

# **WI-FI in Schools: What are the Health Risks?**



## **BRIEFING BOOK**

**February, 2014**

*[www.wirelesseducationaction.org](http://www.wirelesseducationaction.org)*

**For more info, or to volunteer:**  
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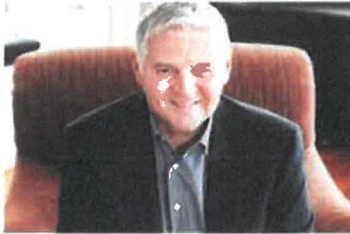
**“It is obviously going to take a health catastrophe of some magnitude before the state will come to terms with the fact that it has a duty to protect the populace and starts passing laws to minimize the risk. Industry’s obsession with profits has been given precedence up to now”**

**Dr. Leberecht von Klitzing, medical physicist at the University of Lübeck**



## INVISIBLE THREAT

February 1, 2014 • by Frank Clegg



### **FRANK CLEGG: LONGTIME PRESIDENT OF MICROSOFT CANADA IS NOW OUR COUNTRY'S LEADING ADVOCATE FOR WIRELESS RADIATION SAFETY.**

Vitality invited high tech leader Frank Clegg, now CEO of the new non-profit organization, Canadians for Safe Technology (C4ST)

It has been three years since the World Health Organization shocked the medical community by warning that exposure to microwave radiation from wireless devices might increase our cancer risk. If the same elite cancer specialists were to meet again today, the warning would be upgraded from a "possible carcinogen" to a "probable carcinogen." That is according to Professor Emeritus Anthony Miller, of the University of Toronto, who was speaking recently to Toronto's Public Works and Infrastructure Committee. (1)

### ***Wi-Fi Linked to ADHD, Learning Disorders***

A recent study demonstrated that pregnant women should be careful about their use of cell phones. Dr. Hugh S. Taylor, chief of reproductive endocrinology and infertility for Yale Medical Group says, "We have shown that behavioral problems in mice that resemble ADHD are caused by cell phone exposure in the womb. The rise in behavioral disorders in human children may be in part due to fetal cellular telephone irradiation exposure." (12)

Children are especially vulnerable since their skulls are thinner and certain tissues of a child's head, including the bone marrow and the eye, absorb significantly more energy than those in an adult head. (13) A highly regarded study from 2011 showed that radiation from a cell phone penetrated 10% of an adult head, whereas it penetrated the skull of a five year old 70%. (14)

Science suggests that exposure to constant wireless radiation impairs learning. However, as with pesticides, when the federal government lags behind, there are local initiatives that can make a difference.

We are C4ST, Canadians for Safe Technology, not No Technology and we are convinced that there is nothing less than the future of our children at stake. The tide is beginning to turn and in numbers, our voices will be heard.



## IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The World Health Organization/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as **possibly carcinogenic to humans (Group 2B)**.

Over the last few years, there has been mounting concern about the possibility of adverse health effects resulting from exposure to radiofrequency electromagnetic fields, such as those emitted by wireless communication devices....

The IARC Monograph Working Group, consisting of 31 scientists from 14 countries, was convened to assess the potential carcinogenic hazards from exposure to radiofrequency electromagnetic fields. They discussed the possibility that these exposures might induce long-term health effects, in particular an increased risk for cancer. This has relevance for public health, particularly for users of mobile phones, as the number of users is large and growing, particularly among young adults and children. International experts shared the complex task of tackling the exposure data, the studies of cancer in humans, the studies of cancer in experimental animals, and the mechanistic and other relevant data.

The data showed a 40% increased risk for gliomas in the highest category of heavy users (reported average: 30 minutes per day over a 10-year period).

Dr Jonathan Samet (University of Southern California, USA), overall Chairman of the Working Group, indicated that "the evidence, while still accumulating, is strong enough to support a conclusion and the **2B classification**. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."

"Given the potential consequences for public health of this classification and findings," said IARC Director Christopher Wild, "it is important that additional research be conducted into the long-term, heavy use of mobile phones. ***Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting.***"



## U. S. PRESIDENT'S CANCER PANEL EXPRESSES CONCERN

**The 2009 U.S. President's Cancer Panel** -- 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."***

"The increasing number of known or suspected environmental carcinogens compels us to action, even though we may currently lack irrefutable proof of harm," Lefall, who is chair of the panel, said in a statement.

Another sensitive issue raised in the report was the risk of brain cancer from cell phones. Scientists are divided on whether there is a link. Until more research is conducted, the panel recommended that people reduce their usage by making fewer and shorter calls, using hands---free devices so that the phone is not against the head and refraining from keeping a phone on a belt or in a pocket.

## **What Have U.S. Government Agencies Said About Chronic Microwave Exposure?**

**1993: Environmental Protection Agency (EPA):** The FCC's exposure standards are "seriously flawed."

Official comments to the FCC on guidelines for the evaluation of electromagnetic effects from radio frequency radiation, FCC Docket ET 93-62, November 9, 1993.

**1993: Food and Drug Administration (FDA):** "FCC rules do not address the issue of long-term, chronic exposure to RF fields." Comments of the FDA to the FCC, November 10, 1993.

**1993: National Institute for Occupational Safety and Health (NIOSH):** The FCC's standard is inadequate because it "is based on only one dominant mechanism—adverse health effects caused by body heating."

Comments of NIOSH to the FCC, January 11, 1994.

**2002: Norbert Hankin, Environmental Protection Agency (EPA) Center for Science and Risk Assessment, Radiation Protection Division:** "The FCC's current exposure guidelines, as well as those of the IEEE and the International Commission on Non-ionizing Radiation Protection (ICNIRP), are thermally based, and do not apply to chronic, "non-thermal" exposure situations. They are believed to protect against injury that may be caused by acute exposures that result in tissue heating or electric shock and burn.

Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, non-thermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/"non-thermal" exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines."

# What Do Physicians, Scientists & Health Policy Experts Have To Say?

**Martha R. Herbert, Ph.D., M.D., Pediatric Neurologist, Harvard Medical School:** “There are thousands of papers that have accumulated over decades that document adverse health and neurological impacts of EMF/RFR. Children are more vulnerable than adults. Current technologies were designed and promulgated without taking account of biological impacts that have nothing to do with the heating of tissue. EMF/RFR from wi-fi 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.”

**Dr. Neil Cherry, Associate Professor of Environmental Health at Lincoln University:** “Electromagnetic fields and radiation damage DNA and enhance cell death rates and therefore they are a Ubiquitous Universal Genotoxic Carcinogen that enhances the rates of Cancer, Cardiac, Reproductive and Neurological disease and mortality in human populations. Therefore there is no safe threshold level. The only safe exposure level is zero, a position confirmed by dose-response trends in epidemiological studies.”

**Dr. Ronald Herberman,** distinguished cancer researcher who served as Founding Director and Professor of Medicine and Pathology at the University of Pittsburgh Cancer Institute, Hillman Professor of Oncology and Vice Chancellor for Cancer Research at the University of Pittsburgh was the **first head of an NIH funded cancer institute in the United States to issue a warning about the potential risks from cell phone technologies:**

*“A disservice has been done in inaccurately depicting the body of science, which actually indicates that there are biological effects from the radiation emitted by wireless devices, including damage to DNA, and evidence for increased risk of cancer and other substantial health consequences” ...“The public the world over has been misled by this reporting.”*

**William Rea, M.D. Past President, American Academy of Environmental Medicine** “Sensitivity to electromagnetic radiation is the emerging health problem of the 21st century. It is imperative health practitioners, governments, schools and parents learn more about it.”

**David Carpenter, M.D., Director, Institute for Health and the Environment, School of Public Health, University of Albany.** “Unfortunately, all of our exposure standards are based on the false assumption that there are no hazardous effects at intensities that do not cause tissue heating. Many public health experts believe it is possible we will face an epidemic of cancers in the future resulting from uncontrolled use of cell phones and increased population exposure to WiFi and other wireless devices.”

**Samuel Milham M.D., MPH, Medical Epidemiologist in Occupational Epidemiology.** “New research is suggesting that nearly all the human plagues which emerged in the twentieth century, can be tied to some facet of our use of electricity. There is an urgent need for governments and individuals to take steps to minimize community and personal EMF exposures.”

**Paul J. Rosch, M.D., Clinical Professor of Medicine and Psychiatry, New York Medical College; Fellow, The Royal Society of Medicine; Emeritus Member, The Bioelectromagnetics Society:** “Children are more severely affected because their brains are developing and their skulls are thinner. A two-minute call can alter brain function in a child for an hour. It is not generally appreciated that there is a cumulative effect and that talking on a cell phone for just an hour a day for ten years can add up to 10,000 watts of radiation. That’s ten times more than from putting your head in a microwave oven. As Alvin Toffler emphasized in Future Shock, “too much change in too short time produces severe stress due to adaptational failure. This gigantic experiment on our children and grandchildren could result in massive damage to mind and body with the potential to produce a disaster of unprecedented proportions.”

HARVARD MEDICAL SCHOOL

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TO: Los Angeles Unified School District

FROM: Martha R Herbert, PhD, MD

RE: Wireless vs. Wired in Classrooms

DATE: February 8, 2013

I am a pediatric neurologist and neuroscientist on the faculty of Harvard Medical School and on staff at the Massachusetts General Hospital. I am Board Certified in Neurology with Special Competency in Child Neurology, and Subspecialty Certification in Neurodevelopmental Disorders.

I have an extensive history of research and clinical practice in neurodevelopmental disorders, particularly autism spectrum disorders. I have published papers in brain imaging research, in physiological abnormalities in autism spectrum disorders, and in environmental influences on neurodevelopmental disorders such as autism and on brain development and function.

**I recently accepted an invitation to review literature pertinent to a potential link between Autism Spectrum Disorders and Electromagnetic Frequencies (EMF) and Radiofrequency Radiation (RFR). I set out to write a paper of modest length, but found much more literature than I had anticipated to review.**

I ended up producing a 60 page single spaced paper with over 550 citations. It is available at [http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec20\\_2012\\_Findings\\_in\\_Autism.pdf](http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec20_2012_Findings_in_Autism.pdf).

In fact, there are thousands of papers that have accumulated over decades – and are now accumulating at an accelerating pace, as our ability to measure impacts become more sensitive – that document adverse health and neurological impacts of EMF/RFR. Children are more vulnerable than adults, and children with chronic illnesses and/or neurodevelopmental disabilities are even more vulnerable. Elderly or chronically ill adults are more vulnerable than healthy adults.

Current technologies were designed and promulgated without taking account of biological impacts other than thermal impacts. We now know that there are a large array of impacts that have nothing to do with the heating of tissue. The claim from wifi proponents that the only concern is thermal impacts is now definitively outdated scientifically.

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 will make it harder for some children to learn, particularly those who are already having problems in the first place.

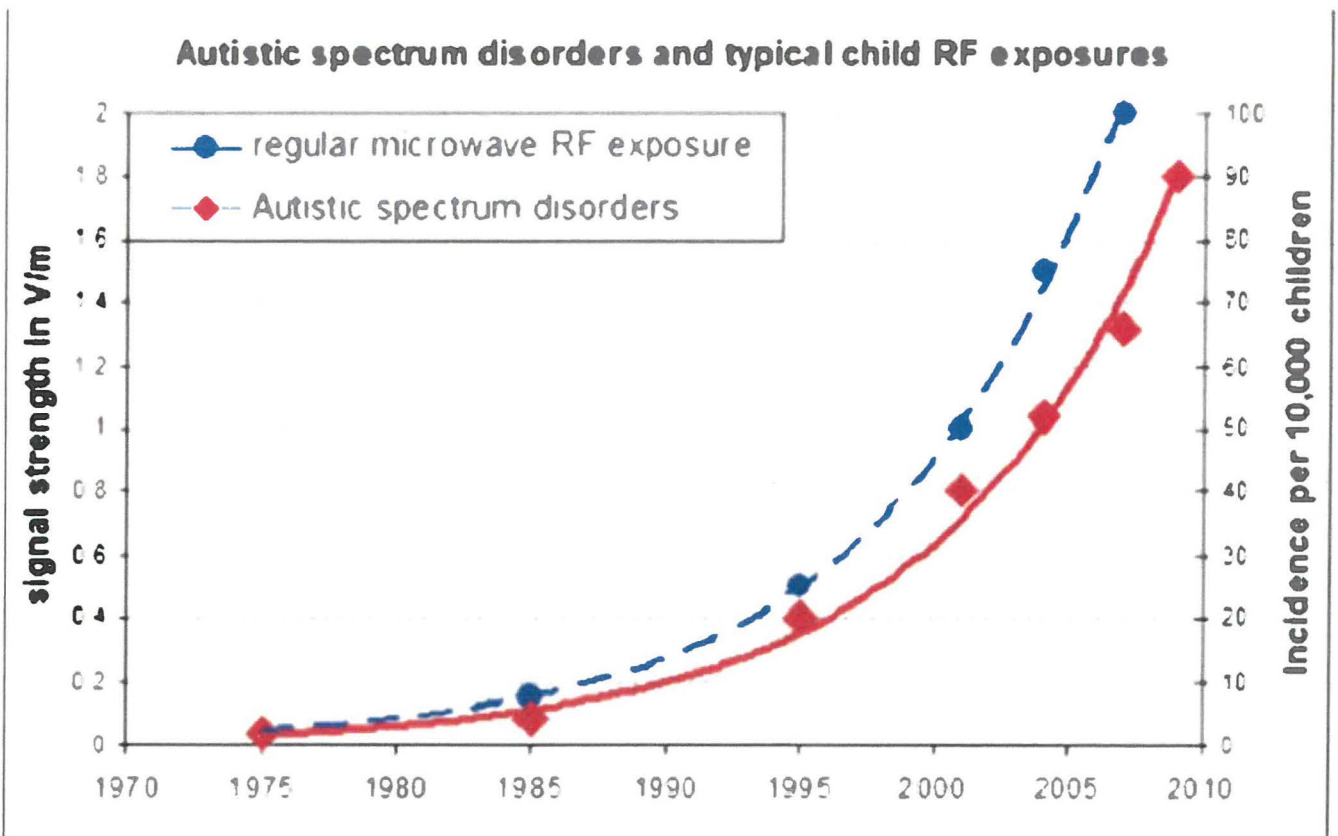


Powerful industrial entities have a vested interest in leading the public to believe that EMF/RFR, which we cannot see, taste or touch, is harmless, but this is not true. Please do the right and precautionary thing for our children

I urge you to step back from your intention to go wifi in the LAUSD, and instead opt for wired technologies, particularly for those subpopulations that are most sensitive. It will be easier for you to make a healthier decision now than to undo a misguided decision later.

Thank you.

Martha Herbert, PhD, MD Pediatric  
Neurology  
Harvard Medical School  
Boston, Massachusetts USA



# American Academy of Environmental Medicine

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## American Academy of Environmental Medicine Recommendations Regarding Electromagnetic and Radiofrequency Exposure

*“Physicians of the American Academy of Environmental Medicine recognize that patients are being adversely impacted by electromagnetic frequency (EMF) and radiofrequency (RF) fields and are becoming more electromagnetically sensitive.”*

The AAEM recommends that physicians consider patients’ total electromagnetic exposure in their diagnosis and treatment, as well as recognition that electromagnetic and radiofrequency field exposure may be an underlying cause of a patient’s disease process.

Based on double-blinded, placebo controlled research in humans,<sup>1</sup> medical conditions and disabilities that would more than likely benefit from avoiding electromagnetic and radiofrequency exposure include, but are not limited to:

- Neurological conditions such as paresthesias, somnolence, cephalgia, dizziness, unconsciousness, depression
- Musculoskeletal effects including pain, muscle tightness, spasm, fibrillation
- Heart disease and vascular effects including arrhythmia, tachycardia, flushing, edema
- Pulmonary conditions including chest tightness, dyspnea, decreased pulmonary function
- Gastrointestinal conditions including nausea, belching
- Ocular (burning)
- Oral (pressure in ears, tooth pain)
- Dermal (itching, burning, pain)
- Autonomic nervous system dysfunction (dysautonomia)
- Neurodegenerative diseases (Parkinson’s Disease, Alzheimer’s Disease, and Amyotrophic Lateral Sclerosis)
- Neurological conditions (Headaches, depression, sleep disruption, fatigue, dizziness, tremors, autonomic nervous system dysfunction, decreased memory, attention deficit disorder, anxiety, visual disruption)
- Fetal abnormalities and pregnancy
- Genetic defects and cancer

## Childrens' and Teens' Brains Are NOT Taken into Consideration by the Telecom Industry's Wireless Exposure Testing

The image below demonstrates the increased absorption of cell phone radiation within the brains of children; studies show that those who begin using their cell phones as children develop brain tumors at a faster rate.



With Permission, Prof. Om P. Gandhi

### Wireless radiation affects children's brains more than adults' brains

*"Children, however, are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. In fact, according to IARC, when used by children, the average RF energy deposition is two times higher in the brain and 10 times higher in the bone marrow of the skull, compared with mobile phone use by adults...it is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes."* Dr. Robert Block, President of the American Academy of Pediatrics, (2012)

The published study "Exposure Limits: The underestimation of absorbed cell phone radiation, especially in children," (Gandhi et al, 2011) notes that the industry---designed process for evaluating microwave radiation from phones results in children absorbing twice the cellphone radiation to their heads, up to triple in their brain's hippocampus and hypothalamus, greater absorption in their eyes, and as much as 10 times more in their bone marrow when compared to adults.

A major study found an 8 fold increase in brain tumors in 20---29 year olds after only 5 years of cell phone use (Hardell et al, 2004). Children and teens will have a lifetime of exposure; a 2011 Pew Research Study found that **8 out of 10 teens sleep with their phones under their pillows.**

## PROFOUNDLY DISTURBING QUOTES FROM SCIENTISTS & DOCTORS

*“Toxic overload is the most frequent cause of illnesses or of a weakened immune response. Aside from toxins, there is growing damaging potential from physical energy which causes problems, of which the most significant portion is represented by the electromagnetic pollution of our environment, produced by mankind in this century. Whether they be physical or energetic, toxins can damage DNA, weaken the body’s defences and lead to the development of cancer and other illnesses. What is so remarkable is the lack of any sense of urgency shown by doctors and scientists in investigating this subject. This is what threatens to become one of the greatest dangers to the health and welfare of our world today.”*

**Prof. Dr. Andrew Weil, doctor and pharmacologist, Harvard University, 1995**

- *“The earth and all living creatures on the land have evolved in an environment that has a low background level of naturally occurring radio frequency radiation. The power density that radiates close to the head of a user from a portable cellular telephone is two billion times higher than that background level.” Robert C. Kane, PhD, “Cellular Telephone Russian Roulette”*
- *“It has been proven beyond any doubt that the unrestricted use of electromagnetic energy has altered the environment on a global scale to such an extent that life is becoming more and more endangered. Only enlightened honesty stands any chance now.” Prof. Dr. R.O. Becker, New York; April 21, 2004*

- *“We are preparing ourselves for all sorts of claims for compensation for damages. Should the danger from mobile telephone radiation ever be proven, it would turn out to be largest potential claim for damages that the insurance industry has ever had to face.”* Julius von Rotenhahn, Frankona-Versicherung (German insurance company), 1994
- *“One in four has either a damaged immune, nervous, or hormone system. One in three is suffering from an allergy of some sort or another. We have now reached the point where we can no longer tolerate any further damage.”* DGUHT, German Society for the Environment and Human Toxicology, 1994
- *“A significant amount of electromagnetic energy penetrates into the head of any person holding a mobile with integral aerial to the ear, whilst making a call. This is the first generation ever, in the entire history of humankind, which holds a powerful microwave transmitter up to its head, on a regular basis, hour after hour, day after day. Excessive telephoning on mobiles is going to have serious consequences. In the course of the next few years, health problems could arise, especially leukemia and brain tumors. I cannot give the all-clear, no, I definitely can’t.”* Prof. Dr. W. Ross Adey, Scientist with Loma Linda University California and one of the most competent world experts on electro-smog, during an ABC news program, in the USA (1997)
- *“Just a two minute call on a mobile telephone already stresses the auditory nerve to extremes. It sets the nerves’ electrical action-potential vibrating, and it is not until seven or eight minutes thereafter that it settles down again. Over a period, these effects can add up to long term disorders. One must be on one’s guard.”* Prof. Dr. Vittorio Coletti, Senior Consultant at the ENT Clinic in Verona, Italy.

# American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



August 29, 2013

The Honorable Mignon L. Clyburn Acting Commissioner  
Federal Communications Commission  
445 12<sup>th</sup> Street SW  
Washington, DC 20054

The Honorable Dr. Margaret A. Hamburg Commissioner  
Food and Drug Administration  
10903 New Hampshire Avenue  
Silver Spring, MD 20993

Dear Acting Chairwoman Clyburn and Commissioner Hamburg:

The American Academy of Pediatrics (AAP), a non-profit professional organization of 60,000 primary care pediatricians, pediatric medical sub-specialists, and pediatric surgical specialists dedicated to the health, safety and well-being of infants, children, adolescents, and young adults appreciates this opportunity to comment on the Proposed Rule "Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies" published in the Federal Register on June 4, 2013.

In the past few years, a number of American and international health and scientific bodies have contributed to the debate over cell phone radiation and its possible link to cancer. The International Agency for Research on Cancer (IARC), part of the United Nations' World Health Organization, said in June 2011 that a family of frequencies that includes mobile-phone emissions is "possibly carcinogenic to humans."

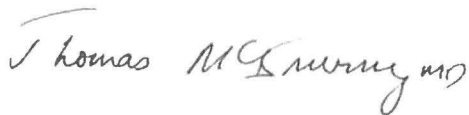
As radiation standards are reassessed, the AAP urges the FCC to adopt radiation standards that:

- **Protect children's health and well-being.** Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.

- **Reflect current use patterns.** The FCC has not assessed the standard for cell phone radiation since 1996. Approximately 44 million people had mobile phones when the standard was set; today, there are more than 300 million mobile phones in use in the United States. While the prevalence of wireless phones and other devices has skyrocketed, the behaviors around cell phone uses have changed as well. The number of mobile phone calls per day, the length of each call, and the amount of time people use mobile phones has increased, while cell phone and wireless technology has undergone substantial changes. Many children, adolescents and young adults, now use cell phones as their only phone line and they begin using wireless phones at much younger ages. Pregnant women may carry their phones for many hours per day in a pocket that keeps the phone close to their uterus. Children born today will experience a longer period of exposure to radio-frequency fields from cellular phone use than will adults, because they start using cellular phones at earlier ages and will have longer lifetime exposures. FCC regulations should reflect how people are using their phones today.
- **Provide meaningful consumer disclosure.** The FCC has noted that it does not provide consumers with sufficient information about the RF exposure profile of individual phones to allow consumers to make informed purchasing decisions. The current metric of RF exposure available to consumers, the Specific Absorption Rate, is not an accurate predictor of actual exposure. AAP is supportive of FCC developing standards that provide consumers with the information they need to make informed choices in selecting mobile phone purchases, and to help parents to better understand any potential risks for their children. To that end, we support the use of metrics that are specific to the exposure children will experience.

**The AAP supports the reassessment of radiation standards for cell phones and other wireless products and the adoption of standards that are protective of children and reflect current use patterns.** If you have questions, please contact Clara Filice in the AAP's Washington Office at 202/347-8600.

Sincerely,



Thomas K.

# Re: Use of Laptop Computers Connected to Internet Through Wi-Fi Decreases Human Sperm Motility and Increases Sperm DNA Fragmentation

By: Jeremy T. Choy and Robert E. Brannigan

Published online: 01 December 2012

Avendaño C, Mata A, Sanchez Sarmiento CA, Doncel GFFertil Steril 2012;97:39–45.e2**Experts' summary:**In this prospective study by Avendaño et al., the authors attempted to evaluate the effect of radio frequency electromagnetic waves (RF-EMW) generated by laptop computers with wireless network connections (Wi-Fi). They used an in vitro model in which each of 29 donor semen samples was processed and aliquoted into two fractions to form control and experimental groups. The experimental group was then incubated underneath an active Wi-Fi-connected laptop for a duration of 4h at a temperature of 25°C, as maintained by an air conditioning system. The control group was incubated under reportedly identical conditions, excluding the presence of any electronic devices. After incubation, sperm vitality, motility, and DNA fragmentation were assessed in each sample. Although there were no statistically significant differences in sperm viability or nonprogressive motility between the control and experimental groups, the authors did find sperm progressive motility to be significantly decreased, and nonmotility to be concomitantly increased, in the Wi-Fi-exposed samples versus controls. Sperm DNA fragmentation was also found to be significantly increased in the experimental group. Thus the authors speculated that use of a wirelessly connected laptop computer may decrease male fertility potential.**Experts' comments:**The technological advancements that pervade modern society, including cellular telephones, laptop computers, and wireless networks, have increased routine exposure of humans to the electromagnetic fields that are generated by these devices. In recent years, concerns have arisen over the safety of human RF-EMW exposure, with investigations of the biological effects of electromagnetic radiation generating much controversy. Multiple in vitro studies have found significant decreases in sperm motility and viability as well as increased reactive oxygen species levels following exposure to RF-EMW from cellular phones [1] and [2]. Given the widespread adoption of Wi-Fi infrastructures in today's society as well as the comparatively higher frequency ranges of RF-EMW that they use [3], similar investigations involving Wi-Fi-connected laptops are merited.

Despite these apparent methodological shortcomings, the work done by Avendaño et al. represents the first extension of RF-EMW investigations to laptops and Wi-Fi, and its contribution should not be discounted. It is clear that further, more conclusive studies are warranted in the ongoing effort to bring clarity to this controversial public health issue.

**Conflicts of interest** The authors have nothing to disclose.



## **Russian National Committee on** **“Non-Ionizing” Radiation Protection...**

**“...THE HEALTH OF THE FOLLOWING  
GENERATIONS IS IN DANGER.”**

<http://www.wiflinschools.com/uploads/3/0/4/2/3042232/rcnirp.pdf>

For the first time in history, we face a situation when most children and teenagers in the world are continuously exposed to the potentially adverse influence of the electromagnetic fields (EMF) from mobile phones and wi-fi in schools. The electromagnetic field is an important biotropic factor, affecting not just a human health in general, but also the processes of the higher nervous activity, including behavior and thinking.

### **Children’s Health Risks Are Very High:**

- Disruption of memory,
- Decline of attention
- Diminishing learning and cognitive abilities  
increased irritability
- Sleep problems
- Increase in sensitivity to the stress
- Increased epileptic readiness.
- Tumors of the brain, acoustical and vestibular  
nerves
- Alzheimer’s disease, Dementia
- Depressive syndrome. Degeneration of the  
nervous structures of the brain.

# Smartphones and iPads change how the human brain works - and are destroying our memories



[Mirror](#)

By Mark Waghorn 09/05/2016



© Provided by Mirror

Smartphones and iPads really do shorten attention spans, a new study has warned.

The multi-media devices are changing how the human brain works - making it harder for us to fully understand information.

Reading screens on tablets and phones makes users focus on a few concrete details rather than the big picture.

Seeing the bigger picture is important because it involves flexible reasoning, creativity, judgement and logical problem solving.

The findings presented at a conference for human-computer interaction serve as a wake-up call to how digital media is harming our ability to use abstract thought.

Classrooms are increasingly becoming digital as work is done on computers rather than in notebooks.

The study found more than 300 participants recruited for four tests performed better at comprehension and problem solving when they read information on print-outs rather than digital platforms.

Professor Geoff Kaufman, of Carnegie Mellon University in Pennsylvania, said: "There has been a great deal of research on how digital platforms might be affecting attention, distractibility and mindfulness and these studies build on this work by focusing on a relatively understudied construct.

"Given psychologists have shown construal levels can vastly impact outcomes such as self-esteem and goal pursuit it's crucial to recognise the role digitisation of information might be having on this important aspect of cognition."

Construal levels are the fundamental amount of concreteness versus abstractness people use in perceiving and interpreting behaviours, events and other informational stimuli.

The researchers wanted to know if processing the same information on a digital versus non-digital platform would affect this.

Reading material and other content was published using the same print size and format in both versions with volunteers aged 20 to 24 years.

Participants were asked to do a series of tasks including filling in a form, reading a short story and comparing different car models - either on paper or on a computer screen.

Those given print-outs paper were much better at understanding the whole material while those using computers remembered particular details.

In a comprehension test about a short story those who had read it in print fared far better in questions about the story's inferences and broader narrative while those who had read the digital document retained more information about minor details.

Mirror

When evaluating the specifications of four fictional cars, 66% of those who had read the comparison on paper could correctly say which was the best model, against 43% of those who had read it on a computer.

For the abstract questions participants using the non-digital platform scored higher on average with 66% correct as compared to those using the digital platform - 48%

On the concrete questions participants using the digital platform scored better with 73 per cent correct as compared to 58 per cent correct.

The study on digital versus non-digital platforms was prompted by earlier research which revealed players of the digital version of the public health strategy game "POX: Save the People" were more inclined to respond with localised solutions rather than looking at the big picture.

Professor Mary Flanagan, of Dartmouth College in New Hampshire, said: "Compared to the widespread acceptance of digital devices as evidenced by millions of apps, ubiquitous smartphones and the distribution of iPads in schools, surprisingly few studies exist about how digital tools affect our understanding - our cognition.

"Knowing the affordances of digital technologies can help us design better software.

"Sometimes it's beneficial to foster abstract thinking and as we know more we can design to overcome the tendencies - or deficits - inherent in digital devices."

The research is being presented at the ACM (Association for Computing Machinery) CHI (Computer-Human Interaction) '16 conference in San Jose in California.

**Press Release:**

## **ACS Responds to New Study Linking Cell Phone Radiation to Cancer**

The U.S. National Toxicology Program (NTP) has released partial results from an animal study of the effect of radiofrequency radiation associated with cell phones. The group found radiofrequency radiation was linked to a higher risk of two cancers. Below is a response from **Otis W. Brawley, M.D., American Cancer Society Chief Medical Officer**.

“For years, the understanding of the potential risk of radiation from cell phones has been hampered by a lack of good science. **This report from the National Toxicology Program (NTP) is good science.**”

“The NTP report linking radiofrequency radiation (RFR) to two types of cancer marks a paradigm shift in our understanding of radiation and cancer risk. The findings are unexpected; we wouldn't reasonably expect non-ionizing radiation to cause these tumors. This is a striking example of why serious study is so important in evaluating cancer risk. It's interesting to note that early studies on the link between lung cancer and smoking had similar resistance, since theoretical arguments at the time suggested that there could not be a link.

“The new report covers only partial findings from the study, but importantly one of the two cancers linked to cell phone radiation was malignant gliomas in the brain. **The association with gliomas and acoustic neuromas had been suspected from human epidemiology studies.** The second cancer, called a schwannoma, is an extremely rare tumor in humans and animals, reducing the possibility that this is a chance finding. And importantly, the study found a ‘dose/response’ effect: the higher the dose, the larger the effect, a key sign that this association may be real.

“The fact that this finding was observed only in male rats has some wondering if the data is not reliable. It's important to note that these sorts of gender differences often appear in carcinogenic studies, so the fact they show up here should not detract from the importance of the findings.

“**This new evidence will undoubtedly factor into ongoing assessments by regulators** to determine the potential cancer risk posed by cell phones. The American Cancer Society eagerly awaits guidance from government agencies, like the U.S. Food and Drug Administration (FDA) and the Federal Communications Commission (FCC), about the safety of cell phone use.

“The NTP was given the difficult task of trying to answer important questions about the potential cancer risk posed by cell phones, and the group did not shirk from its responsibility. NTP staff were clearly aware of the potential importance of this study and went the extra distance to ensure the best science is used. They used double the number of animals required for this type of study; they convened not one but three panels to look at abnormal tissues from treated animals to ensure that what was identified as a brain and heart tumor was indeed a brain and heart tumor; they solicited review from multiple scientists from outside the NTP to critically review all aspects of the data analysis and study findings, to ensure the findings would stand up to the critical assessment expected once these unexpected findings were released.

“While this study adds significantly to the evidence that cell phone signals could potentially impact human health, it does not actually tell us how certain scenarios of cell phone use change our long-term risks of getting cancer. For example, the animal studies were performed at very high signal strengths, near but below levels that would cause animal tissue to heat up. Additional research will be needed to translate effects at these high doses to what might be expected at the much lower doses received by typical or even high-end cell phone users. Also, cell phone technology continues to evolve, and with each new generation, transmission strengths have declined and with it radio frequency exposures.”

# Nearly 200 scientists warn of cellphone health risks

Published time: 13 May, 2015 02:38 Edited time: 14 May, 2015

Biological and health scientists from Russia and Iran to the USA are calling on the UN, the World Health Organization and national governments to develop strict regulations concerning devices and cellphones that create electromagnetic fields.

**Tags** Ecology, Health, UN, SciTech, Internet, Biology, USA, Science

The scientists are from 39 nations and have authored 2,000 peer-reviewed papers on the health and biological effects of non-ionizing radiation, which is part of the electromagnetic field spectrum. In a letter, they say that devices like cellphones pose risks of cancer, genetic damage, changes in reproductive system, and learning and memory deficits.

*“Putting it bluntly they are damaging the living cells in our bodies and killing many of us prematurely,”* said Dr. Martin Blank, from the Department of Physiology and Cellular Biophysics at Columbia University, in a video message.

*“We have created something that is harming us, and it is getting out of control. Before Edison’s light bulb there was very little electromagnetic radiation in our environment. The levels today are very many times higher than natural background levels, and are growing rapidly because of all the new devices that emit this radiation.”*

**One example that was cited is the cellphone. Blank pointed to a study which showed that as cellphone usage has spread widely, the incidence of fatal brain cancer in younger people has more than tripled.**

The scientists see the unregulated use of radio frequency radiation in cellphones and Wi-Fi as developing into a public health crisis. Blank said biologists and scientists are not being heard from committees that set safety standards, that safety limits are much too high and that biological facts are being ignored.

Scientists are appealing to the United Nations Environmental Program (UNEP) to *“convene and fund an independent multidisciplinary committee to explore the pros and cons of alternative to current practices that could substantially lower human exposure to RF and ELF fields.”*

[READ MORE: Berkeley to vote on 'right to know' law on cellphone radiation risks](#)

They request that the deliberations be *“transparent and impartial,”* and involve industry players in the field. However, scientists believe industry *“should not be allowed to bias the process or conclusions.”* Once completed, the analysis would offer the UN and WHO a guide for precautionary action.

Questions have surfaced about the safety of EMF among the scientific community and with the public, but it is largely absent from national debate despite the ubiquitous use of devices, particularly in the United States. *“...In the United States, where non-industry-funded studies are rare, where legislation protecting the wireless industry from legal challenges has long been in place...to suggest it might be a problem – maybe, eventually, a very public-health problem – is like saying our shoes might be killing us,”* wrote journalist Christopher Ketchum in a 2010 GQ article called *“Warning: Your Cell Phone May Be Hazardous to Your Health.”*

# House Bill 3350

Sponsored by COMMITTEE ON HEALTH CARE

## SUMMARY

The following summary is not prepared by the sponsors of the measure and is not a part of the body thereof subject to consideration by the Legislative Assembly. It is an editor's brief statement of the essential features of the measure as introduced.

Directs Department of Education to prepare statement that discloses potential health risks of wireless technology.

Requires public and private schools to distribute statement to employees and parents of students.

Declares emergency, effective July 1, 2015.

## A BILL FOR AN ACT

1  
2 Relating to health risk disclosures in school; and declaring an emergency.

3 **Be It Enacted by the People of the State of Oregon:**

4 **SECTION 1. (1) The Department of Education shall:**

5 (a) Prepare a statement that discloses the potential health risks of wireless technology;  
6 and

7 (b) Make the statement described in paragraph (a) of this subsection available for dis-  
8 tribution by public and private elementary and secondary schools of this state.

9 (2) Each school district must annually distribute the statement prepared under sub-  
10 section (1) of this section to the employees of the school district and to the parents of the  
11 students of the school district.

12 (3) Each private school in this state with students in any grade from kindergarten  
13 through grade 12 must annually distribute the statement prepared under subsection (1) of  
14 this section to the employees of the school and to the parents of the students of the school.

15 **SECTION 2. This 2015 Act being necessary for the immediate preservation of the public  
16 peace, health and safety, an emergency is declared to exist, and this 2015 Act takes effect  
17 July 1, 2015.**

18



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### The American Academy of Environmental Medicine Statement on WiFi in Schools

Adverse health effects, such as learning disabilities, altered immune responses, headaches, ect. from wireless radio frequency fields do exist and are well documented in the scientific literature. Safer technology, such as using hard-wiring, must be seriously considered in schools for the safety of those susceptible individuals who may be affected by this phenomenon.

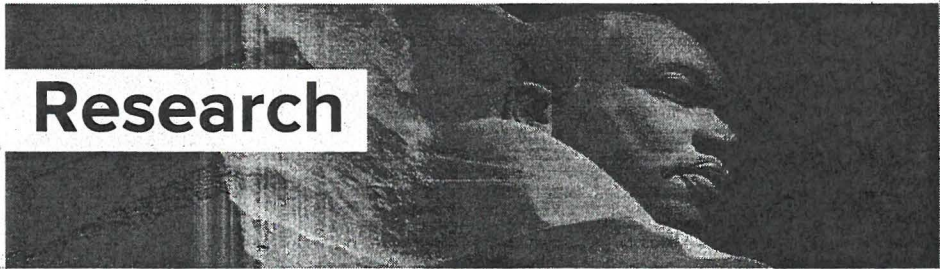
Approved by the American Academy of Environmental Medicine Board of Directors on June 9, 2012.

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# Research

DOWNLOAD THE STUDY

## The Impact of Computer Usage on Academic Performance: Evidence from a Randomized Trial at the United States Military Academy

New Findings, School Reform, May 2016

We present findings from a study that prohibited computer devices in randomly selected classrooms of an introductory economics course at the United States Military Academy. Average final exam scores among students assigned to classrooms that allowed computers were 18 percent of a standard deviation lower than exam scores of students in classrooms that prohibited computers. Through the use of two separate treatment arms, we uncover evidence that this negative effect occurs in classrooms where laptops and tablets are permitted without restriction and in classrooms where students are only permitted to use tablets that must remain flat on the desk surface.

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# Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression

- Martin L. Pall Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University, 638 NE 41st Avenue, Portland, OR 97232-3312, USA

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## Highlights

Microwave EMFs activate voltage-gated Ca<sup>2+</sup> channels (VGCCs) concentrated in the brain. Animal studies show such low level MWV EMFs have diverse high impacts in the brain. VGCC activity causes widespread neuropsychiatric effects in humans (genetic studies). 26 studies have EMFs assoc. with neuropsychiatric effects; 5 criteria show causality. MWV EMFs cause at least 13 neuropsychiatric effects including depression in humans.

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## Abstract

Non-thermal microwave/lower frequency electromagnetic fields (EMFs) act via voltage-gated calcium channel (VGCC) activation. Calcium channel blockers block EMF effects and several types of additional evidence confirm this mechanism. Low intensity microwave EMFs have been proposed to produce neuropsychiatric effects, sometimes called microwave syndrome, and the focus of this review is whether these are indeed well documented and consistent with the known mechanism(s) of action of such EMFs. VGCCs occur in very high densities throughout the nervous system and have near universal roles in release of neurotransmitters and neuroendocrine hormones. Soviet and Western literature shows that much of the impact of non-thermal microwave exposures in experimental animals occurs in the brain and peripheral nervous system, such that nervous system histology and function show diverse and substantial changes. These may be generated through roles of VGCC activation, producing excessive neurotransmitter/neuroendocrine release as well as oxidative/nitrosative stress and other responses. Excessive VGCC activity has been shown from genetic polymorphism studies to have roles in producing neuropsychiatric changes in humans. Two U.S. government reports from the 1970s to 1980s provide evidence for many neuropsychiatric effects of non-thermal microwave EMFs, based on occupational exposure studies. 18 more recent epidemiological studies, provide substantial evidence that microwave EMFs from cell/mobile phone base stations, excessive cell/mobile phone usage and from wireless smart meters can each produce similar patterns of neuropsychiatric effects, with several of these studies showing clear dose-response relationships. Lesser evidence from 6 additional studies suggests that short wave, radio station, occupational and digital TV antenna exposures may produce similar neuropsychiatric effects. Among the more commonly reported changes are sleep disturbance/insomnia, headache, depression/depressive symptoms, fatigue/tiredness, dysesthesia, concentration/attention dysfunction, memory changes, dizziness, irritability, loss of appetite/body weight, restlessness/anxiety, nausea, skin burning/tingling/dermographism and EEG changes. In summary, then, the mechanism of action of microwave EMFs, the role of the VGCCs in the brain, the impact of non-thermal EMFs on the brain, extensive epidemiological studies performed over the past 50 years, and five criteria testing for causality, all collectively show that various non-thermal microwave EMF exposures produce diverse neuropsychiatric effects.

Overall impact **HIGH**  
Time frame **>10 years**

### Unforeseen consequences of electromagnetic fields

The ubiquity of electromagnetic fields (EMF) raises concerns about potential implications for human health, in particular with regard to the use of mobile phones, power lines or antennas for broadcasting. Over the last decade, the spread of wireless devices has accelerated enormously. The convergence of mobile phones with computer technology has led to the proliferation of new and emerging technologies. This development has increased exposure to electromagnetic fields, the health impacts of which remain unknown.

Anxiety over the potential risks related to EMF has risen. Studies are difficult to conduct, since time trend studies are inconsistent due to the still rather recent proliferation of wireless technology. The WHO has classified extremely low-frequency magnetic fields and radiofrequency electromagnetic fields, such as radiation emitted by cell phones, as potentially carcinogenic to humans (Class 2B carcinogen). Furthermore, a recent ruling by an Italian court suggested a link between mobile phone radiation and human health impairment. Overall, however, scientific studies are still inconclusive regarding possible adverse health effects of EMF.

### Potential impact on the insurance industry

If a direct link between EMF and human health problems were established, it would open doors for new claims and could ultimately lead to large losses under product liability covers. Liability rates would likely rise.

Overall impact **HIGH**  
Time frame **>10 years**

### Unforeseen consequences of nanotechnology

Nanotechnology refers to the manipulation of matter on an atomic and molecular scale. Nano-sized particles exhibit unique properties relative to larger particles of the same substance. This enables new applications, but may also pose new risks.

Currently, little is known about the toxicity of nanomaterials or the potential for latent illness that could affect workers and consumers. Additional research in life cycle assessment of nanomaterials and products containing nanomaterials is necessary to better assess the potential exposures. However, there is some evidence that certain nanostructures may accumulate within tissues and organs and can be absorbed by individual cells. Adverse health effects have been observed in studies of material such as carbon nanotubes, nanoparticles of titanium dioxide, or silica nanoparticles.

### Potential impact on the insurance industry

Due to the relatively unknown environmental, health and safety exposures arising from nanomaterials throughout their life cycle, nanotechnology presents the insurance industry with significant challenges. Of key concern are delayed impacts, i.e. the question whether nanomaterials hold some latent hazard. Similar to the asbestos case, there is potential for large losses under product liability, workers' compensation and environmental liability policies.

# Terms and definitions

This page provides an overview of key terms and definitions and explains the ratings used to assess the insights presented in this report.

## What are emerging risks?

We define emerging risks as newly developing or changing risks that are difficult to quantify and could have a major impact on society and insurance industry.

## What is SONAR?

SONAR (systematic observation of notions associated with risk) is Swiss Re's tool for identifying, assessing and managing emerging risks. By means of a network of experts across the company and an interactive web 2.0 platform, Swiss Re collects early signals of emerging risks. All signals are reviewed, assessed and prioritised by a dedicated emerging risk management team which closely interacts with a number of topic experts in Swiss Re's various business areas. The findings are regularly summarised, distributed to relevant stakeholders throughout the company and made available to all employees via Swiss Re's intranet. With this publication, Swiss Re now shares these findings with a wider public.

## What are emerging risk insights?

Emerging risk insights illustrate potential new threats for the insurance industry. They were mainly derived from SONAR, but also incorporate key elements of the Risk Radar of the CRO Forum's Emerging Risk Initiative<sup>1</sup>. All insights have been assessed by Swiss Re's emerging risk management experts. To make it easier to interpret and develop appropriate mitigation measures, insights are grouped by key insurance business area, with a topic being allocated to the area that would potentially be most impacted (Property, Casualty, Life & Health, Financial Markets, Claims, or Operations). Some well-known emerging risks such as climate change or gene technology are not listed as they are already being tackled by Swiss Re and the industry.

## What is meant by overall impact?

The overall impact is an indicator of the potential financial, reputational and/or regulatory impact associated with an emerging risk topic. It is assessed using a high/medium/low scale:

<b>HIGH</b>	Potentially high financial, reputational and/or regulatory impact or significant stakeholder concern
<b>MEDIUM</b>	Potentially medium financial, reputational and/or regulatory impact or moderate stakeholder concern
<b>LOW</b>	Potentially low financial, reputational and/or regulatory impact or low stakeholder concern

## What is meant by time frame?

The time frame describes the period of time in which the risks associated with an insight might manifest and have an impact. We use three time frames to help readers assess the imminence of each topic: 1–3 years, 4–10 years, >10 years. These time frames should not be used as an indicator of when action is needed as some topics expected to occur in the more distant future may nonetheless require action now to prepare for their ultimate occurrence.

<sup>1</sup> For more information on this Initiative see <http://www.thecroforum.org/emerging-risk-initiative-2>

Papers finding adverse biological effects or damage to health from Wi-Fi signals, Wi-Fi-enabled devices or Wi-Fi frequencies (2.4 or 5 GHz).

Papers listed are those where exposures are below the current ICNIRP guideline values. If the ICNIRP values were protective, we would not be seeing the damaging effects reported in the studies below. Children are exposed to Wi-Fi/2.45GHz in schools every day, around the world. Children are sitting with Wi-Fi-enabled tablet computers on their laps and up against their bodies for prolonged periods of time. The studies below support the claim that schools giving children wireless devices to use, or exposing them to Wi-Fi signals, are failing to safeguard the health, development or wellbeing of the young people for whom they are responsible.

Akdag M.Z. et al 2016. Does prolonged radiofrequency radiation emitted from Wi-Fi devices induce DNA damage in various tissues of rats? *J. Chem. Neuroanat.* [Epub ahead of print].  
<http://www.ncbi.nlm.nih.gov/pubmed/26775760>

Atasoy H.I. et al., 2013. Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices. *Journal of Pediatric Urology* 9(2): 223-229. <http://www.ncbi.nlm.nih.gov/pubmed/22465825>

Avendaño C. et al., 2012. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. *Fertility and Sterility* 97(1): 39-45.  
<http://www.ncbi.nlm.nih.gov/pubmed/22112647>

Celik O. et al 2015. Oxidative stress of brain and liver is increased by Wi-Fi (2.45GHz) exposure of rats during pregnancy and the development of newborns. *J Chem Neuroanat.* [Epub ahead of print].  
<http://www.ncbi.nlm.nih.gov/pubmed/26520617>

Chaturvedi C.M. et al., 2011. 2.45GHz (CW) microwave irradiation alters circadian organization, spatial memory, DNA structure in the brain cells and blood cell counts of male mice, *Mus musculus*. *Prog Electromagn Res B* 29: 23-42. <http://www.jpier.org/PIERB/pierb29/02.11011205.pdf> (Full paper).

Ciftci Z.Z. et al., 2015. Effects of prenatal and postnatal exposure of Wi-Fi on development of teeth and changes in teeth element concentration in rats : Wi-Fi (2.45 GHz) and teeth element concentrations. *Biol Trace Elem Res.* 163(1-2): 193-201. <http://www.ncbi.nlm.nih.gov/pubmed/25395122>

Cig B. and Naziroglu M. 2015. Investigation of the effects of distance from sources on apoptosis, oxidative stress and cytosolic calcium accumulation via TRPV1 channels induced by mobile phones and Wi-Fi in breast cancer cells. *Biochem Biophys Acta.* 1848(10 Pt B): 2756-2765.  
<http://www.ncbi.nlm.nih.gov/pubmed/25703814>

Dasdag S. et al., 2015. Effect of long-term exposure of 2.4 GHz radiofrequency radiation emitted from Wi-Fi equipment on testes functions. *Electromagn Biol Med.* 34(1): 37-42. <http://www.ncbi.nlm.nih.gov/pubmed/24460421>

Dasdag S. et al 2015. Effects of 2.4 GHz radiofrequency radiation emitted from Wi-Fi equipment on microRNA expression in brain tissue. *Int J Radiat Biol.* 91(7): 555-561. <http://www.ncbi.nlm.nih.gov/pubmed/25775055>

Deshmukh P.S. et al., 2015. Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation. *Int J. Toxicol.* 34(3): 284-290. <http://www.ncbi.nlm.nih.gov/pubmed/25749756>

Ghazizadeh V. and Naziroglu M. 2014. Electromagnetic radiation (Wi-Fi) and epilepsy induce calcium entry and apoptosis through activation of TRPV1 channel in hippocampus and dorsal root ganglion of rats. *Metab Brain Dis.* 29(3): 787-799. <http://www.ncbi.nlm.nih.gov/pubmed/24792079>

Maganioti A. E. et al., 2010. Wi-Fi electromagnetic fields exert gender related alterations on EEG. 6th International Workshop on Biological Effects of Electromagnetic fields. Paper. <http://www.istanbul.edu.tr/6internatwshopbioeffemf/cd/pdf/poster/WI-FI%20ELECTROMAGNETIC%20FIELDS%20EXERT%20GENDER.pdf>

Megha K. et al., 2015. **Low intensity microwave radiation** induced oxidative stress, inflammatory response and DNA damage in rat brain. *Neurotoxicology* 51: 158-165. <http://www.ncbi.nlm.nih.gov/pubmed/26511840>

Naziroğlu M. et al., 2012. 2.45-Gz wireless devices induce oxidative stress and proliferation through cytosolic Ca<sup>2+</sup> influx in human leukemia cancer cells. *International Journal of Radiation Biology* 88(6): 449-456. <http://www.ncbi.nlm.nih.gov/pubmed/22489926>

Oni M.O., Amuda D.B. and Gilbert C.E. 2011. Effects of radiofrequency radiation from WiFi devices on human ejaculated semen. *International Journal of Recent Research and Applied Studies* 9(2): 292-294. [http://arpapress.com/Volumes/Vol9Issue2/IJRRAS\\_9\\_2\\_13.pdf](http://arpapress.com/Volumes/Vol9Issue2/IJRRAS_9_2_13.pdf)

Ozorak A. et al., 2013. Wi-Fi (2.45 GHz)- and mobile phone (900 and 1800 MHz)- induced risks on oxidative stress and elements in kidney and testis of rats during pregnancy and the development of offspring. *Biol. Trace Elem. Res.* 156(103): 221-229. <http://www.ncbi.nlm.nih.gov/pubmed/24101576>

Papageorgiou C. C. et al., 2011. Effects of Wi-Fi signals on the p300 component of event-related potentials during an auditory haying task. *Journal of Integrative Neuroscience* 10(2): 189-202. <http://www.ncbi.nlm.nih.gov/pubmed/21714138>

Saili L. et al 2015. Effects of acute exposure to WIFI signals (2.45GHz) on heart variability and blood pressure in Albinos rabbit. *Environ Toxicol Pharmacol* 40(2): 600-605. <http://www.ncbi.nlm.nih.gov/pubmed/26356390>

Salah M.B. et al., 2013. Effects of olive leaf extract on metabolic disorders and oxidative stress induced by 2.45 GHz WIFI signals. *Environ Toxicol Pharmacol* 36(3): 826-834. <https://www.ncbi.nlm.nih.gov/pubmed/23994945>

Taheri M. et al., 2015. Klebsiella pneumonia, a Microorganism that Approves the Non-linear Responses to Antibiotics and Window Theory after Exposure to Wi-Fi 2.4 GHz Electromagnetic Radiofrequency Radiation. *J Biomed Phys Eng.* 5(3): 115-120. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4576872/>

Tök L. et al., 2014. Effects of melatonin on Wi-Fi-induced oxidative stress in lens of rats. *Indian Journal of Ophthalmology* 62(1): 12-15. <http://www.ncbi.nlm.nih.gov/pubmed/24492496>

Yildirim M.E. et al., 2015. What is harmful for male fertility: Cell phone or the wireless internet? *Kaohsiung J Med Sci.* 31(9): 480-484. <http://www.ncbi.nlm.nih.gov/pubmed/26362961>

A young boy with short brown hair is seen from the back, holding a silver tablet computer. He is wearing a grey sweater with a black and white striped cuff. The background is a blurred classroom with a green chalkboard.

# Wi-Fi in Schools

Are We Playing It Safe With Our Kids?

“Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.” American Academy of Pediatrics Letter to FCC August 29, 2013 (20)

**By Cindy Russell, MD**

VP of Community Health, SCCMA

Industry has been quite successful in creating magically useful wireless technologies such as cell phones, Ipads, Wi-Fi, and now wearable tech devices such as Google glasses, we all love. Many of these handy gadgets have now reached the typical classroom across the globe. It has become apparent, however, that there are substantial downsides to being too connected to technology and as safety concerns mount, governments such as France and Israel are backing away from the blind adoption of wireless technology in schools, especially for young children.

These devices are cool and convenient, however there remains nagging questions of overuse and safety as the application of these devices has increased to the point we are literally exposed 24 hours a day to this radiation. Wireless microwaves come from many sources both at work and at home.

An increasing number of physicians, scientists, and parents are concerned about long term health effects from Wi-Fi in schools. (42)(43)(44)(49) As any parent knows, computers now are as ubiquitous in schools as they are at work. From kindergarteners on up kids are required to learn computer skills in order to take core testing online. There is a push to enable students to be connected to the internet 24/7 to take photos, email documents, and research a topic. In schools, wired connections for computers have been rapidly being eliminated to install wireless systems that connect students both indoors and outdoors on campus.

Europe and some schools in the U.S. are taking a different more precautionary approach and going back to the future with wired plug in computers. Studies have also cast doubt on some of the benefits of classroom computers and warned of the new age of “Digital Dementia” which has now crept into Korean youth due to the heavy use of electronic gadgets. (17)(48)

Professors in college are banning computers during lectures and finding students learn more. (38) (39)

## **CHILDREN ARE MORE VULNERABLE THUS NEED MORE PROTECTION**

Children have several organ systems that are immature at birth and are thus much more sensitive to toxic exposures. The human brain, one of the top vital organs, is far from being a finished product in youth. Long-term structural maturation of the nervous system is required for successful development of cognitive, motor, and sensory functions. Neuronal axons – long thin projections from the nerve cell – act as electronic transmission lines. Axons in major pathways of the brain continue to develop throughout childhood and adolescence. Myelin is the insulation surrounding individual nerves protecting it from outside electrical charges. The process of myelination is much faster the first two years but continues into adulthood. (16) Children have thinner skulls (29), their immune systems are undeveloped, their cells are dividing more rapidly, thus, they are more vulnerable to EMF radiation and other carcinogens. They also have a longer cumulative exposure to all toxins including EMF radiation.

## **CURRENT WIRELESS SAFETY STANDARDS AND MICROWAVING POTATOES**

Wireless devices work on high frequency microwaves similar to the microwave you use to cook food with. It is with less power but substantial research (1)(2)(3)(4) demonstrates that even at low power within the current safety standards these microwaves can cause biologic harm to plants, animals, and cellular structures. Current Federal Communications Commission (FCC) standards are based only on heat generated by the device, not on adverse biological effects seen in hundreds of studies and at much lower levels.

Our own CMA supports reassessment of EMF standards. The California Medical Association, in 2014, passed a resolution as follows:

“Resolved 1: That CMA supports efforts to re-evaluate microwave safety exposure levels associated with wireless communication devices, including consideration

**Continued on page 18**

of adverse nonthermal biologic and health effects from non-ionizing electromagnetic radiation used in wireless communications and be it further

Resolved 2: That CMA support efforts to implement new safety limits for wireless devices to levels that do not cause human or environmental harm based on scientific research.

## ADVERSE EFFECTS DEMONSTRATED IN PEER REVIEWED PUBLISHED RESEARCH (2)

- DNA with single and double stranded breaks
- Leakage of the blood brain barrier ( two hours of cell phone exposure causes 7+ days of albumin leakage)
- Stress protein production in the body indicating injury
- Infertility/reproductive harm
- Neurologic harm with direct damage to brain cells
- Lowering of melatonin levels
- Immune dysfunction
- Inflammation/oxidation.

## PLAUSIBLE MECHANISM FOUND FOR EMF MICROWAVE EFFECTS

Dr. Martin Pall, Professor Emeritus of Biochemistry, Washington State University has studied how electromagnetic fields impact the cells of our bodies. His 2013 paper on this subject highlights a major biological mechanism of action of EMF microwave radiation on cell structure. His work, along with two dozen prior studies, demonstrated that EMF microwave radiation effects cellular calcium channels and this can be inhibited with calcium channel blockers. "A whole series of biological changes reportedly produced by microwave exposures can now be explained in terms of this new paradigm of EMF actions via Voltage Gated Calcium Channels (VGCC) activation." (14)(15)

## EMF AFFECTS ON WILDLIFE: BIRDS, BEES, AND TOMATO PLANTS

Bird researchers in Germany found that their migratory European Robins lost their sense of navigation when in the city. (5) This was found to be due to the EMF radiation interfering with the bird's special internal magnetic compass. They replicated the experiment over seven years before publishing the results in the prestigious journal *Nature*.

John Phillips and others have found that newts, sea turtles, and migratory birds use a magnetic compass to navigate long distances and this can be interrupted by low levels of EMF. (6)(7) A review of effects on cell towers and wireless devices showed that beehives can have rapid colony collapse with exposure to cell phone radiation. (8)

Plants have been shown to have stress response to EMF from wireless devices. (9)(10) (22) In tomatoes exposed for short duration, the stress response seen by exposure to EMF was prevented by administration of calcium counteracting drugs. (11) Even simple high school science experiments document abnormal seed growth near Wi-Fi routers. (19) There appear to be adverse biological effects of this seemingly harmless radiation.

## HUMAN ELECTROSENSITIVITY: IS IT REAL?

There is varied opinion about those who state they are sensitive to EMF. Scientific research has not given a definitive answer, nevertheless, many seem to suffer from vague and often disabling symptoms they feel in the presence of EMF. Exposure to EMF radiation in some people reportedly causes headaches, memory problems, fatigue, sleep disorders, depression. This is so significant for some people that they have to live in a very low EMF environment to feel normal. (25)

Sweden recognizes electro-sensitivity as a functional impairment and estimates that about 3% of the population suffers from this. (23)(24) Dr. Magda Havas found in replicated studies that some EMF sensitive individuals heart rates increased with wireless devices turned on in double blind study. (12)(26) Researchers at Louisiana State University, in 2011, studied a self reported EMF sensitive physician and found "In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ( $p < .05$ )." They concluded that "EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome." (27)

Genius and Lipp reviewed the current literature on EHS, in 2011, and point to several explanations for this multisystem phenomenon, including toxicant induced loss of tolerance as many with EHS symptoms had high levels of PCB's possibly causing immune dysfunction. Scientific research also identifies an inflammatory response with cytokine production. Another aspect of research points to catecholamine and adrenal gland dysfunction. In addition, heavy metal toxicity has also been proposed as contributing to EHS. (28)

The Austrian Medical Association feels Electrohypersensitivity is a real phenomenon and in 2012 published Guidelines for EMF and Electrohypersensitivity. They state the primary method of treatment should consist in the prevention or reduction of EMF exposure, taking care to reduce or eliminate all sources of EMF if possible. (32)

## GOVERNMENT ACTIONS ON WI-FI IN SCHOOLS

While much of the U.S. is marching forward with Wi-Fi in schools, Europe is changing direction, as indicated by the policies listed below. (45) Internationally there is wide disagreement in standards. The U.S. and Canadian limits are 1000 microwatts/cm<sup>2</sup>. China and Russia are 10 microwatts/cm<sup>2</sup>. Belgium is 2.4 microwatts/cm<sup>2</sup>, and Austria is 0.001 microwatts/cm<sup>2</sup>. The Bioinitiative Report 2012 recommendation for "No Observable Effect" is 0.0003 microwatts/cm<sup>2</sup>. Cosmic background EMF we evolved with is <0.0000000001 microwatts/cm<sup>2</sup>. (2)

## COUNCIL OF EUROPE PARLIAMENT ASSEMBLY 2011 EMF MICROWAVE POLICY : "THE POTENTIAL DANGERS OF ELECTROMAGNETIC FIELDS AND THEIR EFFECT ON THE ENVIRONMENT"

The report notes "other non-ionizing frequencies, whether from ex-

*In May 2011, the International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B).(30)*



tremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications, and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects, and animals, as well as the human body, even when exposed to levels that are below the official threshold values.”

The Council calls for a number of measures to protect humans and the environment, especially from high-frequency electromagnetic fields. One of the recommendations is to “take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumors”. (37)

### **IN FRANCE: A NEW NATIONAL LAW BANS WI-FI IN NURSERY SCHOOLS**

In January 2015, France passed a landmark law that calls for precaution with wireless devices for children and the general public. (34)(35) It calls for:

1. Wi-Fi banned in nursery schools.
2. Wi-Fi routers should be turned off in school when not in use.
3. Schools are informed when new tech equipment is installed.
4. Citizens will have access to environmental cell tower radiation measurements near homes.
5. There will be continued research conducted into health effects of wireless communications.
6. Information on reducing exposure to EMF radiation is mandatory in the contents of the cell phone package.
7. Wi-Fi hotspots are labeled.

### **ISRAELI MINISTRY OF EDUCATION ISSUE GUIDELINES TO LIMIT WI-FI IN SCHOOLS**

On August 27, 2013, the Israeli Ministry of Education issued new guidelines regarding Wi-Fi use in schools. (33) The guidelines will:

1. Stop the installation of wireless networks in classrooms in kindergarten.
2. Limit the use of Wi-Fi between first and third grades. In the first grade, students will be limited to use Wi-Fi to study for one hour per day and no more than three days per week. Between the first and third grades, students will be limited to use Wi-Fi up to two hours per day for no more than four days per week.
3. To limit unnecessary exposure teachers will be required to turn off mobile phones and Wi-Fi routers when they are not in use for educational purposes.
4. All Wi-Fi equipment be tested for compliance with safety limits before and after installation in an Israeli school.
5. Desktop computers and power supplies be kept at least 20 cm from students.

### **2012 THE RUSSIAN COMMITTEE ON NON-IONIZING RADIATION PROTECTION**



### **OFFICIALLY RECOMMENDED THAT WI-FI NOT BE USED IN SCHOOLS.**

**2011 THE RUSSIAN COMMITTEE ON NON-IONIZING RADIATION PROTECTION (RNCNIRP) RELEASED THEIR RESOLUTION ENTITLED “ELECTROMAGNETIC FIELDS FROM MOBILE PHONES: HEALTH EFFECTS ON CHILDREN AND TEENAGERS.”**

According to the opinion of the Russian National Committee on Non-Ionizing Radiation Protection, the following health hazards are likely to be faced by the children mobile phone users in the nearest future: disruption of memory, decline of attention, diminishing learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to the stress, increased epileptic readiness. (36)

**Expected (possible) remote health risks:** brain tumors, tumors of acoustical and vestibular nerves (in the age of 25-30 years), Alzheimer’s

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## Wifi In Schools, continued from page 19

disease, “got dementia”, depressive syndrome, and the other types of degeneration of the nervous structures of the brain (in the age of 50 to 60).

### PLAYING IT SAFE FOR OUR KIDS

A healthy and safe learning environment is a cornerstone of education. Current FCC standards are obsolete and inappropriate as they are based only on heat effects, not biological effects. They give us a false sense of security. There may be higher EMF levels at school than at home as routers are more powerful. Cumulative Effects on DNA or cell structures are not taken into consideration in any safety standard. Because of the long-term exposure to EMF microwave radiation this generation is experiencing, they will be at higher risk for potential health problems. We will not know what happens to our progeny’s DNA until our grandchildren are born.

Considering there has been a more precautionary approach internationally to microwave radiation exposure and the trend is toward less exposure in schools, especially to vulnerable populations such as children, it makes sense to re-evaluate our wireless schools. We buckle our seat belts and wear a helmet when we ride bikes even though we don’t know if we will get in an accident. Although not all the issues of wireless microwaves are understood, there is enough science to understand it acts as a toxicant at even low levels that fall within current safety standards. We also know

3. **Limit Wi-Fi** use, especially in younger grades.
4. **Cell phones stay off and in the backpacks during class** and on the campus during school hours.
5. **Have EMF and electrical measurements done by one or more qualified, experienced consultants before and after any installation.** Understand you may need to increase your knowledge of low and high frequency electromagnetic fields and limits to accurately interpret the reports. The Bioinitiative Report is a very useful compendium that has recommendations for safer levels.
6. **Support efforts by governments to provide independent standardized transparent research to define safe limits in all the different wireless frequencies used commercially.** This could lead to less EMF emissions and safer wireless devices.

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*“Certain high frequency waves used in the fields of radar, telecommunications, and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects, and animals, as well as the human body, even when exposed to levels that are below the official threshold values.”*

that decades of research precedes meaningful regulation in the area of toxins, thus the only reasonable approach is precautionary.

In addition, we need to be thoughtful about how much our kids should use computers and what this is doing not only to them, but to our society as a whole. We get starry eyed with every new wireless gadget, however, in “Alone Together” Sherry Turkle expertly addresses the rise in isolation, loneliness, lack of privacy, and increasing pressure on students in this age of invasive technology. Her thorough and non-judgmental scientific investigation of the psychological effects of computers makes us aware that we need to take care that we do not replace real human connection with a “virtual reality” that will redirect us in an unhealthy direction.

As physicians and parents, we understand that decisions we make today may have far reaching consequences in the future for our kids. Let’s play it safe for them right now.

### RECOMMENDATIONS FOR SCHOOLS

1. **Wired internet connections** like we used to have are the safest and possibly cheapest option – all the benefits of the internet without the risk.
2. **Wireless devices**, but with an on/off switch in each room so teachers can use only when needed for educational purposes.

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# Damage to Baby's Brain Development From Wireless Radiation

## ***National Awareness Campaign by Doctors Urges Pregnant Women To Take Simple Steps to Reduce Baby's Exposure***

*"As a research scientist and physician who studies how microwave radiation affects the outcomes of pregnancy, I am deeply concerned about growing exposures to cell phone and other wireless radiation."*  
- **Dr. Hugh Taylor, Yale University School of Medicine Chair of the Department of Obstetrics, Gynecology and Reproductive Sciences**

***We join together as physicians, scientists and educators to express our concern about the risk that wireless radiation poses to pregnancy and to urge pregnant women to limit their exposures.***

The Baby Safe Project's Joint Statement is signed by dozens of well respected physicians and scientists.

Mikko Ahonen, PhD, University of Tampere, Finland; Jennifer Armstrong, MD, Ottawa Environmental Health Clinic, Ontario, Canada; Priyanka Bandara, PhD, Educator in Environmental Health, NSW Australia; Martin Blank, PhD, Associate Professor of Physiology and Cellular Biophysics, Columbia University; David Brown, PhD, Public Health Toxicologist, Environment and Human Health; Lois Brustman, MD, Maternal-Fetal Medicine Specialist, St. Luke's – Roosevelt Hospital Center, New York; Sheila Bushkin-Bedient, MD, Concerned Health Professionals of New York; David Carpenter, MD, Director, School of Public Health, University at Albany; Richard Clapp, DSc, MPH, Professor emeritus of Environmental Health, Boston University; Devra Davis, Ph.D. MPH, Visiting scholar, University of California at Berkeley; Larysa Dyrszka, MD, Pediatrician, New York, New York; Alvaro Augusto A. de Salles, PhD, Federal University of Rio Grande de Sul, Brazil; Dr. Elizabeth Evans MA, (Cantab) MBBS (London), DRCOG, United Kingdom; Beatrice A. Golomb, MD, PhD, Professor of Medicine, UC San Diego School of Medicine; Oleg Gregoriev, DrSc, PhD, Chairman, Russian National Committee on Non-Ionizing Radiation; Magda Havas, PhD, Associate Professor of Environmental & Resource Studies, Trent University; Gunnar Heuser, MD, Professor emeritus at University of California at Los Angeles; Heidi Hutner, PhD, Director of Sustainability Studies, Stony Brook University, New York; Olle Johansson, PhD, Research at Neuroscience, Karolinska Institutet, Professor at Swedish Royal Institute of Technology, Stockholm; Ellen Kamhi, PhD, RN, The Natural Nurse; Süleyman Kaplan, PhD, Ondokuz Mayıs University, Samsun, Turkey; Henry Lai, PhD, Bioelectromagnetics Research Laboratory, University of Washington; Michael Lerner, PhD, President of Commonwealth; Luana Licata, PhD, University of Rome Tor Vergata; Cynthia Johnson MacKay, MD, Clinical Professor of Ophthalmology, Columbia University College of Physicians and Surgeons; Don Maisch, PhD; Victoria Maizes, MD, Executive Director of Arizona Center for Integrative Medicine; Asish Mehta, MD, MCh, DNB, Neurological surgeon, Mumbai, India; Anthony B. Miller, MD, Professor Emeritus at the School of Public Health, University of Toronto; Joel Moskowitz, PhD, School of Public Health, University of California, Berkeley; Lisa Lavine Nagy, MD, The Preventive and Environmental Health Alliance Inc., Massachusetts; Hildur Palsdottir, PhD, NYU School of Medicine; Janet Perlman, MD, MPH, Pediatrician at Bayside Medical Group, California; Rangasamy Ramanathan, MD, LAC+USC Women's & Children's Hospital, San Francisco; Mary Redmayne, PhD, Adjunct Research Associate at Victoria University of Wellington, New Zealand; Rachel Naomi Remen, MD, Clinical Professor of Family and Community Medicine at UCSF School of Medicine, Lisa Ridgway, MD, Pediatrician, Victor Med Clinic, Victor, Idaho, Aviva Romm, MD,, Boston, Massachusetts, Annie J. Sasco, MD, DrPH, Director of Epidemiology for Cancer Prevention at University of Bordeaux, France; Amit J. Shah, MD, MSCR, Assistant professor, Emory University; Kara Sheinart, MD, Neurologist affiliated with Mount Sinai Hospital & Medical Center, New York; Maya Shetreat-Klein, MD, Pediatric Neurologist and Pediatrician; Stephen Sinatra, M.D., F.A.C.C., C.N.S., C.B.T., Cardiologist, Manchester Memorial Hospital; Narendra P. Singh, PhD, Research Professor, Washington University; Colin L. Soskolne, PhD, Professor of Epidemiology at the University of Canberra, Australia; Ken Spaeth, MD, MPH, Occupational and Environmental Medicine Professor, Hofstra University, ; Yael Stein, MD, Physician and Researcher at Hebrew University – Hadassah Medical Center, Jerusalem, Israel; Anne Steinemann, PhD, University of California at San Diego; Hugh Taylor, MD, Chief of Obstetrics and Gynecology, Yale-New Haven Hospital Leonardo Trasande, MD, Institute of Environmental Medicine, NYU Langone Medical Center, New York; John Wargo, PhD, Professor of Risk Analysis, Environmental Policy, and Political Science, Yale University; Lucy Waletzky, MD, New York; Andrew Weil, MD, Founder and Director of Arizona Center for Integrative Medicine; John West, MD, Surgeon; Jingduan Yang, MD, Thomas Jefferson University Hospital, Philadelphia

Pregnant women are largely unaware that their exposure to wireless radiation may interfere with their child's normal brain development, resulting in behavioral problems, including symptoms resembling ADHD. The BabySafe Project is a national print and social media campaign designed to raise awareness about the issue.

Please see our webpage for resources and videos to share with pregnant mothers.

<http://www.babysafeproject.org/>

# *Are You Pregnant?*

## Protect Your Baby from Wireless Radiation!



Recent studies from Yale University show that exposure to wireless radiation can have profound effects on brain development, including symptoms of Attention Deficit/Hyperactivity Disorder (ADHD).

Now, doctors and researchers around the world are urging pregnant women to take simple steps to limit their exposure to wireless radiation.

For more information, including links to scientific studies and video interviews with medical doctors and public health experts, please visit our web site, **BabySafeProject.org**.

David Morrison  
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www.wirelesswatchblog.org

### ***10 Tips for Reducing Your Exposure to Wireless Radiation***

1. Avoid carrying your cell phone on your body (e.g. in a pocket or bra).
2. Avoid holding any wireless device against your body when in use.
3. Use your cell phone on speaker setting or with an "air tube" headset.
4. Avoid using your wireless device in cars, trains or elevators.
5. Avoid cordless phones, especially where you sleep.
6. Whenever possible, connect to the internet with wired cables.
7. When using Wi-Fi, connect only to download, then disconnect and disable Wi-Fi.
8. Avoid prolonged or direct exposure to Wi-Fi routers.
9. Unplug your home Wi-Fi router when not in use (e.g. at bedtime).
10. Sleep as far away from wireless utility meters (i.e. "smart" meters) as possible



**The BabySafe Project**  
[www.BabySafeProject.org](http://www.BabySafeProject.org)  
**#KnowYourExposure**

What's Your  
Exposure?  
Take the Quiz!

