

EMR and Health

Electromagnetic radiation,
health and well-being

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BioInitiative 2012

A new report by the BioInitiative Working Group finds increased evidence of risk from electrical and wireless sources.

The 2012 Report by the BioInitiative Working Group has concluded that evidence of risk from EMR-emitting technologies justifies new standards that greatly reduce public exposure.

‘There is now much more evidence of risks to health affecting billions of people world-wide. The status quo is not acceptable in light of the evidence for harm,’ said Dr David Carpenter, co-editor of the 2012 Report.

The 21-chapter Report is an updated version of the original BioInitiative Report, published in 2007. It reviews over 1800 new studies published since that time.

‘Overall, these new studies report abnormal gene transcription; genotoxicity and single- and double-strand DNA damage; stress proteins because of the fractal RF-antenna like nature of DNA; chromatin condensation and loss of DNA repair capacity in human stem cells; reduction in free-radical scavengers—particularly melatonin; neurotoxicity in humans and animals; carcinogenicity in humans; serious impacts on human and animal sperm morphology and function; effects on offspring behaviour; and effects on brain and cranial bone development in the offspring of animals that are exposed to cell phone radiation during

‘There is now much more evidence of risks to health affecting billions of people world-wide. The status quo is not acceptable in light of the evidence for harm.’

pregnancy.’

The Report was produced by 29 independent scientists and health experts from around the world, including the Chair of the Russian National Committee on Non-Ionizing Radiation and a Senior Advisor to the European Environment Agency.

The Report says that children are more vulnerable than adults and that other sensitive populations should be considered, for example the foetus, people with other chronic diseases, the elderly and those with electromagnetic hypersensitivity. The authors consider that sperm should be included in the population deserving special protection.

The Report includes a table of studies and the levels at which harmful effects have been observed. These show

(Continued on page 2)

'RFR exposures in daily life alter homeostasis in human beings. These exposures can alter and damage gene expression and cause de novo mutations that prevent genetic recovery and healing mechanisms. These exposures may interfere with normal cardiac and brain function; alter circadian rhythms that regulate sleep, healing, and hormone balance; impair short-term memory, concentration, learning and behavior; provoke aberrant immune, allergic and inflammatory responses in tissues; alter brain metabolism; increase risks for reproductive failure (damage sperm and increase miscarriage risk); and cause cells to produce stress proteins. Exposures now common in home and school environments are likely to be physiologically addictive and the effects are particularly serious in the young.'

BioInitiative Report 2012

(Continued from page 1)

that harmful effects have been found to occur at levels that are thousands of times lower than those permitted by current safety standards. The Report suggests that these standards are outdated and inadequate and recommends that exposure be kept to 'the lowest levels at which effects are not seen'.

Whereas the 2007 BioInitiative Report recommended limiting cumulative outdoor exposure to 0.1 uW/cm² (equal to 100 nanowatts/cm²), the 2012 Report recommends reducing it to 'three orders of magnitude lower.' It recommends 'a scientific benchmark of 0.003 uW/cm² or three nanowatts per cm²'.

For sensitive populations, the levels should be reduced even further, the Report says.

It says, 'Health authorities and regulatory agencies that set public safety standards ... should act now to adopt new, biologically-relevant safety limits that key to the lowest scientific benchmarks for harm coming from the recent

studies, plus a lower safety margin.'

Regulators do not consider the cumulative exposure of people to multiple sources of wireless radiation, even though this radiation has an additive effect, the Report warns.

One chapter of the Report contains the precautionary advice of various health agencies and groups of physicians and precautionary political decisions that have been implemented throughout the world.

'The great strength of the BioInitiative Report is that it has been done independent of governments, existing bodies and industry professional societies that have clung to old standards. Precisely because of this, the BioInitiative Report presents a solid scientific and public health policy assessment that is evidence-based,' said Dr David Carpenter and his co-editor Cindy Sage.

A summary of the findings of the report can be found on pages 8-9.

The BioInitiative Report can be found at www.BioInitiative.org.au.

Kids, phones & headaches

In the first study of its kind, scientists have found that children exposed to mobile phone radiation early in life were more than usually prone to headaches.

The scientists investigated over 52,000 children in Denmark who were part of the Danish National Birth Cohort—a project in which women, pregnant between 1996 and 2002, agreed to provide information about their children over a period of time.

When they investigated the exposure of the children, the scientists found that 39% of the children were exposed to mobile phone radiation before birth, some after birth and 40% had no mobile phone exposure at all.

Seven percent of mothers said they kept their mobile phones in the pocket of a dress or trousers when they were pregnant and 80% left their phones turned on at least 50% of the time.

The researchers found that children who were exposed to mobile phone radiation before and after birth had 30% more chance of developing headaches and migraines than those who had never been exposed. Those who had only been exposed before birth or after birth had about 20% more headaches and migraines.

The risk of migraines was higher among women who used a hands-free devices while they were pregnant, probably, the authors speculate, because the woman kept her phone near the foetus while making calls.

The authors suggest that more studies should be undertaken to confirm these findings. 'Should a true causal effect exist,' they say, 'it would have large public health implications because cell phone exposure is nearly ubiquitous and children are using this technology at younger ages than ever before. (Sudan, M et al, *The Open Pediatric Med J* 6, 46-52, 2012.)

Recommendations

- ◆ 'Health agencies and regulatory agencies should act now to adopt new, biologically-relevant standards.'
- ◆ 'Men of child-bearing age should not wear mobile phones on their body to protect the integrity of sperm DNA.'
- ◆ 'Commonsense measures to limit both ELF-EMF and RFR in the fetus and newborn infant are needed.'
- ◆ 'Pregnant women should be strongly cautioned not to use wireless devices during pregnancy.'
- ◆ 'Children should not use wireless devices except in the case of emergencies.'
- ◆ 'Children should not ... be exposed on an involuntary and chronic basis to wireless in their living, sleeping or learning environments.'
- ◆ 'Wireless laptops and other wireless devices should be strongly discouraged in schools for children of all ages, and wireless systems already installed should be replaced with wired (cable) alternatives.'

BioInitiative Report 2012

Late lessons

A new report from the European Environment Agency advises applying precautionary principle to mobile phone use.

In January the European Environment Agency (EEA) issued a major report which has recommendations for mobile phone users and administrators.

'Late Lessons from Early Warnings Vol II' is a 750-page document that considers the risks of new technologies and the consequences of ignoring them. It includes case studies on mercury poisoning, hormone-disrupting chemicals in plastics, nuclear radiation, genetically modified organisms, nanotechnology and mobile phones.

'The benefits of mobile telecommunications are many but such benefits need to be accompanied by consideration of the possibility of widespread harms. Precaution actions now to reduce head exposures would limit the size and seriousness of any brain tumour risk that may exist. Reducing exposures may also help to reduce the other possible harms that are not considered in this case study,' the report concludes.

In the chapter about the brain tumour risks of mobile and cordless phone use, the report considered evidence from two main groups of studies. The first are studies by the research team of Dr Lennart Hardell, one of the authors of the chapter. These studies showed that:

- ◆ people who used a mobile phone for more than 10 years had nearly 3 times the risk of developing gliomas and acoustic neuromas on the side of the head used for the call;
- ◆ people who used a cordless phone for more than 10 years had 3 times the risk of developing meningiomas and nearly 4 times the risk of gliomas on the side of the head used for the call;
- ◆ the greatest risk of brain tumours was for people who began to use a mobile phone before the age of 20. They had 3 times the risk of gliomas and 5 times the



risk of acoustic neuromas.

The report also considered the group of studies known as the Interphone study, conducted in 13 countries from 2000 to 2004. There was a four-year delay in publishing the study because of disagreements about the results. The study had methodological limitations and probably underestimated the risk and the protocol of the study allowed representatives of industry to be involved as observers or consultants. The Interphone study found:

- ◆ no increased risk of meningiomas overall;
- ◆ highest phone use—equivalent to half an hour's use a day for 10 years—led to 1.4 times the risk of gliomas and nearly twice the risk of gliomas on the same side of the head as used for calls in the temporal lobe.

'Results from the Hardell-group as well as from the Interphone group show an increased risk for glioma and acoustic neuroma associated with long term mobile phone use,' said the report.

Based primarily on these two groups of studies, the International Agency for Research on Cancer classified radiofrequency radiation as a Class 2B carcinogen in 2011.

Despite this evidence, the EEA report says that neither industry nor gov-

ernments have taken the risk seriously. There have been 'unfounded attacks on individual researchers ... a pattern that repeats similar experiences in the asbestos, lead and tobacco histories.'

In the report, Philippe Grandjean said this is the case with many new technologies. 'Despite its presence in a growing body of EU and national legislation and case law, the application of the precautionary principle has been strongly opposed by vested interests who perceive short term economic costs from its use. There is also intellectual resistance from scientists who fail to acknowledge that scientific ignorance and uncertainty are excessively attached to conventional scientific paradigms, and who wait for very high strengths of evidence before accepting causal links between exposure to stressors and harm.'

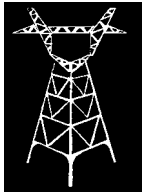
Yet we cannot afford to ignore the warning signs. 'None of the today's established carcinogens, including tobacco, could have been firmly identified as increasing risk in the first 10 years or so since first exposure.'

'Taken together, the examples of late action on known hazards illustrate the high cost of inaction. Globally that cost has been paid in millions of lives and cases of disease and dysfunction, much damage to the environment and species, and very large economic penalties.'

The report calls for independent research on the biological and ecological effects of this radiation, particularly in light of the fact that mobile phones are used by more than five billion people and that other species—such as birds and bees—appear to be affected by it as well as humans.

'Late lessons from early warnings: science, precaution, innovation', EEA Report No 1/2013, <http://www.eea.europa.eu/publications/late-lessons-2>

Research Updates



ELF fields (from electrical sources)

EMFs may cause changes to the immune system that contribute to cancer, according to a study from Iran. I Salehi and team exposed rats to a 50Hz field at 1000mG (the current Australian public exposure limit) for 2 hours a day for 3 months. They found that exposure caused changes in cytokines—which are essential for immunity—including the activation of cells that clear tumours, bacteria and viruses.

The study may help explain how EMF could contribute to the health problems that have been linked with it. (Salehi, I et al, *Electromagn Biol and Med* 2012.)



How cancer cells respond to magnetic fields and melatonin was the subject of a study by M Cid and team from Spain. The researchers exposed hepatocarcinoma cells to a 50Hz field of 100 mG with or without the presence of melatonin, a free radical-scavenging hormone. They found that exposure to the magnetic field caused proliferation of the cancer cells and this was counteracted by melatonin. Conversely, the antiproliferative effect of melatonin was counteracted by application of the magnetic field.

The authors concluded that their findings suggest, 'ELF magnetic fields can stimulate cancer progression by enhancing growth or dedifferentiation of proliferating cancerous cells and/or by inducing clonal expansion of specific cell types.' They suggest that people with low levels of melatonin may be more vulnerable to the effects of magnetic fields and that supplementation with melatonin might be helpful for them. (Cid, MA et al, *Cell Physiol Biochem*, 30(6):1502-1516, 2012.)



Turkish researchers investigated the effects of magnetic fields on some molecules in the brains of rats. They exposed rats to the maximum levels allowed by international standards for two hours a day for 10 months. They found that increased some markers of oxidative stress. (Akdag, MZ et al, *Electromagn Biol Med*, Jan 16, 2013.)



British researchers investigated the effects of the father's exposure to electromagnetic fields on leukemia in offspring. Looking at data for the period 1962-2006, they concluded that paternal exposure to electromagnetic fields significantly increased the risk of developing some types of leukemia, but not lymphatic leukemia or acute myeloid leukemia. (Keegan, TJ et al, *Brit J Cancer* 107(9), 1652-59, 2012.)



Could 'dirty' electricity be contributing to health problems? Dopamine levels of staff in a library were outside normal ranges. When dirty electricity filters were installed, dopamine levels normalised. (Milham, S and Stetzer, D, *Electromagn Biol Med*, Jan 16, 2013.)



Age may affect the way organisms react to magnetic fields, according to research from Serbia. Scientists exposed adult and middle-aged gerbils to 50 Hz fields. They found that exposure increased oxidative stress in all brain regions they tested and the effect was higher in older gerbils than the younger group. (Selaković, V et al, *Cell Biochem Biophys* Jan 6, 2013.)



A meta-analysis of studies on the link between occupational exposure to magnetic fields with neurodegenerative diseases and motor neuron diseases found 'weak associations' but scientists were not convinced these could be attributed to magnetic fields. (Vergara, X et al, *J Occup Environ Med* 55(2):135-46, 2013.)

Other studies on ELF exposure

- ◆ Exposure to electromagnetic fields increased activity of sodium channels in rat brain cells. (He, YL et al, *PLoS One* 8(1), Jan 22, 2013.)
- ◆ Workers exposed to high fields had reduced sleep duration and quality. (Barsam, T et al, *Iranian J Environ Health Sci Eng* 9(1):15, 2012.)



Radiofrequency radiation (from telecommunica- tions sources)

Mobile phone radiation may have potentially harmful effects on the blood and brain, according to a study from Turkey. S Celikozlu and team exposed groups of rats before and after birth to the signal from a GSM mobile phone on standby all day and in talking mode for 30 minutes a day for 80 days. Exposure increased blood glucose levels in one group, which could have implications for diabetes. It also increased proteins levels in one group. It decreased pyramidal cells in the cortex of the brain and caused vascular dilation, which indicates tissue damage in one group. (Celikozlu, S et al, *Electromagn Biol Med* 31(4):344-55, 2012.)



Mobile phone radiation may affect weight, according to a study from Serbia.

The scientists exposed rats to a mobile phone signal for up to 60 days. Exposed rats had significantly lower body mass and, after ten days of exposure, rats showed more anxiety (agitation, irritability) and these behaviours decreased when exposure stopped. Rats who were exposed to the signal and treated with melatonin had less anxiety and improved body mass. (Sokolovic, D, *Bratisl Lek Listy* 113 (5): 265 - 269, 2012.)



Exposure to GSM mobile phone radiation may have a harmful effect on memory. Greek researchers exposed 2-month old mice to a GSM mobile phone signal for 90 minutes a day for 66 or 148 days and tested them for object recognition and the ability to find a location. They found that exposure impaired both types of memory, especially spatial memory, and impairments lasted for two weeks after exposure ceased. The researchers suggest that exposure affected visual information processing in the hippocampus and entorhinal cortex. (Ntzouni, MP et al, *Electromagn Biol Med* Jan 15, 2013.)



Exposure to RF affected heart rate in a study from Poland. A Bortkiewicz and team measured heart rate of 71 exposed workers and compared them with controls. 51% of the workers reported cardiovascular symptoms including dyspnoea, pain, discomfort in the chest or feeling irregular heart eat. These symptoms were reported by only 29% of the control group. Heart rate was higher among exposed than unexposed workers. (Bortkiewicz A et al, *Int J Occup Med Environ Health* 25(4):446-55, 2012.)



RF radiation damaged DNA in experiments from Croatia. M Tkalec and team exposed earthworms to a mobile phone signal of 900 MHz under different exposure conditions. They found that exposures induced the anti-

oxidant stress response, damaged lipids, proteins and DNA. (Tkalec, M et al, *Ecotoxicol Environ Saf*, Jan 23, 2013.)



Turkish scientists exposed rats to a 2.45 GHz mobile phone signal. They found that exposure caused oxidative damage in the animals' testis and depletion of vitamin A and E levels. However, this damage did not occur in rats who received supplements of melatonin. (Oskay, T et al, *Andrologia*, 2012.)



Mobile phone radiation may affect people's hearing, according to research from Saudi Arabia. Over a two year period, researchers at the Ear, Nose and Throat Department of King Abdulaziz University Hospital, tested people's hearing before and after a one-hour use of a mobile phone. They found that exposure had an immediate effect on hearing threshold levels in young people and caused other symptoms. (Alsanosi, AA et al, *Saudi Med J* 34(2), 142-6, 2013.)



Other studies showing effects from RF exposure

- ◆ Exposing wheat seedlings to a 10-kHz field changed membrane integrity and growth characteristics. (Payez, A et al *Electromagn Biol Med* Jan 23, 2013.)
- ◆ 1800 MHz induced DNA damage in cells. (Xu, S et al, *PLoS One* 8(1), 2013.)
- ◆ 1.8 GHz radiation inhibited ciliary beat frequency—involved in protecting against the inhalation of harmful materials. (In, SM et al, *Laryngoscope*, 2012.)
- ◆ Wireless radiation of 2.45 GHz caused oxidative stress in rats' dorsal root ganglion and melatonin prevented this reaction. (Naziroglu, M et al, *Physiol Behav* 105(3), 683-92, 2012.)
- ◆ An RF signal of 1.8 GHz caused protein oxidation in brain tissue of rats and increased nitric oxide

levels. Garlic reduced protein oxidation. (Avci, B et al, *Int J Radiat Biol* 88(11), 799-805, 2012.)



Studies showing no effects

- ◆ No association between adults' cancers and living near a high voltage power line. (Elliott P et al, *Epidemiology* Jan 18, 2013.)
- ◆ Magnetic field exposure did not adversely affect rats' memory. (Wang, X et al, *Bioelectromagnetics* Jan 25, 2013.)
- ◆ Magnetic field exposure did not affect survival or relapse in children with acute lymphoblastic leukemia (Schüz, J et al, *Blood Cancer J*, Dec 21, 2012.)
- ◆ Combined exposure to DCMA and WEDMA signals did not affect some hormone levels in rats. (Jin YB et al, *J Radiat Res* Dec 13, 2012.)



Abbreviations

- RF radiofrequency radiation (including mobile technology)
- ELF extra-low frequency radiation (including electrical sources)
- EMF electromagnetic fields (often used alternatively for ELF)
- mG milliGauss (measurement of magnetic field)
- T Tesla - alternative measurement of magnetic field; also millitesla (mT) and microTesla (µT)
 - ◆ 0.1 mT = 1000 mG
 - ◆ 0.01 mT = 100 mG
 - ◆ 1 µT = 10 mG
- Hz Hertz - a measure of frequency (cycles per second).
 - ◆ Megahertz (MHz) - million Hz
 - ◆ GigaHertz (GHz) thousand million hertz.

Updates from around the globe



Austrian doctors

The Vienna Medical Association have called for more precautions following the Italian court ruling that mobile phones caused a man's brain tumour late last year. (See *EMR and Health*, Dec 2012.)

Association spokesman Piero Lercher said that mobile phone-free public areas should be established, similar to smoke-free spaces, both to protect people and to raise awareness about the technology.

Although mobile phones can be useful, they are being used in unnecessary ways. 'The mobile phone as a constant companion, even in bed, goes beyond the target', he said.

Lercher called for the recycling of mobile phones because they contain rare metals, the mining of which causes environmental degradation.

He also called on industry to develop low-radiation cordless phones. (www2.aekwien.at)

Pediatricians call for phone safety

The American Academy of Pediatricians has announced its support of mobile phone legislation proposed by Congressman Dennis Kucinich.

'The 'Cell Phone Right to Know Act', proposes labels for mobile phones, a research-program to investigate the health effects of mobile phone radiation, and the update of the US standards.

'Children are disproportionately affected by environmental exposures, including cell phone radiation. The differences in bone density and the amount of fluid in a child's brain compared to an adult's brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults,' said Academy President Dr Thomas McInerney. (<http://www.opednews.com/articles/>

American-Academy-of-Pediatry-by-Dennis-Kucinich-121213-724.html)

India closes towers

The Hindustan Times reports that authorities in New Delhi have begun a crackdown on several thousand illegal phone towers because of concerns about the health effects of the radiation they emit. The initial focus has been to close towers on schools and hospitals and one civic agency has announced a policy banning towers from these sensitive areas. (*Hindustan Times* 12.12.2012.)

India investigation

Also in India, the Minister for Communication and Information Technology has advised that a committee will be established to study the harmful effects of radiofrequency radiation on plants and animals. (Times of India, 08.02.13.)

Nepal reduces exposure

The government of Nepal is introducing new guidelines to protect people from the risks of wireless radiation. The Nepal Telecommunications Authority will invite stakeholders to comment on the guidelines before they are finalised. The guidelines will specify radiation limits and practices with which telecommunications companies will be obliged to comply. (Republica, 20.01.13)

WiFi in schools

An Australian community group is opposing the use of WiFi in schools. Called 'WiFi in Schools Australia', the group has organised an online petition to be presented to Prime Minister Gillard. For more information, see www.wifi-in-schools-australia.org

Legal action

A US law firm specializing in class action and injury law suits is offering free consultations for people who believe their brain tumours may have been caused by mobile phone use. Bernstein Liebhart LLP says that 'Victims of cell phone radiation may be entitled to compensation for medical bills, lost wages, and pain and suffering.' Late last year, the company lodged a lawsuit for a man who believes his brain tumour was caused by long-term mobile phone use.

The company's website refers to the 2012 BioInitiative Report and the Italian court decision that mobile phone radiation caused a brain tumour in 2012. (<http://www.prweb.com/releases/cell-phones-brain-cancer/cell-phone-lawsuits/prweb10330633.htm>)

EMR conference

The ninth national conference on electrosmog is to be held in Bern, Switzerland on 20 April. Speakers include Prof Lennart Hardell (Sweden), Dr Dode (Brazil), Prof Levis (Italy) and Drs Favre and Jakob. For details, see: <http://gigaheerz.ch/pages/posts/the-9th-national-congress-of-electrosmog1855.php>

Protecting workers

In December the European Parliament voted to adopt new rules to protect workers from electromagnetic fields. The regulations apply to highly exposed workers such as steel workers or people working near TV towers, powerlines or mobile phone transmitters. The new rules require employers to assess the risks to workers and take steps to reduce them. It will, however, provide exemptions for workers involved in medical imaging and the military. (European Parliament News, 06.12.12.)

Less wireless

A leading US neurologist has called for schools to avoid wireless computer networks.

Assistant Professor of Pediatric Neurology and neuroscientist from Harvard Medical School Dr Martha Herbert wrote to the Los Angeles School District on 8 February, advocating use of wired technologies.

Dr Herbert specialises in the treatment of neurodevelopmental disorders such as autism and is author of the book, 'The Autism Revolution'. She recently reviewed scientific studies showing a potential link between Autism Spectrum Disorders and effects from electromagnetic radiation for the BioInitiative Report and found over 500 papers that were relevant.

'There are thousands of papers that have accumulated over decades ... that document adverse health and neurological impacts of EMF/RFR,' she wrote.

These effects occur without any significant heating and the assumption that only heating effects of wireless networks need to be considered 'is now definitively outdated scientifically,' she said.

'EMF/RFR from wifi and cell towers can exert a disorganizing effect on the ability to learn and remember, and can also be destabilizing to immune and metabolic function.' This, she said, will make it harder for children to learn, if they already have learning problems.



Brain tumour risks

Mobile phone use is related to higher risks for several types of brain tumours, says Professor Lennart Hardell from Sweden's University Hospital.

In a review of the scientific literature, published in December, he found increased risks for gliomas, meningiomas and acoustic neuromas.

Mobile phone use increased the risk of glioma brain tumours:

- ◆ by 70% in the temporal lobe of people who had used phones for more than 10 years
- ◆ by 129% in people who used phones for more than 1640 hours on the same side of the head as their tumours.

Mobile phone use increased the risk of meningiomas:

- ◆ by 25% in the ten or more years of exposure group
- ◆ by 35% in those who used phones for more than 1640 hours on the same side of the head as their tumours

The risk for acoustic neuromas was increased

- ◆ by over 80% in people who used phones for more than ten years
- ◆ by 150% in those who used phones for more than 1640 hours on the same side of the head as their tumours.

Cordless phone use also increased the risk of glioma and acoustic neuromas in the studies Hardell and his team conducted. (Hardell, L et al, *Pathophysiology* Dec 20, 2012.)

Screen risks to kids

Spending too much time in front of the screen is having a devastating effect on the lives of children, says a prominent pediatrician from Sweden.

'Many children spend most of their waking hours in front of the screen,' said Professor Hugo Lagercrantz in January, writing in the journal of the Swedish Medical Association. This includes time spent on DVDs, computers, laptops, smart phones, video games and TVs—often in multiple rooms of a house.

Prof Lagercrantz said statistics show that children in the US spend six hours a day at a screen, while those in Europe use the internet for about 12 hours a week. In addition, screen time is increasing as classrooms introduce electronic gadgets.

Despite the advantages that are claimed for children's use of screen technologies, Prof Lagercrantz said that there are serious disadvantages that parents need to consider:

- ◆ Screen time increases inattention and distraction at school and may aggravate ADHD in children genetically predisposed to it;
- ◆ Spending too much time watching TV delays language development;
- ◆ Each hour of daily TV watching

increases children's body weight by 1 kg—and this increase is not just related to lack of exercise;

- ◆ Adolescent boys who watched more than three hours of TV a day had more criminal behaviour;
- ◆ Screen time reduces time for play which is important for developing creativity and social skills;
- ◆ Screen viewing may reduce empathy which has decreased in the last 30 years.

Lagercrantz advises parents to restrict the amount of time children spend in front of electronic equipment. He says:

- ◆ children under 2 years of age should not watch TV or use tablets at all;
- ◆ two and three year-olds should spend minimal time in front of a screen;
- ◆ children aged 3-7 may spend up to 2 hours a day watching TV or a DVD that involves storytelling, accompanied by an adult;
- ◆ children aged 7-15 should spend no more than 3 hours a day

BioInitiative findings

The 2012 BioInitiative Report shows even more evidence of risk from EMR.

Wireless phones and brain tumours

The two primary sources of evidence for the mobile phone/brain tumour link come from the Interphone and Hardell studies. Hardell, a coauthor of the BioInitiative Report, conducted the meta-analysis on the two groups of studies, reported on page 7.

After reviewing this evidence, the authors of this chapter conclude, 'there is a consistent pattern of increased risk for glioma and acoustic neuroma associated with the use of mobile phones and cordless phones.'

They refer to the conclusion of the Italian Supreme Court that mobile phone radiation was responsible for causing a businessman's brain tumour (reported last issue).

The authors consider that the evidence of risk is sufficient to justify classifying mobile phone radiation as a human carcinogen and that current safety standard are not sufficiently protective.

'New public health standards and limits are needed,' they say.

Childhood cancers

The Report says that childhood leukemia is the most common childhood cancer and the incidence increased early in the 20th century, possibly due to electrification.

The IARC classified magnetic fields of 4 mG as a class 2B carcinogen 2001, based on the many studies showing a link between childhood leukemia and magnetic fields. It did not classify it as a carcinogen based on the lack of supporting animal and mechanism studies.

The Report concludes that there is sufficient evidence to suggest that magnetic fields *cause* childhood leukemia, irrespective of a mechanism having been identified, and that confirming animal studies are not possible



because there is no animal model for the most common form of childhood leukemia. These exposures, it says, should be classified as a group 1 carcinogen.

'Typically, if an agent is classified as a Group 2B carcinogen, precautionary measures are taken at workplaces and special care is recommended if it is present in consumer products (eg lead, styrene, benzofuran, welding fumes).' However, this has not happened in the case of EMR.

International exposure guidelines protect only against immediate effects ('such as nerve and muscle excitations') and are not providing adequate protection. Precautionary measures should be put in place and exposures from powerlines should be kept below an average of 1 mG, the authors say.

Fertility and Reproduction

According to the Report, 'Use of electronic household items and cell phones are reported to decrease fertility potential in men by decreasing sperm count, motility, viability, inducing pathological changes in sperm and testes morphology, and so on.'

Among the reproductive problems it identifies are:

- ◆ changes to sperm motility
- ◆ reduced testicular weight
- ◆ miscarriage
- ◆ DNA damage

- ◆ increased risk of urinary tract abnormality
- ◆ excess of abortions
- ◆ increase in DNA fragmentation
- ◆ early development of embryo abnormalities in sperm head
- ◆ reduced ovarian size (fruit flies) and
- ◆ reduced sperm count.

It suggests these problems may be caused by oxidative stress and free radical action.

As well as impeding fertility, sperm damage may possibly damage embryos, the authors suggest.

'Overall, the evidence from various laboratories studying fertility and reproduction effects over the last ten years is important enough [to] raise questions about possible public health consequences of chronic, long-term exposure to mobile phone use, and when carried on the body close to the reproductive organs.'

Fetal and Neonatal Effects

The Report says that young children can be chronically exposed to many sources of EMR, yet there has been little research on how they are affected by this exposure.

Some studies have found that prenatal exposure increased the risks of children developing leukemia, asthma and behavioural problems and hyperactivity. Others found that:

- ◆ those who used mobile phones had a higher rate of brain tumours
- ◆ those exposed to magnetic fields had higher rates of leukemia.

Babies and fetuses have large numbers of stem cells which appear to be more susceptible to EMR than other (differentiated) cells.

Common-sense precautions should be adopted to protect the very

young, for example educating pregnant women and modifying the design of incubators to reduce magnetic fields.

'New, biologically-based public exposure standards are critically needed,' the authors conclude.

Neurological effects

Both EMF and RF cause changes in the nervous system, the Report says. Of the new studies, 63% show effects from RF and 93% show effects from EMF.

'The nervous system is an electric organ. Thus, it should not be surprising that exposure to electromagnetic fields could lead to neurological changes.'

Among the changes it reports are:

- ◆ changes in the electrical activity of the brain after mobile phone use
- ◆ effects on sleep
- ◆ changes to cognitive function
- ◆ memory effects
- ◆ hyper/hypo-activity and
- ◆ changed emotional states.

Free radical damage may be one factor that contributes to these effects, the Report says.

'There is no definite data showing that these effects are detrimental to human health. However, since effects have been observed, it is advisable that one should limit one's exposure to EMF.'

Genetic effects

The Report updates the 2007 data on the genetic effects of EMR. It says that 63% of the new studies show genetic effects from RF and 81% show effects from EMF and the effects of both EMF and RF are similar.

'Increase in free radical activity and changes in enzymes involved in cellular oxidative processes are the most consistent effects observed in cells and animals.' The authors say there are several hundred studies showing such effects.

According to the Report, EMR has a synergistic effect with other environmental agents, including ionizing radiation, chemical mutagens and x-rays. 'Most of the compounds that interact with EMF are mutagens.'

Studies have found that the genetic effects of EMR may depend on the type of cell that is exposed and the type of wave that's used. For example, some DNA breaks occurred when cells were

exposed to a modulated but not continuous signal.

The Report concludes, 'not very much of the cellular and animal genetic research data directly indicate that EMF (both RF and ELF EMF) is a carcinogen. However, the data show that EMF can possibly alter genetic functions and thus it is advisable that one should limit one's exposure to EMF.'

Stress Response

The authors say that cells have been shown to release stress proteins when exposed to both EMF and RF, even at low levels of exposure. One of the reasons this occurs has to do with the shape of DNA.

'It appears that the DNA molecule is particularly vulnerable to damage by EMF because of the coiled-coil configuration of the compacted molecule in the nucleus. The unusual structure endows it with the self similarity of a fractal antenna and the resulting sensitivity to a wide range of frequencies.'

EMF harms cells at levels a billion times lower than caused by heating. Therefore, existing standards need to be replaced with biologically-based standards 'that could be developed from the research on the stress response.'

Blood-brain barrier

There are no definite conclusions about whether EMR harms the blood-brain barrier that can be drawn from the scientific literature at present, the Report says. However, there are indications of harm.

'The fact that an abundance of studies do show effects is an important warning. This is true even if it can be summarized that the effects most often are weak and are seen in about 40% of the exposed animals.'

The authors refer to studies that found a breaching of the blood-brain barrier at levels that would be found about a meter from a mobile phone or 150-200 metres from a mobile phone base station.

'A single 2-hr exposure to cell phone radiation can result in increased leakage of the BBB, and 50 days after exposure, neuronal damage can be

seen,' the authors say.

Melatonin, breast cancer and Alzheimer's Disease

The Report says that 11 of 13 published studies show that magnetic fields decreased melatonin production and the remaining two appear to be flawed.

Nine of 12 studies show that magnetic fields contribute to Alzheimer's Disease or dementia and the three remaining studies have flaws.

The authors conclude that EMF increases amyloid beta which is a risk factor for Alzheimer's Disease and reduces melatonin which is protective against the disease.

Autism

The Report discusses parallels between the way in which EMF and RFR affect the body and physiological characteristics of people with autism. These parallels include changes to genes, developmental changes and ongoing changes to brain function.

The authors say there is a need for research to consider the evidence for EMR contributing to this condition.

In the meantime, they recommend precautions to protect children. 'Reducing or removing EMF and wireless RFR stressors from the environment is a reasonable precautionary action given the overall weight of evidence.'

Hypothesis for effects

The Report considers the hypothesis that radiofrequency radiation may cause biological problems by disrupting the synchronization of electrical signals in the brain.

'Synchronous biological oscillations in cells (pacemaker cells) can be disrupted by artificial, exogenous environmental signals, resulting in desynchronization of neural activity that regulates critical functions (including metabolism) in the brain, gut and heart and circadian rhythms governing sleep and hormone cycles,' it says.

Watt's the Buzz?

A load of crap?

How could children ever have managed with out them?

Inventers have now turned their fertile imaginations to the humble children's potty in their efforts to find more applications for wireless technology.

The 'ipotty' is a potty with an ipad on a stand attached to the seat designed for toddlers who are being toilet trained.

Now before you poo poo this idea, think of its advantages. Kids can learn to multitask at an early age, they can get into the habit of using their mobile technology in the bathroom and they can learn to irradiate themselves as they poo.

We wonder why no one thought of it earlier! (See *Digital Trends* 12.01.13.)



An interesting gesture

Now you can warm up with radiation this winter.

Italian designers have developed the glove that doubles as a mobile phone. Hold it against your head and you can speak into the microphone sewn into the finger.

That way you can irradiate your head and hand at the same time. (See *Australian IT* 24.1.13.)

Getting the sack

Would you like airline staff to treat you like a sack of potatoes?

Fat chance! you might say.

Well, it's too late!

Engineers of Boeings aircraft used sacks of potatoes as stand-ins for passengers while they tested aircraft Wi-Fi signals—because, they said, potatoes behave in a similar way to the signals to humans.

Really?

Apparently none of the 9000kg of potatoes developed headaches, irritability, memory or concentration problems, depression or brain tumours during the several days of testing.

But, we wonder, did they develop any eye problems?

(See *BBC News* 21.12.12.)

Time for new tech?

As if a mobile phone and ipad are not enough... Computer giant Apple is reportedly planning to develop a watch that has smart phone capabilities. (*Australian IT* 22.02.13.)

Watch out!

Big Brother may be watching you—and sharing information about you with advertisers.

Chinese TV manufacturer TCL has developed what it considers to be a 'smart' television that can watch the people who watch it. The TV has a set-top box that senses who is watching it and can even recognise the voices of family members. It uses this information to provide programs and advertisements targeted towards the audience.

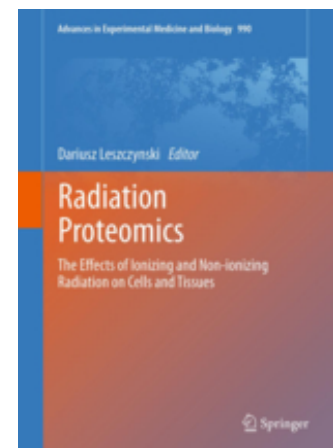
TCL, which manufactures Thomson and RCA televisions, plans to begin selling the TVs in the US later this year.

The technology raises privacy issues—who will have access to the data and how secure will it be? (See *SMH* 10.01.13.)

New book

A new book edited by Professor Dariusz Leszczynski, proteomics studies examining radiation effects on cells and tissues, published February 2013.


For more information, see <http://www.springer.com/biomed/book/978-94-007-5895-7>



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Internet addiction

Internet addiction is soon to be considered a psychiatric disorder.

There's no doubting the value of the internet. A virtual personalized library, it makes information on every conceivable topic available at the touch of the fingertips and provides services from internet banking and online shopping to social networking.

But overuse of the internet is something else altogether.

Psychiatrists say that internet addiction—or internet-use disorder, as it's sometimes called—is such a prob-

lem that they're about to class it as a mental disorder. From May, the psychiatric profession's manual of mental disorders—the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)—will include internet-use among its list of disorders and recommend it for further study.

The Australian Psychological Society has approved the addition to the DSM, but said that it doesn't go far enough. 'A broader issue is that many

other potential behavioral addictions may also be considered for inclusion over time, as technology or social behaviors change' it said in its submission on the revision.

1. 'Submission to the American Psychiatric Association by the Australian Psychological Society on DSM-5 Draft Criteria', 15.06.12.

Australian clinical psychologist Grant Brecht sees many clients with internet addiction. He believes classifying the condition as a mental health disorder is useful because it will help raise awareness about the condition and draw it to the forefront of clinicians' awareness.

'I do think it is useful because so many people are using the internet for long periods of time. Clinically people are getting all sorts of reactions to this,' he told *EMR and Health*.

Brecht says that quite a lot of the clients he sees with this disorder have phobias or relationship problems. They tend to use the internet for relationships, rather than getting out and mixing in society. Using the internet in this way allows people to connect, but not in the way where they are in face-to-face contact and can touch and see each other. 'It's superficial engagement,' he says. 'People are social animals and miss the intimate connection and engagement with others.' The sort of connection they have on the internet, he believes, can build depressive and anxiety disorders.

Recognising internet addiction is not always easy. Brecht says that, like

other addictions, it can creep up on a person slowly over time so that they don't recognise that they are becoming addicted. 'Often it's the family that recognise it first,' he says.

Recognising internet addiction

One of the important indications of internet addiction is anger, says Brecht. 'People start to feel irritable when they can't spend time on the internet. They're distracted from other activities. They're forever waiting to get back on the internet.'

Another indication is loss of social contact. He is consulted by lots of parents concerned about their children sitting in front of a screen for four hours at a time, who are not getting out, mixing with other children and playing in team sports.

'When more than four hours a day is involved, it can be quite maladaptive,' he says.

Avoiding addiction

According to Brecht, avoiding internet addiction is about 'taking commonsense into common practice'.

He recommends that people use the internet to communicate in short bursts, then get out into the real world to engage with others face-to-face.

'Don't spend more than an hour at a time before mixing it with other activities,' he suggests.

Brecht advises parents to keep an eye on their children and try not to let them spend too much time on the internet. 'It's better to intervene earlier rather than later,' he believes. Parents should avoid the temptation to use the internet as a babysitter while they're occupied with other activities.



Grant Brecht a psychologist with 25 years of experience and Director of Grant Brecht and Associates.

Mobiles & kids

New study casts light on the mobile phone habits of young teens.

Just how much and how often are young people using their mobile phones and what might be the implications for their future health?

In a paper published in January, Mary Redmayne investigated the mobile phone habits of 373 year 7 and 8 students, aged 10 to 13, from Wellington, New Zealand.

She found that mobile phones were used by approximately 90% of the students and three quarters owned at least one mobile phone. More than a third of the students had been using a mobile from the age of eight or nine, but some had begun much earlier.

Students tended to use their phones most often for texting, receiving calls and taking photographs. Other popular uses were as an alarm and a calculator.

Most students carried their phones in the pocket of their trousers or skirts and some kept them in the side pocket of a hoodie. A few carried their phones under their bra strap or in their bras. Most of the students kept their phones turned on while they carried them and about 20% of students carried their phones in their pockets, turned on, for more than ten hours a day.

Many students sent texts while their phone was in their pockets and some held their phones close to their body while they used them.

Approximately two thirds of the students kept mobiles next to their bed at night and some kept their phones under their pillows. Many reported being woken by their phone at night time and this

could result in chronic tiredness at school.

Most students used cordless phones at home and had been doing so for nearly six years on average. Nearly 24% of students spent half an hour a day on a cordless phone.

Parents were more likely to perceive mobile phones than cordless phones as harmful.

How might this extensive phone use impact on children's health?

Ms Redmayne says that by the age of 16, many students are likely to have used their phones for more than 1640 hours—a length of time associated with increased glioma brain tumours in a major international (Interphone) study.

She also suggests that students' tendency to use their phones in a pocket or on their lap, warrants study into whether mobile phone radiation might contribute to tumours of the femur or pelvis.

Redmayne, M, *Environmental Health* 12:5, January 2013, <http://www.ehjournal.net/content/12/1/5>

(Continued from page 7)

watching TV or DVDs but then only on rare occasions;

- ◆ children should not have a TV in their bedroom and should not eat in front of the TV.

(Läkartidningen, 08.01.13, <http://www.lakartidningen.se/07engine.php?articleId=19078>— in Swedish)

Laptop earthing plate—available from EMR Australia

The laptop earthing plate protects users from high electric fields emitted from many laptops when they are plugged into the power point.

EMR Australia's laptop earthing plate is placed under the laptop to draw the field away from the body and to earth through the household wiring.



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Top quality, economical gauss meters for hire or purchase. Comes with support material.

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Easy-to-use meter for measuring radiofrequency radiation from wireless sources, available for hire or purchase. Comes with support material.

Mobile phone shields

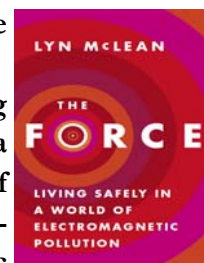
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