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Reply to

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August 29, 2013

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

The Honorable Dr. Margaret A. Hamburg
Commissioner
U.S. 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 subspecialists, 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.” The National Cancer Institute has stated that although studies have not demonstrated that RF energy from cell phones definitively causes cancer, more research is needed because cell phone technology and cell phone use are changing rapidly. These studies and others clearly demonstrate the need for further research into this area and highlight the importance of reassessing current policy to determine if it is adequately protective of human health.

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. McInerny, MD FAAP
President

TKM/cf

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December 12, 2012

The Honorable Dennis Kucinich
2445 Rayburn House Office Building
Washington, DC 20515

Dear Representative Kucinich:

On behalf of the American Academy of Pediatrics (AAP), a non-profit professional organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety and well-being of infants, children, adolescents, and young adults, I would like to share our support of H.R. 6358, the *Cell Phone Right to Know Act*.

The AAP strongly supports H.R. 6358's emphasis on examining the effects of radiofrequency (RF) energy on vulnerable populations, including children and pregnant women. In addition, we are pleased that the bill would require the consideration of those effects when developing maximum exposure 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. It is essential that any new standards for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded through their lifetimes.

In addition, the AAP supports the product labeling requirements in H.R. 6358. These standards will ensure consumers can make informed choices in selecting mobile phone purchases. They will also enable parents to better understand the potential dangers of RF energy exposure and protect their children.

On July 24, the U.S. Government Accountability Office (GAO) published a report on federal cell phone radiation exposure limits and testing requirements. The GAO noted that the Federal Communications Commission's (FCC) most recent data indicates that the number of estimated mobile phone subscribers has grown from approximately 3.5 million in 1989 to approximately 289 million at the end of 2009. Cell phone use behaviors have also changed during that time. The quantity and duration of cell phone calls has increased, as has the amount of time people use mobile phones, while cell phone and wireless technology has undergone substantial changes. Many more people, especially adolescents and young adults, now use cell phones as their only phone line, and they begin using wireless phones at much younger ages.

Despite these dramatic changes in mobile phone technology and behavior, the FCC has not revisited the standard for cell phone radiation exposure since 1996. The current FCC standard for maximum radiation exposure levels is based on the heat emitted by mobile phones. These guidelines specify exposure limits for hand-held wireless devices in terms of the Specific Absorption Rate (SAR), which measures the rate the body absorbs radiofrequency (RF). The current allowable SAR limit is 1.6 watts per kilogram (W/kg), as averaged over one gram of tissue. Although wireless devices sold in the United States must ensure that they do not exceed the maximum allowable SAR limit when operating at the device's highest possible power level, concerns have been raised that long-term RF energy exposure at this level affects the brain and other tissues and may be connected to types of brain cancer, including glioma and meningioma.

In May 2011, the International Agency for Research on Cancer (IARC), the United Nations' World Health Organization's (WHO) agency promoting international cancer research collaboration, classified RF energy as "possibly carcinogenic to humans." In addition, the National Cancer Institute has stated that although studies have not definitively linked RF energy exposure from cell phones to cancer, more research is required to address rapidly changing cell phone technology and use patterns.

This and other research identified by the GAO demonstrates the need for further research on this issue, and makes clear that exposure standards should be reexamined.

The GAO concluded that the current exposure limits may not reflect the latest research on RF energy, and that current mobile phone testing requirements may not identify maximum RF energy exposure. The GAO proposed that the FCC formally reassess its limit and testing requirements to determine whether they are effective. The AAP commends the activities proposed under H.R. 6358, as they would address this research gap and improve consumer knowledge and safety. Establishing an expanded federal research program as the basis for exposure standards will ensure that consumer protections incorporate the latest research. Currently, the National Institute of Health (NIH), the only federal agency the GAO identified as directly funding research on this topic, provided approximately \$35 million from 2001 to 2011. Given this previous funding level, the AAP supports the \$50 million per fiscal year for seven years that H.R. 6358 would authorize.

The AAP appreciates your recognition of the need for new research and standards for mobile phone radiation, and is pleased to support H.R. 6358. For further assistance, please do not hesitate to contact Sonya Clay, Assistant Director, Department of Federal Affairs, at 202-347-8600 or sclay@aap.org.

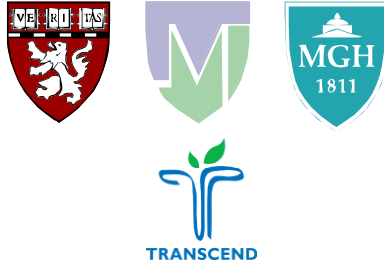
Sincerely,

A handwritten signature in cursive script that reads "Thomas K. McInerney".

Thomas K. McInerney, MD, FAAP
President

HARVARD MEDICAL SCHOOL

Martha R. Herbert, Ph.D., M.D.
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December 12, 2015

Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

cc Montgomery County City Council

Dear Montgomery County School District,

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.

A few years ago I 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 and it was published in a revised and somewhat shortened form in two parts in the peer reviewed indexed journal *Pathophysiology* (2013) with the title: "Autism and EMF? Plausibility of a pathophysiological link." Please also see the appendix to this letter which contains a summary of this material and includes substantial scientific citations.

More recently I published an article entitled "[Connections in Our Environment: Sizing up Electromagnetic Fields.](#)" in *Autism Notebook Spring 2015* edition in which I summarized and personalized the information in the . In this article I describe how here is a whole series of problems at the cellular, sub-cellular and metabolic levels and immune levels that have been identified in autism. And interestingly, for every single one of those problems, there's literature about how EMFs can create those kinds of problems.

The argument I made in these articles is not that EMF is proven to cause autism, but rather, that EMF can certainly contribute to degrading the physiological integrity of the system at the cellular and molecular level" – and this in turn appears to contribute to the pathogenesis/causation not only of autism but of many highly common chronic illnesses, including cancer, obesity, diabetes and heart disease.. Please see this article on page 24-25 at the link <http://virtualpublications.soloprinting.com/publication/?i=252361>

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.

Radiofrequency electromagnetic radiation 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 learning or medical problems in the first place. And since half of the children in this country have some kind of chronic illness, this means that a lot of people are more vulnerable than you might expect to these issues.

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 opt for wired technologies in Montgomery County classrooms, particularly for those subpopulations that are most sensitive. It will be easier for you to make a healthier decision now than to undo misguided decisions later.

Thank you.



Martha Herbert, PhD, MD

Selected pertinent publications

[Connections in our Environment: Sizing up Electromagnetic Fields](#) by M.R. Herbert (published in Autism Notebook Spring 2015, pp. 24-25) reviews in two pages key points of the more technical Herbert & Sage Autism-EMF paper

Herbert, M.R. and Sage, C. "Autism and EMF? Plausibility of a Pathophysiological Link". [Part 1: Pathophysiology, 2013, Jun;20\(3\):191-209](#), epub Oct 4, PMID 24095003. [Pubmed abstract for Part 1](#). [Part II: Pathophysiology, 2013 Jun;20\(3\):211-34](#). Epub 2013 Oct 8, PMID 24113318. [Pubmed abstract for Part II](#).

APPENDIX: MORE DETAILED SUMMARY OF THE PATHOPHYSIOLOGY

I became interested in the health and brain effects of electromagnetic frequency (EMF) and radiofrequency radiation (RFR) exposures in relation to my brain research because I was interested in how such exposures might alter brain function. In order to familiarize myself in more detail existing literature on the pathophysiological impacts of EMF/RFR, I coauthored a 40,000 word chapter in the 2012 update of the Bioinitiative, ¹ and published an updated 30,000 word version of that paper ("Autism and EMF? Plausibility of a Pathophysiological Link") in 2013 in two parts in the peer reviewed journal *Pathophysiology*. ^{2,3} My intention was to assess the plausibility of an association between increasing incidence of autism spectrum disorder and increasing EMF/RFR exposures. Rather than directly address the epidemiological issues, I looked at the parallels between the pathophysiological features documented in autism and the pathophysiological impacts of EMF/RFR documented in the peer-reviewed published scientific literature.

I will include here a brief summary of the paper (prepared for a lay audience) of the features of EMF/RFR that I reviewed (with citations at the end of this letter):

- EMF/RFR stresses cells. It lead to cellular stress, such as production of heat shock proteins, even when The EMF/RFR isn't intense enough to cause measurable heat increase. ⁴⁻⁶
- EMF/RFR damages cell membranes, and make them leaky, which makes it hard for them to maintain important chemical and electrical differences between what is inside and outside the membrane. This degrades metabolism in many ways – makes it inefficient. ⁷⁻¹⁵
- EMF/RFR damages mitochondria. Mitochondria are the energy factories of our cells. Mitochondria conduct their chemical reactions on their membranes. When those membranes get damaged, the mitochondria struggle to do their work and don't do it so well. Mitochondria can also be damaged through direct hits to steps in their chemical assembly line. When mitochondria get inefficient, so do we. This can hit our brains especially hard, since electrical communication and synapses in the brain demands huge amounts of energy.
- EMF/RFR creates "oxidative stress." Oxidative stress is something that occurs when the system can't keep up with the stress caused by utilizing oxygen, because the price we pay for using oxygen is that it generates free radicals. These are generated in the normal course of events, and they are "quenched" by antioxidants like we get

in fresh fruits and vegetables; but when the antioxidants can't keep up or the damage is too great, the free radicals start damaging things.

- EMF/RFR is genotoxic and damages proteins, with a major mechanism being EMF/RFR-created free radicals which damage cell membranes, DNA, proteins, anything they touch. When free radicals damage DNA they can cause mutations. This is one of the main ways that EMF/RFR is genotoxic – toxic to the genes. When they damage proteins they can cause them to fold up in peculiar ways. We are learning that diseases like Alzheimer's are related to the accumulation of mis-folded proteins, and the failure of the brain to clear out this biological trash from its tissues and fluids.
- EMF/RFR depletes glutathione, which is the body's premier antioxidant and detoxification substance. So on the one hand EMF/RFR creates damage that increases the need for antioxidants, and on the other hand they deplete those very antioxidants.^{1,16}
- EMF/RFR damages vital barriers in the body, particularly the blood-brain barrier, which protects the brain from things in the blood that might hurt the brain. When the blood-brain barrier gets leaky, cells inside the brain suffer, be damaged, and get killed.^{1,16,17}
- EMF/RFR can alter the function of calcium channels, which are openings in the cell membranes that play a huge number of vital roles in brain and body.¹⁸⁻²⁷
- EMF/RFR degrades the rich, complex integration of brainwaves, and increase the “entropy” or disorganization of signals in the brain – this means that they can become less synchronized or coordinated; such reduced brain coordination has been measured in autism.²⁸⁻⁴⁰
- EMF/RFR can interfere with sleep and the brain's production of melatonin.⁴¹⁻⁴³
- EMF/RFR can contribute to immune problems.⁴⁴⁻⁵⁰
- EMF/RFR contribute to increasing stress at the chemical, immune and electrical levels, which we experience psychologically.^{51-57 17, 58-62 63-68}

Please note that:

1. There are a lot of other things that can create similar damaging effects, such as thousands of “xenobiotic” substances that we call toxicants. Significantly, toxic chemicals (including those that contain naturally occurring toxic elements such as lead and mercury) cause damage through many of the same mechanisms outlined above.
2. In many of the experimental studies with EMF/RFR, damage could be diminished by improving nutrient status, particularly by adding antioxidants and melatonin.⁶⁹⁻⁷²

I understand that the concept of electromagnetic hypersensitivity is not always well understood in the medical and scientific communities. Indeed, the inter-individual variability is perplexing to those who would expect a more consistent set of features.

But given the range of challenges I have listed that EMF/RFR poses to core processes in biological systems, and given the inter-individually variable vulnerability across these symptoms, it is really not surprising that there would be subgroups with different combinations of symptom clusters.

It also appears to be the case that the onset and duration of symptoms or even brain response to EMR/RFR can be variable. This again is to be expected given the mediation of these symptoms through a variety of the above-listed pathophysiological processes, many of which differ in scale (ranging from molecular to cellular to tissue and organ) and time course of impact. The different parts of the body also absorb this energy differently, both

because of their biophysical properties and as a function of their state of health or compromise thereof.

Here is a list of subgroups of symptom clusters identified by a group of German physicians, that exemplifies these variability issues:

- Group 1** no symptoms
- Group 2** sleep disturbance, tiredness, depressive mood
- Group 3** headaches, restlessness, dazed state, irritability, disturbance of concentration, forgetfulness, learning difficulties, difficulty finding words
- Group 4** frequent infections, sinusitis, lymph node swellings, joint and limb pains, nerve and soft tissue pains, numbness or tingling, allergies
- Group 5** tinnitus, hearing loss, sudden hearing loss, giddiness, impaired balance, visual disturbances, eye inflammation, dry eyes
- Group 6** tachycardia, episodic hypertension, collapse
- Group 7** other symptoms: hormonal disturbances, thyroid disease, night sweats, frequent urge to urinate, weight increase, nausea, loss of appetite, nose bleeds, skin complaints, tumors, diabetes

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3 August 2016

Petaluma City Schools
District Office
200 Douglas Street
Petaluma, California 94952

Dear Sirs/Madams:

I am a public health physician who served as the Co-Editor of the Bioinitiative Report, published in 2007 as a comprehensive review of the adverse health effects of radiofrequency electromagnetic fields.

There is strong and consistent evidence that excessive exposure to radiofrequency electromagnetic fields has adverse human health effects. Of particular concern is the clear evidence that children are more vulnerable than adults. The best-documented adverse effects are an increase in risk of cancer, but cancers do not appear immediately upon exposure but rather come years later. The National Toxicology Program has within the past couple of months reported that even rats exposed to radiofrequency radiation develop brain cancer! Within a school setting there is increasing evidence that excessive exposures reduce learning ability, which is the last thing one wants in a school. Some children will also develop a syndrome of electrohypersensitivity, where they get headaches and reduced ability to pay attention and learn. While these effects are not nearly as well documented as those relating to cancer, they are particularly important within a school. This is especially the case in a wireless computer classroom, where exposure can be very high. However there will be essentially no exposure in a wired computer classroom.

The exposure levels of the Federal Communications Commission are totally outdated and do not protect the health of the public, especially of children. I urge you to abandon any plans for wireless communication within schools. It is of course critical that all children have access to the Internet, but when this is done through wired connections they will not be exposed to excessive electromagnetic fields.

Yours sincerely,



David O. Carpenter, M.D.
Director, Institute for Health and the Environment
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4 August, 2016

Dear Petaluma City Schools;
Superintendent Gary Callahan and Board of Trustees

Regarding: Wireless technology should not be used in schools or pre-schools due to health risks for children and employees

We have been asked to declare our opinion about wireless technology in schools by parents that are concerned about their children.

Based on current published scientific studies, we urge your administration to educate themselves on the potential risks from wireless technologies in schools, and to choose wired teaching technologies. The well-being and educational potential of children depends on it.

High-speed connectivity to schools is important but it can be a wired connection instead of Wi-Fi. Wireless classroom infrastructure and wireless devices for schoolchildren should be avoided for these reasons:

- Wireless radiofrequency (RF) radiation emissions were classified as a Possible Human Carcinogen (group 2B) by the World Health Organization International Agency for Research on Cancer (IARC) in May 2011. One of the signers, Dr Hardell, was part of the evaluation group.
- The IARC classification holds for *all forms of radio frequency radiation* including RF-EMF emissions from wireless transmitters (access points), tablets and laptops.
- Epidemiological studies show links between RF radiation exposure and cancer, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RF radiation exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Foetal exposures in both animal and human studies may result in altered brain development in the young offspring, with disruption in learning, memory and behaviour.
- Recently a report was released from The National Toxicology Program (NTP) under the National Institutes of Health (NIH) in USA on the largest ever animal study on cell phone RF radiation and cancer (<http://biorxiv.org/content/biorxiv/early/2016/05/26/055699.full.pdf>). An increased incidence of glioma and malignant schwannoma in the heart was found. Interestingly our research group and others have in epidemiological studies shown that persons using wireless phones (both mobile phones and cordless phones; DECT) have an increased risk for glioma and acoustic neuroma. Acoustic neuroma or vestibular schwannoma is the same type of tumour as the one found in the heart, although benign.
- The research showing increased brain cancer risk in humans *has strengthened* since the IARC 2011 classification as new research has been published which repeatedly shows a significant association after RF radiation exposure. In addition, tumour

promotion studies have now been replicated showing cancer promotion after exposures at low levels.

- It is our opinion and that of many colleagues that the current IARC cancer risk classification should move to an *even higher* risk group. The carcinogenic effect has been shown in human and animal studies. Several laboratory studies have shown mechanistic effects in carcinogenesis such as oxidative stress, down regulation of mRNA, DNA damage with single strand breaks.
- In summary RF radiation should be classified as Carcinogenic to Humans, Group 1 according to the IARC classification. This classification should have a major impact on prevention.

The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse health effects at levels much lower than current ICNIRP and FCC public safety limits. Compliance with government regulations does not mean that the school wireless environment is safe for children and staff (especially pregnant staff).

As researchers in cancer epidemiology and RF radiation exposures, we have published extensively in this area and it is our opinion that schools should choose wired Internet connections. Multiple epidemiological research studies show that exposures equivalent to 30 minutes a day of cell phone use over ten years results in a significantly increased brain cancer risk.

What will be the health effect for a child exposed all day long in school for 12 years? Wireless networks in schools result in full body low level RF radiation exposures that can have a cumulative effect on the developing body of a child. No safe level of this radiation has been determined by any health agency and therefore we have no safety assurances. Cancers can have long latency periods (time from first exposure until diagnosis) and it will take decades before we know the full extent of health impacts from this radiation. The statistics and effects will be borne by the children you serve.

Wi-Fi in schools, in contrast to wired Internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Promoting wireless technology in schools disregards the current health warnings from international science and public health experts in this field.

We recommend that your school district install wired Internet connections and develop curriculum that teaches students at all ages safer ways to use their technology devices. If cell phones and other wireless devices are used in the school curriculum (as many schools are now doing with Bring your Own Device Policy) then there should be educational curriculum in place and well posted instructions in classrooms so that the students and staff use these devices in ways that reduce exposure to the radiation as much as possible.

Supporting wired educational technologies is the safe solution in contrast to potentially hazardous exposures from wireless radiation.

Respectfully submitted

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August 4, 2016

Petaluma City Schools
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Re: Adverse Effects of Radiofrequency fields

I am writing to express my concern over the increasing exposure of children in schools to Radiofrequency Fields (e.g. from wi-fi, as required for cell phones and iPads, and emitted by cell towers) and the lack of concern expressed by many councils, governments and School Boards on this issue. In particular, justification for the “safety” of radiofrequency fields is placed upon the use of outdated safety standards, based upon tissue heating, whereas it has now been well demonstrated that adverse biological effects occur at far lower levels of radiofrequency fields that do not induce tissue heating, including a recent animal study performed by the National Toxicology Program in the United States which found an increased incidence of brain cancers and other cancers in rats exposed to prolonged Radiofrequency fields.

I am a physician and epidemiologist specializing in cancer etiology, prevention, and screening, expert in epidemiology, and particularly causes of human cancer. I have performed research on ionizing radiation and cancer, electromagnetic fields and cancer, and have served on many committees assessing the carcinogenicity of various exposures, including working groups of the International Agency for Research on Cancer (IARC), widely regarded as providing unbiased assessment on the carcinogenicity of chemicals and other exposure to humans.

In 2011, an IARC working group designated radiofrequency fields as a class 2B carcinogen, a possible human carcinogen. Since that review a number of additional studies have been reported. One of the most important was a large case-control study in France, which found a doubling of risk of glioma, the most malignant form of brain cancer, after two years of exposure to cell phones. After five years exposure the risk was five-fold. They also found that in those who lived in urban environments the risk was even higher. In my view, and that of many colleagues who have written papers on this issue, these studies provide evidence that radiofrequency fields are not just a possible human carcinogen but a probable human carcinogen, i.e. IARC category 2A. It would be impossible to ignore such an assessment in regulatory approaches.

It is important to recognize that there are no safe levels of exposure to human carcinogens. Risk increases with increasing intensity of exposure, and for many carcinogens, even more with increasing duration of exposure. The only way to avoid the carcinogenic risk is to avoid exposure altogether. This is why we ban known carcinogens from the environment and why much effort is taken to get people, particularly young people, not to smoke. We now recognize that exposure to carcinogens in childhood can increase the risk of cancer in adulthood many years later. Further, people vary in their genetic makeup, and certain genes can make some people more susceptible than others to the effect of carcinogens. It is the young and those who are susceptible we should protect.

As an epidemiologist who has done a great deal of work on breast cancer, I have been concerned by a series of case reports from California and elsewhere of women who developed unusual breast cancers in the exact position where they kept cell phones in their bras. These are unusual cancers. They are multifocal, mirroring where the cell phone was kept. Thus in these relatively young women the radiofrequency radiation from very close contact with a cell phone has caused breast cancer.

Not only brain and breast cancers but parotid gland tumors, tumors of the salivary gland, have been associated with prolonged exposure to cell phones.

Given the long natural history of cancer and the fact that human populations have not been exposed for a sufficient length of time to reveal the full adverse effects of radiofrequency fields, it is extremely important to adopt a precautionary approach to the exposure of humans to such fields. An individual, if appropriately informed, can reduce her or his exposure to radiofrequency fields from devices that use wi-fi, but in the case of cell towers, smart meters and wi-fi in schools, the exposure they receive is outside their control. Then, with the people who manufacture these devices and those who promote wi-fi failing to issue adequate health warnings, we are reaching a situation where schools, work places and homes are being saturated with radiofrequency fields.

Thus to avoid a potential epidemic of cancer caused by radiofrequency fields from wi-fi and other devices, we should introduce means to reduce exposure as much as reasonably achievable, use hard wire connections to the internet and strengthen the codes that are meant to protect the public.

Yours sincerely

A handwritten signature in black ink, appearing to read 'A. B. Miller', written in a cursive style.

Anthony B. Miller, MD, FRCP(C), FRCP, FACE
Professor Emeritus
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Karolinska Institutet
Department of Neuroscience
Experimental Dermatology Unit

Stockholm, December 8, 2015

To:

MCPS CEO Dr. Andrew Zuckerman [Andrew_Zuckerman@mcpsmd.org]
MCPS Superintendent Mr. Larry Bowers [Larry_Bowers@mcpsmd.org]
MCPS Chief Technology Officer Mr. Sherwin Collette [Sherwin_Collette@mcpsmd.org]
MCPS Board of Education [boe@mcpsmd.org]
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cc:

Montgomery County Council [county.council@montgomerycountymd.gov]

Dear Madame or Sir,

My name is Olle Johansson, and I am an associate professor, heading the Experimental Dermatology Unit at Sweden's Karolinska Institute in the Department of Neuroscience. I understand you have recently made public pronouncements regarding the safety of Wi-Fi. As a neuroscientist who has been studying the biophysical and epidemiological effects of electromagnetic fields (EMFs) for over 30 years, I believe this designation is short-sighted.

Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that the exposure to electromagnetic fields not only may induce acute thermal effects to living organisms, but also non-thermal effects, the latter often after longer exposures. This has been demonstrated in a very large number of **non-ionizing radiation** studies and includes cellular DNA-damage, disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier, impact on vessel and immune functions, and loss of fertility. Whereas scientists can observe and reproduce these effects in controlled laboratory experiments, epidemiological and ecological data derived from long-term exposures in well-designed case-control studies reflect this link all the way from molecular and cellular effects to the living organism up to the induction and proliferation of diseases observed in humans. It should be noted that we are not the only species at jeopardy; practically all animals, plants and bacteria may be at stake. Although epidemiological and ecological investigations as such never demonstrate causative effects, due to the vast number of confounders, they confirm the relevance of the controlled observations in the laboratories.

Many times since the early 1980s I have pointed out that the public's usage of cell phones has become the largest full-scale biological and medical experiment ever with mankind, and I was also the first person to firmly point out that this involuntary exposure violates the Nuremberg Code's principles for human experimentation, which clearly states that voluntary

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consent of human subjects is absolutely essential. Among many effects seen, the very serious one is the deterioration of the genome. Such an effect - if seen in a food item under development or in a potential pharmaceutical drug - immediately would completely ban it from further marketing and sale; genotoxic effects are not to be allowed or spread. For these reasons above, we, scientists, can not accept that children undergo an enormous health risk for their present and future, by being exposed to WI-FI in kindergardens or schools (even if the WI-FI masts/routers are not in the children's classroom). The precautionary principle has to be respected. Furthermore, when men place cell phones in their front pocket, or laptops on their laps, it should be noted that experimental studies have demonstrated that after similar exposures there is a decrease in sperm count as well as in the quality of sperm, which is a phenomenon that could affect society's overall ability to procreate in the future. Experiments in mice point to that it may be true already in 5 generations time.

Many other states including France, Russia, Israel and Germany, have employed various precautionary steps and their responses (including labelling cell phones and other transmitting devices with SAR ratings, discouraging the use of cell phones and other wireless gadgets by children, warning parents of the risks, and removing or restricting WiFi in schools and replacing it with hard-wired ethernet) as a result of the *WHO/IARC classification of radiofrequency electromagnetic radiation in 2011 as a Class 2B carcinogen as well as the earlier classification of power-frequent magnetic fields in 2001 also as a Class 2B carcinogen*, the information summarized in the Bioinitiative Reports of 2007 and 2012, and the other considerable international and independent research and reviews, that show adverse biological effects from electromagnetic fields, including heart palpitations, headaches, skin rashes, damage to DNA, mental health effects, impaired concentration, decreased problem-solving capacity, electrohypersensitivity, etc., are about to set a new standard for educational quality with due respect to children's and staff's health.

In the case of "protection from exposure to electromagnetic fields", it is thus of paramount importance to act from a prudence avoidance/precautionary principle point of view. Anything else would be highly hazardous. Total transparency of information is the key sentence here, as I believe the public does not appreciate having the complete truth revealed years after a certain catastrophe already has taken place. For instance, it shall be noted, that today's recommended values for wireless systems, such as the SAR-values, are just recommendations, and not safety levels. Since scientists observe biological effects at as low as 20 microWatts/kg, can it truly be stated that it is safe to allow irradiation of humans at SAR 2 W/kg, or at 100,000 times stronger levels of radiation?

IMBALANCED REPORTING

Another misunderstanding is the use of scientific publications (as the tobacco industry did for many years) as 'weights' to balance each other. But one can NEVER balance a report showing a negative health effect with one showing no effect. This is a misunderstanding which, unfortunately, is very often used both by the industrial representatives as well as official authorities to the detriment of the general public. True balance would be reports showing negative health effects against *exact replications* showing no or positive effects. However, this is not what the public has been led to believe.

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NEED FOR INDEPENDENT RESEARCH

In many commentaries, debate articles and public lectures - for the last 20-30 years – I have urged that completely independent research projects must be inaugurated immediately to ensure our public health. These projects must be entirely independent of all types of commercial interests; public health can not have a price-tag! It is also of paramount importance that scientists involved in such projects must be free of any carrier considerations and that the funding needed is covered to 100%, not 99% or less. This is the clear responsibility of the democratically elected body of every country.

WHO/INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC), 2011

Very recently (in Lyon, France, May 31, 2011) the WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer. This should be added to the previous (2001) 2B classification of power-frequent (ELF) electromagnetic fields – emitted at high levels from handheld gadgets, such as eReaders and mobile phones – as a risk factor for childhood leukemia. Given the 2001 very close votes (9 to 11) for moving it to 2A and all the new knowledge that has accumulated since 2001, today the association between childhood leukemia and power-frequent (ELF) electromagnetic fields would definitely be signed into the much more serious 2A (“probably carcinogenic”) category. So, the ‘red flag’ is – unfortunately – flying very high.

INVOLUNTARY EXPOSURE

According to Article 24 of the UNICEF’s Child Convention “children have the right to ... a clean and safe environment, and information to help them stay healthy”. We must all ensure that this article never is violated. This is about our social responsibility, and is very much a public health issue.

In summary, electromagnetic fields may be among the most serious and overlooked health issues today, and having these fields checked and reduced/removed from schools and kindergardens may be essential for health protection and restoration, and is a must for persons with the functional impairment electrohypersensitivity as for children who are more fragile (cf. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Johansson O, Kern M, Kundi M, Lercher P, Mosgöller W, Moshammer H, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R, "EUROPAEM EMF Guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses", Rev Environ Health 2015; 30: 337–371). In addition, as recently discussed in a think-tank group here in Stockholm, it is very important to constantly educate oneself and participate in the general debate and public discussions to keep the information build-up active. Thus, it is of paramount importance to keep the "kettle boiling", never blindly trusting or accepting given 'facts', but only read and think for yourself and for your loved ones. Only so you can arrive at a genuinely working precautionary principle.

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CONCLUSION

In conclusion, wireless systems, such as Wi-Fi routers or cell towers, and their electromagnetic fields, can not be regarded as safe in schools, but must be deemed highly hazardous and unsafe for the children as well as for the staff.

I encourage governments and local health and educational bodies to adopt a framework of guidelines for public and occupational EMF exposure that reflect the Precautionary Principle. As noted, the Precautionary Principle states when there are indications of possible adverse effects, though they remain uncertain, the risks from doing nothing may be far greater than the risks of taking action to control these exposures. The Precautionary Principle shifts the burden of proof from those suspecting a risk to those who discount it — as some nations have already done. Precautionary strategies should be based on design and performance standards and may not necessarily define numerical thresholds because such thresholds may erroneously be interpreted as levels below which no adverse effect can occur.

Some 100 years back, we learned the hard lessons of ionizing radiation and the need for strict health protections – now we must openly face the possibility that we must take a seat in life's school and learn again. This time it is about non-ionizing radiation.

Based on all of the above, I strongly urge you to reconsider your public stance on the safety of Wi-Fi, cell towers, and similar systems in schools as their non-ionizing radiation emissions very likely are hazardous and unsafe for students, staff and teachers.

With my very best regards
Yours sincerely
Olle Johansson

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MCPS Board of Education
MCPS Office of Technology
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Carver Educational Services Center
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January 3, 2016

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers,
Board of Education and Office of Technology;

I have been asked to comment on the [MCPS Statement Concerning Deployment of Wireless Computing Technologies](#). I am happy to do so.

The first paragraph in that statement is not relevant to the issue at hand because it is perfectly possible to use wired communication for such education. This document is being produced on a computer on which I only use wired communication, connecting to the internet, connecting to my printer and for other purposes, as well.

The 2nd and 3rd paragraphs of your statement may well be technically correct. However these give us no assurance whatsoever of safety of Wi-Fi fields. The FCC guidelines as are many other such guidelines, are based on the assumption that only heating effects of microwave/lower frequency EMFs can have biological effects. However that assumption has been falsified by thousands of studies published from the 1950s to the present, each showing that non-thermal levels of exposure often produce biological effects. For example, in 1971, the U.S. Office of Naval Medical Research produced a document reporting over 100 different non-thermal effects [1], listing 40 apparent neuropsychiatric changes produced by non-thermal microwave frequency exposures, including 5 central/peripheral nervous system (NS) changes, 9 central NS effects, 4 autonomic system effects, 17 psychological disorders, 4 behavioral changes and 2 misc. effects [1]. It also listed cardiac effects including ECG changes and cardiac necrosis as well as both hypotension and hypertension, and also 8 different endocrine effects.

Changes affecting fertility included tubular degeneration in the testis, decreased spermatogenesis, altered sex ratio, altered menstrual activity, altered fetal development, programmed cell death (what is now known as apoptosis) and decreased lactation. Many other non-thermal changes were also listed for a total of over 100 non-thermal effects. They also provided [1] approximately 2000 citations documenting these various health effects. That was almost 45 years ago and is only the beginning of the evidence for the existence of non-thermal effects. My own recent paper [2] shows that widespread neuropsychiatric effects are caused by non-thermal exposures to many different microwave frequency electromagnetic fields (EMFs).

Tolgskaya and Gordon [3] in 1973 published a long and detailed review of effects of microwave and lower frequency EMFs on experimental animals, mostly rodents. They report that non-thermal exposures impact many tissues, with the nervous system being the most sensitive organ in the body, based on histological studies, followed by the heart and the testis. They also report effects of non-thermal exposures on liver, kidney, endocrine and many other organs. The nervous system effects are very extensive and include changes many changes in cell structure, disfunction of synaptic connections between neurons and programmed cell death and are discussed in Refs. [2,3] and more modern studies reporting extensive effects of such non-thermal EMF exposures on the brain are also cited in [2]. There are also many modern studies showing effects of non-thermal exposures on fertility in animals.

The Raines 1981 National Aeronautics and Space Administration (NASA) report [4] reviewed an extensive literature based on occupational exposures to non-thermal microwave EMFs. Based on multiple studies, Raines [4] reports that 19 neuropsychiatric effects are associated with occupational microwave/ radiofrequency EMFs, as well as cardiac effects, endocrine including neuroendocrine effects and several other effects.

I reviewed many other scientific reviews on this topic, each of which clearly supports the view that there are various non-thermal health impacts of these EMFs [5]. In 2015, 206 international scientists signed [a statement](#) sent to the United Nations Secretary General and to member states, stating that international safety guidelines and standards are inadequate to protect human health [6]. Each of these 206 scientists from 40 countries had scientific publications on biological effects of such EMFs and therefore each is well qualified to judge this. ***It can be seen from this statement to the UN, that there is a strong scientific consensus that current safety guidelines and standards are inadequate because they do not take into consideration all of the non-thermal health effects produced by various EMF exposures.***

That scientific consensus also rejects, therefore, the FCC EMF guidelines, guidelines that cannot be defended despite your own attempt to do so in MCPS Statement Concerning Deployment of Wireless Computing Technologies.

It can be seen from the previous paragraphs, that the following non-thermal effects of EMF exposures are well documented:

- Ø Widespread neuropsychiatric effects
- Ø Several types of endocrine (that is hormonal) effects
- Ø Cardiac effects impacting the electrocardiogram (Note: these are often associated with occurrence of sudden cardiac death)
- Ø Male infertility

However, there are many additional types of biological changes produced by non-thermal EMF exposures (reviewed in 5,7] including:

- Ø Oxidative stress
- Ø Changes in calcium fluxes and calcium signaling
- Ø Several types of DNA damage to the cells of the body, including single strand and double strand DNA breaks and 8-OH-guanine in DNA
- Ø Cancer (which is undoubtedly caused, in part, by such DNA damage)
- Ø Female infertility
- Ø Lowered melatonin; sleep disruption
- Ø Therapeutic effects of EMFs when they are highly controlled and focused on a specific part of the body

It can be seen from the above, that each of the things that we most value as individuals and as a species are being attacked by non-thermal microwave frequency EMFs [5.7]:

§ **Our Health**

§ **Our brain function**

§ **The integrity of our genomes**

§ **Our ability to produce healthy offspring**

I want to emphasize that the specific health effects listed above are **not** the only things that are likely to be impacted by non-thermal EMF exposures, they are however the best documented such effects.

While it has been clear for many years that there are many non-thermal health effects of microwave frequency EMFs, it has not been clear until about 2 ½ years ago, how these effects are produced by such exposures. I stumbled onto the mechanism in 2012 and published on it in mid-2013. This 2013 paper [8] was honored by being placed on the Global Medical Discovery web site as one of the most important medical papers of 2013. At this writing, it has been cited 61 times according to the Google Scholar database, with over 2/3rds of those citations during 2015. So clearly it is having a substantial and rapidly increasing impact on the scientific literature. I have given 26 professional talks, in part or in whole on EMF effects in 10 different countries over the last 2 1/4 years. So it is clear that there has been a tremendous amount of interest in this research.

What the 2013 study showed [8], was that in 24 different studies (and there are now 2 more that can now be added [2]), effects of low-intensity EMFs, both microwave frequency and lower frequency EMFs could be blocked by calcium channel blockers, drugs that block what are called voltage-gated calcium channels (VGCCs). There were a total of 5 different types of calcium

channel blocker drugs used in these studies, with each type acting on a different site on the VGCCs and each thought to be highly specific for blocking VGCCs. What these studies tell us is that these EMFs act to produce non-thermal effects by activating the VGCCs. Where several effects were studied, when one of them was blocked or greatly lowered, each other effect studied was also blocked or greatly lowered. This tells us that the role of VGCC activation is quite wide – many effects go through that mechanism, possibly even all non-thermal effects in mammals. There are a number of other types of evidence confirming this mechanism of action of microwave frequency EMFs [2,]. Each of the 11 health impacts caused by non-thermal EMF exposures can be explained as being produced by indirect effects of VGCC activation [5,7].

It is now apparent [7] that these EMFs act directly on the voltage sensor of the VGCCs, the part of the VGCC protein that detects electrical changes and can open the channel in response to electrical changes. The voltage sensor (and this is shown on pp. 102-104 in [7]) is predicted, because of its structure and its location in the plasma membrane of the cell, to be extraordinarily sensitive to activation by these EMFs, about 7.2 million times more sensitive than are single charged groups elsewhere in the cell. What this means is that arguments that EMFs produced by particular devices are too weak to produce biological effects, are immediately highly suspect because the actual target, the voltage sensor of the VGCCs is extremely sensitive to these EMFs. **Because heating is mostly produced by forces on these singly charged groups elsewhere in the cell, limiting safety guidelines to heating effects means that these guideline allow exposures that are something like 7.2 million times too high.**

Why then does the FCC stick with these totally unscientific safety guidelines? That is the 64 billion dollar question. The FCC has been shown, in a long detailed document published by Harvard University Center for Ethics, to be a “captured agency”, that is captured by the telecommunications industry that the FCC is supposed to be regulating [9; can be obtained full text from web site listed in 9]. So perhaps the failure of the FCC to follow the extensive science in this important area, can be understood. Of course, what that means is that the FCC is completely failing in its role of protecting the public and it is a major blunder, therefore for either you or any other organization to depend on the FCC guideline as a reliable predictor of impacts of EMFs in humans.

So what is known about health impacts of Wi-Fi EMFs?

Table 1. The following Table summarizes various health impacts of Wi-Fi EMF exposures:

Citation(s)	Health Effects
[10,11,12,13,14,15,16]	Sperm/testicular damage, male infertility
[10,15,17,18,19,20]	Oxidative stress
[20]	Calcium overload

[11,12,20]	Apoptosis (programmed cell death)
[17]	Melatonin lowering; sleep disruption
[10,13]	Cellular DNA damage
[21]	MicroRNA expression (brain)
[18]	Disrupts development of teeth
[22]	Cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation
[23,24]	Neuropsych changes including EEG
[25]	Growth stimulation of adipose stem cells (role in obesity?)

Each of the effects reported above in 2 to 7 studies have an extensive literature for their occurring in response to various other microwave frequency EMFs so it should be clear that these observations on Wi-Fi exposures are highly probable to be correct. These include (see Table 1) findings that Wi-Fi exposures produce impacts on the testes leading to lowered male fertility; oxidative stress; intracellular calcium overload; apoptosis (a process that has an important causal role in neurodegenerative diseases); cellular DNA damage; neuropsychiatric changes including EEG changes. Each of these are very serious and oxidative stress has causal roles in many different human diseases; intracellular calcium overload has many different consequences – for example, it has a central role in causing neurodegenerative diseases; cellular DNA damage can cause cancer and produce mutations that impact future generations (if there are any). Other Wi-Fi effects each only documented by a single study are also effects where a variety of other non-thermal microwave EMFs also cause these, as shown by extensive literature on each of them. These include: melatonin lowering and sleep disruption; and the effects reported by Sali et al [22] cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation. So these may well be correct observations as well despite having only a single Wi-Fi specific study for each.

Summary:

1. The EMF safety guidelines supported by the FCC and others assume that only heating effects need be of concern. These assumptions have been known to be false for at least 45 years and there is a scientific consensus on this, that has lead to the petition by 206 highly qualified international scientists to the UN stating that current safety guidelines are inadequate.
2. We now know that low intensity non-thermal exposures work via VGCC activation and that indirect effects of such VGCC activation can produce each of the health effects that have been widely reported to occur in response to such EMF exposures for something like 60 years.

These attack:

a. Our health

- b. Our brain function**
- c. The integrity of our genomes**
- d. Our ability to produce healthy offspring**

3. The voltage sensor of the VGCCs is stunningly sensitive to such low intensity EMFs, about 7.2 million times more sensitive than are singly charge groups elsewhere in our cells. The consequence of this is that safety guidelines allow exposures that are very roughly 7.2 million times too high.

4. The FCC has been shown, in a detailed Harvard University study, to be a Captured Agency, captured by the industry that it is supposed to be regulating. This provides an additional reason to be very highly skeptical about all FCC safety guidelines.

5. 15 studies have each shown health effects of Wi-Fi, most of which have also been shown to occur in response to low intensity exposures to other types of microwave frequency EMFs. These are likely to have massive health effects by producing male infertility (female infertility has not been studied in response to Wi-Fi), oxidative stress (involved in dozens of human diseases), cellular DNA damage (possibly leading to both cancer and mutations in future generations), life threatening cardiac effects, cellular apoptosis and also intracellular calcium overload (with both of these possibly leading to neurodegenerative diseases), various neuropsychiatric changes and many others.

It is my view that it is sheer insanity to fail to see the threat to our and to all human civilization by continuing to ignore the threats from such EMFs, starting with Wi-Fi.

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Board Member
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Board of Education

Re: Health effects of cell tower radiation

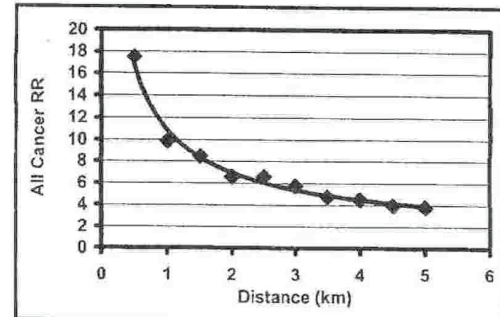
As an active researcher on biological effects of electromagnetic fields (EMF) for over twenty five years at Columbia University, as well as one of the organizers of the 2007 online Bioinitiative Report on the subject, I am writing in support of a limit on the construction of cell towers in the vicinity of schools.

There is now sufficient scientific data about the biological effects of EMF, and in particular about radiofrequency (RF) radiation, to argue for adoption of precautionary measures. We can state unequivocally that EMF can cause single and double strand DNA breakage at exposure levels that are considered safe under the FCC guidelines in the USA. As I shall illustrate below, there are also epidemiology studies that show an increased risk of cancers associated with exposure to RF. Since we know that an accumulation of changes or mutations in DNA is associated with cancer, there is good reason to believe that the elevated rates of cancers among persons living near RF towers are probably linked to DNA damage caused by EMF. Because of the nature of EMF exposure and the length of time it takes for most cancers to develop, one cannot expect 'conclusive proof' such as the link between helicobacter pylori and gastric ulcer. (That link was recently demonstrated by the Australian doctor who proved a link conclusively by swallowing the bacteria and getting the disease.) However, there is enough evidence of a plausible mechanism to link EMF exposure to increased risk of cancer, and therefore of a need to limit exposure, especially of children.

EMF have been shown to cause other potentially harmful biological effects, such as leakage of the blood brain barrier that can lead to damage of neurons in the brain, increased micronuclei (DNA fragments) in human blood lymphocytes, all at EMF exposures well below the limits in the current FCC guidelines. Probably the most convincing evidence of potential harm comes from living cells themselves when they start to manufacture stress proteins upon exposure to EMF. The stress response occurs with a number of potentially harmful environmental factors, such as elevated temperature, changes in pH, toxic metals, etc. This means that *when stress protein synthesis is stimulated by radiofrequency or power frequency EMF, the body is telling us in its own language that RF exposure is potentially harmful.*

There have been several attempts to measure the health risks associated with exposure to RF, and I can best summarize the findings with a graph from the study by Dr. Neil Cherry of all childhood cancers around the Sutro Tower in San Francisco between the years 1937 and 1988. Similar studies with similar results were done around broadcasting antennas in Sydney, Australia and Rome, Italy, and there are now studies of effects of cellphones on brain cancer. The Sutro tower contains antennas for broadcasting FM (54.7 kW), TV (616 kW) and UHF (18.3 MW) signals over a fairly wide area, and while the fields are not uniform, and also vary during the day, the fields were measured and average values estimated, so that one could associate the cancer risk with the degree of EMF exposure.

The data in the figure are the risk ratios (RR) for a total of 123 cases of childhood cancer from a population of 50,686 children, and include a 51 cases of leukaemia, 35 cases of brain cancer and 37 cases of lymphatic cancer. It is clear from the results that the risk ratio for all childhood cancers is elevated in the area studied, and while the risk falls off with radial distance from the antennas, as expected, it is still above a risk ratio of 5 even at a distance of 3km where the field was $1\mu\text{W}/\text{cm}^2$. This figure is what we can expect from prolonged RF exposure. In the Bioinitiative Report, we recommended $0.1\mu\text{W}/\text{cm}^2$ as a desirable precautionary level based on this and related studies, including recent studies of brain cancer and cellphone exposure.



As I mentioned above, many potentially harmful effects, such as the stress response and DNA strand breaks, occur at nonthermal levels (field strengths that do not cause a temperature increase) and are therefore considered safe. It is obvious that the safety standards must be revised downward to take into account the nonthermal as well as thermal biological responses that occur at much lower intensities. Since we cannot rely on the current standards, it is best to act according to the precautionary principle, the approach advocated by the European Union and the scientists involved in the Bioinitiative report. In light of the current evidence, the precautionary approach appears to be the most reasonable for those who must protect the health and welfare of the public and especially its most vulnerable members, children of school-age.

Sincerely yours,

Martin Blank, Ph.D.

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December 13, 2015

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers, Board of Education and Office of Technology;

In my capacity as a pediatric occupational therapist, biologist, international speaker, and author on the subject of the impact of technology on child development and learning, I'm writing to you on behalf of students, teachers, and parents requesting you reconsider the use of devices which operate using wireless radiation.

Please find below guiding principles regarding managed balance between technology and healthy activity, as well as information on wireless radiation. More judicious use of educational based technologies in a safe manner, will serve to ensure sustainable futures for all children. Reversion to Ethernet or fiber optic cable devices, until such time as the World Health Organization deems wireless to not be harmful to young children, is recommended.

Guiding principles for the use of educational based technology in school environments.

Minimize Risk and Maximize Safety.

- Wireless radiation has not been proven safe (WHO 2011).
- Recent research indicates wireless radiation causes harmful effects to adult humans (Avendano 2012, Hardell 2013).
- Long term effects of wireless radiation on children are unknown at this time (AAP 2013).
- Children have thinner skulls, more aqueous bodies, and have rapidly developing cells, indicating they are exceedingly more vulnerable to harmful effects from wireless radiation than adults (AAP 2013, C4ST 2015).
- The American Academy of Pediatrics and the Canadian Pediatric Society recommends no more than 1-2 hours total technology use per day, including

educational technology. Many schools exceed these expert guidelines (AAP 2014).

Weigh Risk vs. Benefit.

- Education technology is not evidence based and is laden with conflict of interest e.g. manufacturers claims are financially motivated, and are not substantiated by university level research.
- Traditional and standardized teaching methods have substantive research support and evidence, yet are being rapidly replaced with education technology.

Ensure adequate foundational skills prior to use of technology.

Children need to balance the following 4 critical factors with technology, to optimize development and learning. Time spent with technology adversely affects these factors.

- *Movement*: stimulates vestibular, proprioceptive and cardiovascular systems.
- *Touch*: stimulates parasympathetic system for lowered cortisol and adrenalin.
- *Human Connection*: activates parasympathetic system; a life sustaining force.
- *Nature*: attention restorative, improves learning, erases effects of technology.
- *See video*: [Message to Schools on EdTech](#)

Risks associated with the use of technology by children are as follows:

- *Sedentary nature* of technology use is causally related to the recent rise in obesity/diabetes, developmental delay and learning difficulties (Tremblay 2011, HELP EDI Mapping 2009/13, Ratey 2008, PISA 2012).
- *Isolating factor* of technology use is associated with escalation in social impairments, mental illnesses (including adhd and autism), and self-regulation difficulties (Houtrow 2014).
- *Overstimulation* from technology use is a causal factor in rise in attention deficit, aggression, sleep disturbance, and chronic stress from hyper-arousal of the sympathetic nervous system (Christakis 2004, Gentile 2009, Markman 2010, Bristol University 2010).
- *Neglect* of students by teachers and support staff who are engaged in their own personal technology, is unfortunately common.
- Consequently, the risks associated with using education technology far outweigh the dubious benefits.

When In Doubt, Act With Caution.

- Existing research on harmful effects of wireless radiation on *adults*, indicates taking a cautionary approach when considering same radiation exposure to *children* (AAP 2014).



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- Rapid cell turnover in children creates particular concern regarding potential DNA damage from wireless radiation, and consequent susceptibility to cancer. While rise in cancer incidence is becoming more apparent, rise in rates of cancer in children will not be observable until adulthood.
- Removal of wireless radiation and reversion to Ethernet cabled devices, will ensure immediate and long term safety to all students, teachers, and support staff.
- Defaulting to a remote authority regarding removing wireless radiation from schools, is not acting in the best interests of students and staff, and may not be defensible in a court of law.

Montgomery County's statement that the radiofrequency levels in schools "is compliant" with federal regulations *does not* assure safety to the students in your care. The current proposed technology plan to further increase the use of screens in classrooms on a daily basis, clearly does not support children's healthy development.

The implications of failure of schools to act with caution now regarding wireless radiation and technology, could potentially be horrific in both scope and magnitude, and may constitute neglect of children. Please act now to safeguard your children's future.

Respectfully,

CRowan

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P.O. Box 58
Teton Village, WY 83025
www.ehtrust.org

Montgomery County Board of Education
Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

January 20, 2016

Dear Montgomery County Board of Education,

Concerned parents in your school district have asked me to write to you regarding the health risks of wireless radiofrequency radiation exposure in the classroom. Based on what I have been told, I want to urge you to halt programs that currently have students use their own phones in ways that expose their eyes and brains to levels of radiation that have never been tested for safety.

I was Founding Director of the Board on Environmental Studies and Toxicology of the U.S. National Research Council, and Founding Director of the Center for Environmental Oncology at the University of Pittsburgh Cancer Institute. President Clinton appointed me to the Chemical Safety and Hazard Investigation Board, and I am former Senior Advisor to the Assistant Secretary for Health in the Department of Health and Human Services. I founded the non-profit Environmental Health Trust in 2007 to provide basic research and education about environmental health hazards. Our scientific team is currently focusing on the health risks of radiofrequency radiation as an important public health issue.

Many people are unaware that cell phones and wireless laptops and tablets function as two-way microwave radios. A typical classroom might have the following scenario: every student has a laptop--which is typically tested for use 8 inches from an adult male body--a cell phone in the pocket--which is also tested at a minimum distance from an adult male body-- and a network transmitter on the ceiling and possibly a cell tower outside next to the sports field. All these devices emit microwave radiation which can be readily absorbed into children's bodies and brains.

Manufacturers specifically recommend that cell phones be used “as tested”—at this little-known minimum distance from the body. Recently, [Consumer Reports](#) in November advised that people should not keep phones in the pocket—advice that few children or adults appreciate. *These devices have never been tested for safety with children.* Accumulating research indicates that long-term exposure to low levels over long lifetimes could pose a serious risk to our health.

Regarding tested distances for using laptops, the Federal Communications Commission (FCC) states that laptops and computers are “mobile devices are transmitters designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.” The body in this instance refers to a large male weighing more than 200 pounds and standing six feet tall.

As the county is preparing to increase student use of Chromebooks, please be aware that the Samsung [Chromebook manual](#) states:

“United States of America USA and Canada Safety Requirements and Notices

- Do not touch or move antenna while the unit is transmitting or receiving.
- Do not hold any component containing the radio such that the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Regardless of the power levels, care should be taken to minimize human contact during normal operation.
- This device should be used more than 20 cm (8 inches) from the body when wireless devices are on and transmitting.
- FCC Statement for Wireless LAN use: *“While installing and operating this transmitter and antenna combination the radio frequency exposure limit of 1mW/cm² may be exceeded at distances close to the antenna installed. Therefore, the user must maintain a minimum distance of 20cm from the antenna at all times.”*

As one of the leaders in educational policy of this nation, your school district has an opportunity to set an example for school districts nationwide by installing safer technology in classrooms and educating students, teachers and staff about tested distances that devices should be used to reduce radiation. A number of public and private schools have already implemented such policies. Just as we provide children with seat belts and bike helmets, a precautionary approach to wireless is recommended by many scientists and governments worldwide.

For more information about all of these issues, please read cell phone instructions for various models at <http://showthefineprint.org>. Our [newly posted Ebook](#) also details fine print safety instructions in wireless device user manuals.

When children use these devices close to their bodies, they are exceeding these safety instructions, and exposing themselves to radiofrequency (RF) radiation levels which can exceed our government FCC RF radiation exposure limits. The FCC RF exposure limit was designed to protect the public from the thermal (heating) effects of acute exposure to RF energy. The FCC states, “Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because of the relative lack of available blood flow to dissipate the excess heat load.”

CHILDREN ABSORB MORE RADIATION THAN ADULTS

Our recently published research in the [IEEE Spectrum](#) with investigators at the Federal Universities of Brazil provides new state-of-the-art radiation exposure brain modeling which confirms that substantially higher radiofrequency radiation doses occur in younger children as compared to adults even where products comply with tested guidelines developed for adults.

FCC REGULATIONS ARE OUTDATED

FCC exposure limits were set more than 19 years ago and were based on decades-old research. The Government Accountability Office published a [2012 Report](#) that calls on the FCC to formally reassess their current RF energy (microwave) exposure limits, stating that the “FCC RF energy exposure limit *may not* reflect the latest research.” I encourage you to read scientific submissions to FCC Proceeding Number 13-84 at <http://bit.ly/1aGxQiq>. It is unknown when the FCC will make a ruling, however, *until that time* the current outdated FCC limits are *not reflective* of the current state of science.

FCC REGULATIONS DO NOT PROTECT THE PUBLIC FROM BIOLOGICAL EFFECTS

As the California Medical Association states in their [2014 Resolution](#) calling for updated FCC Regulations, “peer reviewed research has demonstrated adverse biological effects of wireless EMF [electromagnetic fields] including single and double stranded DNA breaks, creation of reactive oxygen species, immune dysfunction, cognitive processing effects, stress protein synthesis in the brain, altered brain development, sleep and memory disturbances, ADHD, abnormal behavior, sperm dysfunction, and brain tumors.”

In May 2015, over 200 scientists who have authored more than 2,000 articles on this topic appealed to the United Nations to address “the emerging public health crisis” related to cellphones and other wireless devices, urging that the United Nations Environmental Programme (UNEP) initiate an assessment of alternatives to current exposure standards and practices that could substantially lower human exposures to non-ionizing radiation. These scientists state that “the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, “ and are “ insufficient to protect public health.” They also state that “the various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.” Please see their website at <https://emfscientist.org>.

INCREASED CANCER RISK

Wireless radiofrequency radiation was classified as a Class 2B “Possible Human Carcinogen” by the World Health Organization’s International Agency for Research on Cancer in 2011. According to many scientists, evidence *has increased* since 2011, indicating that cell phone and wireless radiation should be classified as a “probable carcinogen.” Those exposed at younger ages show four to eight times increased cancer risk. [Replicated research](#) just published in Biochemical and Biophysical Research Communications indicates that radiofrequency acts as a *tumor promoter* at low to moderate levels.

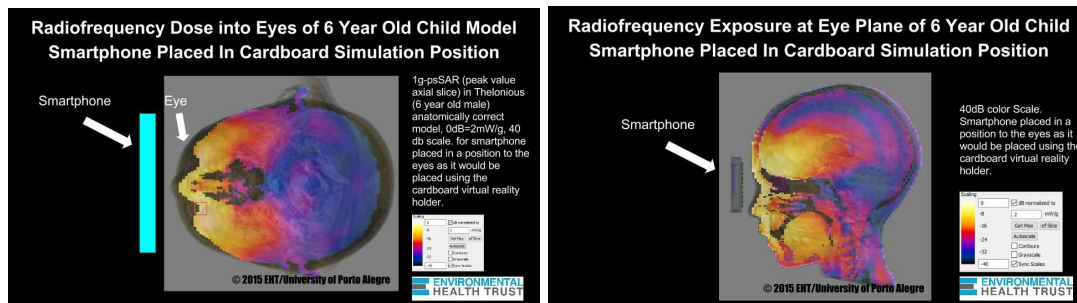
CONCERN FOR PREGNANT STUDENTS AND STAFF

Pregnant students and staff are especially at risk from wireless because the fetus is the most vulnerable to toxic exposures. Several experimental studies are showing irreversible changes after prenatal exposure to cell phone and wireless radiation such as altered brain functioning, decreased brain cells and altered reproductive organ development. More than 100 physicians, scientists and public health professionals joined together to express their concern about the risk that wireless radiation poses to pregnancy and now *urge pregnant women to limit their exposures*. Please read these scientists [BabySafe Joint Statement](#)

VIRTUAL TECHNOLOGY RESULTS IN HIGHER EXPOSURES TO THE EYE AND BRAIN

Most recently, I was contacted by a parent in your district about the virtual reality devices now used in MCPS classrooms to go on a virtual “field trip.” As indicated by online instructions, this experience involves using smartphones placed directly in front of the child’s eyes so that they can directly watch a fascinating video of faraway lands. The smartphone is streaming radiation throughout the classroom from the teacher's iPad for the entire “field trip.”

Please be aware that FCC regulations set decades ago did not utilize science that looks at the effects from cell phones on different body tissues such as the eyes. Upon hearing about this issue, I contacted EHT-associated scientists at federal universities of Brazil who do state-of-the-art computer modeling. I asked them to position the phone as it would be in the virtual reality cardboard for use in front of the child’s eyes and assess the microwave radiation. The yellow and orange color show the highest exposures.



My colleagues and I are sharing this work with you today because we believe you should have more information about microwave radiation exposures that will take place through this system.

This research image above utilizes [a sophisticated computer system](#) that the U.S. Food and Drug Administration (FDA) currently applies to evaluate medical devices. It simulates the radiation absorption into *anatomically correct models*--something that currently used systems for testing phones and devices cannot do. [In a study from Memorial Sloan-Kettering Cancer Center](#), radiation physicist David Gultekin, working with Bell Labs electrical engineer Lothar Moeller, reported that normal working cell phones can create tiny hotspots within brain tissue. Unlike other organs, [eyes](#) do not have circulation to effectively carry away heat.

In addition to the impact from the microwave radiation, there could also be impacts to a child’s retina from the blue light emitted by the screen. Youths under the age of 20, and especially very young children,

have little or no yellowing of the lens (which helps protect the adult eye). Therefore, blue light (or UV) which enters the eye is unfiltered in children and strikes the retina at full-strength exposing not only the retina, but the lens to possible damage over the long time. Such injury may not be evident until later in time.

In 2010, [Andreas Christ and team](#) reported that children's hippocampus and hypothalamus absorbs 1.6–3.1 times higher and the cerebellum absorbs 2.5 times higher microwave radiation compared to adults; children's bone marrow of the skull absorbs 10 times higher microwave radiation than in adults, *and children's eyes absorb much higher microwave radiation than adults*. A recent [Deans' Lecture](#) I delivered to University of Melbourne provides an overview on this research.

SIMPLE STEPS WILL PROTECT CHILDREN

Compelling research raises the possibility of very serious harm to children from radiofrequency radiation exposures well below “FCC compliant” levels. Legal does not mean safe. Based on the preliminary work that I share with you here, I urge you to forgo the use of such devices such as virtual reality cardboard as there is no research that has considered their impact on children’s eyes. At this time, the smart choice for school decision makers is to act now and reduce radiofrequency wireless exposures. In fact, many countries (over 20) and health authorities worldwide recommend reducing radiofrequency radiation to children.

More recently, the Cyprus Government's National Committee on Environment and Children's Health released a [video about reducing wireless](#) and I invite you to watch this excellent example of responsible action at this link <https://www.youtube.com/watch?v=H43IKNjTvRM> .

I understand that your county has a Bring Your Own Device policy whereby cell phones are not only allowed *in* the classroom but are actively used in the curriculum. As I have been told, students in film class might use their cell phones to take footage to create a movie, and in some math classes they use their cell phones as a calculator. Advice should be routinely provided to any student using a wireless device at school about *how to reduce exposures*. For example, if phones are used on airplane mode, and wireless is turned off on computers then these devices will neither send nor receive microwave radiation.

When powered on, phones undergo short bursts of microwave radiation up to 900 times per minute, *whether or not the phone is being used for talking*. Once teachers and students are educated on how they can simply turn their phone onto airplane mode, then they can use the phone in the classroom *without* being exposed to unnecessary radiofrequency radiation.

Likewise, laptops such as Chromebooks are also emitting constant radiation and at much higher levels when a student is streaming video or using cloud based applications. Laptops can easily be hardwired to ethernet so that students can safely use the internet without radiation emissions. Please review the [Best Practices for Low EMF in Schools developed by the Northeast Collaborative For High Performing Schools](#) which details how schools can reduce exposure to radiofrequency fields and still have full internet connectivity.

Along with [the recommendation](#) of over 200 scientists (see <https://emfscientist.org>) and health authorities worldwide, I recommend that the best course of action is to take simple precautions—as many nations already currently advise. *Children’s exposures to wireless radiation should be reduced as much as possible.* We have a responsibility to act now to reduce children’s exposure to radiofrequency radiation. Children’s nervous, immune and reproductive systems are rapidly developing and, along with pregnant women, children deserve an abundance of caution.

As several colleagues and I wrote in [a letter](#) to the U.S. Secretary of Education just a few months ago, we recommend your school district do the following:

1. **Raise school community awareness through new educational curriculum:** Students, teachers and their families should be given information on wireless health risks and simple precautionary steps they can take to protect their health. It is important to teach children how to use technology both safely and more responsibly in order to protect their health and wellbeing.
2. **Install a safe communication and information technology infrastructure in schools to meet educational needs:** Solutions exist to reduce exposures to wireless emissions and mitigate the health risk. Low-EMF Best Practices have been developed, allowing educational needs to be met with safer, hard-wired Internet connections, which are also faster and more secure.

Low-EMF Best Practices are the solution that allows for full communication, information access and learning tools use in the classroom while minimizing unnecessary health risks. Your district can thoughtfully integrate safe technology into every classroom while responsibly safeguarding the health of every generation.

I fully understand that this information has not been widely understood. I would be happy to provide or develop an online technical briefing to your senior staff to assist you as you make decisions today that will affect the health of students for the rest of their lives.

Yours respectfully,



Devra Davis, PhD MPH
President and Founder
Environmental Health Trust
Visiting Professor of Medicine
The Hebrew University, Hadassah Medical Center
Associate Editor, *Frontiers in Radiation and Health*
ehtrust.org

July 28, 2014

Board of Trustees
Fay School
48 Main Street
Southborough, MA 01772

Re: Advisability of WiFi in schools

Dear Sirs/Madams:

This is concerning potential adverse health effects associated with exposure to radiofrequency/microwave (RF/MW) radiation, specifically that from wireless routers and wireless computers. I am writing to express concern that students at your school are experiencing electrosensitivity symptoms from these technologies.

I am a public health physician who has been involved in issues related to electromagnetic fields (EMFs) for several decades. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research that showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I served as Director of the Wadsworth Laboratory of the New York State Department of Health, as well as Dean of the School of Public Health at the University at Albany/SUNY. I have edited two books on effects of EMFs, ranging from low frequency fields to radiofrequency/ microwave radiation, or the kind emitted by WiFi routers, cell phones, neighborhood antennas and wireless computer equipment. I served as the co-editor of the BioInitiative Report 2012 (Bioinitiative.org), a comprehensive review of the literature showing biological effects at non-thermal levels of exposure, much of which has since been published in the peer-reviewed journal, *Pathophysiology* (attached). Also, I served on the President's Cancer Panel that examined radiation exposures as they relate to cancer risk, in 2009, and a report from that testimony is also attached. Thus, this is a subject which I know well, and one on which I take a public health approach rooted in the fundamental principle of the need to protect against risk of disease, even when one may not have all the information that would be desirable.

There is clear and strong evidence that intensive use of cell phones increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The evidence for this conclusion is detailed in the attached publications. The WHO's International Agency for Research on Cancer has also classified the radiation from both cell phones and WiFi as a Class 2B "Possible Carcinogen" (2011). WiFi uses similar radio-frequency radiation as cell phones (in the 1.8 to 5.0 GHz range). The difference between a cell phone and a WiFi environment, however, is that while the cell phone is used only intermittently, and at higher power, a WiFi environment is continuous, and transmitting even when not being used. In addition, WiFi transmitters are indoors, where people (and in this case, children) may be very close by, or certainly close to devices using the WiFi, such as wireless computers, iPads and smart boards, the radiation from which can be intolerable to sensitive people.

Furthermore, commercial routers, like those in schools, operate at much higher wattage than consumer routers. They are designed to penetrate through materials like cement, wood and brick, to handle dozens to hundreds of users, and to reach into outdoor areas, so industrial grade routers are of much greater concern.

An additional consideration to appreciate is that it is not only the power of wireless radiation that causes biological dysregulation, but the frequencies, pulsing, amplitude, and the quantity and kind of information being transmitted that can have effects as well. These 'non-thermal effects' have been shown in thousands of studies to be biologically active, and may be more important than the effects from the power. Thus, while a router may be in the ceiling, or not right next to a student, teacher or administrator, the known biological and health effects, particularly the non-thermal ones, are still very much occurring.

Finally, while acute electrosensitivity symptoms, like the ones I understand your students are experiencing, are of course of great concern (such as cognitive effects impairing attention, memory, energy levels, and concentration; cardiac irregularities, including in children; or, headaches or other symptoms in students wearing braces), the full effects for society from chronic and cumulative exposures are not known at this time. Given what we do know, however, including the DNA effects, I must, as a public health physician, advise minimizing these exposures as much as possible. Indications are that cell phones and wireless technologies may turn out to be a serious public health issue, comparable to tobacco, asbestos, DDT, PCBs, pesticides and lead paint, or possibly worse given the ubiquitous nature of the exposures. While unfortunately we must wait for federal regulation to catch up with the science, the prudent thing to do in the interim would be to exercise precaution at every opportunity.

Computers and the world-wide web have tremendous value in education, but the value also depends on how these are used in numerous respects. As wired internet connections do not pose radiation risk, are readily available, are faster and more secure than WiFi, and are now even available for certain tablets, I highly recommend you factor the risks I have described into your technology planning. At the same time, I would urge you to take the complaints of your students very seriously, and potentially involve the school nurse and teachers in helping to assess the extent of the electrosensitivity problem among students at the school.

An excellent reference on the EMF and electrosensitivity science is "Electrosensitivity and Electrohypersensitivity—A Summary" (2013) authored by M.J. Bevington and available through Electrosensitivity-U.K. (www.es-uk.info/)

If I can be of further help, please do not hesitate to call.

Yours sincerely,



David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

Enclosures

Martin Blank, PhD
Department of Physiology and Cellular Biophysics
Columbia University
New York, NY 10032

July 25, 2014

Mr. Thomas McKean, President, Board of Trustees
Mr. James Shay, President-Elect, Board of Trustees
Fay School
48 Main Street
Southborough, MA01772

To the Board of Trustees,

It has been brought to my attention that school children have become symptomatic at your school after installation of WiFi. I am writing to express my concern and to encourage you to review the independent science on this matter.

I can say with conviction, in light of the science, and in particular in light of the cellular and DNA science, which has been my focus at Columbia University for several decades, putting radiating antennas in schools (and in close proximity to developing children) is an uninformed choice. Assurances that the antennas are within 'FCC guidelines' is meaningless today, given that it is now widely understood that the methodology used to assess exposure levels only accounts for one type of risk from antennas, the thermal effect from the power, not the other known risks, such as non-thermal frequencies, pulsing, signal characteristics, etc. They fail also to consider multiple simultaneous exposures from a variety of sources in the environment, and cumulative exposures over a lifetime. Compliance with FCC guidelines, thus, unfortunately, is not in any way an assurance of safety today, as the guidelines are fundamentally flawed. Until the guidelines and advisories in the U.S. are updated, the intelligent thing for your Board of Trustees to do is to exercise the Precautionary Principle and hard wire all internet connections.

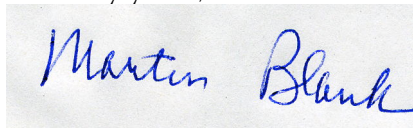
I know this might be disappointing to hear, as I understand you have invested in the WiFi. But there is no amount of money that could justify the added physiological stress from wireless antenna radiation and its many consequences, most in particular for children. Our research has shown that the cellular stress response, a protective reaction that is indicative of cellular damage, occurs at levels that are deemed 'safe'. Many other harmful reactions have been reported, such as the impairment of DNA processes that can account for the observed increased risk of cancer, as well as the potential cognitive decline, and sleep effects that may be due to impairment of the blood brain barrier. The DNA effects are of particular concern for future generations, an area of research that is just beginning to raise alarms. As with other environmental toxic exposures, children are far more vulnerable than adults, and they will have longer lifetimes of exposure.

The science showing reasons for concern about the microwave radiation emitted by antennas is abundant and there will be a day of reckoning. As I explain in my recent book,

Overpowered, The Precautionary Principle instructs us that in the face of serious threats, a lack of scientific 'certainty' never justifies inaction. The changes occurring at the molecular level, and known associations with many diseases, are sufficient at this time to give us pause and to recommend minimizing exposures to these fields, in our homes, schools, neighborhoods and workplaces. There is significant potential for risk, and to very large numbers of people, and the effects are occurring nonetheless whether or not we are noticing them.

I recommend you hardwire the internet connections at your school, and also encourage students to use hard wired connections at home for internet access, as well as for all computer equipment connections and voice communications.

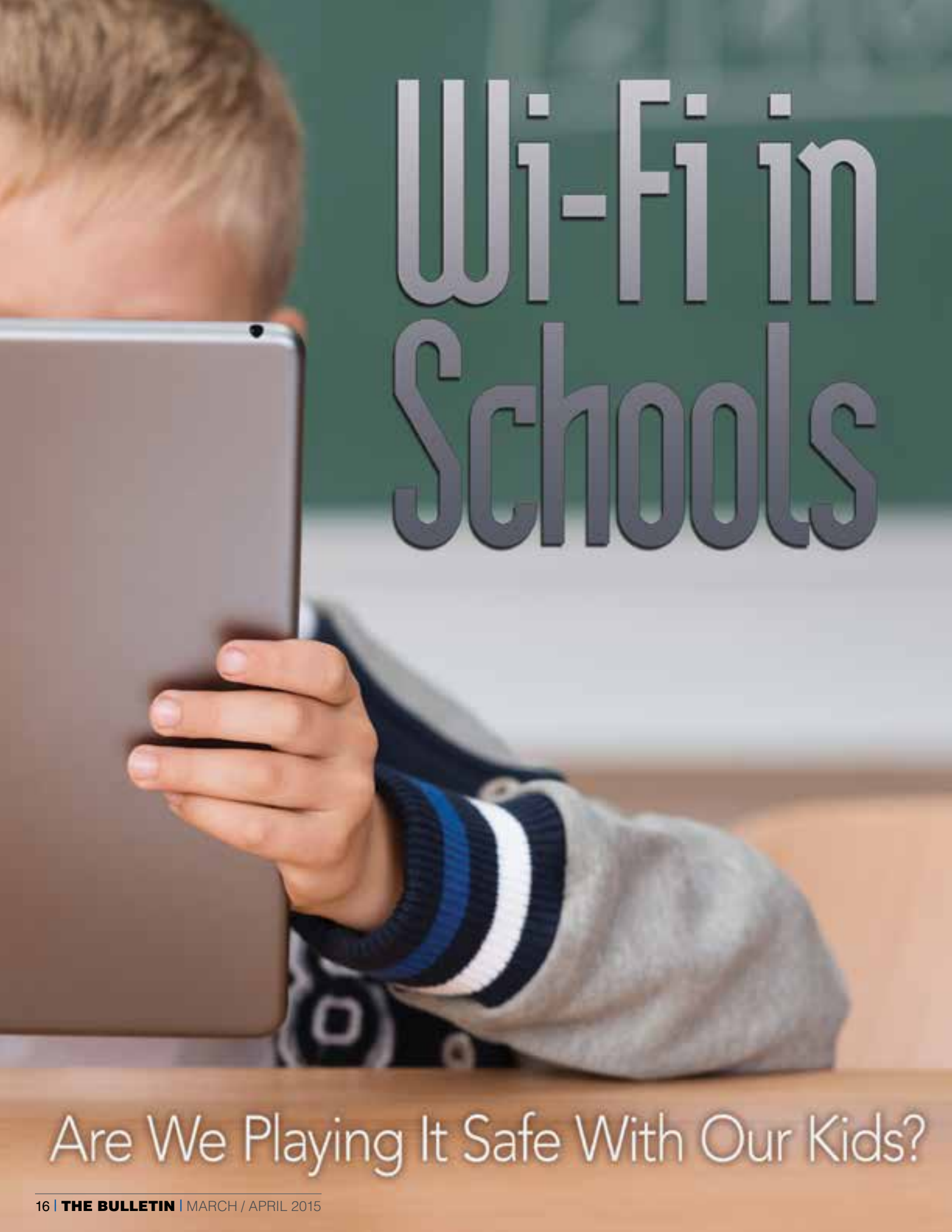
Sincerely yours,



Martin Blank, PhD
mb32@columbia.edu,



Martin Blank, PhD, Special Lecturer and (ret.) Associate Professor, Columbia University, Department of Physiology and Cellular Biophysics. Dr. Blank is a leading expert in the effects of electromagnetic fields on DNA and biology, and Past President of the Bioelectromagnetics Society. He holds two PhDs, in physical chemistry and in colloid science, an interdisciplinary field involving chemistry, physics and nanoscience. Dr. Blank was author of the BioInitiative Report's section on the impact of electromagnetic fields on Stress Proteins; Editor of the journal *Pathophysiology's* special issue on Electromagnetic Fields (2009); and co-author of "Electromagnetic fields and health: DNA based dosimetry" (2012), which recommends a new way of assessing the biological impact of electromagnetic fields across the spectrum, using DNA. Dr. Blank's book, "*Overpowered—What Science Tells Us About the Dangers of Cell Phones and Other WiFi-Age Devices*", was published in 2014.



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 Electro-hypersensitivity. 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)

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

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/cm². China and Russia are 10 microwatts/cm². Belgium is 2.4 microwatts/cm², and Austria is 0.001 microwatts/cm². The Bioinitiative Report 2012 recommendation for "No Observable Effect" is 0.0003 microwatts/cm². Cosmic background EMF we evolved with is <0.0000000001 microwatts/cm². (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-

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

Continued on page 20

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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STEPHEN T. SINATRA M.D., F.A.C.C.

F.A.C.N., C.N.S., C.B.T.,
Integrative Metabolic Cardiology

July 16, 2014

Chairman and Trustees
Fay School
48 Main Street
Southborough, MA 01772

RE: Wi-Fi in Schools

Dear Chairman and Trustees:

I am writing this letter on behalf of concerned parents of children who are attending schools with Wi-Fi technology. I'm a cardiologist and co-founder of Doctors for Safer Schools, an organization dedicated to informing teachers, parents and superintendents about the uncertainty and possible environmental health hazards of Wi-Fi technologies.

The heart is a delicate and complex electromagnetic organ that can be adversely affected by exogenous signals from wireless technology and microwave radiation. For this reason it is unwise to expose students and teachers to Wi-Fi radiation for internet access, especially when safer alternative wired options are available. Children are particularly vulnerable to this radiation and the incidents of cardiovascular events including sudden cardiac arrest, seems to be increasing, especially among young athletes (up to the age of 19). In some cases this is due to undetected heart defects, blunt trauma to the heart in contact sports, and heat stress during strenuous exercise, but in instances these irregularities may be exacerbated by or due to microwave signals interfering with the autonomic nervous system that regulates the heart.

I know this because I am a board certified cardiologist and have been a Fellow of the American College of Cardiology since 1977. At the Manchester Memorial Hospital in Connecticut, I served in several roles, including Chief of Cardiology, Director of Cardiac Rehabilitation, and Director of Medical Education.

In both Canada and the United States a large number of students are complaining that they feel unwell in classrooms that have Wi-Fi technology. These complaints have been investigated and what emerges is the following:

1. Symptoms common among these students include headaches, dizziness, nausea, feeling faint, pulsing sensations or pressure in the head, chest pain or pressure, difficulty

concentrating, weakness, fatigue, and a racing or irregular heart accompanied by feelings of anxiety. These symptoms may seem diverse but they indicate autonomic dystonia or dysfunction of the autonomic nervous system.

2. Symptoms do not appear in parts of the school that do not have this technology (Wi-Fi-free portables) and they do not appear in homes that do not have wireless technology.

3. We know that the heart is sensitive to and can be adversely affected by the same frequency used for Wi-Fi (2.4 GHz) at levels a fraction of federal guidelines (less than 1%) and at levels that have been recorded in two Ontario schools with Wi-Fi technology.

4. The incidence of sudden cardiac arrests (SCA) among young athletes is increasing and doctors don't know why. In one small Ontario community, the number of students experiencing SCA is disturbingly high. Whether WiFi and nearby cell phone antennas exacerbate SCA needs to be investigated further before students are subjected to these fields.

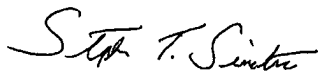
In conclusion it is unwise to install wireless technology (WiFi) in schools. We do not know what the long-term effects of low-level microwave radiation are on students and teachers. The safety of this technology on children has not been tested and I would advise that you follow the precautionary principle that states the following:

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

(Rio Conference 1992).

The principle implies that we have a social responsibility to protect the public from exposure to harm, when scientific investigations have found a plausible risk. That "plausible risk" exists for microwave radiation at very low levels. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result. In some legal systems the application of the precautionary principle has been made a statutory requirement.

Sincerely,

A handwritten signature in black ink that reads "Stephen T. Sinatra". The signature is written in a cursive, flowing style.

Stephen T. Sinatra, M.D., F.A.C.C., F.A.C.N., C.N.S



Karolinska Institutet
Department of Neuroscience
Experimental Dermatology Unit

Stockholm, July 24, 2014

Mr. Thomas McKean, President, Board of Trustees
Mr. James Shay, President-Elect, Board of Trustees
Fay School
48 Main Street
Southborough, MA 01772

Ladies and Gentlemen,

It has been brought to my attention that children in your school are physically being impacted by radiation from WiFi antennas, and that some of the student's reactions have been severe. I was concerned to learn this. It is unwise to chronically expose children to this type of radiation, as their bodies are more sensitive than adults and the radiation has been shown to impair not just physiological functioning but cognitive function and learning.

Radiation of the kind emitted by WiFi transmitters impacts attention, memory, perception, learning capacity, energy, emotions and social skills. There is also diminished reaction time, decreased motor function, increased distraction, hyperactivity, and inability to focus on complex and long-term tasks. In some situations, children experience cardiac difficulties. In one Canadian school district, incidence of cardiac arrest in children was 40x the expected rate, and defibrillators have had to be placed at each school. Online time, particularly multi-tasking in young children, has been linked with a chronically distracted view of the world preventing learning critical social, emotional and relational skills. There is a physiological as well as psychological addiction taking place. I am sure, that as stewards of the lives of the children in your charge, you would not wish any of these outcomes.

Given the large and growing body of science indicating biological and health effects from the radiation emitted by antennas, it would be most imprudent at this time to permit wireless antennas on—or inside—your property. Understand the FCC exposure guidelines only protect against the acute power density, or acute thermal, effects, and they do nothing to protect against the other aspects of the radiation's risk, such the frequencies, amplitude, pulsing, intensity, polarity and biologically disruptive information content. Thus, until the FCC establishes guidelines for the non-thermal effects, any reliance by your school on current FCC guidelines, based solely on *thermal effects* would necessarily be incomplete. I urge a school of your caliber to be a leader on this issue, and appreciate that two wrongs do not make a right.

I enclose for your review the transcript of the Seletun Scientific Statement laying out the key concerns on this topic. If I can be of further help, please, do not hesitate to be in touch.

Yours truly,

Olle Johansson, Associate Professor
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CC: cheemf@lists.healthandenvironment.org

Sent: 2/8/2013 2:21:54 P.M. Pacific Standard Time

Subj: [cheemf] Adoption of Wi-Fi in Los Angeles USD classrooms

TO: Los Angeles Unified School District (LAUSD)

FROM: Joel M. Moskowitz, Ph.D.

Director, Center for Family and Community Health

School of Public Health

University of California, Berkeley

RE: Adoption of Wi-Fi in Classrooms

DATE: February 8, 2013

Based upon my review of the research of the health effects associated with exposure to radiofrequency (RF) electromagnetic radiation (EMR), especially microwave radiation, I feel compelled to register my concern that adoption of Wi-Fi in LAUSD classrooms is likely to put at risk the health of many students and employees in the District.

In December, Dr. Gayle Nicoll of URS Corporation asked me to serve as an expert reviewer for a report that URS prepared for the LAUSD regarding the adoption of Wi-Fi in classrooms. Since Ms. Nicoll could not assure me that URS has no conflicts of interest, I turned down her request and sent her references to recent studies about Wi-Fi radiation. I cc:ed Board members and key staff as I was concerned about the health risks of unnecessarily subjecting 660,000 children to 13,000 hours of Wi-Fi microwave radiation during their K-12 school years.

Although I have not seen the URS report, I imagine it is based on the FCC's outmoded 1996 safety standards which only protect the public from the **thermal risk of RF EMR exposure** (i.e., from heating of tissue). For the past three years, in numerous media interviews I have been calling on the FCC to strengthen its standards and testing procedures to protect the public and workers from the low-intensity, **non-thermal risks of RF EMR exposure** that have been reported in hundreds, if not thousands, of research studies. These include increased risk of neurological and cardiovascular problems, sperm damage and male infertility, reproductive health risks, and cancer.

The **precautionary principle** should be applied to this critical policy decision. This principle, developed at a U.N. environmental conference in 1992 states that in the absence of scientific consensus if an action has a suspected risk of causing harm, the burden of proof it is not harmful falls on those taking the action, and all reasonable measures to reduce the risk must be taken.

Internet access can be provided to students through wires or optical fiber without installing Wi-Fi in the classrooms.

For further information, please see my **Electromagnetic Radiation Safety web site** at <http://saferemr.blogspot.com> where I have archived news releases and links to recent reports by major scientific groups and political agencies.

Sincerely,

Joel M. Moskowitz, Ph.D.

=====

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December 1, 2015

Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

Attention: Dr. Andrew Zuckerman, Chief Operating Officer
MCPS Board of Education Members

This letter of comment has been prepared after reviewing the *Montgomery County Public Schools Radiofrequency (RF) Summary Monitoring Report* dated July 2015 produced by AECOM Environment.

1) The instrument cited as being used for the peak measurements in section 7, a Narda SRM-3006, is not suitable to measure the very short (1 millisecond) spikes typically found in WiFi 802.11n communication. As stated on page 7-1, each data sweep takes 550 milliseconds, making the instrument unsuitable for reliably logging the short bursts typical in 802.11n WiFi communications. Palit et al conclude that 50% of the uplink traffic will be in bursts shorter than 2 milliseconds. The peak levels of those packets will not be reliably logged by a device with a 550 millisecond sweep time.

Palit et al, 2012. Anatomy of WiFi Access Traffic of Smartphones and Implications for Energy Saving Techniques. International Journal of Energy, Information and Communications, Vol. 3, Issue 1.

2) Even the average-level tests seem inconsistent with engineering reality. Figure 7.1 shows a background noise level mostly flat between 2.4GHz and 5.8GHz. That noise (typically -70dBm) is generally consistent with the internal thermal noise in a quality wide-band measuring instrument. Two tiny peaks out of that noise are represented to be the "average electric field generated at one foot away from an AP in use at Beverly Farms Elementary School." Even with just the 802.11n beacon-frame idling, the peak field a foot away from an access point should be a million times higher than the levels of figure 7.1. Why do we just see a blip on the chart? Clearly some unusual 'averaging' has occurred, yet the parameters of that averaging, and the potential clinical implications of that averaging, are not noted in the annotation to the Figures. Further, Figure 7.2 shows a background noise level some 10dB higher than figure 7.1, something that would be very unusual in measurements at these Gigahertz frequencies.

3) The RF exposure estimates are additionally inadequate because, in reality, there is no way to meet the distancing that AECOM's report bases its measurements on for an individual student. In normal use, kids hover over devices. They hug them to the body. They put them in their laps at lunchtime, on the couch and in bed doing homework. It is entirely unrealistic to expect teachers and parents to guarantee that students always keep their Chromebooks at some arbitrary distance during use.

4) The report concludes with classroom RF measurement comparisons to an outdated 2007 BioInitiative Report recommendation of 0.1 uW/cm². (Section 7). Graphics need to be re-drawn with comparisons to the 2012 recommended BioInitiative level, and do so not only for a 12” spacing, but also for the one-inch distance measured from the Chromebook (Figure 7-3 and 7-4). Using an arbitrary 12” distance to report and compare to either the 2007 or 2012 BioInitiative recommendations will seriously underestimate RF exposures since students don’t always (or even typically) maintain a foot of distance. Their ‘leaning in’ and having to place their faces close to the device is common usage, and is unavoidable.

5) The methodology is not specific as to the number of operating devices and clustering of students at work – which is necessary to characterize exposures from a room full of operational wireless devices. Figure 2.1 shows multiple wireless devices connected to one wireless router. Measuring one or several Chromebooks rather than one Chromebook for each of the 25-35 students plus router isn’t how a normal classroom operates. **It does not** produce RF measurements of a typical class using many wireless devices at once, so this is a fundamental flaw. It will underestimate RF exposures.

6) There is also a comment to be made here about the setup – how does this methodology reasonably reflect how smaller or younger children with short arms and torsos actually use tablets? What RF exposures they can expect to receive? The likely consequence to the measurements is greater exposure. Unless the students are using chopsticks instead of their fingers, or are using wired keyboards that increase the distance to the wireless device, RF exposures will be worse for the younger or smaller-stature students.

7) This Report appears to legitimize MCSD’s use of wireless in the classroom by asserting compliance with the 2007 BioInitiative Report recommendation, yet the report does not mention the significant revision of that threshold in the years between 2007 and 2012. Both BioInitiative Reports clearly state that their recommendations are interim and ‘that they may have to go lower.’ Recent studies of students reporting headache, irritability, concentration and behavior problems at levels as low as 0.003-0.006 uW/cm², indicate that neither BioInitiative Report threshold may be low enough to assure safety. As the co-editor of the BioInitiative Reports, and a founding member of the BioInitiative Working Group, the way in which our work has been invoked is not consistent with the findings of the BioInitiative Reports overall. The conclusions of this report cannot be said to give a positive assertion of safety because of the degree of uncertainty over whether the testing equipment was adequate (we believe it was not); the lack of comparison data; and the failure to measure RF exposures at realistic distances from the student(s).

8) Correct BioInitiative citations are:

BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at

www.bioinitiative.org, December 31, 2012.

BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) at www.bioinitiative.org, August 31, 2007

CONCLUSION

The data in this report cannot therefore be used to infer safety, or lack of safety, of children in any of the tested locations.

Respectfully submitted,

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September 22, 2014

On behalf of the BioInitiative Working Group, we are writing to express our concern about the views expressed by CEOs from Google, Dell, Apple, Adobe, eBay, Facebook, the George Lucas Educational Foundation and others to the FCC supporting wireless technologies in schools.

Your letter to the FCC dated July 7, 2014 titled Education Superhighway, states:

“Today, we are writing to you to urge swift bi-partisan action at your July 11, 2014 meeting to adopt the E-Rate modernization proposal set forth by Chairman Wheeler.”
“By responsibly investing \$2 billion of unused funds and providing predictable ongoing support for Wi-Fi, the plan will make dramatic progress in bringing high-speed connectivity to our classrooms.”

No one denies that bringing high-speed connectivity to our classrooms is important. But it can be a wired connection and does not have to be WiFi. It does not reflect well on the ethics of your corporations to encourage the FCC to provide \$2 billion dollars for new wireless classroom infrastructure and devices for school children, knowing that wireless emissions have been classified as a Possible Human Carcinogen by the World Health Organization’s International Agency for Research on Cancer (2011). To promote wireless technologies in schools is to deliberately and knowingly disregard current health warnings from international science and public health experts.

Saturating schools with wireless technology will likely create unnecessary liability for municipalities and result in a loss of public trust and confidence in the corporations that push their wireless products with a blind eye toward health concerns.

Epidemiological studies show links between radiofrequency radiation (RFR) exposure and cancers, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RFR exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Fetal exposures in both animal and human studies result in altered brain development in the young offspring, with disruption in learning, memory and behavior. The brain development of a fetus can be impaired by in-utero exposure to a pregnant woman. The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse effects at levels much lower than current FCC public safety limits. WiFi in schools, in contrast to wired internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Corporations cannot avoid responsibility simply by asserting compliance with existing legal, but outdated and inadequate FCC public safety limits.

Today, corporations that deal with educational technology should be looking forward and helping school administrators and municipal leaders to access safe, wired solutions. Your corporations can reasonably foresee and offer alternatives to potentially hazardous exposures to wireless radiation by choosing to support wired educational technologies.



Thank you for your attention to this letter.

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David O. Carpenter, MD, Tel: 518-525-2660 Email: dcarpenter@albany.edu
Co-Editors, BioInitiative 2012 Report
For the BioInitiative Working Group

Copies: CEOs signing Education Superhighway letter to the FCC
Federal Communications Commission
The White House, President Obama
US Secretary of Education Secretary Arne Duncan

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May 13, 2013

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Open Letter to the Superintendents
of the School Districts of the United States

The American Academy of Environmental Medicine (AAEM) strongly supports the use of wired Internet connections.

The AAEM comprises Medical Doctors, Osteopaths, and PhD researchers focusing on the effects of environmental agents on human health. For forty years the Academy has trained Physicians to treat the most difficult patients who are often overlooked by our medical system, because the cause of their illness, rather than being caused by an infection or traditionally understood cause, is related to more basic underlying causes such as chemical, toxic metal, food or radiation exposures.

In May 2011 the World Health Organization elevated exposure to wireless radiation, including WiFi, into the Class 2b list of Carcinogens.

There is consistent emerging science that shows people, especially children who are more vulnerable due to developing brains, and thinner skulls, are affected by the increasing exposure to wireless radiation. In September 2010, the Journal of the American Society for Reproductive Medicine-Fertility and Sterility, reported that only four hours of exposure to a standard laptop using WiFi caused DNA damage to human sperm.

In December 2012 the American Academy of Pediatrics- representing 60,000 pediatricians, wrote to Congress requesting it update the safety levels of microwave radiation exposure especially for children and pregnant women.

In a school setting, children are exposed to WiFi for an unprecedented period of time, for their entire childhood. Some of these signals will be much more powerful than is received at home, due to the need for the signals to go through walls, and serve multiple computers simultaneously. The school signals are dozens of times more powerful than the café and restaurant systems.

To install this system in your school district risks a widespread public health hazard that the medical system is not yet prepared to address. Statistics show that you can expect to see an immediate reaction in 3% and delayed effects in 30%, including teachers.

It is better to exercise caution and substitute with a safe alternate such as a wired connection, which is not classified as a possible Carcinogen. While more research is being conducted children must be protected. Wired technology is not only safer, it also stronger and more secure.

While the debate ensues about the dangers of WiFi, cell phone towers and cell phones, it is the doctors who must deal with the after affects. Until we can determine why some get sick and others do not, and some are debilitated for indeterminate amounts of time, we implore you to not take the risk, with the health of so many children who have entrusted you to keep them safe while at school.

Respectfully,

The Executive Committee of the American Academy of Environmental Medicine

Message to Schools and Colleges about Wireless Devices and Health

If wireless devices, such as Wi-Fi, are used in your schools and colleges, then the health of your students, your faculty, and your staff can be at risk. This is a difficult problem but an addressable one if you act.

Background: Wireless devices transmit information using radiofrequency/microwave radiation. The international biomedical research community has been studying the biological impact of such radiation for decades, but more intensely in recent years. Thousands of peer-reviewed studies published in biomedical research journals have contributed to our understanding of this impact. So many serious biological effects have been found that immediate responsive action is warranted. Further, these biological effects are occurring at levels of radiation far lower than earlier understood. Simply stated, a worldwide health crisis is emerging and is becoming a hallmark of the 21st Century. The international biomedical research community is trying to warn us; but we, in the USA, are not yet listening. I hope this message will help to change that.

As a scientist, I urge you to look into the **health impact of the radiofrequency/microwave radiation** produced by wireless devices. Examples of wireless devices of concern in our environment are Wi-Fi in all of its forms; cell phones and cell towers (especially those located on school grounds); cordless phones; wireless computers, whether desktop, laptop, or tablet versions; wireless baby monitors; wireless smart electricity meters; emerging wireless smart appliances; and microwave ovens (because they always leak radiation).

This crisis is the consequence of many factors. Here are some of them:

- All living things are bioelectrical in nature. That is why electrocardiograms and electroencephalograms work. They, of course, measure the tiny electrical signals that operate the heart and the brain. The critical tasks performed by these tiny electrical signals, and so many other electrical signals in all living things, can be disrupted by radiofrequency/microwave radiation.
- The levels of manmade radiofrequency/microwave radiation in our environment are increasing exponentially and already exceed, by many orders of magnitude, the levels at which all life on Earth evolved. Simply stated, we are drowning in a rising sea of manmade radiofrequency/microwave radiation.
- The invisible nature of radiofrequency/microwave radiation leaves the public and the decision-makers unaware of the rising levels of radiation around them.
- The genuine usefulness of wireless devices promotes denial of the risks.
- The intense advertising, the economic power, and the political power of profitable wireless industries enable them to dominate the public dialogue and to hold sway over government regulators and legislators.
- Current Federal standards for limiting the exposure of the public to radiofrequency/microwave radiation are outdated and overly permissive. Those standards are based on thermal heating alone. In effect, the Government claims that if you are not cooked too much by the radiation, then you are fine. Those Federal standards ignore the many biological effects that occur at much lower levels of radiation, leaving the public unprotected.
- Federal and state governments are advocating unlimited expansion of wireless technology, and are even co-funding such expansion and mandating the acceptance of wireless technology by the public. Such

actions reflect a widespread lack of understanding of, or willful blindness to, the underlying science and its consequences for public health.

- Some of the more serious consequences of exposure to radiofrequency/microwave radiation (such as DNA damage, cancer, and infertility) are especially nefarious because they give no early warning signs.
- Other consequences of exposure do give early warning signs (such as sleep disruption, headaches, fatigue, ringing in the ears, memory loss, dizziness, heart arrhythmia, and many others); but those signs are too often dismissed because they can have other causes as well, complicating identification of the true cause.
- The absence of routine training of physicians in the biological effects of radiofrequency/microwave radiation makes it difficult for physicians to identify the causes and to provide responsive guidance.
- Even aware individuals cannot control their exposure in any environment shared with others, because the radiation around them, much like second-hand smoke, is forced on them by unaware individuals. Only governments can fully solve this problem, but they are currently part of the problem. For now the public will have to protect itself, and that will require public education and action.

Fortunately, many of the services that wireless devices offer can be realized with much safer wired devices. The wired devices achieve connectivity with fiber-optic, coaxial, or Ethernet cables. The wired devices are faster, more reliable, and more cyber secure. They are, however, less mobile, often less convenient, and somewhat more expensive to install. But those drawbacks pale in comparison to the benefits of good health.

Simply stated, schools and colleges can protect their students, staff, and faculty from the health risks posed by wireless devices, including Wi-Fi, by converting to safe wired connectivity. If your institution lacks the resources to convert now, do consider shutting down your wireless devices anyway and converting as soon as you can. You can advance learning without leaving a trail of illness behind you, some of which can be lifelong.

As a suggested starting place for exploring the concerns about the radiation from wireless devices, I have appended an “Annotated List of References” and an “Annotated List of Videos”. Please view, especially, video (1) called “Wi-Fi in Schools, the Facts”, made in Australia, on page 6.

Regards,

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My background

I am a retired U.S. Government scientist (Ph.D., Applied Physics, Harvard University, 1975). During my Government career, I worked for the Executive Office of the President, the National Science Foundation, and the National Institute of Standards and Technology. For those organizations, respectively, I addressed Federal research and development program evaluation, energy policy research, and measurement development in support of the electronics and electrical-equipment industries and the biomedical research community. I currently interact with other scientists and with physicians around the world on the impact of the environment – including the radiofrequency/microwave environment – on human health.

ANNOTATED LIST OF REFERENCES

The international biomedical research community has conducted thousands of studies seeking to identify the biological effects of exposure to both low frequency and radiofrequency electromagnetic fields, extending into the microwave region. So many serious biological effects have been found from such fields, at levels earlier thought to be low enough to be safe, that immediate action is needed to alert and protect the public.

The most massive review of this biomedical literature is the 1479-page BioInitiative 2012 Report which considered about **1800** biomedical research publications, most issued in the previous five years. The BioInitiative 2012 Report was prepared by an international body of 29 experts, heavy in Ph.D.s and M.D.s, from 10 countries, including the USA which contributed the most experts (10). The review concludes that "The continued rollout of wireless technologies and devices puts global public health at risk from unrestricted wireless commerce unless new, and far lower[,] exposure limits and strong precautionary warnings for their use are implemented."

BioInitiative Working Group, Cindy Sage, M.A. and David O. Carpenter, M.D., Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012

<http://www.bioinitiative.org>

A group of six doctors in Oregon, led by Paul Dart, M.D., released, in June 2013, a 74-page review of **279** biomedical research publications. This review makes the health case against "cell phones, base stations, Wi-Fi, Smart Meters and other RF [*radiofrequency*] or ELF [*extremely low frequency*] -emitting devices". The review notes that "The current levels of exposure need to be reduced rather than increased further. The FCC [*Federal Communications Commission*] must especially protect vulnerable groups in the population including children and teenagers, pregnant women, men of reproductive age, individuals with compromised immune systems, seniors, and workers." This review is posted on the website of the FCC at the link entitled "Health Effects of RF - Research Review (87)".

Biological and Health Effects of Microwave Radio Frequency Transmissions, A Review of the Research Literature, A Report to the Staff and Directors of the Eugene Water and Electric Board, June 4, 2013

<http://apps.fcc.gov/ecfs/comment/view?id=6017465430>

Michael Bevington, in 2013, published a book that summarizes the findings of **1828** international biomedical research publications. The book describes the symptoms caused by exposure to electromagnetic radiation, the many diseases associated with such exposure, and the relative risk levels associated with specific sources of electromagnetic radiation. The citations of papers include the PMID index numbers for easy location on the PubMed.gov website of the National Institutes of Health. This website provides the largest index to the biomedical research literature in the world.

Electromagnetic Sensitivity and Electromagnetic Hypersensitivity: A Summary by Michael Bevington
NEW EDITION: March 2013

<http://www.es-uk.info>

About 200 scientists from 39 countries around the world submitted an international appeal to the United Nations and to the World Health Organization in May 2015. These scientists seek improved protection of the public from harm from the radiation produced by many wireless sources, including "cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors" among others.

Together, these scientists have published over 2000 peer-reviewed research papers on this subject.

<https://www.emfscientist.org/index.php/emf-scientist-appeal>

The International Agency for Research on Cancer, of the World Health Organization, has already classified radiofrequency electromagnetic fields as a Class 2B carcinogen ("possible carcinogen"), based primarily on the increased risk of brain cancer. That decision was made in 2011. Since then, the research supporting a higher classification of risk ("probable carcinogen", or even "known carcinogen") has continued to build.

http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

The American Academy of Environmental Medicine (AAEM), which trains physicians in preparation for Board Certification in Environmental Medicine, states: "The AAEM strongly supports the use of wired Internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and 'smart meters'." AAEM further states that "The peer reviewed, scientific literature demonstrates the correlation between RF [*radiofrequency*] exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions. The evidence is irrefutable." The AAEM concludes: "To install WiFi in schools plus public spaces risks a widespread public health hazard that the medical system is not yet prepared to address."

AAEM, Wireless Radiofrequency Radiation in Schools, November 14, 2013

<http://www.aeonline.org/pdf/WiredSchools.pdf>

The American Academy of Pediatrics (AAP), whose 60,000 doctors care for our children, supports the development of more restrictive standards for radiofrequency radiation exposure that would better protect the public, particularly the children. The AAP, in a letter to the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), dated August 29, 2013, states that "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."

<http://apps.fcc.gov/ecfs/document/view?id=7520941318>

The U.S. Government bears a major responsibility for the exponential growth in the levels of radiation from wireless devices in the environment. In 1996, the U.S. Congress passed, and the President signed, the Telecommunications Act of 1996. Under pressure from the cell phone industries, this law included this provision: "No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities [*cell towers*] on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [*Federal Communications*] Commission's regulations concerning such emissions." Because the Federal Communications Commission's regulations on radiation exposure are so permissive, this provision prevents state and local governments from protecting their people from radiation from cell towers, based on health concerns.

Telecommunications Act of 1996

<https://transition.fcc.gov/Reports/tcom1996.pdf>

The Federal Communications Commission (FCC) has acted in partnership with the wireless industries by permitting wireless radiation levels far higher than the biomedical research literature indicates are necessary to protect human health. The success of the wireless industries in capturing the FCC, the committees in the U.S. Congress that oversee the FCC, and the Executive Branch is detailed in a new monograph from the Center for Ethics at Harvard University. As an example of that capture, the President recently appointed, as head of the FCC, the former head of the CTIA – The Wireless Association, which is the major lobbying organization for the wireless industry. This, of course, is the infamous "revolving door".

Norm Alster, *Captured Agency: How the Federal Communications Commission is Dominated by the Industries It Presumably Regulates* (2015)

<http://ethics.harvard.edu/news/new-e-books-edmond-j-safra-research-lab>

Further, the U.S. Government's "American Recovery and Investment Act of 2009" provided funding that was used to motivate the installation of wireless smart meters (also called the "Advanced Metering Infrastructure" or "AMI") by offering cost sharing, in the form of grants, to the utilities that would adopt such meters.

https://www.smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program.html

Many states then extended the impact of the above Act by *mandating* the acceptance of wireless smart meters by the public. These meters contain microwave transmitters/receivers and are placed either on, or inside, every home and many businesses. A California court-ordered document indicates that each smart meter broadcasts bursts of radiation, on average about 10,000 times per day and up to a maximum of about 190,000 times per day. Such bursts flood neighborhoods with radiation, day and night, throughout the year.

http://emfsafetynetwork.org/wp-content/uploads/2011/11/PGERFDataOpt-outalternatives_11-1-11-3pm.pdf

Increasingly, the public is becoming aware of the threat that wireless radiation poses to health. The initial opposition focuses primarily on *mandated* sources of exposure, especially when the individuals exposed include the unborn and young children as they are among the most vulnerable. Thus, the strongest initial opposition is surfacing for cell towers, especially on school grounds; for Wi-Fi in schools and colleges; and for wireless smart meters placed on, or inside, homes and businesses. Most states now have opposition groups, and some states have even 10 or 20 such groups. These groups are pursuing relief through state regulatory bodies, through state legislatures, and through the courts. Below is a sampling of the hundreds of U.S. websites that reflect the nature and scope of the opposition to the unbridled expansion of wireless technology. Such websites seek to educate the public and decision-makers, and thus to promote responsive action, based on the underlying science.

The BabySafe Project

<http://www.babysafeproject.org/the-science/>

National Association for Children and Safe Technology

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

Stop Smart Meter's listing of groups in the USA and other countries opposed to wireless smart meters

<http://stopsmartmeters.org/frequently-asked-questions/contacts-database/>

Smart Grid Awareness, a Website by SkyVision Solutions, Consumer Protection Advocate

<http://smartgridawareness.org>

ANNOTATED LIST OF VIDEOS

There are hundreds of videos on the Internet that address the impact of wireless radiation on health. Here are just a few that provide an especially good introduction to this topic. An Internet search will surface many more.

(1) An introduction to the health risks posed by Wi-Fi in schools

Wi-Fi in Schools, the Facts (September 9, 2013) (18 minutes)

Produced by Wi-Fi in Schools Australia.

<https://www.youtube.com/watch?v=QQryZbxlgXI&feature=youtu.be>

(2) Wide ranging overview of the impact of electromagnetic radiation on human health, particularly at microwave frequencies, with a special emphasis on children and the school environment

Electromagnetic Radiation Health for Children 2014 (70 minutes)

Presented by Dr. Erica Mallery-Blythe, a UK physician.

<https://www.youtube.com/watch?v=sNFdZVeXw7M>

(3) Documentary on the wireless industry's efforts to suppress public awareness of the health effects of wireless radiation

Microwaves, Science & Lies (2014) (90 minutes)

Produced by Jean Heches and Nancy de Meritens of France.

<https://vimeo.com/ondemand/17755/89417454>

(4) Samples of video testimony by individuals harmed by the radiation from wireless devices

Cell Phones Cause Cancer (October 17, 2012) (9 minutes)

Presented by Jimmy Gonzalez, Esq.

<https://www.youtube.com/watch?v=DII0VJd0IA8>

Woman suffers acute radiation exposure from a bank of smart meters (January 21, 2015) (3 minutes).

Produced by Maryland Smart Meter Awareness.

<https://www.youtube.com/watch?v=F9QZuWPw6Y0&feature=youtu.be>

Man experiences adverse health effects from exposure to a smart meter (March 7, 2013) (3 minutes).

Presented by Garic Schoen of Gaithersburg, MD.

Produced by Maryland Smart Meter Awareness.

<http://marylandsmartmeterawareness.org/smart-meter-news/maryland-ms-resident-testimony-to-economic-matters-committee-re-hb1038-on-march-14-2013/>

Individuals with high sensitivity to the radiation from wireless devices search for increasingly rare safe electromagnetic environments.

Searching for a Golden Cage (May 8, 2014) (13 minutes)

Produced by Nadav Neuhaus.

<http://time.com/golden-cage/>

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www.isde.org
and members of HEAL -
Health and Environment Alliance
www.env-health.org
and HCWH -
Health Care Without Harm.
www.noharm.org

Linked officially with WHO -
World Health Organisation

Affiliated to International
Physicians for the Prevention
of Nuclear War - IPPNW
(Nobel Prize Winner 1985)

Charity No. 14368

7th January, 2013

Dear Principal,

The Irish Doctors Environmental Association (IDEA) has very serious concerns in relation to the ubiquitous use of Wi-Fi in Irish schools, and alerts you to the warnings of many leading international scientists and medical doctors who believe Wi-Fi is harmful to health, especially children's health.

<http://wifiinschools.org.uk/resources/safeschools2012.pdf>

Wi-Fi is an unregulated technology and there is absolutely no evidence that it is safe.

Since May 31st, 2011, radiofrequency electromagnetic fields (as in Wi-Fi) have been classified by the World Health Organisation as 'possibly carcinogenic' to humans. The IDEA unequivocally supports the Council of Europe, The European Environmental Agency and The International Commission for Electromagnetic Safety (ICEMS) in urging the adoption of the Precautionary Principle to protect human health.

Warnings by Scientists and Doctors:

<http://www.iemfa.org/index.php/appeals>

The Precautionary Principle has already been adopted by a number of Governments and agencies internationally.

Governments & organisations banning and warning against Wi-Fi:

http://www.cellphonetaskforce.org/?page_id128

While we fully support the promotion of technology in education we urge you to use wired technologies for your own safety and that of your pupils and staff. The tragedy of avoidable illness is only superseded by the knowledge that it could have been avoided.

Yours sincerely

Elizabeth Cullen M.B. B.Ch. B.A.O. M.Sc. Ph. D

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April 9, 2014

Via email: rec@harlanglaw.dk

Dear members of The Committee on Radiation Protection/Komitéen for Strålebeskyttelse:

My name is Frank Clegg and I am the CEO of Canadians for Safe Technology, C4ST, a volunteer based, national organization which promotes the safe use of wireless technology.

In my previous role as President of Microsoft Canada, I witnessed the incredible benefits that technology can provide. I also witnessed the potential harmful effects if technology is not implemented safely. Though wireless technologies afford schools various advantages, this solution cannot overshadow the evidence which demonstrates cause for concern. I request that you consider the following important facts.

The Canadian Teachers' Federation (CTF) is a national alliance of provincial and territorial teacher organizations that represent nearly 200,000 elementary and secondary school teachers across Canada. In their submission to the public consultation of the Royal Society of Canada, Oct. 28, 2013, they submitted the following recommendations. (Safety Code 6 is Health Canada's guideline regarding the limits of radiation from wireless devices).

Recommendations...

... That Safety Code 6 include a recommendation for prudent use of Wi-Fi whenever possible including the recommendation to limit consistent exposure in schools by turning off wireless access points when not in use. ...

That Safety Code 6 exposure thresholds be based upon both thermal and biological effects of exposure to Wi-Fi.

... That the Expert Panel recommend an education program regarding the relative safety of Wi-Fi exposure and that appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi access points and devices.

As reported by CBC News on Aug. 17, 2013, <http://www.cbc.ca/news/canada/toronto/story/2013/08/17/toronto-cell-phone-ban.html> "The Elementary Teachers' Federation of Ontario has updated its policy position on the student use of personal electronic devices, preferring for them to be turned off and put away unless a teacher says otherwise. That policy, which was amended at the union's annual general meeting, informs ETFO in its discussions with the government and school boards on related issues. A portion of that policy now states that such devices, which include cellphones, should "be stored and turned off during the instructional day unless their use is directly authorized by staff." In a separate resolution, ETFO voted to study the effects of non-ionizing electromagnetic radiation, the potentially harmful radiation emitted by cellphones. A report is due on the matter in February."

In a letter to the Peel Region, April 22, 2013, The American Academy of Environmental Medicine stated "To install this widespread wireless internet access system in Peel District schools risks a widespread public health hazard that the medical system is not yet prepared to address. Statistics show that you can expect to see an immediate reaction in 3% and delayed effects in 30%, including teachers."

In 2012, the BC Confederation of Parent Advisory Councils passed resolution 18 which states: "BCCPAC call on Boards of Education to cease to install Wi-Fi and other wireless networks in schools where other networking technology is feasible."
<http://www.bccpac.bc.ca/resolutions/wi-fi-classrooms-committee-report>

In May 2011, the World Health Organization (WHO) announced that the radiation emitted from wireless devices, including Wi-Fi, is a Class 2B carcinogen, which falls into the same category as lead and DDT.

You may already be aware that some schools and libraries in France and Switzerland have already removed Wi-Fi due to the suspected harmful health effects.

The Council of Europe, which includes 47 countries, adopted resolution 1815 which suggests in member countries "give preference to wired Internet connections, and strictly regulate(s) the use of mobile phones by schoolchildren on school premises."

The European Parliament (EU) resolutions 2008/2211(INI) & 2007/2252(INI,) state: "wireless technology (mobile phones, Wi-Fi / WiMAX, Bluetooth, DECT landline telephones) emits EMFs that may have adverse effects on human health... particularly to young people whose brains are still developing... **the limits on exposure to electromagnetic fields which have been set for the general public are obsolete.**" (emphasis in original)

Other countries such as Israel, Russia, Switzerland, Frankfurt, Bavaria, and Salzburg have followed suit making the difficult decision to use hard wired connections as well. Recently, France passed a law recommending hard wired technology in schools.

The Austrian Medical Chamber shares that “WiFi may lead to concentration difficulties and memory problems in certain individuals.” The Austrian Medical Association recommends Wi-Fi free school environments.

The International Society of Doctors for the Environment (ISDE) and Irish Doctors Environmental Association (IDEA) advises to “Avoid Wi-Fi in home or work if possible, particularly in schools or hospitals. Use wired technology whenever possible” sharing that: “Because of the potentially increased risks for the fetus, infants and young children due to their thinner more permeable skulls and developing systems, particularly the immune and neurological systems, based on the precautionary principal and on the mounting evidence for harm at the sub-cellular level, we recommend that EMR exposure should be kept to a minimum.”

The American Academy of Pediatrics (AAP) - 60,000 Pediatricians and Pediatric Surgeons calls for caution as well stating that “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... the current exposure limits may not reflect the latest research on RF energy” and lends support to removing Wi-Fi from schools as well.

As stewards of the public trust, I urge you to ensure the safest possible learning environment for the students in your care and to set an example for school districts by removing Wi-Fi and adopting “Best Practices” which limit the use of other wireless technologies.

Sincerely,



Frank Clegg
CEO,
Canadians for Safe Technology (C4ST)
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cc: Susanne Hansen, sh.klodskov@gmail.com



28 February 2011

Chairman and Trustees
Kawartha Pine Ridge District School Board
Education Centre
1994 Fisher Drive
Peterborough, Ontario K9J7A1

Dear Sirs/Madams:

This is concerning potential adverse health effects associated with exposure to radiofrequency (RF) radiation, specifically that from wireless routers. I am a public health physician who has been involved in issues related to electromagnetic fields (EMFs) for a number of years. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research which showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I have edited two books on effects of EMFs, including RF radiation. I served as the co-editor of the Bioinitiative Report (www.bioinitiative.org), a comprehensive review of the literature on this subject. The public health chapter from this report was subsequently published in a peer reviewed journal, and that is attached. Also I testified before the President's Cancer Panel on this subject in 2009, and a publication coming from that testimony is also attached. Thus this is a subject which I know well, and one on which I take a public health approach that has as a fundamental principle the need to protect against risk of disease even when one does not have all the information that would be desirable.

There is clear and strong evidence that intensive use of cell phones increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The evidence for this conclusion is detailed in the attached publications. WiFi uses similar radiofrequency radiation (1.8 to 5.0 GHz), although the intensity of exposure in the immediate environment is much lower than what one gets from holding a cell phone close to your head. The difference between a cell phone and a WiFi environment, however, is that while the cell phone is used only intermittently a WiFi environment is continuous. In addition WiFi transmitters are indoors, where people (and in this case, children) may be very close to them. There is evidence from Scandinavian studies of cell phone usage that children who use cell phones are about five times more likely to develop brain cancer than if use starts as an adult. Thus it is especially important to protect children.

To my knowledge there has not been any health investigation of individuals living or working in WiFi environments as compared to others who are not. However, because the radiation is the same as those for cell phones, there is every reason to assume that the health effects would be the same, varying only in relation to the total dose of radiation. Wired facilities do not generate any RF radiation. While there is not specific proof that WiFi increases risk of cancer, there is certainly no evidence that it is safe. I urge you to not put WiFi in any school. Children should not be put at increased risk of developing cancer.

Yours sincerely,

David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

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Montgomery County Schools
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850 Hungerford Drive
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13th December 2015

PhD Mikko Ahonen, Tampere, Finland
MD Lena Hedendal, Luleå, Sweden
MSc. Tarmo Koppel, Tallinn, Estonia

1. Regarding: Measurements related problems in the MCPS Wi-Fi Report

We have analysed the measurement report and would like to note the following:

- In the **Comparison-table 2.2.** the MCPS provides only average values, no peak values. In cell phone technologies (like GSM) the difference between average and peak value is 2-fold. **In Wireless local area technologies like Wi-Fi, the difference between average value and peak value is up to 100-fold** (Ferro & Potorti, 2005). Note that in the table 2.2. by the MCPS only average values are presented. Later you provide **in the chapter 7.2.2 Maximum, Instantaneous Power Density, which needs attention since these levels occasionally exceeded in your school measurements allowable EMC-levels (EN60601-1 → 3 V/m) for medical instruments** (Robinson *et al.*, 2003).

- **Almost all MCPS measurements were done in the near field of the devices under 3 wavelengths.** The wavelength for 2,4 GHz is 12,5 cm and for 5 GHz is 6 cm. That means that the near field will be <37,5 cm for 2,4 GHz and <18 cm for 5 GHz. In order to assess power density exposure in near field one needs to measure both electric and magnetic field components.

- The MCPS has not provided **information about Wi-Fi technology, namely it's beacon signal.** This signal, officially **SSID (Service Set Identifier)**, is created by the access point (AP) by sending constantly SSID 10 times in a second, at 10 Hz (Ferro and Poporti, 2005). **Mobile industry has patented technology to avoid this constant SSID sending for health reasons** (Swisscom, 2004). This SSID sending at 10 Hz is an additional risk-factor and it should be mentioned. Our brain operates in alpha, beta and gamma bands. This Wi-Fi beacon overlaps the alpha band. Low-frequency EMFs (including low-frequency pulses) have an effect on evoked potentials of the brain (Carrubba *et al.*, 2008).

- **Because of the risk of this 10 Hz Beacon signal of Wi-Fi, The European Academy for Environmental Medicine has assigned very strict precautionary RF-levels for Wi-Fi** (Belyaev et al., 2015). Please, pay attention to Wi-Fi RF power density peak-levels in the next picture.

RF source Max Peak/Peak Hold	Daytime exposure	Nighttime exposure	Sensitive populations ¹⁾
Radio broadcast (FM)	10,000 $\mu\text{W}/\text{m}^2$	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$
TETRA	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$
DVB-T	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$
GSM (2G) 900/1800 MHz	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
DECT (cordless phone)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
UMTS (3G)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
LTE (4G)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
GPRS (2.5G) with PTCCH [*] (8.33 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$
DAB+ (10.4 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$
Wi-Fi 2.4/5.6 GHz (10 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$

Picture. Precautionary levels for RF-radiation. **For Wi-Fi less than 10 $\mu\text{W}/\text{m}^2$ (peak value), which is 0,001 $\mu\text{W}/\text{cm}^2$ (peak value).** By the European Academy for Environmental Medicine (Belyaev et al., 2015, p. 356)

- **We would like to draw attention to long-term exposure related health risks.**

Radiofrequency radiation from Wi-Fi devices causes fertility problems as shown by several in vivo and in vitro studies (see for example Atasoy et al., 2013, Avendaño et al., 2012, Dasdag et al., 2015a, Shokri et al., 2015).

Additionally, **RF-radiation from Wi-Fi access points (AP) causes oxidative stress in cells which leads to several disorders** (see for example Nazıroğlu et al., 2012, Aynali et al., 2013, Salah et al., 2013). The overall detrimental impact of RF radiation induced oxidative stress is summarised in the review of Yakymenko et al. (2015).

2. Regarding: The IARC classification of RF-EMF as Group 2B, i.e., ‘possibly’ carcinogenic to humans and the MCPS Report’s inaccurate interpretation

The classification of radiofrequency electromagnetic fields (RF-EMF) as Group 2B, i.e., ‘possibly’ carcinogenic to humans, was made by 30 scientists from 14 countries at a meeting 2011 for the International Agency for Research on Cancer (IARC), World Health Organization (IARC 2011, Baan et al. 2012). **The working group mainly based their classification on one cohort study (Schüz et al., 2006) and five case-control studies (Muscat et al., 2000, Inskip et al., 2001, Auvinen et al., 2002, The Interphone study group, 2010, Hardell et al., 2011).**

They also reviewed more than 40 studies that assessed the carcinogenicity of RF-EMF in rodents, including seven 2-year cancer bioassays and also many studies with endpoints relevant to mechanisms of carcinogenesis, including genotoxicity, effects on immune function, gene and protein expression, cell signaling, oxidative stress, and apoptosis (Baan et al., 2011).

The referred INTERPHONE study (The Interphone study group, 2010), in the MCPS radiation report, was one of the case-control studies. **The Interphone study was a multicentre study of mobile phone use and brain tumours, including malignant tumours in the brain as glioma and benign tumours as acoustic neuroma and meningioma.** The pooled analysis included 2708 glioma cases and 2972 controls (participation rates 64% and 53%, respectively). In the Interphone study a regular user of mobile phones had an average of at least one call per week for a period of ≥ 6 months. **This very low user group was compared to several other groups of low users compared to nowadays more extensive use of mobile phones.** The highest group of users, ≥ 1640 hours was divided in three sub groups depending on how many years they had used a mobile phone. For the shortest time span on 1-4 years only 23 of the glioma cases and 8 of the controls had used their mobile phones for more than 1640 hours. If any of these 23 persons with a brain cancer or any of the 8 controls had used their mobile phones for only one year they would have used it at least in average for four and a half hours a day during a year. If they instead had talked in their mobile phones during four years it would be for an average of a little more than an hour a day. For the group of users between 5 and 9 years, 84 cases and 73 controls, the use per day would be at least between 54 minutes and 30 minutes. **For the long user group of 10 years or more, 93 cases and 73 controls, they talked in their mobile phones for 27 minutes a day or less for more than 10 years of use.**

For the main part of cases their use of mobile phones had been for a lot less than four hours a day. Today when most people use only their mobile phone and landline phones both at home and at work are becoming scarce, an amount of 4 hours or more wireless telephone use / day for salesman, telephone operators and so on is not uncommon.

In the Interphone study there was an statistical significant increased risk for a malignant brain tumour of 1.4 times (odds ratio, OR, 1.4, 95% CI 1.03-1.89) only for the highest user group of a total on more than 1640 hours.

Hardell et al. (2011) in Sweden found that **cases who had used a mobile phone for more than 1 year had an increased risk for glioma of 1.3 (OR 1.3, 95% CI 1.1-1.6).**

The risk increased with increasing time since first use and with total call time, reaching 3.2 times (OR 3.2, CI 2.0-5.1) for more than 2000 hours of use. Use of the mobile phone on the same side of the head as the tumour was associated with higher risk.

Since 2011 several other studies have been published which are strengthening the possible association between RF-EMF and cancer. Using the Bradford Hill viewpoints for evaluating strengths of evidence of the risk for brain tumours associated with use of mobile and cordless phones the classification should be upgraded to group 1 carcinogen, i.e., “the agent is carcinogenic to humans” (Hardell & Carlberg, 2013).

New case-control studies have verified Hardell's studies (Coureau et al., 2014) and up to 20 years of mobile phone use have found even higher risk for brain tumours (Hardell & Carlberg, 2015).

A newly published study has found a tumor promotion effect on mice from exposure to radiofrequency electromagnetic fields below exposure limits for humans (Lerchl *et al.*, 2015). RF-EMFs do not cause direct DNA damage. On the contrary **numerous studies have shown generation of reactive oxygen species (ROS) that can cause oxidative damage of DNA. This is a well-known mechanism in carcinogenesis for many agents.** The broad biological potential of ROS and other free radicals makes radiofrequency radiation a potentially hazardous factor for human health, not only cancer risk but also other health effects (Yakymenko *et al.*, 2015).

The IARC classification of RF-EMF as Group 2B, possibly carcinogenic to humans, doesn't only include exposure from mobile phones near the ear. **The classification includes all sources of RF-EMFs.** The exposure from mobile phone base stations, Wi-Fi access points, smart phones, laptops and tablets can be long term, sometimes around the clock both at home and at school. **This constant exposure to lower levels of exposure may be as deleterious to health as higher exposure during short time** (Fragopoulou et al., 2012, Dasdag et al., 2015b). **This risk may be accentuated for children because their probable longer use of wireless devices** (Morgan et al., 2014). **Children are also growing and have more immature cells which can be more sensible to RF-EMF** (Markova et al., 2010)

In conclusion, long term health effects from RF EMFs are still under investigation and a significant amount of troublesome scientific evidence has surfaced. By using wireless technologies at close range, long term health risks cannot be excluded. Therefore, we recommend schools to use wired technologies.

Respectfully submitted

Sincerely,



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24 March 2014

Open letter by British medical doctors: Health and safety of Wi-Fi and mobile phones

We wish to highlight our concern over the safety of exposure to microwave radiation from wireless technology, particularly for vulnerable groups like children, pregnant women, the elderly and those with compromised health.

There is growing concern that chronic (long-term) exposure to radiofrequency/microwave radiation from wireless technologies causes damage, particularly genetic damage, cognitive damage, cancer and decreased fertility. There is now substantial evidence of a link between mobile phone use and brain cancer. This was recognised by the International Agency for Research on Cancer (IARC)'s 30-strong panel of scientists, which in 2011 classed radiofrequency radiation as "possibly carcinogenic".

Additionally, doctors are encountering a significant and growing number of people presenting with a range of acute (short-term) symptoms from wireless radiation, including headaches, palpitations, rashes, fatigue, sleep disturbance, allergies and memory and concentration problems.

International medical agencies have recognised the evidence of harm (see appended list) but these rulings may take many years to be reflected in public health policy. This controversy is a common characteristic of scientific understanding when environmental exposures are new.

New technologies and substances often come with scientific conflict, which can continue for several decades before consensus is achieved. Commercial pressures often delay the acceptance of health risks, even when scientific evidence is compelling. In the case of tobacco, asbestos, x-rays and leaded petrol, for example, it took many decades before damage was established and accepted by health agencies and, during those decades, millions of people suffered ill health and death as a result of the delay. Now, despite evidence of harm, wireless technology is being rolled out widely.

We urge health agencies and the public to act immediately to reduce exposure to radiofrequency/ microwave radiation. This is especially important for children, who are physiologically more vulnerable to this exposure, and for whom adults have a safeguarding responsibility. Children's health should be put ahead of convenience and commercial benefits. Children should not use mobile phones except in an emergency, and WiFi should be replaced with wired alternatives in schools and other settings where children spend considerable time.

Yours faithfully,

Dr Elizabeth Evans MA (Cantab), MBBS (Lond), DRCOG – Medical Doctor
Dr Andrew Tresidder MRCP (1989), MBBS (Lond) – Medical Doctor
Dr Erica Mallery Blythe BM - Medical Doctor
Dr Elizabeth Cullen MBBCh BAO MSc PhD – Medical Doctor
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Dr Rodney Adeniyi-Jones LRCP&SI, MRCP – Medical Doctor
Dr Jenny Goodman MA, MBChB – Ecological Physician

Dr Damian Downing MBBS, MSB – President BSEM
Dr Elena Toma MD - Psychiatrist
Dr Joan Kinder MA, MBBChir(Cantab), MRCPCH – retired Consultant Paediatrician
Dr Sarah Myhill MBBS – General Practitioner (GP)
Dr Dee Marshall MBBS, MFHom – Medical Doctor
Dr Charles Forsyth MBBS, FFHom – Medical Doctor
Dr Zac Cox BDS - Dentist

Appendix – International Rulings

1. In 2011 the **World Health Organization’s scientific panel, the International Agency for Research on Cancer (IARC)**, reviewed all the evidence on carcinogenesis (cancer-causing) and categorised electromagnetic radiation from mobile phones and Wi-Fi as **Possibly Carcinogenic (Class 2B)**.

See http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

2. **The Council of Europe has called for member states to take measures to reduce exposure to electromagnetic fields and give preference to wired internet connections for children, particularly in schools and classrooms.**

The Parliamentary Assembly stated that “the Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.”

See <http://assembly.coe.int/mainf.asp?link=/documents/adoptedtext/ta11/eres1815.htm>

3. **The BioInitiative Report**, updated in 2012 by 29 scientists, states that **biological effects are clearly established and occur at very low levels of exposure to electromagnetic fields and radiofrequency radiation** from just minutes of exposure to mobile phone masts (cell towers), Wi-Fi, and wireless utility ‘smart’ meters.

See <http://www.bioinitiative.org/conclusions>

4. **The American Academy of Environmental Medicine** stated in a 2012 Position Paper that “**Multiple studies correlate RF exposure with diseases such as cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity.**”

See http://aaemonline.org/emf_rf_position.html

6. **International Society of Doctors for the environment (ISDE) and Irish Doctors’ Environmental Association (IDEA)** state that “**there is sufficient scientific evidence to warrant more stringent controls** on the level and distribution of electromagnetic radiation [EMR]. The joint statement and recommendations are part of a call by medical and scientific experts for safe technologies in schools.”

See <http://www.env-health.org/news/members-news/article/isde-idea-statement-on>

5. **The Safe Schools Report 2012** lists statements by **other doctors and medical associations** raising concerns over children’s exposure to electromagnetic fields from Wi-Fi and other wireless technology.

See <http://wifischools.org.uk/resources/safeschools2012.pdf>



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July 10, 2009.

Open Letter to Parents, Teachers, & School Boards Regarding Wi-Fi Networks in Schools and Cell Phone Antennas near School Property

I am a scientist who does research on the health effects of electromagnetic radiation and I am becoming increasingly concerned that a growing number of schools are installing WiFi networks and are making their school grounds available for cell phone antennas.

You will be told by both the federal government (Federal Communication Commission in the US; Health Canada and Industry Canada in Canada) as well as by the Wi-Fi provider that this technology is **safe** provided that exposures to radio frequency radiation remain below federal guidelines.

This information is **outdated** and **incorrect** based on the growing number of scientific publications that are reporting adverse health and biological effects below our “short-term, thermal-based” guidelines (see www.bioinitiative.org) and the growing number of scientific and medical organizations that are asking for stricter guidelines to be enforced.

For these reasons it is irresponsible to introduce Wi-Fi microwave radiation into a school environment where young children and school employees spend hours each day.

FACT:

- 1. GUIDELINES: Guidelines for microwave radiation (which is what is used in Wi-Fi) range 5 orders of magnitude in countries around the world.** The lowest guidelines are in Salzburg Austria and now in Liechtenstein. The guideline in these countries is 0.1 microW/cm². See short video (<http://videos.next-up.org/SfTv/Liechtenstein/AdoptsTheStandardOf06VmBioInitiative/09112008.html>). In Switzerland the guideline is 1 and in both Canada and the US it is 1000 microW/cm²!

Why do Canada and the US have guidelines that are so much higher than other countries? Our guidelines are based on a short-term (6-minute in Canada and 30-minute in US) heating effect. It is assumed that if this radiation does not heat your tissue it is “safe”. This is NOT correct. Effects are documented at intensities well below those that are able to heat body tissue. See attached report: *Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink Wi-Fi Network* (2007). These biological effects include increased permeability of the blood brain barrier, increased calcium flux, increase in cancer and DNA breaks, induced stress proteins, and nerve damage. Exposure to this energy is associated with altered white blood cells in school children; childhood leukemia; impaired motor function, reaction time, and memory; headaches, dizziness, fatigue, weakness, and insomnia.

- 2. ELECTRO-HYPER-SENSITIVITY:** A growing population is adversely affected by these electromagnetic frequencies. The illness is referred to as “electro-hyper-sensitivity” (EHS) and is recognized as a disability in Sweden. The World Health Organization defines EHS as:

“ . . . a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). . . EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards. “

Health Canada acknowledges in their Safety Code 6 guideline that some people are more sensitive to this form of

energy but they have yet to address this by revising their guidelines.

Symptoms of EHS include sleep disturbance, fatigue, pain, nausea, skin disorders, problems with eyes and ears (tinnitus), dizziness, etc. It is estimated that 3% of the population are severely affected and another 35% have moderate symptoms. Prolonged exposure may be related to sensitivity and for this reason it is imperative that children's exposure to microwave radiation (Wi-Fi and mobile phones) be minimized as much as possible.

3. **CHILDREN'S SENSITIVITY:** Children are more sensitive to environmental contaminants and that includes microwave radiation. The Stewart Report (2000) recommended that children not use cell phones except for emergencies. The cell phone exposes your head to microwave radiation. A wireless computer (Wi-Fi) exposes your entire upper body and if you have the computer on your lap it exposes your reproductive organs as well. Certainly this is not desirable, especially for younger children and teenagers. For this reason we need to discourage the use of wireless technology by children, especially in elementary schools. That does not mean that students cannot go on the Internet. It simply means that access to the Internet needs to be through wires rather than through the air (wireless, Wi-Fi).
4. **REMOVAL OF WI-FI:** Most people do not want to live near either cell phone antennas or Wi-Fi antennas because of health concerns. Yet when Wi-Fi (wireless routers) are used inside buildings it is similar to the antenna being inside the building rather than outside and is potentially much worse with respect to exposure since you are closer to the source of emission.

Libraries in France are removing Wi-Fi because of concern from both the scientific community and their employees and patrons.

The Vancouver School Board (VSB) passed a resolution in January 2005 that prohibits construction of cellular antennas within 1000 feet (305 m) from school property.

Palm Beach, Florida, Los Angeles, California, and New Zealand have all prohibited cell phone base stations and antennas near schools due to safety concerns. The decision not to place cell antennas near schools is based on the likelihood that children are more susceptible to this form of radiation. **Clearly if we do not want antennas "near" schools, we certainly do not want antennas "inside" schools!** The safest route is to have wired internet access rather than wireless. While this is the more costly alternative in the short-term it is the least costly alternative in the long run if we factor in the cost of ill health of both teachers and students.

5. **ADVISORIES:** Advisories to limit cell phone use have been issued by the various countries and organizations including the UK (2000), Germany (2007), France, Russia, India, Belgium (2008) as well as the Toronto Board of Health and the Pittsburgh Cancer Institute (July 2008). While these advisories relate to cell phone use, they apply to Wi-Fi exposure as well since both use microwave radiation. If anything, Wi-Fi computers expose more of the body to this radiation than do cell phones.
6. **PRECAUTIONARY PRINCIPLE:** Even those who do not "accept" the science showing adverse biological effects of microwave exposure should recognize the need to be careful with the health of children. For this reason we have the Precautionary Principle, which states:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation.

In this case "States" refers to the School Board and those who make decisions about the health of children.

The two most important environments in a child's life are the home (especially the bedroom) and the school. For this reason it is imperative that these environments remain as safe as possible. **If we are to err, please let us err on the side of caution.**

Respectfully submitted,
Dr. Magda Havas,
Associate Professor
Trent University
July 10, 2009

Shallow Minds: How the Internet and Wi-Fi in Schools Can Affect Learning

By Cindy Lee Russell, MD
VP-Community Health, Santa Clara County Medical Association

Most of us cannot live without our computers, text messaging, e-mail, and immediate access to the vast cloud of information, especially kids and teenagers who have grown up in the age of the Internet. In fact, more schools are integrating computers at younger ages, even in kindergarten. Forty-nine states are phasing out cursive handwriting altogether. What effects does it have, however, on learning, brain development, cognition, and brain health? Studies have shown some interesting ways that technology is rewiring and shaping our brain, which may not be “all good.”

A growing body of scientific evidence suggests that the Internet, with its distractions and interruptions, is turning us into scattered, superficial thinkers. What does that portend for our kids?

Multitasking and Internet Addiction

Nicholas Carr explains, in his book “The Shallows,” that we are changing the way we process information. “Dozens of studies by psychologists, neurobiologists, educators, and Web designers point to the same conclusion: When we go online, we enter an environment that promotes cursory reading, hurried and distracted thinking, and superficial learning... The Net delivers precisely the kind of sensory and cognitive stimuli-repetitive, intensive, interactive, addictive, that have been shown to result in strong and rapid alterations in brain circuits and functions.”

Researchers from Stanford, in 2009, gave a battery of cognitive tests to a group of heavy and light media Internet multitaskers. They found that the heavy multitaskers were much more easily distracted by “irrelevant environmental stimuli” and had less control over their working memory. In addition, they were much less able to focus on a particular task. Professor Clifford Nass, who led the research, stated intensive multitaskers are “suckers for irrelevancy. Everything distracts them.” (5)

“Teaching is a human experience. Technology is a distraction when we need literacy, numeracy, and critical thinking.” Paul Thomas, author and associate professor of education at Furman University

Law School Professors Ban Laptops in Classrooms

Several years ago, professors who were irritated with students surfing the Web and hiding behind laptop screens began banning the use of the Internet or laptops in the classroom. Laptops have been banned in classes at Harvard Law School, Yale, George Washington University, University of Virginia, and South Texas College of Law, to mention a few. (4)(15) A 2006 study by Carrie Fried backed up the policies, demonstrating that students who used laptops in

class spent considerable time multitasking. They more importantly found that the level of laptop use was negatively related to several measures of student learning. (3)

A 2012 survey by Elon University, the Pew Internet, and American Life Project asked over 1,000 leaders in the U.S. their thoughts about cognition in our millennial generation. They were asked to consider how the Internet and its environment are changing, for better or worse. Overall, the survey found that multitasking is the new norm and that hyper-connectivity may be leading to a lack of patience and concentration. The “always on” ethos may be encouraging a culture of expectation and instant gratification.

Brain Maturation, Learning, Memory, and Intelligence

The maturation of intelligence requires quiet, deep thought, and time. Established research findings in cognitive science leads to the conclusion that laptop use, especially with Wi-Fi access, could interfere with learning.

The hippocampus, which lies under the cortex, is intimately involved in long-term memory storage. Initial experiences are stored and stabilized in the hippocampus and then later transferred to the cortex. Removal of the hippocampus does not affect long-term memories, but prevents new memories from forming.

Learning depends on the ability to transfer information from our working memory to long-term memory and weave this into other acquired knowledge. There is a bottleneck in the passage of working memory to long-term memory. We have a limited ability as humans to capture and process information. The Internet provides too many choices and too much information at once. Excess distracting information creates “overload,” preventing long-term memorization and important information is lost. No one disagrees that we need to protect our memories. As author Nicholas Carr highlights, personal memory is not just for the individual to function, but it shapes and sustains our collective cultural memory.

Brain Drain:

Adverse Neurologic and Health Effects of Wireless Microwave Communications

A growing body of peer reviewed research is showing neurologic damage to fetal brain and other systems from Wi-Fi and other microwave wireless sources. In a prior article, “Why-Fi: Is Wireless Communication Hazardous to Your Health?” in the Sept/Oct 2010 SCCMA *Bulletin*, the full range of effects of EMF from our cell phones and wireless devices was discussed. New basic science research in the last three years is confirming these findings. Initially, the Bioinitiative report of 2007 reviewed the biological effects of low level EMF. It found that there was clear evidence of adverse effects to living systems at current environmental exposures and at doses well below the threshold of the International Commission of Non-Ionizing Radiation Protection (ICNIRP) safety guidelines. Current microwave safety limits are based solely on the heating of tissue and do not take into account research showing negative biological effects on DNA, cancer, protein synthesis, skin tissue changes, sperm motility and viability, cognitive functioning, and disruption of the blood brain barrier.

Current Research on Cognition and Wireless Communication

Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice. *Scientific Reports*. March 2012.

Aldad et al noted that neurobehavioral disorders are increasingly prevalent in children with 3%-7% of school-aged children diagnosed with attention deficit hyperactivity disorder (ADHD). The etiology is unclear, however, an association between prenatal cellular telephone use and hyperactivity in children has been postulated by others. To test this, he exposed pregnant mice to cell phone radiation throughout gestation (days 1-17), with a sham cell phone control group. He found that the exposed group had dose responsive impaired neurologic transmission in the prefrontal cortex and that the mice exposed in utero were hyperactive and had impaired memory. He concluded “that these behavioral changes were due to altered neuronal developmental programming.”(3)

Microwave Radiation Induced Oxidative Stress, Cognitive Impairment, and Inflammation in Brain of Fischer Rats. Megha. 2012.

Megha evaluated the intensity of oxidative stress, cognitive impairment, and brain inflammation in rats exposed to typical cell phone microwave radiation. They were subjected to 900 and 1,800 MHz EMF for two hours a day, for 30 days. They state, “Significant impairment in cognitive function and induction of oxidative stress in brain tissues of microwave exposed rats were observed, in comparison with sham exposed groups... Results of the present study indicated that increased oxidative stress due to microwave exposure may contribute to cognitive impairment and inflammation in brain.”

Effect of Low Level Microwave Radiation Exposure on Cognitive Function and Oxidative Stress in Rats. Deshmukh. 2013.

The author highlights the exponential increase in wireless communication devices we are exposed to. He evaluated the effects of cell phone radiation on oxidation in tissues, in addition to cognition in rats. They subjected rats to 900 MHz EMF for two hours per day, five days a week, for 30 days, with an unexposed control group. “Results showed significant impairment in cognitive function and increase in oxidative stress, as evidenced by the increase in levels of MDA (a marker of lipid peroxidation) and protein carbonyl (a marker of protein oxidation) and unaltered GSH content in blood. Thus, the study demonstrated that low level MW radiation had significant effect on cognitive function and was also capable of leading to oxidative stress.”

The Internet Can Damage Teenage Brains

A large radiologic study from China, published July 2011, looked at structural brain changes in Internet-addicted teenagers. It is estimated that 24 million teenagers are addicted to the Internet in China. The researchers found a consistent atrophy of grey matter in parts of the brain and shrinkage of the surface of the brain in those addicted to the Internet. The effects were worse the longer the addiction. In addition, the study revealed changes in white matter of the brain, which

function to transmit messages in the brain to the grey matter. They concluded these structural abnormalities were most likely associated with functional impairments in cognitive control.

“It strikes me as a terrible shame that our society requires photos of brains shrinking in order to take seriously the common-sense assumption that long hours in front of screens is not good for our children’s health. Dr Aric Sigman, Fellow of the Royal Society of Medicine

WHO Classifies EMF as a Carcinogen

In 2011, The WHO/International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as “possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer¹, associated with wireless phone use.”

France Bans Wi-Fi in Schools, But Replaces With Ethernet

The French National Assembly, March 2013, passed an amendment to ban Wi-Fi in their schools until it’s proven “safe for human consumption.” They instead agreed to install far safer, wired Ethernet cable connections.

The Council of Europe has called for a ban on Wi-Fi use in schools and also recommends a wired alternative.

In Austria, the Austrian Medical Society has also issued a policy statement asking for a ban of Wi-Fi in schools.

The U.K. has a useful frequently-updated website on Wi-Fi in schools, which provides much scientific research. <http://www.wifiinschools.org.uk/> Still the controversy persists.

The Cost of a Virtual World

There are a host of concerns with classroom technology, and the virtual world it creates, that have not been explored in the rush to “modernize” education and prevent our kids from becoming “computer illiterate,” despite the fact that computers are designed for ease of use. These issues range from distraction in the classroom, impairment of cognitive development and long-term memory, deficiency in learning social skills, Internet addiction, cyber bullying, access to inappropriate content, eye fatigue, and security risks to online learning networks. In addition, the sheer cost of computers and continuous upgrades is likely to break many school budgets. We have not mentioned the issue of toxic e-waste, another growing public health problem.

Common Sense

We will not get rid of the Internet or computers. We should not ignore, however, the enlarging body of science that points to real threats to public health and, especially, our children’s safety and well-being. The best approach is precautionary. Reduce the risk by reducing the microwave emissions. It is our obligation as physicians and parents to protect our children. They are the

future and our legacy.

1. Remove wireless devices (white boards and routers) in schools in favor of wired connections and fiberoptic.
2. If there is Wi-Fi, then give teachers the authority to turn it off when not in use or if they feel it is not necessary.
3. Ban cell towers near or on schools.
4. Limit screen time on computers.
5. Limit or ban cell phone use in the class.
6. Limit or ban cell phone use at home.
7. Do not allow laptops to be placed on laps.
8. Undertake independent scientific studies on Wi-Fi and computer use that look at acute and long-term health effects.
9. Train teachers how to recognize symptoms of EMF reactions.
10. Conduct meetings with parents and teachers to address this issue in each school.

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Minimize health risks from electronic devices

Published in the September 2016 NJEA Review

by Adrienne Markowitz and Eileen Senn

Desktops, laptops, tablets, eBook readers, printers, projectors, smart boards, smart TVs, cellphones, cordless phones and wireless networks (WiFi) have become ubiquitous in schools. At their best, they are powerful tools for education. At their worst, they threaten the physical and mental health of teachers, paraeducators, secretaries, librarians and other school staff members and students who spend numerous hours using the devices.

Physical health risks from electronic devices include pain and tingling from repetitive strain injuries to the hands and wrists; pain in the neck, shoulders and back; dry, burning, itchy eyes, blurred vision and headaches; altered sleep patterns and next-day fatigue from exposure to blue screen light; distracted driving; and various health problems from exposure to radiation.

Mental health risks arise from stress due to raised expectations for multitasking, productivity and proficiency with devices; dealing with malfunctioning devices; student and colleague distraction from and addiction to devices; and intrusion of devices into nonwork time.

WiFi devices emit radiation

Radio frequency (RF) electromagnetic frequency (EMF) radiation is sent and/or received by the antennae of phones, routers and other wireless devices. RF radiation is capable of causing cancer, reproductive, neurological and ocular effects. The amount of radiation exposure received depends on the amount of time exposed and distance from the source. Radiation levels fall off exponentially with distance from antennae. If you double the distance, the radiation is four times less. If you triple the distance, it is nine times less, and so on. Children and developing fetuses are particularly at risk because their bodies are still growing. People with implanted medical devices are at risk for device interference.

Hazards and solutions

The most straightforward ways to minimize health risks are to use electronic devices in moderation and to maximize your distance from them. There are also specific solutions to specific hazards listed below.

Local associations should work with their UniServ field representative to negotiate solutions that are in the control of district administrators such as providing training and ergonomic equipment and hard-wiring devices. Individuals should take steps within their control, such as:

For repetitive strain injuries

- Use voice control/speech recognition.
- Use ergonomic alternatives to traditional mice and keyboards.
- Use as many fingers as possible when typing and both thumbs when texting.

For neck, shoulder and back pain

- Ensure an ergonomic workstation.
- When using a hand-held device, support it and the forearms.
- Avoid bending the head down or jutting it forward.
- Take frequent, short breaks from the device.
- Ensure good posture and change positions frequently.
- Stand and do stretching exercises.

For eye pain, blurred vision and headaches

- Use sufficient, but not excessive, lighting.
- Use assistive technology built into Apple, Android and Windows devices.
- Enlarge and darken the cursor and pointer.
- Enlarge the font; magnify the text.
- Use text-to-speech instead of reading.
- Use special computer glasses.
- Relax the eyes on a minibreak.

For altered sleep patterns and next-day fatigue

- Stop using devices at least one hour before bedtime.

For distracted driving

- Use hands-free devices, preferably speakerphones.
- Pull over and park.
- Let someone else drive.

For radiation exposure

- Keep devices away from the body and bedroom.
- Carry phones in briefcases, etc., not on the body.
- Put devices on desks, not laps.
- Hard wire all devices that connect to the internet.
- Hard wire all fixed devices such as printers, projectors and boards.
- Use hard-wired phones instead of cell or cordless phones.
- Text rather than call.
- Keep conversations short or talk in person.
- Put devices in airplane mode, which suspends EMF transmission by the device, thereby disabling Bluetooth, GPS, phone calls, and WiFi.
- Use speaker phone or ear buds instead of holding the phone next your head.
- Take off Bluetooth devices when not using them.

For stress

- Training in device use, assistive technology.
- Easy access to user manuals.
- Easily available technical support.

Cell phones and cancer

The National Toxicology Program (NTP) is conducting the largest set of laboratory rodent studies to date on cellphone RF radiation. The studies cost \$25 million and are designed to mimic human exposure. They are based on the cellphone

frequencies and modulations currently in use in the United States. The NTP studies are designed to look at effects in all parts of the body.

On May 27, 2016, NTP released a report with partial results of the studies. They found increased occurrence of rare brain tumors called gliomas and increases in nerve tumors called schwannoma of the heart in male rats. The released results are partial because more rat studies and all of the mouse studies will be forthcoming by 2017. The cells that became cancerous in the rats were the same types of cells as those that have been reported to develop into tumors in human cellphone users.

The EMF produced by cellphones was classified as possibly carcinogenic to humans by the World Health Organization in 2011. They found that long-term use of a cell phone might lead to two different types of tumors, gliomas and acoustic neuroma, a tumor of the auditory nerve.

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For altered sleep patterns and next-day fatigue

- Stop using devices at least one hour before bedtime.

For distracted driving

- Use hands-free devices, preferably speakerphones.
- Pull over and park.
- Let someone else drive.

For radiation exposure

- Keep devices away from the body and bedroom.
- Carry phones in briefcases, etc., not on the body.
- Put devices on desks, not laps.
- Hard wire all devices that connect to the internet.
- Hard wire all fixed devices such as printers, projectors and boards.
- Use hard-wired phones instead of cell or cordless phones.
- Text rather than call.
- Keep conversations short or talk in person.
- Put devices in airplane mode, which suspends EMF transmission by the device, thereby disabling Bluetooth, GPS, phone calls, and WiFi.
- Use speaker phone or ear buds instead of holding the phone next your head.
- Take off Bluetooth devices when not using them.


For stress


- Training in device use, assistive technology.
- Easy access to user manuals.
- Easily available technical support. 📞


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For more information


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Cell phones and cancer

The National Toxicology Program (NTP) is conducting the largest set of laboratory rodent studies to date on cellphone RF radiation. The studies cost \$25 million and are designed to mimic human exposure. They are based on the cellphone frequencies and modulations currently in use in the United States. The NTP studies are designed to look at effects in all parts of the body.

On May 27, 2016, NTP released a report with partial results of the studies. They found increased occurrence of rare brain tumors called gliomas and increases in nerve tumors called schwannoma of the heart in male rats. The released results are partial because more rat studies and all of the mouse studies will be forthcoming by 2017. The cells that became cancerous in the rats were the same types of cells as those that have been reported to develop into tumors in human cellphone users.

The EMF produced by cellphones was classified as possibly carcinogenic to humans by the World Health Organization in 2011. They found that long-term use of a cell phone might lead to two different types of tumors, gliomas and acoustic neuroma, a tumor of the auditory nerve.



Resolution 1815 (2011)¹

Final version

The potential dangers of electromagnetic fields and their effect on the environment

Parliamentary Assembly

1. The Parliamentary Assembly has repeatedly stressed the importance of states' commitment to preserving the environment and environmental health, as set out in many charters, conventions, declarations and protocols since the United Nations Conference on the Human Environment and the Stockholm Declaration (Stockholm, 1972). The Assembly refers to its past work in this field, namely [Recommendation 1863 \(2009\)](#) on environment and health: better prevention of environment-related health hazards, [Recommendation 1947 \(2010\)](#) on noise and light pollution, and more generally, [Recommendation 1885 \(2009\)](#) on drafting an additional protocol to the European Convention on Human Rights concerning the right to a healthy environment and [Recommendation 1430 \(1999\)](#) on access to information, public participation in environmental decision-making and access to justice – implementation of the Århus Convention.
2. The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. According to the World Health Organization, electromagnetic fields of all frequencies represent one of the most common and fastest growing environmental influences, about which anxiety and speculation are spreading. All populations are now exposed in varying degrees to electromagnetic fields, the levels of which will continue to increase as technology advances.
3. Mobile telephony has become commonplace around the world. This wireless technology relies upon an extensive network of fixed antennae, or base stations, relaying information with radio-frequency signals. Over 1.4 million base stations exist worldwide and the number is increasing significantly with the introduction of third generation technology. Other wireless networks that allow high-speed Internet access and services, such as wireless local area networks, are also increasingly common in homes, offices and many public areas (airports, schools, residential and urban areas). As the number of base stations and local wireless networks increases, so does the radio-frequency exposure of the population.
4. While electrical and electromagnetic fields in certain frequency bands have wholly beneficial effects which are applied in medicine, other non-ionising frequencies, whether from extremely 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.
5. As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty. Given the context of growing exposure of the population, in particular that of vulnerable groups such as young people and children, there could be extremely high human and economic costs if early warnings are neglected.

1. Text adopted by the Standing Committee, acting on behalf of the Assembly, on 27 May 2011 (see [Doc. 12608](#), report of the Committee on the Environment, Agriculture and Local and Regional Affairs, rapporteur: Mr Huss).



6. The Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.

7. Moreover, the Assembly notes that the problem of electromagnetic fields or waves and their potential consequences for the environment and health has clear parallels with other current issues, such as the licensing of medication, chemicals, pesticides, heavy metals or genetically modified organisms. It therefore highlights that the issue of independence and credibility of scientific expertise is crucial to accomplish a transparent and balanced assessment of potential negative impacts on the environment and human health.

8. In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.1. 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 tumours;

8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. pay particular attention to "electrosensitive" people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;

8.1.5. in order to reduce costs, save energy, and protect the environment and human health, step up research on new types of antenna, mobile phone and DECT-type device, and encourage research to develop telecommunication based on other technologies which are just as efficient but whose effects are less negative on the environment and health;

8.2. concerning the private use of mobile phones, DECT wireless phones, WiFi, WLAN and WIMAX for computers and other wireless devices such as baby monitors:

8.2.1. set preventive thresholds for levels of long-term exposure to microwaves in all indoor areas, in accordance with the precautionary principle, not exceeding 0.6 volts per metre, and in the medium term to reduce it to 0.2 volts per metre;

8.2.2. undertake appropriate risk-assessment procedures for all new types of device prior to licensing;

8.2.3. introduce clear labelling indicating the presence of microwaves or electromagnetic fields, the transmitting power or the specific absorption rate (SAR) of the device and any health risks connected with its use;

8.2.4. raise awareness on potential health risks of DECT wireless telephones, baby monitors and other domestic appliances which emit continuous pulse waves, if all electrical equipment is left permanently on standby, and recommend the use of wired, fixed telephones at home or, failing that, models which do not permanently emit pulse waves;

8.3. concerning the protection of children:

8.3.1. develop within different ministries (education, environment and health) targeted information campaigns aimed at teachers, parents and children to alert them to the specific risks of early, ill-considered and prolonged use of mobiles and other devices emitting microwaves;

8.3.2. for children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises;

- 8.4. concerning the planning of electric power lines and relay antenna base stations:
 - 8.4.1. introduce town planning measures to keep high-voltage power lines and other electric installations at a safe distance from dwellings;
 - 8.4.2. apply strict safety standards for the health impact of electrical systems in new dwellings;
 - 8.4.3. reduce threshold values for relay antennae in accordance with the ALARA principle and install systems for comprehensive and continuous monitoring of all antennae;
 - 8.4.4. determine the sites of any new GSM, UMTS, WiFi or WIMAX antennae not solely according to the operators' interests but in consultation with local and regional government authorities, local residents and associations of concerned citizens;
- 8.5. concerning risk assessment and precautions:
 - 8.5.1. make risk assessment more prevention oriented;
 - 8.5.2. improve risk-assessment standards and quality by creating a standard risk scale, making the indication of the risk level mandatory, commissioning several risk hypotheses to be studied and considering compatibility with real-life conditions;
 - 8.5.3. pay heed to and protect "early warning" scientists;
 - 8.5.4. formulate a human-rights-oriented definition of the precautionary and ALARA principles;
 - 8.5.5. increase public funding of independent research, in particular through grants from industry and taxation of products that are the subject of public research studies to evaluate health risks;
 - 8.5.6. create independent commissions for the allocation of public funds;
 - 8.5.7. make the transparency of lobby groups mandatory;
 - 8.5.8. promote pluralist and contradictory debates between all stakeholders, including civil society (Århus Convention).

Recommendations to the Maryland Children's Environmental Health and Protection Advisory Council

On the Children's Health and Radiofrequency Exposures Report

Clifford S. Mitchell, M.D.
Maryland Children's Environmental Health and Protection Advisory Council
% Rachel M. Hess-Mutinda
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Prevention & Health Promotion Administration,
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November 10, 2016

Dear Dr. Clifford S. Mitchell;

We are writing you in strong support of the Maryland Children's Environmental Health and Protection Advisory Council's draft recommendations to reduce children's exposure to radiofrequency radiation. We offer this information and our recommendations to include in your final report.

Children and Radiofrequency Radiation

Radiofrequency radiation constitutes a significant environmental exposure for children in schools and at home. Schools are rapidly integrating cell phones and wireless technology into classrooms. The radiofrequency electromagnetic (RF--EMF) radiation environment in classrooms is significant because of the high numbers of radiation emitting devices (laptops, tablets, cell phones, ceiling mounted access points, virtual reality) in use for long periods of time in each classroom.

As the [US EPA has detailed](#), FCC regulations were set intending to protect from thermal effects only and not intending to protect from non-thermal effects from long-term chronic exposures. Since, the World Health Organization's International Agency for the Research on Cancer classified radiofrequency radiation as a [Class 2 B Carcinogen in 2011](#), evidence has [significantly increased](#) that long-term radiofrequency radiation exposure causes cancer. It has been scientifically demonstrated that adverse biological effects can occur at non-thermal levels of radiofrequency fields. A recent animal study performed by the [National Toxicology Program](#) in the United States found an increased incidence of cancer and increased DNA damage in rats with prolonged exposure to radiofrequency fields that were too weak to increase temperature. Importantly, these adverse effects (and other effects now well documented in scientific literature) occurred at levels below those that cause "thermal" injury, contrary to what had long been espoused by the FCC. Therefore, FCC regulations do not provide adequate protection for children as the regulations do not account for biological effects at these *non-thermal* levels.

The [American Academy of Pediatrics](#) (AAP) - in response to the NTP results- now recommends that children's exposure to cell phone is reduced and specifies steps parents can take to reduce exposure such as "*Make only short or essential calls on cell phones*" and "*Avoid carrying your phone against the body like in a pocket, sock, or bra.*" because "*Cell phone manufacturers can't guarantee that the amount of radiation you're absorbing will be at a safe level.*"

The AAP has long called on the federal government to [inform the public](#) and to [strengthen](#) FCC limits because children are more vulnerable to radiofrequency radiation exposures due to their unique anatomy and physiology, and rapid development. Considering that children will have a lifetime of exposure, it is critically important to reduce childhood RF exposures in schools and homes and equally important to address the myriad of ways children are exposed be it from Wi-Fi, tablets and/or cell phones.

Consistent with these expert recommendations we make the following recommendations to the State of Maryland. We also are commenting to the The Maryland Children's Environmental Health and Protection Advisory Council whose [Committee on Wireless and Health has drafted Guidelines of which we are adding these recommendations.](#)

Recommendations to the Department of Health

The Department of Health should advise the public on ways to reduce radiofrequency exposure from cell phones and wireless devices, with special emphasis on protecting children.

Please see these examples of experts who have issued specific recommendations to reduce exposure:

- **The Connecticut Department of Health:** *"It is wise to reduce your exposure to radiofrequency energy from cell phones whenever possible."* [Read the Connecticut Department of Public Health Cell Phone Q and A about Cell phones here.](#)
- **Massachusetts Department of Public Health:** *"Consider a wired Local Area Network (LAN) instead of wireless, and wired connections to computers and other individual devices. Use a wired landline instead of a cell phone for everyday calls. --Limit children's use of cell phones except for emergencies."* ["Best Practices for Technology" by Dr. Robert S. Knorr, Director, Environmental Epidemiology Program, Bureau of Environmental Health.](#)
- **American Academy of Pediatrics:** *10 Safety Tips for Parents* [Read their Recommendations to Reduce Exposure to Children](#)

The Maryland Department of Health should create and maintain a webpage with information on how to reduce cell phone and wireless device exposure, just as the [Connecticut Department of Health](#), the [Massachusetts Bureau of Environmental Health](#) and [San Francisco](#) and [Burlingame](#), California have done.

Note: The governments of France, Belgium, Canada, Austria, the United Kingdom (UK) , India, Australia, Germany, Switzerland, Israel, Finland, Greece, Russia, Switzerland, Cyprus, Singapore, Turkey and the Council of Europe all have online [public resources](#) specifically recommending that children's exposure should be reduced or minimized, and governments provide resources detailing how the public can reduce exposure to radiofrequency radiation. As the UK ministry states, *"Government advice is to be on the safe side and limit mobile phone use by children."*

Countries such as France, Israel, Germany, and the state and local governments of Ghent Belgium, Navarra, Vitoria, and the Basque Parliament of Spain, South Tyrol Borgofranco d'Ivrea, Piemonte and Turin Italy, specifically recommend against Wi-Fi or have outright banned Wi-Fi in daycare centers, kindergartens and/or schools. When the plan to remove Wi-Fi from all Haifa Israel schools was announced, Haifa Mayor Yona Yahav was quoted stating, *"When there is a doubt, when it comes to our children, there is no doubt."*

The Department of Health should provide resources that inform doctors and other clinicians about advising patients how to reduce cell phone/Wi-Fi exposure and how to clinically assess Radiofrequency (RF) exposure during patient visits. The Department of Health can create a Factsheet for Parents and a Factsheet for Clinicians that includes interview questions to ask during patient visits.

The Department of Health should provide information to obstetricians and gynecologists so they can provide information to patients about how to reduce exposures during clinic visits. Please see [the BabySafe Project](#) for examples of resources to share with pregnant women.

Recommendations to Schools

Reduce Radiofrequency Field Technology ALARA (As Low As Reasonably Achievable)

In order to reduce classroom RF exposures schools should install Low RF-EMF technology and reduce radiofrequency radiation exposures according to ALARA (As Low As Reasonably Achievable) principles. To reduce children's RF exposure in classrooms, schools should:

- Install corded (non-wireless) LAN systems in classrooms so that teacher and student computers (portable and desktop) connect to the internet without the added RF radiation exposure associated with wireless.
- Ensure the wireless emissions are disabled on devices in use by students.
- Install corded (not cordless) telephones in all classrooms for voice communication and security. This enables emergency calls to be received without either the radiation – or distraction from classwork – associated with cell phone use in the class.
- Choose non-wireless options for all other technology communication such as printers, security, mouse, keyboard, video cameras, HVAC, speakers, headphones, microphones and other accessories.
- Include information on FCC fine print warnings in the Bring Your Own (Mobile) Device (BYOD) Policy.
- Provide adaptors and accessories for personal devices so that devices can be used without wireless radiation emissions in classrooms when needed as classroom tools.
- Post reminder notices in classrooms instructing device users to turn off Wi-Fi, Bluetooth, and any other wireless settings on devices and accessories that connect non-wirelessly (even if they are purses or bags).
- Prohibit cell towers near and on school buildings and grounds.

Educational Curriculum for Schools

- Teach student and teachers *why* and *how* to reduce radiation exposure from cell phones and technology devices as part of digital citizenship curriculum for students and for staff training.
- Offer educational workshops for parents to learn how to decrease cell phone and wireless device RF exposures at home.
- Post cell phone/wireless device RF reduction “Best Practices” in every classroom.

Partial RF Reduction Measures in Schools

The following measures are not fully protective but only provide a *partial* reduction in radiation exposure. *However, fully wired (non-wireless) systems will eliminate the RF exposure from school technology. With partial or half-measures, children will continue to be exposed to significant RF radiation emitted by wireless devices and by all the building's access points (which transmit radiation continuously) whether exposed as users or bystanders.*

- Ensure all computers, tablets and laptops are used on a table and NOT on a student's lap.
- Ensure students' heads and bodies are at maximum distance from all wireless devices (e.g., children should not lie on the floor with their heads inches from the laptop screen, nor should the lid of the computer behind them be near their back or head.)
- Install a switch for the teacher to turn Wi-Fi routers and access points OFF in classrooms when not in use.

- Plan for wireless download of applications and content onto devices to occur *outside of* school hours. Therefore during the school day the device will be fully loaded and the device's Wi-Fi antennae (and WiFi router or access point) can be turned off while children are using devices.
- Allow students who want to avoid RF to use ethernet and other corded connections for their computers. Most classrooms *already* have an ethernet port on the wall to plug into. (Note: if a child is using an ethernet connected computer but is sitting in close proximity to a child on Wi-Fi or is sitting in front of a child using WiFi then the ethernet using child will still be getting radiation exposures from the nearby WiFi users in addition to the Wi-Fi access point.)
- Ensure that the wireless antennas are always OFF on cell phones and BYOD Devices.

*Note: In several school districts some grades use digital devices in most of their academic classrooms and, thus, partial halfway reductions such as "turn it off when not in use" will have minimal impact as the devices are "in use" for several hours each day. **Therefore, the most effective means to reduce exposure for maximum protection is to ensure the school infrastructure is 100% hardwired with ethernet connections.***

Manufacturer's Instructions in Cell Phones and Wireless Devices

As digital devices are used as classroom tools, the Department of Education should ensure that students and staff are aware of the FCC instructions for devices they use.

- Students and staff should be informed that wireless devices emit RF radiation and that the device manual specifies separation distances that are necessary between persons and emitting machines in order to avoid exposure that exceeds FCC guidelines.
- Students need to be aware that most laptop instructions specify the separation distance must be at least 20 cm (approximately 8 inches) and in fact, most cell phone instructions specify a distance as well which is different for each phone depending on the make and model. Most districts have (or are moving towards) a Bring Your Own Device Policy, so a variety of models are in use in classrooms.

Please note that the Queensland Department of Education, Training and Employment issued [Your Guide to Safe Technology](#), a guide that informs students that *all wireless devices emit low levels of electromagnetic radiation and students should follow the manufacturer's usage guideline.*

Recommendations to the General Assembly

The General Assembly should consider:

- Funding a public health education initiative on electromagnetic radiation and health.
- Right To Know Legislation requiring that the public is clearly informed that cell phones and "wireless" devices emit radiofrequency radiation and how the public can reduce exposure.
- Legislation that reduces RF exposures to the public with special consideration for child care centers, schools, community centers, municipal buildings and hospitals and other healthcare settings.

Sincerely,

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AAP responds to study showing link between cell phone radiation, tumors in rats

Melissa Jenco, News content editor

Some rats developed tumors after being exposed to cell phone radiation, according to preliminary results of a study released Thursday.

In light of the findings, the Academy continues to reinforce its recommendation that parents should limit use of cell phones by children and teens.

“They’re not toys. They have radiation that is emitted from them and the more we can keep it off the body and use (the phone) in other ways, it will be safer,”



said Jennifer A. Lowry, M.D., FAACT, FAAP, chair of the AAP Council on Environmental Health Executive Committee.

The [study by the National Toxicology Program](#), part of the National Institute of Environmental Health Sciences, exposed rats to radiofrequency radiation for nine hours a day for two years beginning in utero and compared them to rats that were not exposed. Some of the male rats developed malignant tumors in their hearts and brains while the control group did not, according to the report, which included only partial findings.

Dr. Lowry, chief for the Section of Clinical Toxicology at Children's Mercy Hospital, said it is difficult to translate the results in rats to humans, and exposure was heavier than it would be for most people.

In *Pediatric Environmental Health, 3rd Edition*, the Academy recommends “exposures can be reduced by encouraging children to use text messaging when possible, make only short and essential calls on cellular phones, use hands free kits and wired headsets and maintain the cellular phone an inch or more away from the head.” The book also warns against talking on the phone or texting while driving.

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We recommend

Study: 3% of young children have high blood lead levels
Melissa Jenco et al., AAP News , 2016

AAP Conference Preview: Environmental health expert to tackle tough questions
Carla Kemp et al., AAP News , 2016

NCE Preview: Environmental health expert to tackle tough questions
Carla Kemp et al., AAP News , 2016

Pesticides and Kids: An AAP Report
James Roberts, MD, MPH, et al., Medscape , 2013

AAP: No Amount of Lead Exposure Is Safe for Children
PracticeUpdate , 2016

Cell Phones and Cancer: Is There a Connection?
Bret Stetka, MD, et al., Medscape , 2011

Keeping Children Home Is Often Not Justified



Healthy Children (/English) > Safety & Prevention (<https://www.healthychildren.org/English/safety-prevention>) > All Around (<https://www.healthychildren.org/English/safety-prevention/all-around>) > Cell Phone Radiation & Children's Health: What Parents Need to Know

SAFETY & PREVENTION

Cell Phone Radiation & Children's Health: What Parents Need to Know

Children are not just little adults; their growing minds and bodies make them uniquely vulnerable to the effects of the environment around them, including cell phone radiation. Because technology is being adopted by children at younger ages than ever before, it's even more important to investigate if cell phone usage is a health hazard.



What is cell phone radiation, anyway?

There are two types of radiation: ionizing and non-ionizing.

- **Ionizing radiation** (e.g., x-rays, radon, sunlight) is high frequency (and high energy).
- **Non-ionizing** is low frequency (low energy) radiation.

Cell phones have non-ionizing radiation. Your phone sends radio frequency waves from its antenna to nearby cell towers. When you make a call, text, or use data, your phone receives radio frequency waves to its antenna from cell towers.

What does the latest research say?

Several studies have been done to find out if cell phone use can lead to cancer. These types of studies in people have not shown clear evidence of an increased cancer risk with cell phone use. While there was a slight increase in a type of brain tumor, called a glioma, in a small group of people who spent the most total time on cell phone calls in one study, other studies have not found this to be true.

In May 2016, the US National Toxicology Program, which is part of the National Institutes of Health (NIH), released partial findings from a two-year study (<http://biorxiv.org/content/early/2016/05/26/055699>) that exposed rats to the types of radio frequency radiation that cell phones give off and compared them with a non-exposed group. Some rats developed cancerous tumors after being exposed to the radiation—showing a potential connection between exposure to radiation and an increased risk of cancer.

A few words of caution about this study:

- This study was only done on rats. While rats can be good test subjects for medical research, they are not the same as humans. We do not yet know if the same results would occur in people.
- The rats were exposed to very large amounts of radiation—nine hours a day, seven days a week, for two years. This is far more than most people spend holding their cell phones.
- More male rats developed cancerous tumors after being exposed to the radiation than female rats. Some of the rats who developed tumors lived longer than the control group rats that were not exposed to radiation.
- The analysis of all of the data from this study is not yet complete.

Why is more research needed?

Parents should not panic over the latest research, but it can be used as a good reminder to limit both children's screen time (/English/family-life/Media/Pages/Media-Time-Family-Pledge.aspx) and exposure from cell phones and other devices emitting radiation from electromagnetic fields (EMF) (/English/safety-prevention/all-around/Pages/Electromagnetic-Fields-A-Hazard-to-Your-Health.aspx). Partial findings from studies like this one give scientists reason to look into the issue more. **The American Academy of Pediatrics (AAP) supports more research into how cell phone exposure affects human health long term, particularly children's health.**

How can we limit cell phone radiation for ourselves and our children?

The AAP reinforces its existing recommendations on limiting cell phone use for children and teenagers. The AAP also reminds parents that cell phones are not toys, and are not recommended for infants and toddlers (/English/family-life/Media/Pages/Tablets-and-Smartphones-Not-for-Babies.aspx) to play with.

Cell phone safety tips for families:

- Use text messaging when possible, and use cell phones in speaker mode or with the use of hands-free kits.
- When talking on the cell phone, try holding it an inch or more away from your head.
- Make only short or essential calls on cell phones.
- Avoid carrying your phone against the body like in a pocket, sock, or bra. Cell phone manufacturers can't guarantee that the amount of radiation you're absorbing will be at a safe level.
- Do not talk on the phone or text while driving (/English/ages-stages/teen/safety/Pages/Sample-Driving-Rules-Teens-Must-Follow.aspx). This increases the risk of automobile crashes.
- Exercise caution when using a phone or texting while walking or performing other activities. "Distracted walking" injuries are also on the rise.
- If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure.
- Keep an eye on your signal strength (i.e. how many bars you have). The weaker your cell signal, the harder your phone has to work and the more radiation it gives off. It's better to wait until you have a stronger signal before using your device.
- Avoid making calls in cars, elevators, trains, and buses. The cell phone works harder to get a signal through metal, so the power level increases.
- Remember that cell phones are not toys or teething items.

Are there any regulations in place to limit cell phone radiation in the United States?

The Federal Communications Commission (FCC) decides how much radiation cell phones are allowed to give off in the US. Currently, the FCC limit is at 1.6 W/Kg. The FCC, however, has not revised the standard for cell phone radiation since 1996, and a lot has changed since then.

- There are now more cell phones in the United States than there are people.
- The number of cell phone calls per day, the length of each call, and the amount of time people use cell phones has increased.
- Cell phone and wireless technology have had huge changes over the years. For example, how many cell phone models have you had since 1996?

Another problem is that the cell phone radiation test used by the FCC is based on the devices' possible effect on large adults—not children. Children's skulls are thinner and can absorb more radiation.

Where the AAP stands:

The AAP supports the review of radiation standards for cell phones in an effort to protect children's health, reflect current cell phone use patterns, and provide meaningful consumer disclosure. Providing parents with information about any potential risks arms them with the information they need to make informed decisions for

their families. The AAP advocates for more research into how cell phone exposure affects human health long term, particularly children's health.

Additional Information & Resources:

- Cell Phones: What's the Right Age to Start? (</English/family-life/Media/Pages/Cell-Phones-Whats-the-Right-Age-to-Start.aspx>)
- Parents of Young Children: Put Down Your Smartphones (</English/family-life/Media/Pages/Parents-of-Young-Children-Put-Down-Your-Smartphones.aspx>)
- Cell Phones (<http://www.niehs.nih.gov/health/topics/agents/cellphones/>) (National Institute of Environmental Health Sciences)
- Cell Phones and Cancer Risk Fact Sheet (<http://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet>) (National Cancer Institute)

Last Updated 6/13/2016

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Healthy Children (/English) > Safety & Prevention (<https://www.healthychildren.org/English/safety-prevention>) > All Around (<https://www.healthychildren.org/English/safety-prevention/all-around>) > Electromagnetic Fields: A Hazard to Your Health?

SAFETY & PREVENTION

Electromagnetic Fields: A Hazard to Your Health?

Household Appliances:

For most people, their highest magnetic field exposures come from using household appliances with motors, transformers, or heaters.



- If a parent is concerned about electric and magnetic field exposure from appliances, identify the major sources of exposure and limit a child's time near those appliances.
- Manufacturers have reduced magnetic field exposures from electric blankets (since 1990) and from computers (since the early 1990s).
- Because magnetic fields decline rapidly with increasing distance, an easy measure is to increase the distance between children and the appliance.

Power Lines:

A Massachusetts study published back in 1993 showed a significant association between proximity to power lines and depressive symptoms; that is, people who were able to see the towers from their house or yard were nearly 3 times more likely than those living farther away to experience depression. A Finnish study done a few years later confirmed a much higher risk of severe depression among those living within 100 yards of a power line.

There remains some degree of uncertainty in the literature on electric and magnetic field exposure and developing cancer (/English/health-issues/conditions/cancer/Pages/default.aspx). This uncertainty should be considered in the context of the low individual risk and the comparable environmental risks (eg, traffic accidents) in other locations.

Obtaining magnetic field measurements in the home sometimes will show that field levels are at approximately the average level despite proximity to the power line.

Cell Phones:

In recent years, concern has increased about exposure to radio frequency electromagnetic radiation emitted from cell phones and phone station antennae. An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing:

- Headaches (/English/health-issues/conditions/head-neck-nervous-system/pages/Headaches.aspx)
- Memory problems
- Dizziness (/English/health-issues/conditions/head-neck-nervous-system/Pages/Dizziness-and-Fainting-Spells.aspx)
- Depression (/English/health-issues/conditions/emotional-problems/pages/Childhood-Depression-What-Parents-Can-Do-To-Help.aspx)
- Sleep problems

Short-term exposure to these fields in experimental studies have not always shown negative effects, but this does not rule out cumulative damage from these fields, so larger studies over longer periods are needed to help understand who is at risk. In large studies, an association has been observed between symptoms and exposure to these fields in the everyday environment.

Last Updated 11/21/2015

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Jennifer Lowry, MD
Chair of the AAP Council on Environmental Health
Director of MAPEHSU
Chief, Section of Toxicology
Pediatrician, Department of Pediatrics
Children's Mercy Hospital
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October 27, 2016

Dear Dr. Jennifer Lowry,

We were delighted to learn that based on the cancer findings from the National Toxicology Program (NTP) study on cell phone radiofrequency radiation (RFR), the American Academy of Pediatrics has reconfirmed its recommendation to limit exposure of children and teenagers to cell phones and other devices that emit RFR. However, along with that recommendation were four statements that downplayed the significance of the results from the NTP study. We are referring to the [Healthy Children.org AAP webpage with Ten Cell Phone Safety Tips](#).

Our comments provided below are intended to provide clarification on the reliability of available data on cancer risks associated with exposure to cell phone RFR. Based on the accumulating scientific evidence of increased cancer risk from cell phone RFR, it is necessary that health agencies and individuals promote precautionary measures now rather than waiting for absolute proof of human harm.

Statement 1: *“While there was a slight increase in a type of brain tumor, called a glioma, in a small group of people who spent the most total time on cell phone calls in one study, other studies have not found this to be true.”*

Response: In their evaluation of the cancer risk of radiofrequency radiation, an expert working group of the International Agency for Research on Cancer (IARC) noted that brain cancer risks were increased significantly after 10 years of use, and risk levels were greatest on the side of the head on which users held their cell phones. Risks of glioma and acoustic neuroma were increased significantly in the multicenter Interphone case-control study as well as in pooled case control studies of Northern European countries that were included in the Interphone study, and in case control studies by Hardell et al. in Sweden¹²³⁴⁵⁶⁷⁸. The classification of RFR as a possible human

¹ Schoemaker, M. J., Swerdlow, A. J., Ahlbom, A., Auvinen, A., Blaasaas, K. G., Cardis, E., ... & Klæboe, L. (2005). Mobile phone use and risk of acoustic neuroma: results of the Interphone case-control study in five North European countries. *British Journal of Cancer*, *93*(7), 842-848.

carcinogen by IARC was based on “positive associations observed between exposure to radiofrequency radiation from wireless phones and glioma, and acoustic neuroma,” and for which a causal relationship was considered to be credible⁸⁹. Those associations were not considered to represent “sufficient evidence of carcinogenicity” at that time because recall bias in the case-control studies could not be fully ruled out as a possible contributing factor.

Since the IARC classification additional published studies indicate an association with increased tumor formation¹⁰¹¹¹²¹³¹⁴.

Statement 2: “*This study (NTP) was only done on rats. While rats can be good test subjects for medical research, they are not the same as humans. We do not yet know if the same results would occur in people.*”

The findings of brain tumors (gliomas) and malignant Schwann cell tumors of the heart in the NTP study, as well as DNA damage in brain cells of exposed animals, present a major public health concern because these tumors occurred in the same types of cells that had been reported to develop into tumors (gliomas and acoustic neuromas) in epidemiological studies of adult cell phone users.

Carcinogenicity studies in rodents are useful for several important reasons: (1) animals and humans exhibit similarities in biological processes of disease induction (that is why animal models are used in preclinical trials of new pharmaceutical agents), (2) it is unethical to intentionally expose humans to agents in order to test for adverse health effects such as cancer, (3) every agent that is known to cause cancer in humans is carcinogenic in animals when

² Lahkola, A., Auvinen, A., Raitanen, J., Schoemaker, M. J., Christensen, H. C., Feychting, M., ... & Tynes, T. (2007). Mobile phone use and risk of glioma in 5 North European countries. *International Journal of Cancer*, *120*(8), 1769-1775.

³ INTERPHONE Study Group. (2010). Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. *Int. J. Epidemiol.*, *39*(3), 675-94.

⁴ INTERPHONE Study Group. (2010). Supplementary Material - Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. *Int. J. Epidemiol.*, *39*(3), 675-94.

⁵ INTERPHONE Study Group. (2011). Acoustic neuroma risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. *Cancer Epidemiol.*, *35*, 453-64.

⁶ Cardis, E. et al. (2011). Risk of brain tumours in relation to estimated RF dose from mobile phones: results from five Interphone countries. *Occup. Environ. Med.*, *68*(9), 631-40.

⁷ Hardell L., Carlberg M., & Hansson M.K. (2011). Pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones including living and deceased subjects. *Int J Oncol.*, *38*(5):1465-74.

⁸ Han, Y. Y., Kano, H., Davis, D. L., Niranjan, A., & Lunsford, L. D. (2009). Cell phone use and acoustic neuroma: the need for standardized questionnaires and access to industry data. *Surgical neurology*, *72*(3), 216-222.

⁹ International Agency for Research on Cancer. (2011). IARC classifies radiofrequency electromagnetic fields as possibly carcinogenic to humans. *Press release*, (208).

⁹ IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. (2013). Non-ionizing radiation, Part 2: Radiofrequency electromagnetic fields. *IARC monographs on the evaluation of carcinogenic risks to humans/World Health Organization, International Agency for Research on Cancer*, *102*(2), 1-460.

¹⁰ Coureau, G. et al. (2014). Mobile phone use and brain tumours in the CERENAT case-control study. *Occup Environ Med.*, *71*(7), 514-22.

¹¹ Lerchl, A., Klöse, M., Grote, K., Wilhelm, A. F., Spathmann, O., Fiedler, T., ... & Clemens, M. (2015). Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans. *Biochemical and biophysical research communications*, *459*(4), 585-590.

¹² Hardell, L., & Carlberg, M. (2015). Mobile phone and cordless phone use and the risk for glioma—Analysis of pooled case-control studies in Sweden, 1997–2003 and 2007–2009. *Pathophysiology*, *22*(1), 1-13.

¹³ Hardell, L., Carlberg, M., Söderqvist, F., & Mild, K. H. (2013). Case-control study of the association between malignant brain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use. *International Journal of Oncology*, *43*(6), 1833-1845.

¹⁴ Hardell, L., & Carlberg, M. (2013). Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. *Reviews on environmental health*, *28*(2-3), 97-106.

adequately tested (IARC, preamble), (4) almost one-third of human carcinogens were identified after carcinogenic effects were found in well-conducted animal studies, (5) animal studies can eliminate the need to wait for a high incidence of human cancers (which may clinically manifest as much as 30 years from time of first exposure) before implementing public health-protective strategies, and (6) the control of exposure conditions in animal studies can eliminate the potential impact of confounding factors on the interpretation of study results.

Statement 3: *“The rats were exposed to very large amounts of radiation—nine hours a day, seven days a week, for two years. This is far more than most people spend holding their cell phones.”*

Response: While the exposure limit to RFR by the Federal Communications Commission is 0.08 W/kg averaged over the whole body, the localized exposure limit is 1.6 W/kg averaged over any one gram of tissue. For cell phone users, body tissues located nearest to the phone’s antenna receive higher exposures than tissues located distant from the antenna. Thus, when an individual holds a cell phone next to his or her head, exposure to the brain will be much higher than exposures averaged over the whole body. When considering organ-specific risk (e.g., risk to the brain) from cell phones, the important measure of exposure is the 1.6 W/kg value. Cell phone manufacturers provide values for their phone’s emissions. Many cell phones emit radiation that can produce local doses near 1.6 W/kg. In the NTP study in which animals were exposed to 1.5, 3, and 6.0 W/kg RFR, exposures in the brain were within 10% of the whole body exposure levels. Therefore, with respect to exposures to the brain, exposures of rats to RFR were similar to or slightly higher than human exposures from cell phones held next to the head.

Experimental carcinogenicity studies are generally conducted in small groups of rodents (approximately 50 animals of each sex and species per exposure or control group), and incidence values of adverse effects are used to assess health risks to potentially millions of exposed people. While an increased incidence of 1% in an experimental study would not be statistically significant, such an increase or even an increase in brain cancer risk of 0.001% in the general population would be dreadful; this concern is particularly pertinent for cell phones as there are more than 250 million cell phone users in the US and more than 4 billion users worldwide. Thus, to identify a hazardous agent, exposure levels in animal studies are often much higher than human exposures, while lower doses are included for analyses of dose-response relationships and assessments of human health risks. The NTP study of RFR could not use exposure intensities much higher than that of cell phones in order to prevent any measurable increases in body temperature. Consequently, the duration of exposure was extended to nine hours a day to determine whether cell phone radiation could cause adverse health effects and to provide data to characterize dose-response relationships for any detected effect and to assess human risk.

Statement 4: *“More male rats developed cancerous tumors after being exposed to the radiation than female rats. Some of the rats who developed tumors lived longer than the control group rats that were not exposed to radiation.”*

While the incidence of brain tumors and schwannomas of the heart was greater in exposed male rats than in female rats, these rare and uncommon tumors were observed only in RFR exposed

animals of both sexes with none observed in the controls. In addition, pre-cancerous lesions (glial hyperplasia and Schwann cell hyperplasia) were observed only in RFR exposed male and female rats. Observing numerical differences in response between the sexes is common in animal carcinogenicity studies as well as in human populations. For example, brain cancer mortality rates are approximately 50% higher in men than in women, and for many human cancers (e.g., colon-rectal, liver, soft tissue including heart, kidney, non-Hodgkin lymphoma, etc.) the incidence and mortality rates are much higher in men than in women. The different response rate between male and female rats in the RFR study does not alter the relevance of the cancer findings from this study.

The criticism that exposed rats lived longer than control rats, which might have affected the tumor findings, is an inaccurate portrayal and interpretation of the data for at least two reasons. First, there was no statistical difference in survival between control male rats and the exposure group with the highest rate of gliomas and heart schwannomas (male rats exposed to CDMA modulated RFR at 6 W/kg). Second, no glial cell hyperplasias (potential pre-cancerous lesions) or heart schwannomas were observed in any control rat, even though glial cell hyperplasia was detected in a CDMA-exposed rat as early as week 58 and heart schwannomas were detected as early as week 70 in exposed rats during the 2-year study. Thus, survival was sufficient to detect tumors or pre-cancerous lesions in control male rats. The exclusive findings of these tumors and pre-cancerous lesions in exposed animals support the carcinogenic potential of RFR in living organisms.

We hope these comments are helpful to you as the AAP develops future recommendations to protect children from adverse effects of RFR. It is also important to note that actively used cell phones are not the exclusive source of exposure to RFR, other sources of daily exposures include cell phones powered on even when not communicating, Wi-Fi devices, cordless phones and cell towers. Babies, toddlers and preschoolers are handed iPads and tablets as toys to play games and watch movies on. Many young children engage in wireless streamed content through devices resting on their laps, yet parents are unaware such Wi-Fi connectivity results in radiofrequency exposure to their bodies.

For children, health risks may be greater than that for adults because of greater penetration and absorption of cell phone radiation in the brains of children and because the developing nervous system of children is more susceptible to tissue damaging agents.

Sincerely,

Ron Melnick PhD

Senior Toxicologist and Director of Special Programs in the Environmental Toxicology Program at the National Institute of Environmental Health Sciences (NIEHS), National Institutes of Health, now retired.

Devra Davis, PhD MPH

President and Founder [Environmental Health Trust](#)

Visiting Professor Hebrew University Hadassah Medical Center

Does Cell Phone Use Cause Brain Cancer? What the New Study Means For You

Groundbreaking study reveals the strongest link yet between cell phone radiation and cancer. Important advice for all consumers.

By Jeneen Interlandi

May 27, 2016

The [results of a new study](#) by the National Toxicology Program—the largest and most expensive study of its kind—show a link between cell phone radiation and cancer in rats.

For many people, these findings likely raise questions and concerns about the safety of devices that we now carry with us nearly all the time.

Consumer Reports health and safety experts, who have long been concerned about the potential risks of cell phones and urged precautions when using them, say the new study supports that caution.

"Consumers don't need to stop using their phones," says Michael Hansen, Ph.D., a senior scientist with Consumer Reports who has studied this issue for years. "But there are some simple, common-sense steps you can and should take to reduce your exposure."

Specifically, Consumer Reports recommends that you:

- Try to keep the cell phone away from your head and body. Keeping it an arm's distance away significantly reduces exposure to the low-level radiation it emits. This is particularly important when the cellular signal is weak—when

your phone has only one bar, for example—because phones may increase their power then to compensate.

- Text or video call when possible, because this allows you to hold the phone farther from your body.
- When speaking, use the speakerphone on your device or a [hands-free headset](#).
- Don't stow your phone in your pants or shirt pocket. Instead, carry it in a bag or use a belt clip.

Below, answers to other basic questions about the study and what it means for you and your family.

So What Did This New Study Find?

The [study](#) found that male rats had a higher incidence of two kinds of tumors when exposed to the same type of radiation emitted by cell phones.

The results are not conclusive, and the overall relevance to human cell phone use is something that's "not currently completely worked out," said John Bucher, Ph.D., associate director of the NTP, part of the National Institutes of Health.

But the [new report](#) adds weight to human epidemiological studies that have previously raised similar concerns, and when combined with those earlier studies, is poised to force a reconsidering among federal agencies of the potential risks posed by cell phones. "In my experience," Bucher said, "the people who have reviewed our findings agree with the findings."

A spokesman for CTIA, a trade group for the wireless industry, says "Numerous international and U.S. organizations, including the U.S. Food and Drug Administration, World Health Organization, and American Cancer Society, have determined that the already existing body of peer-reviewed and published studies shows that there are no established health effects from radio frequency signals used in cellphones."

Why Should I Be Worried About a Study Using Rats?

Animal studies are actually the gold standard for determining cancer risk, for several reasons.

For one, it is unethical to expose humans to suspected carcinogens in a lab setting.

Second, studies in animals such as rats and mice can be completed much more quickly than they can be in humans, simply because their lifespans are so much shorter than ours. For example, the new NIH study involved exposing the rodents to cell phone radiation for just two years.

Finally, animal studies can validate results of previous observational studies in humans. Those studies, which track large groups of people over time, can look for associations between how many hours people said they used cell phones every day and the incidence of cancers in those people, but they can't prove a cause and effect relationship. Laboratory studies in rats, showing that exposure to cell phone radiation can cause cancers compared to a similar non-exposed group of rats, give credence to the results of observational human studies, and point strongly to cause and effect.

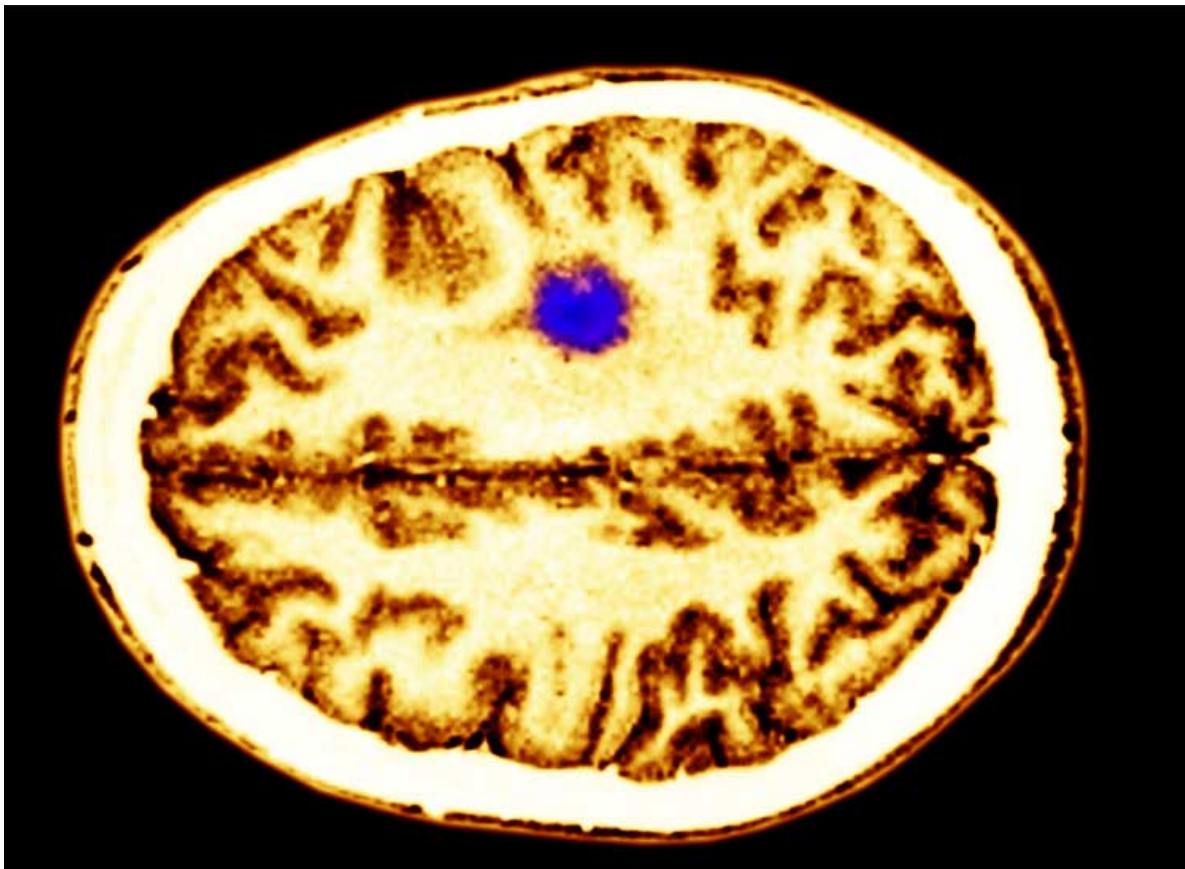
What Do Studies in Humans Show?

The current animal studies are worrisome precisely because they do line up with the results of some previous observational studies in humans.

Last year, [Consumer Reports reviewed that research](#), focusing on five large population studies that investigated that question. Together the studies included more than a million people worldwide, comparing cell phone users with nonusers.

Three of the studies—one from Sweden, another from France, and a third that combined data from 13 countries—suggest a connection between heavy cell phone use and gliomas, the same kind of tumors detected in the new NIH study. Those tumors are usually cancerous and often deadly.

One of those studies also hinted at a link between cell phones and acoustic neuromas (noncancerous tumors); that kind of tumor is related to the second cancer detected in the current study, malignant schwannoma of the heart.



This MRI shows a possible glioma in a human brain. The NIH study suggests cell phones radiation could cause that kind of cancer in rats.

How Might Cell Phone Radiation Cause Cancer?

Scientists [previously thought](#) that the radiation from cell phones might damage cells by heating human tissue. At high power levels radiofrequency waves—the kind emitted by cell phones—can heat up water molecules. Since human tissue is mostly water, scientists hypothesized that those waves might cause damage by heating.

The Federal Communications Commission’s cell phone emission test—which all cell phones must pass before being allowed on the market—is based on that principle.

But in 2011, scientists at the NIH found that low level radiation, held close to the head, could alter brain cells without raising body temperatures. Likewise, in 2015, German researchers reported that the same type of radiation emitted by cell phones could promote the growth of brain tumors in mice without raising body temperatures.

The NTP study controlled for heating effects by making sure that the body temperatures of exposed rats did not increase by more than 1° C (1.9° F), suggesting that the cancers were triggered by some other mechanism.

Read our previous coverage about the potential dangers of radiation from [cell phones](#) and [CT scans and X-rays](#).

How Well Does the NTP Study Mimic Current Cell Phone Usage?

The study used specially designed chambers that allowed researchers to expose rodents to standardized doses of radiation. The rodents were exposed for nine hours total each day, at intervals of 10 minutes on, 10 minutes off, for two years.

The radiation frequencies and signal modulation used were the same used by 2G (GSM or CDMA) phones, which were standard when the study began. Newer cell phones use 3G (such as UMTS or CDMA-2000) or 4G (LTE), which may have lower power outputs and different signal modulation.

“These changes may be a critical difference in whether there is a hazard today,” says Consumer Reports’ Hansen. “But the study raises enough concern with the older technologies that we recommend an additional study be done with current technology.”

The rodents were exposed over their entire bodies. While that’s obviously different than the way humans use cell phones, the rodent results are still revealing, Hansen says.

“The reason we see schwannomas in the heart here, and not the auditory system, could be due to the fact that in rodents the heart is closer to the surface of the body,” he says. “What’s more important is that the cell type found in the heart in the NTP study is the same as in some brain tumors found in several human epidemiology studies.”

What Does Consumer Reports Think the Government and Industry Should Do Now?

The substantial questions and concerns raised by this and previous research regarding cell phones and cancer requires swift and decisive action by the government and industry. Specifically, Consumer Reports believes that:

- The National Institutes of Health should commission another animal study using current cell phone technology to determine if it poses the same risks as found in this new study.
- The Federal Communications Commission should update its requirements for testing the effect of cell phone radiation on human heads. The agency's current test is based on the devices' possible effect on large adults, though research suggests that children's thinner skulls mean they may absorb more radiation. The FCC should develop new tests that take into account the potential increased vulnerability of children.
- The Food and Drug Administration and the FCC should determine whether the maximum specific absorption rate of 1.6 W/kg over a gram of tissue is an adequate maximum limit of radiation from cell phones.
- The Centers for Disease Control and Prevention should repost its advice on the potential hazard of cell phone radiation and cautionary advice that was taken down in August 2014.
- Cell phone manufacturers should prominently display advice on steps that cell phone users can take to reduce exposure to cell phone radiation.



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October 27, 2016

**RE: Maryland Children's Environmental Health and Protection Advisory Council
Recommendations to Reduce Children's Exposure to Radiofrequency Radiation**

Dear Dr. Clifford S. Mitchell, Chair of the Maryland Children's Environmental Health and Protection Advisory Council;

We are writing in strong support of the Maryland Children's Environmental Health and Protection Advisory Council's recommendations to reduce children's exposure to radiofrequency radiation.

In this letter we would like to clarify the importance of the recent findings of the National Toxicology Program Study of Radiofrequency Radiation detailed in the [Report of Partial findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats \(Whole Body Exposure\)](#) in regards to the upcoming recommendations of the Council.

When the study was [nominated by the FDA](#) little was known about possible health effects of long-term exposure to non-thermal levels of cell phone RFR. Guidelines for RFR exposure established by the Federal Communications Commission (FCC) in 1997 were at that time and to this day based largely on protection against acute injury from thermal effects.

Therefore, the NTP study was designed to test the null hypothesis. The objective was to test the hypothesis that radiofrequency radiation (RFR) *could not cause* adverse health effects (i.e., hazard ID) and to provide data to characterize dose-response relationships for any detected toxic and/or carcinogenic effects of cell phone radiofrequency radiation (RFR) in Sprague-Dawley rats and B6C3F1 mice exposed unconstrained in reverberation chambers. The resulting data could then be used to assess risks to human health.

The NTP study is the largest most carefully designed animal study ever done on radiofrequency radiation. Approximately four thousand rodents were used in the NTP studies to evaluate the potential toxicity and carcinogenicity of RFR in animal models. First, pilot studies and subchronic studies were conducted to determine the maximum intensity of RFR radiation that could be employed without inducing any heating effect. Then the final two year chronic studies exposed rodents prenatally and for the majority of their lifetime (up to 24 months) utilizing the information from the pilot and subchronic studies. Exposure conditions in the chronic study were carefully established to provide uniform RFR intensities to rats (1.5, 3, and 6 W/kg) that are similar to or slightly higher than the FCC localized exposure limit of 1.6 W/kg, and which have been reported to be emitted by many cell phones. These levels were determined not to change the body temperature of the animals.

Exposed male rats had statistically significant increased numbers of very rare tumors--malignant gliomas and schwannomas of the heart. These findings provide consistency with epidemiological reports of increases in gliomas and acoustic neuromas (schwann cells) among humans exposed to cell phone radiation. The cells that become cancerous in the rats were the same types of cells as those that have been reported to develop into tumors in human epidemiological studies.

Not only were cancers of the brain and heart statistically increased in the male rats but the NTP also reported statistically significant evidence of DNA damage from nonthermal exposure in mice as well as in rats (male rats: frontal cortex, hippocampus, liver, blood; male mice: frontal cortex; female rats: frontal cortex; female mice: liver, blood).

As a senior scientist with the National Toxicology Program, Ron Melnick PhD was one of 22 experts who participated in the World Health Organization (WHO) International Agency for the Research on Cancer (IARC) evaluation of RFR five years ago. At that time, IARC classified RFR as possibly carcinogenic to humans largely based on positive associations that had been observed between long term cell phone use and malignant brain tumors and tumors of Schwann cells that surround the auditory nerve leading from the inner ear to the brain (acoustic neuroma). Brain cancer risks were increased significantly after 10 years of use, and risk levels were greatest on the side of the head on which users held their cell phones. Based on the evidence available in 2011, a causal relationship was considered to be credible, and deemed by IARC as "limited evidence of carcinogenicity."

However, the IARC working group did not conclude that there was "sufficient evidence of carcinogenicity" (i.e., causal relationship had been firmly established), because recall bias in the case-control studies could not be fully ruled out as a possible contributing factor. At that time there was not sufficient evidence of carcinogenicity in experimental animals because no comprehensive research had been done that adequately tested for long term effects in an animal study. *That* was 2011.

Now in 2016, the National Toxicology program provides us with significant new scientific evidence of carcinogenicity in experimental animals. In addition to the NTP, additional experimental research has found a tumor promoting effect. A [2015 study](#) (replicating a [2010](#)

[study](#)) found that weak RFR can promote the growth of lymphomas, lung and liver tumors in mice. The human evidence has increased as well with more published research finding associations between long term RFR exposure and brain cancer ([Coureau et al., 2014](#), [Hardell et al., 2014](#), [Morgan et al. 2015](#).)

Conclusions:

The NTP tested the hypothesis that low level RFR radiation could not cause health effects and that hypothesis has now been disproved. The NTP study results clearly show that low level RFR can cause adverse health effects. According to NIEHS, the majority of NIH scientists who reviewed the NTP data agree that the RFR exposure caused the tumors in exposed rats.

Our federal government has based RFR exposure limits on the now invalidated assumption that RFR at low levels is unable to cause health effects. Cancer, genotoxicity and organ damage are serious health effects shown to be caused by non-thermal RFR exposures in the NTP study. This study, in the context of the current body of research where hundreds of studies also find adverse biological effects at seemingly low levels, *has shifted the paradigm*.

It is likely that health risks would be higher for children because of greater penetration and absorption of cell phone radiation in the brains of children and because of increased susceptibility of the child's developing nervous system. It is also important to note that actively used cell phones are not the exclusive source of exposure to RFR, other sources of daily exposures include cell phones powered on even when not communicating, Wi-Fi devices, cordless phones and cell towers.

Based on this new information, regulatory agencies should make strong recommendations for the public to take measures to reduce RFR exposure. The recommendation to take precautions "if you are concerned" or "if you are worried" is inadequate. A policymaker's recommendation for children and pregnant women to reduce exposure to cell phones and wireless devices is responsible action informed by the best available science.

We are writing you in strong support of the Maryland Children's Environmental Health and Protection Advisory Councils recommendations to inform schools, clinicians and the public on this critically important environmental health issue. Radiofrequency radiation exposure should be reduced as much as possible in schools and at home where children spend most of their time to protect their health and well being.

Sincerely,

Ron Melnick PhD

Senior Toxicologist and Director of Special Programs in the Environmental Toxicology Program at the National Institute of Environmental Health Sciences (NIEHS), National Institutes of Health, now retired.

Devra Davis, PhD MPH

President and Founder Environmental Health Trust

Visiting Professor Hebrew University Hadassah Medical Center



Radiofrequency Radiation Exposures to Children in Schools
Comments to the Maryland Children's Environmental Health and Protection Advisory Council
On the Children's Health and Radiofrequency Exposures Report

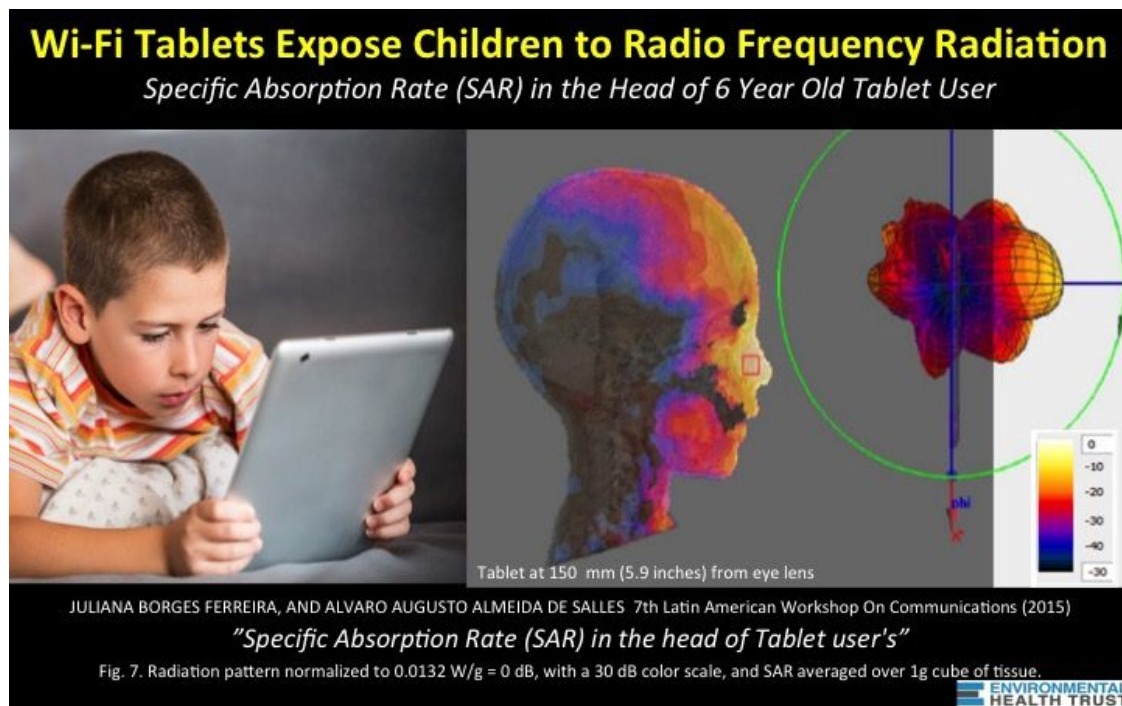
This document contains comments to the [Draft WiFi Report](#) to be discussed by the Council on September 19, 2016.

What radiofrequency radiation (RF) exposures are children receiving while in schools?

RadioFrequency exposure to children is cumulative (it adds up over time), involuntary (they are unaware and have no choice) and comes from multiple transmitters in the current classroom environment. Children spend most of their time at home and in schools and that is why school exposures are a critical area of exposure for children.

The school environment is unique in that it has a *high density* of radio frequency transmitters in a *small* space. Sources of radiofrequency radiation in classrooms include WLAN access points, cell phones, fitness trackers, wearables *and* wireless tablets, laptops, computers, clickers, mouse, printer, virtual reality and gaming devices. Many schools have a cell tower on school land with radiation coming into classrooms through windows which face the antennas. In addition, some schools have wireless security systems, speakers, paging systems and video cameras. **None of these exposures existed in classrooms a mere decade ago.** They represent a new daily exposure for children.

As an example, a classroom of 30 middle/high school children may have radiation from 31 wireless laptops, 31 cell phones, one high density access point, a wireless printer, 30 wireless class clickers, at least ten fitbits or wearable fitness monitors (connecting to the student's cell phone continuously) *at a minimum*. Even preschool and kindergarten children use [wireless tablets daily](#). Younger grades often utilize wireless tablets with a wireless keyboard and by third grade many have cell phones in pockets.

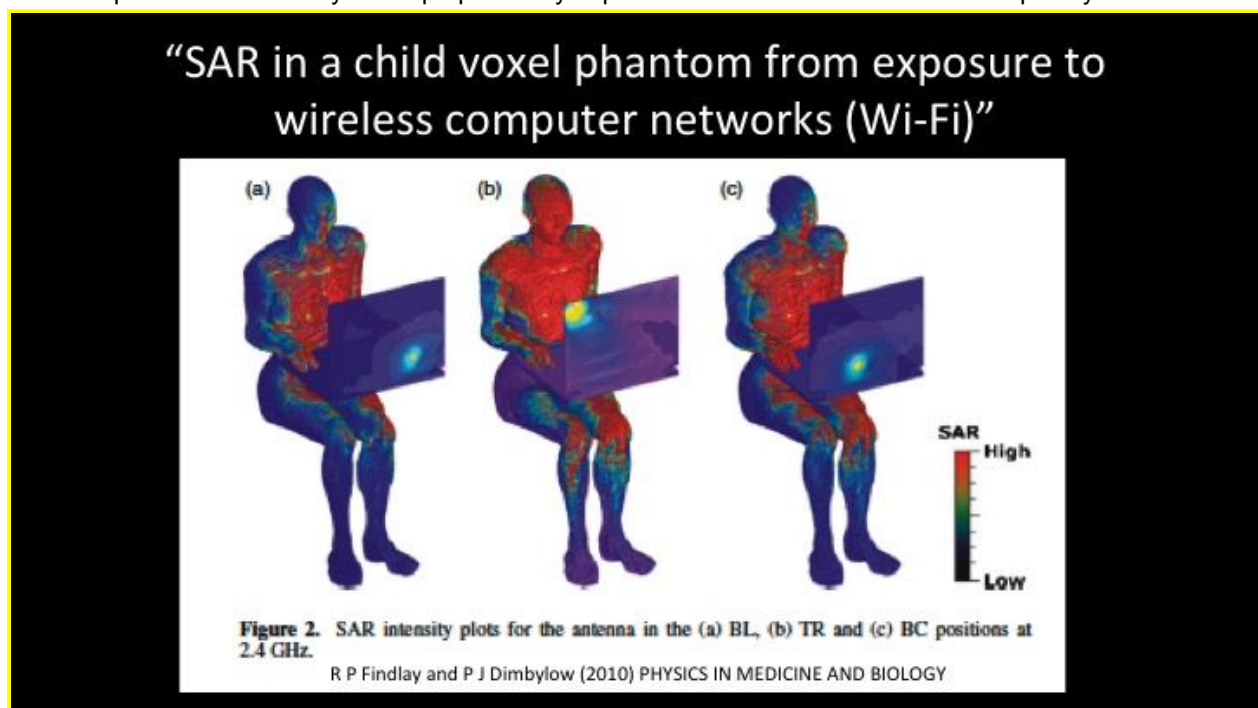


Children are absorbing the highest radiofrequency radiation from **near field** exposures- meaning the transmitting devices nearest to them such as their cell phones and the wireless computer they are using *and* the devices in use by students sitting nearest to them. Children receive **far field** exposure from devices in use across the room, the Wi-Fi access point mounted on the ceiling and any outside transmitters such as a nearby cell tower.

Wi-Fi radiation is not low.

Wi-Fi exposures are erroneously described as “low” because such descriptions are comparing power density levels or SAR measurements to FCC exposure regulations. Indeed, the measurements are low in comparison to FCC regulations or to International guidelines. However, it is all a matter of perspective. In fact, *extremely low levels* of radiofrequency radiation have been shown to have adverse effects. [Please see the Bioinitiative 2012 Chart showing examples of published research showing health effects at such low levels of radiofrequency radiation.](#)

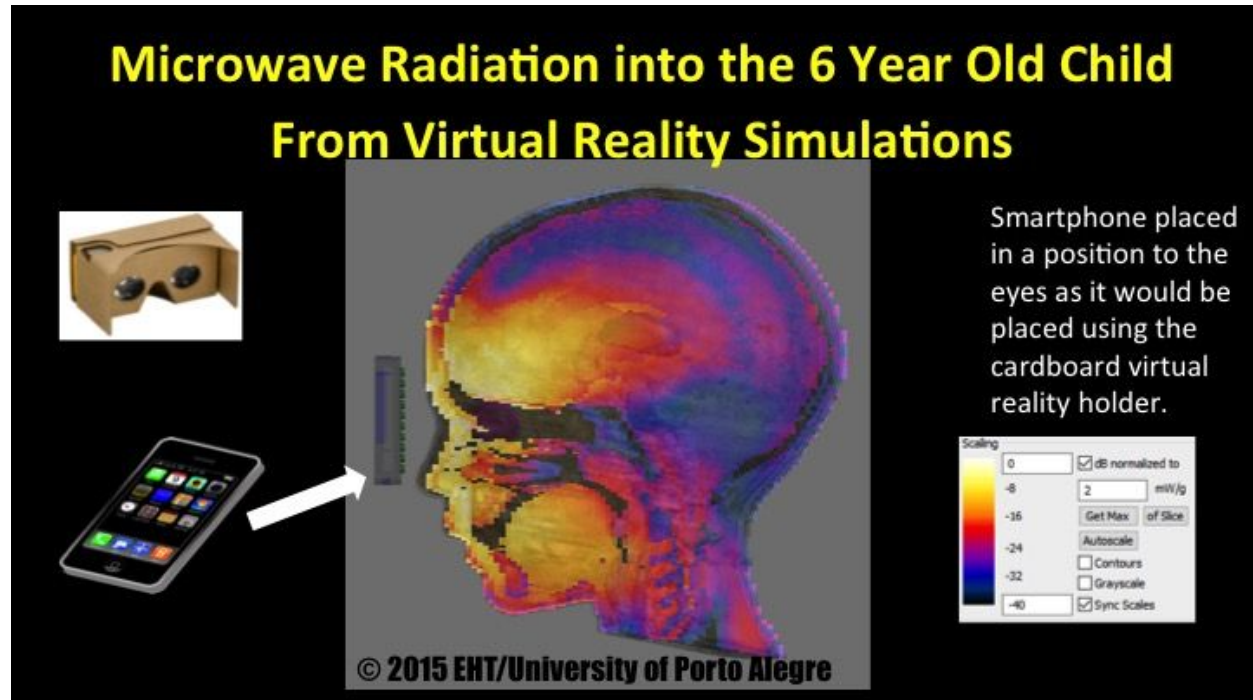
For example, the slide below shows SAR intensity and how the SAR varies depending on the location of the transmitting antennae. The authors clarify how measurements are well below thermally based limits. Thermally based limits **do not consider** biological impacts which occur at non-thermal levels. Wi-Fi radiation penetrates the body and laptops clearly expose the head and chest to radiofrequency radiation.



Virtual reality technology in Classrooms is a growing exposure

Virtual reality field trips -whereby transmitting smartphones are placed in cardboard to the eyes of children- are becoming an increasingly classroom experience and this technology exposes children’s eyes and brain to cell phone radiation **in the near field**. Last year Google brought this technology to Maryland schools as a special one time event and this year Google is making the technology more available to *schools so they can go on regular “virtual” field trips*. Please see this example of radiofrequency exposure from a smartphone

mounted in a cardboard virtual reality case as is used in many Maryland schools last year and learn more about [this scientific imaging here](#).



Variables Impacting Children's Actual Exposures

The amount of radiation a child absorbs is different for each child. Wireless radiation penetrates the body differently depending on the size and unique anatomy of the child. However, research has shown that children absorb proportionately more radiation than adults. "When electrical properties are considered, a child's head's absorption can be over two times greater, and absorption of the skull's bone marrow can be ten times greater than adults " ([Gandhi et al 2011](#)).

Coverage affects a child's exposure. If the signal is poor in a room, the device increases power to connect. So if a cellphone has only one bar, it will put out significantly more power than if the user has all bars. Likewise, if a tablet or laptop is used wirelessly in an area of spotty coverage, the emissions are higher because more power is used to connect the laptop to the router or access point.

Building construction and room furniture can have a significant impact on total exposure because building materials reflect radiofrequency differently. For example, if a student is working at a desk facing a row of metal cabinets, radiation will be reflected *back* at the child likely increasing exposure to the child.

Due the complex high density electromagnetic environment in schools, any discussion of children's RF-EMF exposures in schools must consider *not just* exposures from Wi-Fi access points, *but also* exposures from *all the other devices in use* in the room such as laptops, tablets and cell phones *in addition to nearby base stations*.

Radiofrequency exposures in schools constitutes involuntary exposure for children. Parents and staff need to be fully informed of these exposures just as they are for pesticide applications on school grounds.

What health outcomes are linked to radiofrequency exposure?

Scientists are in agreement that radiofrequency radiation (non-ionizing radiation) at high levels can have a heating effect which is damaging to health because the heat damages tissue, causing blindness sterility and other health issues. Current government FCC exposure limits are set to protect against this effect *only* despite research showing a myriad of *other* serious adverse effects from low *non-heating* levels of radiofrequency radiation.

"Whereas peer reviewed research has demonstrated adverse biological effects of wireless EMF including single and double stranded DNA breaks, creation of reactive oxygen species, immune dysfunction, cognitive processing effects, stress protein synthesis in the brain, altered brain development, sleep and memory disturbances, ADHD, abnormal behavior, sperm dysfunction, and brain tumors;"- [California Medical Association Wireless Resolution 2014](#)

Recently a report was released from The National Toxicology Program (NTP) on the largest ever animal study on cell phone RF radiation and cancer finding an increased incidence of glioma and malignant schwannoma in the heart. Thus, the research showing increased cancer risk in humans has significantly strengthened since the IARC 2011 classification as new research has been published in addition to the NTP study which repeatedly shows a significant association after long term RF radiation exposure in addition to tumour promotion after exposures at low levels.

This document will first detail issues related to the *heating effects* of radiofrequency radiation exposures and then detail issues related to the *non-heating* effects with special emphasis on children.

School children are not adequately informed nor protected from heating effects of radiofrequency radiation and are using devices in violation of FCC instructions.

In order to ensure that wireless devices do not cause hazardous heating of tissue, they are pre-market tested for radiofrequency emission levels at various distances mimicking use at a distance from the body. Every device has instructions in the safety manual stating that "in order to meet FCC limits" the cell phone or laptop must be held at a minimum of this distance away from the body. For example, many cell phones are tested at about half an inch and laptops at about 8 inches. However school children are using cell phones, laptops and other wireless tech in classes for classwork **unaware of these distances.**

Typical student mobile device use use violates FCC instructions. Children are carrying cell phones in pockets and bras and resting cell phones on their laps as they text or scroll the internet. Laptops are used on laps as children sit cross legged on the floor. Such common practices are seen everywhere, yet they are actually in violation of the FCC instructions and could result in non compliance with FCC radiofrequency limits. In other words, children (and staff) could be getting radiofrequency exposures *far higher* than FCC limits.

Examples of the FCC Instructions

Samsung 3G Laptop: "Usage precautions during 3G connection : Keep safe distance from pregnant women's stomach or from lower stomach of teenagers. Body worn operation: Important safety information regarding radiofrequency radiation (RF) exposure. To ensure compliance with RF exposure guidelines the Notebook PC must be used with a minimum of 20.8 cm antenna separation from the body."

Blackberry Bold 9930: "Keep the BlackBerry device at least 0.59 in. (15 mm) from your body

(including the abdomen of pregnant women and the lower abdomen of teenagers) when the BlackBerry device is turned on and connected to the wireless network.”

iPhone 4: " To be sure that human exposure does not exceed the FCC guidelines, always follow these instructions... keep iPhone at least 15 mm (5/8 inch) away from the body, and only use carrying cases, belt clips, or holders that do not have metal parts and that maintain at least 15 mm (5/8) inch separation between the iPhone and the body." To view the information on your iPhone go to Settings > General > About > Legal > RF Exposure.

HP Chromebook 14 G4

“WARNING! Exposure to Radio Frequency Radiation: The radiated output power of this device is below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact is minimized during normal operation of tablet PCs and notebook computers...To avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antennas should not be less than 20cm.

“...Mobile devices are transmitters designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.” [FCC, BULLETIN 65, 1997](#)

Environmental Health Trust has many more examples of FCC instructions at [the EHT website Page on Fine Print](#).

Schools have a duty of care to the students and should inform students and staff about these instructions to assure the devices- used as classroom tools- are not exposing students to radio frequency radiation *that exceed FCC limits*.

Adverse health effects have been shown to occur at radiofrequency levels below FCC limits.

Peer reviewed research has demonstrated a myriad of adverse biological effects from wireless radiation including reproductive damage, DNA breaks, creation of reactive oxygen species, immune dysfunction, stress protein synthesis in the brain, altered brain development, sleep disturbances, cognitive changes, behavioral issues and increased brain tumors.

These effects have occurred at wireless radiation exposure levels hundreds of times lower than presently legal international limits. These effects have occurred *after* exposure to devices that are government approved and legally sold to the public.

In 2016, Dr. Martha Herbert a Harvard pediatric neurologist spoke at the [Pediatric Academic Societies](#) detailing the mechanisms by which EMF/RFR stresses cells, damages cell membranes, damages mitochondria, and can impact brain health. “Given how much we have already learned about the subtle biological, cellular and electrical impacts of EMF/RFR, we need to update our out-of-date regulations to take into account of how exquisitely vulnerable we now know we are.” ([See her slides here](#)). At this professional symposium Yale Chief of Obstetrics Dr. Hugh Taylor discussed risks of cell phone radiation to pregnant women ([See his slides here](#)) and Environmental Health Trust’ Dr. Devra Davis detailed how children were more vulnerable to radiofrequency radiation ([See her slides here](#)). Please see the Appendix for a short compilation on research for several of these health endpoints.

Several recent scientific studies have significantly added to the weight of evidence showing carcinogenic effects at non-heating radio frequency power levels.

- 2016 Results from the [National Toxicology Program](#) study found a carcinogenic effect with a dose response at non- thermal levels in male rats exposed for two years.
- 2015 Results of a replication study [Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans](#), published in *Biochemical and Biophysical Research Communications*, Lerchl et al. replicated an [earlier experiment](#) that found that weak cell phone signals can promote the growth of tumors in mice.
- 2014 Results from a French study [Mobile phone use and brain tumours in the CERENAT case-control study](#), published in *Occup Environ Med*. found a statistically significant association in the heaviest users when considering life-long cumulative duration for meningiomas and number of calls for gliomas.

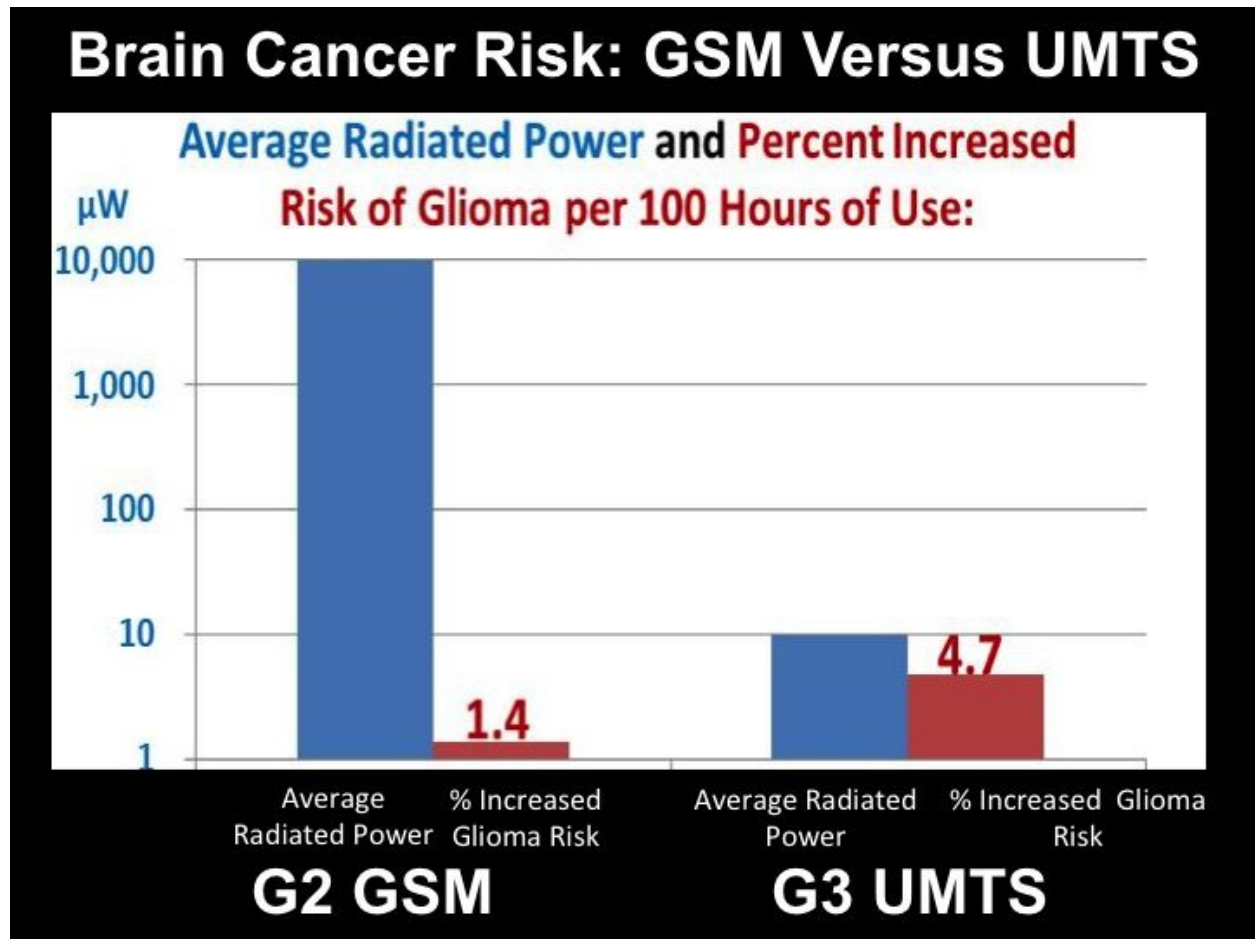
Newer Technology Could be More Dangerous - Even at Seemingly “Low” Power Levels.

Many schools have responded to wireless health concerns by taking power density measurements. Usually, the schools find radiofrequency levels in classrooms to be “well below” FCC limits and then school policymakers decide to keep wireless systems with the flawed assumption that radiation levels below FCC limits is equivalent to “safety”. This is flawed reasoning. Meeting FCC limits *does not* ensure safety.

In fact significant research suggests *low* power may not mean *low* risk. Several studies show adverse health effects at radiation levels thousands of times lower than FCC limits. [The Bioinitiative 2012 RF Color Charts](#) summarize many studies at specific power levels that report biological effects and are relevant to compare with exposures from cell towers, WI-FI, ‘smart’ wireless utility meters, wireless laptops, baby monitors, cell phones and cordless phones.

As a recent example, consider the recent research that compares 2G (GSM technology) to 3G (UMTS-talk, text, and data- Smartphone technology). People usually assume, the more power you absorb, the higher the risk. However, when scientists reviewed the first ever paper that looks at brain cancer risk by type of phone used- 2 or 3 G- they came to [a stunning conclusion](#). The *lower* power 3G UMTS phones had a higher glioma (a type of brain cancer) risk than the *higher* power 2G GSM phones. Although 3G technology has up to 1000 less power, this technology shows a more than three times for glioma in comparison to 2G. These differences speak to the complexity of understanding wireless communication exposures and how various

signal characteristics, such as modulation and waveform must be considered *in addition to power density*.



Pulsed microwaves have been shown to be more biologically active than continuous radiation of the *same* frequency and *same* power level (Pall 2013). Radiofrequency radiation reports that only document average power density in school buildings and compare the levels to FCC limits are **not** the best way to measure the safety of the electromagnetic environment. Compliance with FCC limits *does not mean* that children are safe in school.

FCC radio frequency exposure limits are inadequate to protect children.

Children are not adequately protected by outdated FCC radiofrequency exposure limits for two reasons. First, FCC regulations are not based on up to date science that considers childrens unique anatomy and vulnerability to radiofrequency. Instead FCC regulations are based on research and test methods that employ an adult male model.

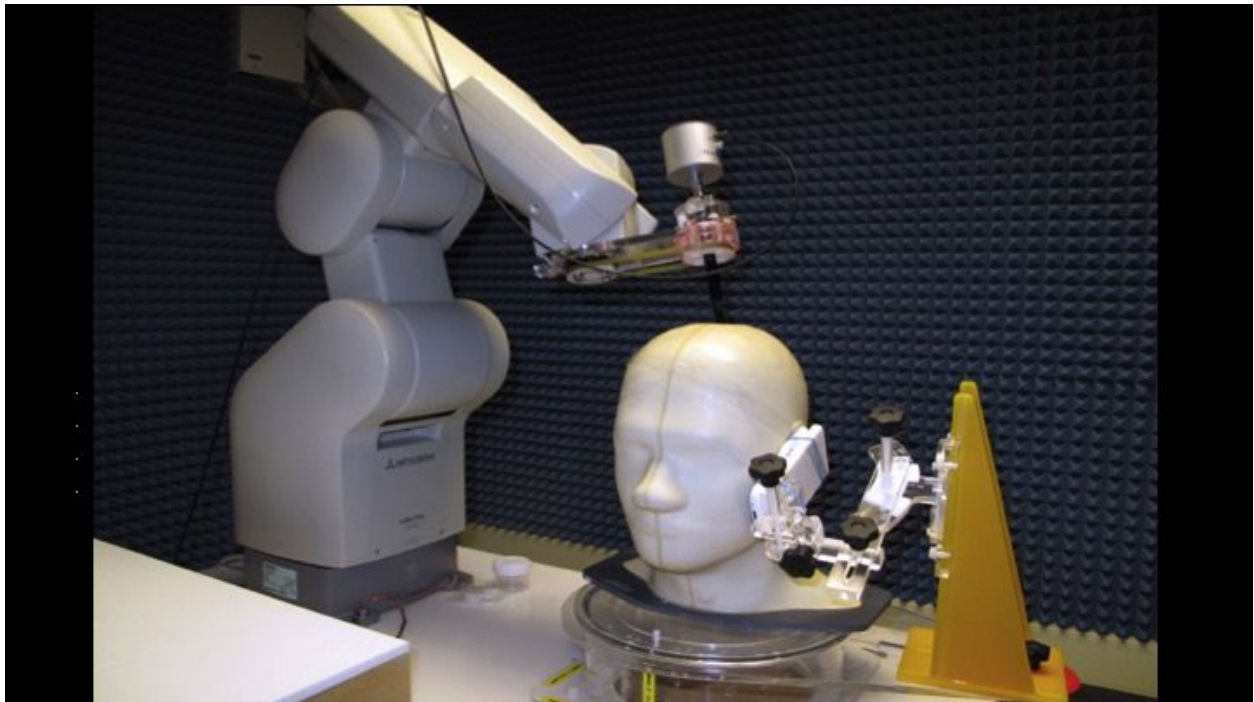
Stem cells are more active in children and research shows that microwaves impact stem cells stronger than other cells.

“The strongest microwave effects were always observed in stem cells. This result may suggest both significant misbalance in DSB repair and severe stress response. Our findings that stem cells are most sensitive to microwave exposure and react to more frequencies than do differentiated cells may be important for cancer risk assessment and

indicate that stem cells are the most relevant cellular model for validating safe mobile communication signals.”

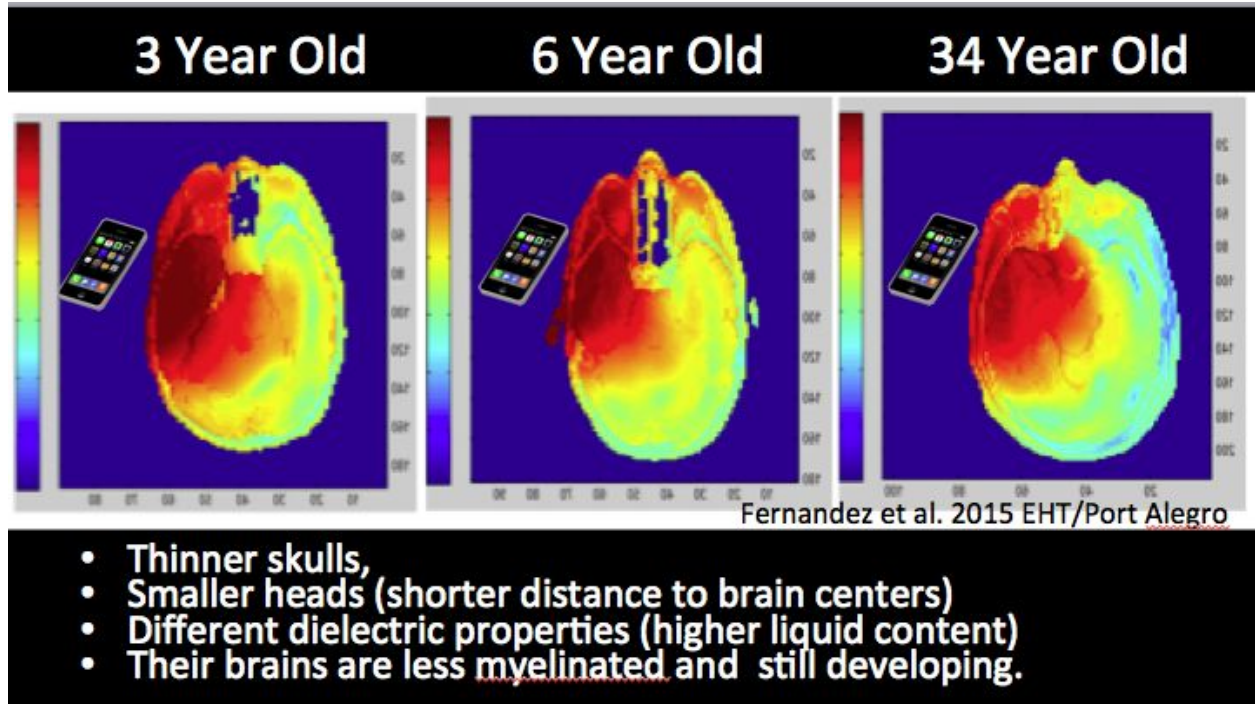
Markovà et al in [Microwaves from Mobile Phones Inhibit 53BP1 Focus Formation in Human Stem Cells More Strongly Than in Differentiated Cells: Possible Mechanistic Link to Cancer Risk.](#)

See below an example of the large head model used for device certification. Children have thinner skulls and more water in their tissues resulting in deeper RF absorption, yet their anatomy is not considered when such a model is utilized.



Second, the FCC has not reevaluated FCC exposure limits since 1996 when they were set based on research from a 1986 Report. Therefore, FCC regulations on human exposure to radiofrequency are out of date **by three decades.**

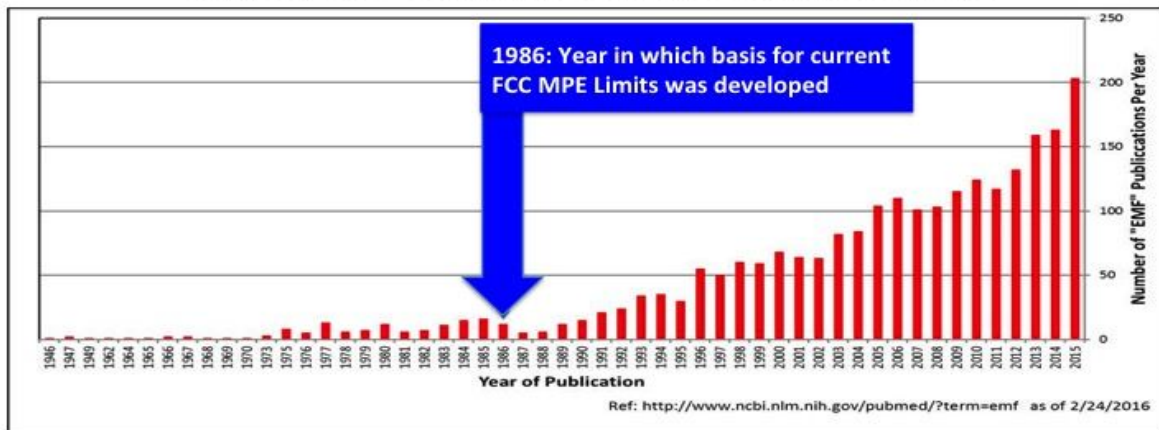
See these images pulled from research from a peer-reviewed paper published in the IEEE/Access entitled "[Dosimetric Simulations of Brain Absorption of Mobile Phone Radiation: the relationship between psSAR and age](#)" by Professors Claudio Fernandez and Alvaro de Salles at Federal Universities of Brazil and Devra Davis of Environmental Health Trust detailing how sophisticated computer imaging can simulate exposures of children's brains to cell phones showing children's increased RF exposure.



In the slide below please note the amount of published research (as found in Pub med) since 1986 on radiofrequency radiation.

FCC RF Human Exposure Levels are Outdated/Based on 1986 Research

Number of "EMF" Publications Per Year on NIH's Pubmed Database



FCC exposure limits are primarily based on 1986 National Council on Radiation Protection and Measurement (NCRP) Report No. 86 "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields" available at <http://www.ncrppublications.org/Reports/086>.

US government and other expert groups have repeatedly stated that FCC limits are outdated, not based on current science and have failed to consider effects on children.

In 2012, the Government Accountability Office (GAO) published their report ["Exposure and Testing Requirements for Mobile Phones Should Be Reassessed"](#) that calls on the FCC to "formally reassess and, if appropriate, change its current RF energy (microwave) exposure limit," and "The Federal

Communications Commission's (FCC) RF energy exposure limit may not reflect the latest research, and testing requirements may not identify maximum exposure in all possible usage conditions."

The FCC opened an inquiry on their outdated human exposure limits in 2013.

In response to the GAO Report, the FCC opened a proceeding in 2012 to explore whether it should change its radiofrequency exposure standards stating, "we specifically seek comment as to whether our current limits are appropriate as they relate to device use by children." Over 900 submissions have been made to the FCC. To access these papers go to the FCC's web site for [Proceeding Number 13-84](#). To date no actions have been taken by the FCC or any other Federal agency since 2013. In other words, nothing has changed since 1996 and no review has been completed. Instead, documents have simply been submitted. It could take years before the agency takes action and actually reviews the submitted documents.

"In the Inquiry we ask whether any precautionary action would be either useful or counterproductive, given that there is a lack of scientific consensus about the possibility of adverse health effects at exposure levels at or below our existing limits. Further, if any action is found to be useful, we inquire whether it could be efficient and practical." -The FCC in 2013

Several agencies and health organizations have raised concerns about FCC limits.

- **The Department of the Interior states** that *"The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."* Read The [2014 Letter](#).
- **The 2008 National Academy of Sciences (NAS) Report, [Identification of Research Needs Relating to Adverse Health Effects of Wireless Communication](#)**, was tasked to identify any inadequacies in the research upon which the current US Radiofrequency radiation (RF) safety guidelines are based. The NAS Report found numerous inadequacies in that research record. The report found significant research gaps in regards to children and identified a priority research area to be to "characterize exposure of juveniles, children, pregnant women, and fetuses, both for personal wireless devices (e.g., cell phones, wireless personal computers, [PCs] and for RF fields from base station antennas including gradients and variability of exposures, the environment in which devices are used, and exposures from other sources, multilateral exposures, and multiple frequencies."
- **The American Academy of Pediatrics** has repeatedly called on the government to update its regulations stating that "Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children." [Read their letter to the FCC in 2013 here](#).
- **The California Medical Association** passed a Wireless Resolution that states :
Whereas scientists are increasingly identifying EMF from wireless devices as a new form of environmental pollution with a growing body of peer reviewed scientific evidence finding significant adverse health and biologic effects on living organisms with exposure to low levels of non-ionizing microwaves currently approved and used in wireless communication, and
Whereas peer reviewed research has demonstrated adverse biological effects of wireless EMF including single and double stranded DNA breaks, creation of reactive oxygen species, immune dysfunction, cognitive processing effects, stress protein synthesis in the brain, altered brain development, sleep and memory disturbances, ADHD, abnormal behavior, sperm dysfunction, and brain tumors; and... **Resolved, That CMA support efforts**

to implement new safety exposure limits for wireless devices to levels that do not cause human or environmental harm based on scientific research. [Read it here](#) . [Read a magazine article on their resolution here](#).

- **The LA School District Uses a RF-EMF Exposure Threshold 10,000 Less Than the FCC Limits:** The OEHS supported a precautionary threshold level that is 10,000 times lower than the current Federal Communications Commission standard. Read the RF Report the LA School District Used to recommend a cautionary exposure level. If the FCC limits are “not outdated” then why would they do this? [RADIOFREQUENCY \(RF\) EVALUATION REPORT Use of Wireless Devices in Educational Settings](#)

Dr. De Kun Li sums up the problem with FCC regulations:

“In summary, we do not currently have scientific data to determine where the safe RF exposure level is regarding the non thermal effects. Therefore, it should be recognized that we are dealing with uncertainty now and most likely for the foreseeable future. The question for government agencies especially those concerned with public health and safety, is, given the uncertainty, should we err on the side of safety and take precautionary measures avoidance measures? *Unknown does not mean safe.* ”

[Letter from Dr. De-Kun Li, MD, PhD, MPH to the FCC](#)

“The FCC **is not a health and safety agency**, we defer to other organizations and agencies with respect to interpreting the biological research necessary to determine what levels are safe.”

[-The Federal Communications Commission in 2013](#)

Scientific authorities and expert groups worldwide have recommended reducing radiofrequency exposures.

The EMF Scientists Appeal

- In May 2015, a group of over 200 scientists from 39 nations who have authored more than 2,000 articles on this topic appealed to the United Nations to address “the emerging public health crisis” related to cell phones and other wireless devices. These scientists state that “the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, and are “insufficient to protect public health.”
- They state that “the various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.” See the International EMF Scientist Appeal at <https://emfscientist.org>.

The French National Agency of Health Security of Food, Environment and Labour

- 2016 “[Radiofrequency Exposure and the Health of Children](#)” Report recommends reducing exposures to young children and strengthening regulations to ensure “sufficiently large safety margins” to adequately protect the health of young children.
- [2013 French Agency for Food, Environmental and Occupational Health & Safety Report](#) recommends hands free phones, SAR labeling, and “limiting the population's exposure to radiofrequencies... especially for children and intensive users, and controlling the overall exposure that results from relay antennas.”

Canadian Parliament Standing Committee on Health of the House of Commons "Radio Frequency Electromagnetic Radiation and the Health of Canadians"

- This [June 2015 Canadian Parliament Report](#) has 12 recommendations including “That the Government of Canada develop an awareness campaign relating to the safe use of wireless

technologies, such as cell phones and Wi-Fi, in key environments such as the school and home to ensure that Canadian families and children are reducing risks related to radiofrequency exposure.”

The Council of Europe Resolution 1815:

- In 2011 The Parliamentary Assembly of the Council of Europe issued [The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment](#). A call to European governments to “take all reasonable measures” to reduce exposure to electromagnetic fields “particularly the exposure to children and young people who seem to be most at risk from head tumours.”
“For children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises.” [Read Resolution 1815](#)

The Vienna Medical Association

The Vienna Medical Association has issued Guidelines on Reducing RF radiation. [Vienna Medical Association Guidelines](#) include : “Make calls at home and at work via the fixed corded (not wireless) network - Internet access via LAN cable (eg via ADSL, VDSL, fiber optic) no Radiation, is fast and secure data transfer. Constant radiation emitters like DECT cordless telephones, WLAN access points, data sticks and LTE Home base stations (Box, Cube etc.) should be avoided!”

The World Health Organization’s International Agency for Research on Cancer

- The WHO/IARC classified all radiofrequency electromagnetic fields as “possibly carcinogenic to humans”. [Read the IARC Monograph](#). [The Lancet article](#) indicates how this applies to all radio frequency electromagnetic fields including Wi-Fi.

Swiss Physicians for the Environment

“the risk of cancer for this type of [wireless] radiation is similar to that of the insecticide DDT, rightfully banned... From the medical point of view, it is urgent to apply the precautionary principle for mobile telephony, WiFi, power lines, etc.” [Read the Swiss Physicians Letter here.](#)

The American Academy of Environmental Medicine

“Adverse health effects, such as learning disabilities, altered immune responses, headaches, etc. 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. ” Read the [The American Academy of Environmental Medicine's Open Letter to the Superintendents of the School Districts of the United States](#)

International Society of Doctors for the Environment and Irish Doctors Environmental Association

- These Societies have made the following recommendations: Avoid Wi-Fi in home or work if possible, particularly in schools or hospitals and Use wired technology whenever possible.
- “Because of the potentially increased risks for the foetus, infants and young children due to their thinner more permeable skulls and developing systems, particularly the immune and neurological systems, based on the precautionary principle and on the mounting evidence for harm at the sub-cellular level, we recommend that EMR exposure should be kept to a minimum.”
- [Read the Statement Here.](#)

Bioinitiative Working Group

In a [Letter to Education Super Highway CEOs](#) the Co-Editors of the Bioinitiative Report Cindy Sage and David Carpenter sent a letter on behalf of the Bioinitiative Working Group to the CEO's on the health risks of wireless infrastructure in US schools stating:

“WiFi in schools, in contrast to wired internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Corporations cannot avoid responsibility simply by asserting compliance with existing legal, but outdated and inadequate FCC public safety limits. Today, corporations that deal with educational technology should be looking forward and helping school administrators and municipal leaders to access safe, wired solutions.” [Read the Letter to Education Super Highway CEOs](#). [Click here to go to the Bioinitiative 2012 Report](#).

The BabySafe Project Joint Statement

- As of August 2016 over 200 physicians, scientists and public health professionals from around the world have signed onto this Project “to express their concern about the risk that wireless radiation poses to pregnancy and to urge pregnant women to limit their exposures.”
- “We call on our elected leaders to support such research and to advance policies and regulations that limit exposures for pregnant women. We call on industry to implement and explore technologies and designs that will reduce radiation exposures until such research is carried out.”
- The BabySafe Project Lists [“Ten Ways to Reduce Your Wireless Exposure”](#) which includes “Whenever possible, connect to the internet with wired cables”. See the Project Website at <http://www.babysafeproject.org/>

What are the policy options to protect children from this risk?

Over a dozen countries officially recommend that cell phone radiofrequency radiation is *reduced* for children and they have enacted policy that protects children.

Haifa Israel has installed Corded connections in all schools and the country of Israel officially recommends wired connections in schools. France has banned Wi-Fi in kindergartens and the Wi-Fi must be turned OFF in schools as the default setting. Belgium has banned cell phones for young children and Wi-fi is prohibited in Ghent.

Several countries have detailed public information on how the public can reduce exposure to cell phones, computers and other wireless devices. Around the world, many private schools are removing the wireless. Please see the Appendix for a full list of International Policy which can serve as useful examples to governments on policy options.

Solutions for schools exist at each level at which radiofrequency exposures are created.

These RF exposures are occurring due to choices made by school policymakers in three ways:

Purchasing: The school decided to purchase a wireless technology system W-LAN plus laptops and/or tablets for internet connectivity and classroom instruction.

Policy: Many schools are creating and passing a Bring Your Own Device Policy allowing a myriad of wireless in the classroom in addition to school issued devices.

School cell tower leasing agreements: School land is increasingly seen as a choice spot to place cell towers because schools are in need of extra funds. Some schools have monopole towers erected (for example, next to ball fields) and other schools have cell antennae directly mounted on buildings. Sometimes cell antennae are mounted near schools and the school is not directly a

decisionmaker but can be a part of the decision making process by commenting on the proposed towers.

Reductions in exposure can occur from actions at each of these levels:

Purchasing: Schools internet connectivity needs can be met by choosing Low EMF technology such as corded connections in the classrooms.

Policy: Schools can develop mobile device policy that minimizes children's exposures such as keeping tablets on tables, not laps, and ensuring cell phones are powered off during classes. .

Leasing agreements: Schools can choose not to lease to cell tower companies where radiation beams will be angled into children's play areas or into classrooms through windows facing the tower.

Recommendations to the Department of Health

The Department of Health should advise the public on ways to reduce radiofrequency exposure from cell phones and wireless devices, with special emphasis on protecting children. For example, the Connecticut Department of Health **issued specific recommendations to reduce exposure stating**, *"It is wise to reduce your exposure to radiofrequency energy from cell phones whenever possible."* [Read the Connecticut Department of Public Health Cell Phone Q and A about Cell phones here.](#)

The Department of Health should create and maintain a webpage with information on how to reduce exposure, just as the [Connecticut Department of Health](#) and [San Francisco](#) and [Burlingame](#) in California have done.

Note: The governments of France, Belgium, Canada, Austria, the United Kingdom (UK) , India, Australia, Germany, Switzerland, Israel, Finland, Greece, Russia, Switzerland, Cyprus, Singapore, Turkey and the Council of Europe all have online [public resources](#) specifically recommending that children's exposure should be reduced or minimized, and governments provide resources detailing how the public can reduce exposure to radiofrequency radiation. As the UK ministry states, *"Government advice is to be on the safe side and limit mobile phone use by children."*

Countries such as France, Israel, Germany, and the state and local governments of Ghent Belgium, Navarra, Vitoria, and the Basque Parliament of Spain, South Tyrol Borgofranco d'Ivrea, Piemonte and Turin Italy, specifically recommend against Wi-Fi or have outright banned Wi-Fi in daycare centers, kindergartens and/or schools. When the plan to remove Wi-Fi from all Haifa Israel schools was announced, Haifa Mayor Yona Yahav was quoted stating, *"When there is a doubt, when it comes to our children, there is no doubt."*

The Department of Health should provide resources that inform doctors and other clinicians about advising patients how to reduce exposure and how to clinically assess Radiofrequency (RF) exposure during patient visits. The Department of Health can create a Factsheet for Parents and a Factsheet for Clinicians that includes interview questions to ask during patient visits.

The Department of Health should provide information to obstetricians and gynecologists so they can provide information to patients about how to reduce exposures during clinic visits. Please see [the BabySafe Project](#) for examples of resources to share with pregnant women.

Recommendations to Schools

Reduce Radiofrequency Field Technology ALARA (As Low As Reasonably Achievable)

In order to reduce classroom RF exposures schools should install Low RF-EMF technology and reduce radiofrequency radiation exposures according to ALARA (As Low As Reasonably Achievable) principles. To reduce children's RF exposure in classrooms, schools can:

- Install corded (non-wireless) LAN systems in classrooms so that teacher and student computers (portable and desktop) connect to the internet without RF radiation exposures.
- Install corded (not cordless) telephones in all classrooms for voice communication and security.
- Choose non-wireless options for all other technology communication such as printers, security, mouse, keyboard, video cameras, HVAC, speakers, headphones, microphones and other accessories.
- Include information on FCC fine print warnings in the Bring Your Own (Mobile) Device (BYOD) Policy.
- Provide adaptors and accessories for personal devices so that devices can be used without radiation emissions in classrooms when needed as classroom tools.
- Post reminder notices in classrooms instructing device users to turn off Wi-Fi, Bluetooth, and any other wireless settings on devices and accessories that connect non-wirelessly (even if they are purses or bags).
- Prohibit cell towers near and on school buildings and grounds.

Partial RF Reduction Measures in Schools

The following measures are not fully protective but only provide a *partial* reduction in radiation exposure. *However, fully wired (non-wireless) systems will eliminate the RF exposure from school technology. With partial or half-measures, children will continue to be exposed to significant RF radiation emitted by wireless devices and by all the building's access points (which transmit radiation continuously) whether exposed as users or bystanders.*

- Ensure all computers, tablets and laptops are used on a table and NOT on a student's lap.
- Ensure students' heads and bodies are at maximum distance from all wireless devices (e.g., children should not lie on the floor with their heads inches from the laptop screen, nor should the lid of the computer behind them be near their back or head.)
- Install a switch for the teacher to turn Wi-Fi routers and access points OFF in classrooms when not in use.
- Plan for wireless download of applications and content onto devices to occur *outside of* school hours. Therefore during the school day the device will be fully loaded and the device's Wi-Fi antennae (and WiFi router or access point) can be turned off while children are using devices.
- Allow students who want to avoid RF to use ethernet and other corded connections for their computers. Most classrooms *already* have an ethernet port on the wall to plug into. (Note: if a child is using an ethernet connected computer but is sitting in close proximity to a child on Wi-Fi or is sitting in front of a child using WiFi then the ethernet using child will still be getting radiation exposures from the nearby WiFi users in addition to the Wi-Fi access point.)
- Ensure that the wireless antennas are always OFF on BYOD Devices.

Note: In several school districts some grades use digital devices in most of their academic classrooms and, thus, partial halfway reductions such as "turn it off when not in use" will have minimal impact as the devices are "in use" for several hours each day. Therefore, the most effective means to reduce exposure for maximum protection is to ensure the school infrastructure is 100% hardwired with ethernet connections.

Educational Curriculum for Schools

- Teach student and teachers *why* and *how* to reduce radiation exposure from technology devices as part of digital citizenship curriculum for students and for staff training.

- Offer educational workshops for parents to learn how to decrease RF exposures at home.
- Post RF reduction “Best Practices” in every classroom.

Manufacturer's Instructions in Cell Phones and Wireless Devices

As digital devices are used as classroom tools, the Department of Education should ensure that students and staff are aware of the FCC instructions for devices they use.

- Students and staff should be informed that wireless devices emit RF radiation and that the device manual specifies separation distances that are necessary between persons and emitting machines in order to avoid exposure that exceeds FCC guidelines.
- Students need to be aware that most laptop instructions specify the separation distance must be at least 20cm (approximately 8 inches) and most cell phone instructions specify a distance under an inch (depending on the make and model). Most districts have (or are moving towards) a Bring Your Own Device Policy, so a variety of models are in use in classrooms.

Please note that the Queensland Department of Education, Training and Employment issued [Your Guide to Safe Technology](#), a guide that informs students that *all wireless devices emit low levels of electromagnetic radiation and students should follow the manufacturer's usage guideline.*

Recommendations to the General Assembly

The General Assembly should consider:

- Funding a public health education initiative on electromagnetic radiation and health.
- Right To Know Legislation requiring that the public is clearly informed that cell phones and “wireless” devices emit radiofrequency radiation and how the public can reduce exposure.
- Legislation that reduces RF exposures to the public with special consideration for child care centers, schools, community centers, municipal buildings and hospitals and other healthcare settings.

APPENDIX

- I. Letters from the American Academy of Pediatrics on Children and Radiofrequency Radiation.
- II. Summary of International Policy Actions on Reducing Wireless Exposures to Children
- III. Sampling of Research on RF-EMF and Health
- IV. US Government Documents on RF Radiation Showing Federal Agency Concerns Over Lack of Protections for Children.

The American Academy of Pediatrics Supports the Right To Know About These Safety Instructions and specifically details these concerns to Congress in 2012 and again to the Federal Communications Commission in 2013 as seen in the attached letters.



August 29, 2013

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

The Honorable Dr. Margaret A. Hamburg Commissioner
U.S. 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 subspecialists, 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." The National Cancer Institute has stated that although studies have not demonstrated that RF energy from cell phones definitively causes cancer, more research is needed because cell phone technology and cell phone use are changing rapidly. These studies and others clearly demonstrate the need for further research into this area and highlight the importance of reassessing current policy to determine if it is adequately protective of human health.

As radiation standards are assessed, 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. McInerney, MD FAAP
President

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™



December 12, 2012

The Honorable Dennis Kucinich
2445 Rayburn House Office Building
Washington,
DC 20515

Dear Representative Kucinich:

On behalf of the American Academy of Pediatrics (AAP), a non-profit professional organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to

the health, safety and well-being of infants, children, adolescents, and young adults, I would like to share our support of H.R. 6358, the Cell Phone Right to Know Act.

The AAP strongly supports H.R. 6358's emphasis on examining the effects of radiofrequency (RF) energy on vulnerable populations, including children and pregnant women. In addition, we are pleased that the bill would require the consideration of those effects when developing maximum exposure 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. It is essential that any new standards for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded through their lifetimes.

In addition, the AAP supports the product labeling requirements in H.R. 6358. These standards will ensure consumers can make informed choices in selecting mobile phone purchases. They will also enable parents to better understand the potential dangers of RF energy exposure and protect their children.

On July 24, the U.S. Government Accountability Office (GAO) published a report on federal cell phone radiation exposure limits and testing requirements. The GAO noted that the Federal Communications Commission's (FCC) most recent data indicates that the number of estimated mobile phone subscribers has grown from approximately 3.5 million in 1989 to approximately 289 million at the end of 2009. Cell phone use behaviors have also changed during that time. The quantity and duration of cell phone calls has increased, as has the amount of time people use mobile phones, while cell phone and wireless technology has undergone substantial changes. Many more people, especially adolescents and young adults, now use cell phones as their only phone line, and they begin using wireless phones at much younger ages.

Despite these dramatic changes in mobile phone technology and behavior, the FCC has not revisited the standard for cell phone radiation exposure since 1996. The current FCC standard for maximum radiation exposure levels is based on the heat emitted by mobile phones. These guidelines specify exposure limits for hand-held wireless devices in terms of the Specific Absorption Rate (SAR), which measures the rate the body absorbs radiofrequency (RF). The current allowable SAR limit is 1.6 watts per kilogram (W/kg), as averaged over one gram of tissue. Although wireless devices sold in the United States must ensure that they do not exceed the maximum allowable SAR limit when operating at the device's highest possible power level, concerns have been raised that long-term RF energy exposure at this level affects the brain and other tissues and may be connected to types of brain cancer, including glioma and meningioma.

In May 2011, the International Agency for Research on Cancer (IARC), the United Nations' World Health Organization's (WHO) agency promoting international cancer research collaboration, classified RF energy as "possibly carcinogenic to humans." In addition, the National Cancer Institute has stated that although studies have not definitively linked RF energy exposure from cell phones to cancer, more research is required to address rapidly changing cell phone technology and use patterns.


This and other research identified by the GAO demonstrates the need for further research on this issue, and makes clear that exposure standards should be reexamined. The GAO concluded that the current exposure limits may not reflect the latest research on RF energy, and that current mobile phone testing requirements may not identify maximum RF energy exposure. The GAO proposed that the FCC formally reassess its limit and testing requirements to determine whether they are effective. The AAP commends the activities proposed under H.R. 6358, as they would address this research gap and improve consumer knowledge and safety. Establishing an expanded federal research program as the basis for exposure standards will ensure that consumer protections incorporate the latest research. Currently, the National Institute of Health (NIH), the only federal agency the GAO identified as directly funding research on this topic, provided approximately

\$35 million from 2001 to 2011. Given this previous funding level, the AAP supports the \$50 million per fiscal year for seven years that H.R. 6358 would authorize.

The AAP appreciates your recognition of the need for new research and standards for mobile phone radiation, and is pleased to support H.R. 6358.

For further assistance, please do not hesitate to contact Sonya Clay, Assistant Director, Department of Federal Affairs, at 202-347- 8600 or sclay@aap.org.

Sincerely,



Thomas K. McInerney, MD, FAAP
President

These letters can be accessed online:

American Academy of Pediatrics Letter to the FCC

<http://apps.fcc.gov/ecfs/document/view?id=7520941318>

American Academy of Pediatrics Letter to Congress

<http://nebula.wsimg.com/b625b7cc6847a58ab1b7f25d326802d2?AccessKeyId=045114F8E0676B9465FB&disposition=0&alloworigin=1>

CNN: Sanjay Gupta discusses the Fine Print Safety Instructions

<https://www.youtube.com/watch?v=HF6O8NDaQXY>

Consumer Reports November 2015 recommends that consumers be aware of instructions

<http://www.consumerreports.org/cro/smartphones/cell-phone-radiation>

The Today Show November 2015: Pediatricians on cell phone FCC distances

<http://www.today.com/health/pediatricians-new-warning-limit-childrens-exposure-cellphones-t535>

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II. Summary of International Policy Actions On Reducing Wireless Exposures to Children

France:

[2016 The French National Agency of Health Security of Food, Environment and Labour Report](#) recommends regulatory changes to ensure "sufficiently large safety margins" to protect the health of young children. "ALL wireless devices, including tablets, cordless phones, remote controlled toys, wireless toys, baby monitors and surveillance bracelets, should be subjected to the same regulatory obligations as cell phones."

[National Legislation "Law on sobriety, transparency, information and consultation for exposure to electromagnetic waves" passed in 2015.](#) WiFi Banned in Nursery Schools: WIFI and Wireless devices will

be banned in “the spaces dedicated to home, to rest and activities of children under 3 years”. WiFi on “OFF” as Default to Minimize Exposures in Schools: In elementary schools, WIFI routers should be turned off when not in use. Schools Will be Informed: The school board should be informed when new tech equipment is being installed.

Belgium

Cell phones and cell phone ads are banned for young children and SAR labeling on phones is mandatory. Official government recommendations to reduce exposures are on the government website. Some municipalities have banned wifi in school for young children.

Spain

Several municipalities have passed resolutions urging the removal of wireless networks in schools and public places and recommending a precautionary approach with children and information campaigns to educate the public.

Canada

The health agency offers “practical advice” to reduce exposure to children. The Parliament issued a Radiofrequency Report recommending action to protect public health. [Canadian Parliament Standing Committee on Health of the House of Commons issued a report "Radio Frequency Electromagnetic Radiation and the Health of Canadians"](#)

Australia

The Australian Radiation Protection and Nuclear Safety Agency has issued a 2015 [Fact Sheet](#) titled How to Reduce exposure from mobile phones and other wireless devices. ARPANSA recommends that parents encourage their children to limit their exposure stating that “It is recommended that, due to the lack of sufficient data relating to children and their long term use of mobile phones, parents encourage their children to limit their exposure by reducing call time, by making calls where reception is good, by using hands-free devices or speaker options, or by texting.” [Read it HERE.](#)

Italy

In 2015, the Italian State Parliament of South Tyrol voted to [allow the application of the precautionary principle](#) mandating the state government to: To replace existing wireless networks whenever possible with networks that emit less radiation at schools, preschools, hospitals, nursing homes, and other public facilities. [The Supreme Court](#) ruled a man’s brain tumor was caused by his cell phone use.

Israel

The Ministry of Health states “Precautions should be strictly enforced with regard to children, who are more sensitive to developing cancer. The Israeli Government created the public education webpage National Information Ctr for Non-Ionizing Radiation. The Israeli Ministry Of Education has issued guidelines limiting WiFi and cell phone use in schools and officially recommends wired networks in schools. The Ministry of Health published [Environmental Health in Israel 2014](#) which states that “Precautions should be strictly enforced with regard to children, who are more sensitive to developing cancer.” and that “wireless communication networks in schools be reduced.” The Health Ministry recommends “sensible use of cellular and wireless technology, including: considering alternatives like landline telephones, use of a speaker while talking on a cellphone, and refraining from installing the base of wireless phones in a bedroom, work room, or children’s room.” The Report states that “Findings in Israel clearly indicated a link between cellphone use for more than 10 years and the development of tumors in the salivary glands, particularly among people who

held the telephone on the same side where the tumor developed and individuals in the highest category of exposure (heavy use in rural areas).”

Linda S. Birnbaum, Director, USA National Institute of Environmental Health Sciences and National Toxicology Program wrote in the Israeli Report final chapter that, “ If some of the studies turn out to be harbingers of things to come, we may have major health consequences from the nearly ubiquitous presence of wireless equipment.”

Haifa (Israel’s third largest city) removes Wi-fi from all schools. Haifa Mayor Yona Yahav said that the city would replace the wireless network with a wired connection that will provide safer options to students.” [Read the news article here.](#) This action occurred after [this news report aired.](#)

Switzerland

The Switzerland Federal Office for the Environment has issued specific guidelines to reduce exposure and has created factsheets for the public. The Governing Council of Thurgau Canton recommends for schools” to forgo the use of wireless networks when the structural makeup of a given school building allows for a wired network.“ The Switzerland Federal Office for the Environment FOEN has [a webpage on Wi-Fi](#) which states “caution should be exercised primarily when using devices held close to the body, such as laptops, PDAs and Internet telephones..” and gives recommendations on how to reduce exposure including turning the Wi-Fi off when not in use, installing the access point one metre away from places where you work, sit or rest for long periods of time and keeping laptops off laps.

The Switzerland Federal Office for the Environment FOEN has [a webpage on Cell Phones](#) which details ways to reduce mobile phone radiation. FOEN also has additional EMF factsheets on various EMF sources including on [baby monitors](#) where they state that “it is advisable to reduce the infant’s exposure to emissions as far as possible.”

Germany

The Federal Office for Radiation Protection provides tips for reducing radiation exposure to smartphones, tablets and wireless devices and several states recommend wired rather than wireless installations in schools. “Since long term effects could not be sufficiently examined up to now the Federal Office for Radiation Protection (BfS) recommends to keep exposures to these fields as low as reasonably achievable.” [Read the precautionary advice here.](#) The FORP recommends landline phone instead of mobile phone base stations and that schools should not connect wirelessly to the internet. [Read a 2015 statement here.](#)

Austria

The Public Health Department of Salzburg Region recommends against wireless in schools. No Wi-Fi in Salzburg Schools and many schools are Wi-Fi free. The [Austrian Medical Society](#) has issued cell phone safety guidelines. Austria’s” [Highest Health Council of the Ministry of Health](#)” has a [brochure](#) with advice to reduce exposure to cell phone radiation. It states that since the long term research is still not completed, it is advisable to take simple precautions to reduce exposure.

India

2012 The Ministry of Communications and Information Technology issued [new EMF guidelines](#) with new Exposure Limits lowered to 1/10 of the ICNIRP level, and SAR labeling on phones. [Official cell phone radiation guidelines](#) Precautionary Guidelines for mobile users. [Municipal Corporation of Greater Mumbai](#), the civic body that governs the capital city of [Mumbai](#) in [Maharashtra](#) (India’s richest municipal organization) in 2016 in its new policy on mobile towers, no longer allows cell towers on playgrounds, recreational grounds, gardens and parks. [Read news article.](#) 2013: [Supreme Court of India](#) upheld the High Court of the State of Rajasthan decision to remove all cell towers from the vicinity of schools, hospitals and playgrounds because of radiation “hazardous to life.” Two hundred and four mobile

towers installed on the school premises of Rajasthan have been removed in compliance. Read a [Document prepared by Dr. Sharma, Sr. Deputy Director of the Indian Council of Medical Research on Indian Research Studies](#).

Russia

The Russian National Committee on Non-Ionizing Radiation Protection has issued strong recommendations to reduce exposure to children and issued several reports. [The Russian National Committee on Non-Ionizing Radiation Protection](#) in ELECTROMAGNETIC FIELDS FROM MOBILE PHONES: HEALTH EFFECT ON CHILDREN AND TEENAGERS has repeatedly [warned](#) about electromagnetic radiation impacts on children and recommended WiFi not be used in schools.

United Kingdom

The UK National Health Service has changed its advice. In 2011 it offered specific [Recommendations](#) to reduce cell phone radiation exposure to children. [Read the 2011 recommendations](#) which stated, "Children are thought to be at higher risk of health implications from the use of mobile phones. This is because their skulls and cells are still growing and tend to absorb radiation more easily. It is recommended that children use mobile phones only if absolutely necessary." Then, the National Health service changed the public advice text. Now they state: "If there are any health risks from the use of mobile phones, children might be more vulnerable because their bodies and nervous systems are still developing. Research carried out to date hasn't supported a link between mobile phone use and childhood cancers such as leukaemia. However, if you have any concerns, you can lower your child's exposure to radio waves by only allowing them to use mobile phones for essential purposes and keeping calls short." [Read the new text here](#).

Cyprus

"Be Precautionary and reduce exposure to phones, Wi-Fi and other wireless devices," states the Cyprus Government's National Committee on Environment and Child Health (ECH). [See the Commission's EMF brochure](#) on reducing the risks to children from exposure to the Non Ionizing Radiation (mobile phones, Wi-Fi, tablets, etc.) which specifically addresses not just cell phones but all wireless devices. The Cyprus National Committee on Environment and Child Health created a short PSA for citizens about children and wireless radiation. Watch the video translated into english here <https://www.youtube.com/watch?v=996vzcCYCnE>

Finland

The Radiation and Nuclear Safety Authority officially recommends reduced radio frequency exposure for children ([since 2009](#)) and [details advice to reduce exposure](#) to the public. "In particular, children's unnecessary exposure should be avoided as their life-long exposure will be longer than that of those who begin using mobile phone as adults and as only scant research exists on health effects to children."

Singapore

Singapore's National Environmental Agency specifically [advises precautions for the public](#) to reduce exposure while further research is being carried out. Below is the exact text found on the [Frequently asked Questions About Radiation Protection](#).

Taiwan

In 2015 the government Updated their [Protection of Children and Youths Welfare and Rights Act](#) to ban cell phones for young children: Complete ban on children under the age of two from using electronic devices such as iPads, televisions and smartphones. Parents can be fined NT\$50,000 (about \$1600 US Dollars)

Namibia

Namibia's atomic energy review report states that current so called "safety" standards DO NOT protect citizens from long term health effects.

- "ICNIRP guidelines do not guarantee adequate protection against the long term effects of exposure, such as increased risk of cancer. " -Republic of Namibia:Atomic Energy Board: [The Atomic Energy Review](#)

Turkey

The Ministry of Health has issued [public information brochures](#) that recommend limiting exposure especially for pregnant women and children (Pregnant women and children (under 16) are more vulnerable and they should use the phone only when necessary, Prefer speaker or headset, Decrease time on phones, Use low SAR phone, Keep phone away from the body, Keep phones out of baby and children's bedroom, Turn phone off when you sleep or keep it one meter away from bedside.) In addition the Ministry is developing regulation on prohibiting phone use for children. The [EMF in schools is monitored](#) and the public can get measurements on EMF levels from cell towers and schools at a national site. [A Project funded by Ministry of Internal Affairs](#), accomplished by Temkoder (Prevention, Measurement of Electromagnetic Pollution and Training Organization) resulted in secondary school student training in the safer usage of cellular phones.

Greece

The Greek government website materials recommend reducing cell phone radiation to children under 16 and they inform citizens of non-ionizing radiation power levels in their community. The Q and A on RF radiation states the following text about children. [Read it here on page 32 and 33](#)

Even though it hasn't been proven conclusively that children are more sensitive/reactive than adults to exposure to radiation, nevertheless, the direct/pointed recommendation of international organizations is that children be discouraged from [literally translated, learn not to trust] using cell phones. The above statement is supported by the following:

1. *Up to about the age of 16, the nervous system of the human body is in the process of development. Consequently, it's totally possible (although not conclusively proven by relevant scientific research) that up until this age, human being are more sensitive to any number of factors/elements/determinants.*
2. *Younger people have more years ahead of them than older persons during which the long-term effects of mobile phones can be manifested.*
3. *Environmental factors/elements have a greater general impact on the health of children than on the health of adults.*

United States

Legislation has been introduced at the state and national level. Some Communities have issued proclamations, resolutions and started initiatives to inform the public of wireless health issues.

2014: The Connecticut Department of Public Health has issued specific recommendations to reduce exposure to cellphone radiation. It is notable that the Department has provided information more in depth than the CDC, EPA and FDA in detailing 7 steps on how people can reduce exposure. Furthermore, the Department states "It is wise to reduce your exposure to radiofrequency energy from cell phones whenever possible." [Read the Connecticut Department of Public Health Cell Phone Q and A about Cell phones here.](#)

2016: Onteora School District in New York State USA: District adopts "Best Practices with Wi-Fi" [Read the April 20, 2016 Meeting Minutes Page 2.](#) "Turn off the device when not in use and at the end of each day. If device is to stay on, turn Wi-Fi off when not in use. Always place device on a solid surface. Viewing distance should be a minimum of 12 inches from the screen. Staff was asked by the Principals to post this in areas that contain computers and devices. They are reminding staff to follow it."

2015: [Ashland Public Schools, Mass \(USA\)](#): The District has passed "Best Practices" to turn the WiFi off when not in use and keep devices away from the body [Download Slides](#). [Video of parent who initiated this](#). [Video of school board member](#) discussing the process. [Read Magazine article on Ashland's Decision Here](#).

2014 California, Berkeley: [May 12, 2015 Berkeley Adopted the Cell Phone "Right to Know" Ordinance on a Unanimous Vote](#). Berkeley is the first city in the nation to require cell phone retailers to provide those who purchase a new phone an informational fact sheet which informs buyers to read the user manual to learn the cell phone's minimum separation distance from the body. The text states: "The City of Berkeley requires that you be provided the following notice: To assure safety, the Federal Government requires that cell phones meet radio frequency (RF) exposure guidelines. If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation. Refer to the instructions in your phone or user manual for information about how to use your phone safely." [Full text here](#).

2014 New York: [Wireless Router Labeling in all Suffolk Public buildings](#): 12/2014 The Suffolk County Legislature passed legislation to require all county buildings to post notices that wireless routers are in use such as, "Notice: Wireless technology in use." The resolution, sponsored by Legis. William Spencer (a physician), warns that every wireless device emits radio frequency radiation or microwave radiation. It notes that studies "that have looked at the effects of low-level RFR radiation on human cells and DNA have been inconclusive." [Read Press Release](#).

2014 Maryland, Greenbelt: [The Greenbelt Maryland City Council voted unanimously on November 24, 2014](#) to do the following:

1. Alert citizens about the fine print warnings and possible health risks of cell phones and wireless devices By sharing the Environmental Health Trusts 10 Steps to Safe Tech and Doctors Advice on Cell Phones Brochure in City health fairs and city centers.
2. To send the FCC Chairman a letter urging the adoption of "radiation standards that will protect human health and safety."
3. To oppose cell towers on school grounds and write a letter to the local school board and County Executive.

2012 Wyoming: Jackson Hole issued a [Proclamation of Cell Phone Awareness](#)

2012 Florida: Pembroke Pines, passed Resolution [3362](#) expressing the City's "Urgent Concerns" about Wireless Radiation and Health and which encourages citizens to read their manuals and presents information on how to reduce exposure by using a headset or speakerphone. Jimmy Gonzalez, an attorney who had developed brain cancer after heavy cell use, initially petitioned the Commission. [Watch the Video of his powerful testimony here](#).

2010 California, San Francisco: [Cell Phone Radiation \(How to Reduce Exposures\)](#) Webpage launched. Answers on [how to reduce exposures](#) to cell phone radiation. The City developed a poster, factsheets and display stickers with public health information.

2010 California: Burlingame California City has cell phone safety [guidelines](#) .

2010 Maine, Portland: October declared "Cell Phone Awareness Month"

Research showing Children's Increased Radiofrequency Exposure

Fernandez-Rodriguez, C.E.; De Salles, A.A.A.; Davis, D.L., "[Dosimetric Simulations of Brain Absorption of Mobile Phone Radiation—The Relationship Between psSAR and Age.](#)" in Access, IEEE , vol.3, no., pp.2425-2430, 2015 doi: 10.1109/ACCESS.2015.2502900

Morris, R.D.; Morgan, L.L.; Davis, D.L., "[Children Absorb Higher Doses of Radio Frequency Electromagnetic Radiation From Mobile Phones Than Adults.](#)" in Access, IEEE , vol.3, no., pp.2379-2387, 2015 doi: 10.1109/ACCESS.2015.2478701

Gandhi OP, Morgan LL, De Salles AA, Han YY, Herberman RB, Davis DL. (2012). [Exposure limits: the underestimation of absorbed cell phone radiation, especially in children.](#) Electromagn Biol Med. 31(1), 3451.

Redmayne M, Johansson O. [Radiofrequency exposure in young and old: different sensitivities in light of age-relevant natural differences.](#) Rev Environ Health. 2015 Dec 1;30(4):323-35. doi: 10.1515/reveh-2015-0030.

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Christ A, Gosselin MC, Christopoulou M, Kühn S, Kuster N. [Age-dependent tissue-specific exposure of cell phone users.](#) Phys Med Biol. 55(7):1767-1783, 2010.

de Salles, A. A., Bulla, G., Rodriguez, C. E. (2006). [Electromagnetic absorption in the head of adults and children due to mobile phone operation close to the head.](#) Electromagn. Biol. Med 25(4):349–360.

Wiat, A. Hadjem, M.F. Wang and I. Bloch, "[Analysis of RF exposure in the head tissues of children and adults](#)" Physics in Medicine and Biology, Vol.53, pp. 3681-3695, 2008

Kühn S, Jennings W, Christ A, Kuster N. [Assessment of induced radio-frequency electromagnetic fields in various anatomical human body models.](#) Phys Med Biol. 54(4):875-890, 2009.

Selected Research on Radiofrequency Impacts on Health

CANCER

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2.Coureau et al., (2014). [Mobile phone use and brain tumours in the CERENAT case-control study.](#) *Occup Environ Med.* 71(7), 514-22.

3. Lerchl et al., (2015) [Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans...](#) Biochemical and Biophysical Research Communications, Available online 6 March 2015.
4. Morgan LL, Miller AB, Sasco A, Davis DL, [Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen \(2A\) \(review\)](#). Int J Oncol. 2015 May;46(5):1865-71. Epub 2015 Feb 25.
5. Carlberg M, Hardell L. [Decreased Survival of Glioma Patients with Astrocytoma Grade IV \(Glioblastoma Multiforme\) Associated with Long-Term Use of Mobile and Cordless Phones](#). International Journal of Environmental Research and Public Health. 2014;
6. L. Hardell, M. Carlberg, [Cell and cordless phone risk for glioma - Analysis of pooled case-control studies in Sweden, 1997-2003 and 2007-2009](#), Pathophysiology (2015), Available online 29 October 2014.
7. Lerchl et al., [Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans](#). Biochemical and Biophysical Research Communications, Available online 6 March 2015.
8. Soffritti et al., [Life-span exposure to sinusoidal-50 Hz magnetic field and acute low-dose \$\gamma\$ radiation induce carcinogenic effects in Sprague-Dawley rats](#), International Journal of Radiation Biology. Vol. 92, Iss. 4, 2016
9. Yakymenko et al., (2015) [Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation](#). Electromagnetic Biology and Medicine. July 7,

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US Government Documents on RF Radiation and inadequacy of FCC limits:

- 2014: U.S. [Department of the Interior Letter \(2014\) on FCC Guidelines](#)
- 2002 [EPA Letter on the RF Exposure Limits ONLY protecting from Heating Effects](#)
- 2008: National Academy of Sciences (NAS) Report, [Identification of Research Needs Relating to Adverse Health Effects of Wireless Communication.](#)
- 2003: [Interagency Radio Frequency Workgroup 2003 Letter from EPA Norbert Hankin on Additional Concerns about RF Exposure Guidelines](#)
- 1999: [Radio Frequency Interagency Workgroup Concerns About RF Exposure Gregory Lotz NIOSH Letter](#)
- 1995: [EPA Letter to the FCC on Development of Guidelines](#) by the EPA- they were never finished. .
- 1984: [US Science Advisory Board Letter that recommends that the EPA develop radiation protection guidance to protect the public](#) (Note: the EPA standards were never issued.)
- 1983: [EPA: Biological Effects Of RadioFrequency Radiation](#)