturbances. But people have not been paying a lot of attention to these other types of studies.”

Dr. Volkow said future research may even show that the electromagnetic waves emitted from cellphones could be used to stimulate the brain for therapeutic reasons. She said the research should not set off alarms about cellphone use because simple precautions like using a headset or earpiece can alleviate any concern.

“It does not in any way preclude or decrease my cellphone utilization,” she said.

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Publish Date: 3/2/2011 12:00:00 AM

Submitter Info:

First Name: Janice

Last Name: Forberg

Mailing Address: 1793 Rome Ave.

City: St. Paul

Country: United States

State or Province: MN

Postal Code: 55116

Organization Name: null

I am writing as an individual whose health is adversely affected by EMF pollution (Electromagnetic Frequencies). It is my understanding that you are considering phasing out land-line telephones. This is the only type of phone that I can safely use. I do not have a cell phone; my computer is hard-wired, NOT Wi-Fi so as to preserve my health.

Please leave us a choice to use a land-line phone; some of us will not be able to communicate without it as all other current forms of communication (short of snailmail) are fraught with EMF pollution.

Europe is ahead of us regarding EMF pollution research. We need our federal government to do some genuine (i.e. non-industry inspired) research into the dangers of EMF pollution to ALL human beings on the planet. We can not afford, once again, to rush headlong into yet one more high technology solution which brings more problems than it solves!

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Publish Date: 3/2/2011 12:00:00 AM

Submitter Info:

First Name: kevin

Last Name: jones

Mailing Address: 4740 Wendover st

City: Eugene

Country: United States

State or Province: OR

Postal Code: 97404

Organization Name: null

RE: FCC-2001-0078-0001

Please keep the land line telephone service intact and functioning. People need access to phones that don't produce electromagnetic radiation. I have helped pay for the system that is in place, don't use a cell phone and don't want to be squeezed out of the phone system. The jury is still out for the safety of cell phones. They took out trolley cars from Detroit and now they could never afford to put them back even though we see that the auto was a relatively short term experiment and very polluting, don't get rid of these lines either. Keep access for all, it's the law. Thanks ~ Kevin

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Submitter Info:

First Name: Elizabeth

Last Name: Kelley

Mailing Address: 3031 N. Gai a Place

City: Tucson

Country: United States

State or Province: AZ

Postal Code: 85745

Organization Name: Electromagnetic Safety Alliance, Inc.

I strongly oppose this proposed rule. There has been no public debate on potential impact on human health and safety, environment, privacy, security or affordability. People must be given the choice of keeping their land-line phones. The telecommunications industry bought the right to deploy antennas over people's objections through the 1996 Federal telecommunications Act and set exposure guidelines at levels that do not protect health. These rules have been repeatedly challenged in court. This proposed rule implies that the FCC is more interested in wireless telecom services than our city and state charters, the Americans for Disabilities Act, and the U.S. Constitution. The FCC says it is not a health agency yet continues to ignore the scientific evidence that demonstrates that there is harm with these radiofrequency exposure conditions which are increasing. No government agency studies these exposure conditions in their impact on living tissue which is a major failing of acting in the public trust. By striving for more bandwidth, speed and coverage, FCC is ignoring the people who are at risk due to involuntary chronic exposure to radiofrequency radiation and will not adopt wireless technologies. This includes those who are electrically hypersensitive or whose physical impairments have granted them accommodation rights under the Americans for Disabilities Act (up to 35% of the population) and people who have surgically installed medical implants that could be disabled by wireless signals - about 12% of the population. Medical doctors recommend children and pregnant women limit their use of wireless mobile devices based on scientific evidence that shows links to brain cancers, other cancers and neurological diseases. Do not replace the fixed wired land line phone systems with a national wireless broadband infrastructure until these cahnge can be proven to be safe, secure reliable and affordable and

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Submitter Info:

First Name: Cheryl

Last Name: Clayton

Mailing Address: PO Box 5143

City: Eureka

Country: United States

State or Province: CA

Postal Code: 95502

Organization Name: null

I am deeply opposed to the elimination of wired telephone service. I do not use a cell phone, I do not need a cell phone, nor do I want a cell phone. These devices are not only a health risk, but also an unnecessary expense. I am visually impaired and cannot see well enough to even use a cell phone. I do not find internet phone service to be at all satisfactory or reliable. This proposal is absolutely ridiculous. When the power goes out, the only access to emergency services is through my wired telephone.

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Submitter Info:

First Name: Helene

Last Name: Smith

Mailing Address: 6333 N. Greenvi ew Ave., Apt. 2C

City: Chicago

Country: United States

State or Province: IL

Postal Code: 60660

Organization Name: null

I am challenged with Chronic Fatigue Syndrome, Environmental Sensitivities and Electromagnetic Sensitivity. I get severe headaches from using cell phones. Also, it is harder for me to handle cell phones (both the small size and the heat given off).

I am begging you to keep landlines around at LEAST as an option for those of us who can actually become ill from using wireless devices!

Thank you!

Sincerely,
Helene Smith

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Submitter Info:

First Name: Alison

Last Name: Denning

Mailing Address: PO Box 519

City: Mt Baldy

Country: United States

State or Province: CA

Postal Code: 91759

Organization Name: null

I still live in an area that is dependent on landlines for phone and internet service. For health reasons I need this option to remain available to me. I am concerned that soon there will be nowhere remote enough from wireless technology to maintain my health. Landlines are safe while mobile phones have questionable safety. Landlines must be maintained for the growing population of people who must have wired equipment to maintain their health.
Respectfully, Alison Denning

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Submitter Info:

First Name: Judy

Last Name: Taylor

Mailing Address: 285 Lindero Ter

City: Fremont

Country: United States

State or Province: CA

Postal Code: 94536

Organization Name: null

Please do not dismantle the landline phone network. I am very concerned about the health effects of cellphones and wireless technology. We are being bombarded with increasing amounts of electromagnetic pollution from all the wireless technologies and cellphone towers proliferating in our environment. I have friends who have become extremely sensitive to electromagnetic frequencies due to our constant exposure to ever increasing amounts of EMFs. They must use landlines because cellphones and computers make them sick. Please do not make it impossible for these individuals to communicate via the telephone.