

Wireless Devices and Children's Health

Pediatric Academic Societies

Devra Davis PhD MPH

President, Environmental Health Trust

Visiting Professor Hebrew University, Hadassah Medical Center

Pediatric Academic Societies Meeting, May 3, 2016

Baltimore, Maryland

copyright@ www.ehtrust.org permission
granted only for limited use with
attribution to Environmental Health
Trust copy to info@ehtrust.org



Career Highlights

- Danforth Foundation Fellow, University of Chicago, 1967-71, PhD in Science Studies
- National Cancer Institute Senior Post-Doctoral Fellow in Epidemiology, Johns Hopkins University, 1981-82, MPH
- Founding Director Board on Environmental Studies and Toxicology, National Research Council, National Academy of Sciences 1983-93 (group advising bans on indoor smoking)
- Clinton Presidential Appointee 1994-99 National Chemical Safety & Hazard Investigation Board, with bi-partisan Senate approval
- Visiting Professor, Hebrew University, Hadassah Medical Center and Ondokuz Mayıs Medical School, Samsun, 2015-16
- More than 200 technical publications, 11 edited monographs, 3 popular books

Presentation Followed by Q and A

Devra Davis PhD MPH

Overview on Wireless Exposure and Children's Health

Hugh Taylor MD PhD

Fetal Exposure to Cell Phones

Martha Herbert PhD MD

The Link between Autism and Electromagnetic Fields

Catherine Steiner-Adair, EdD

Clinical psychological impacts of digital devices on families and children

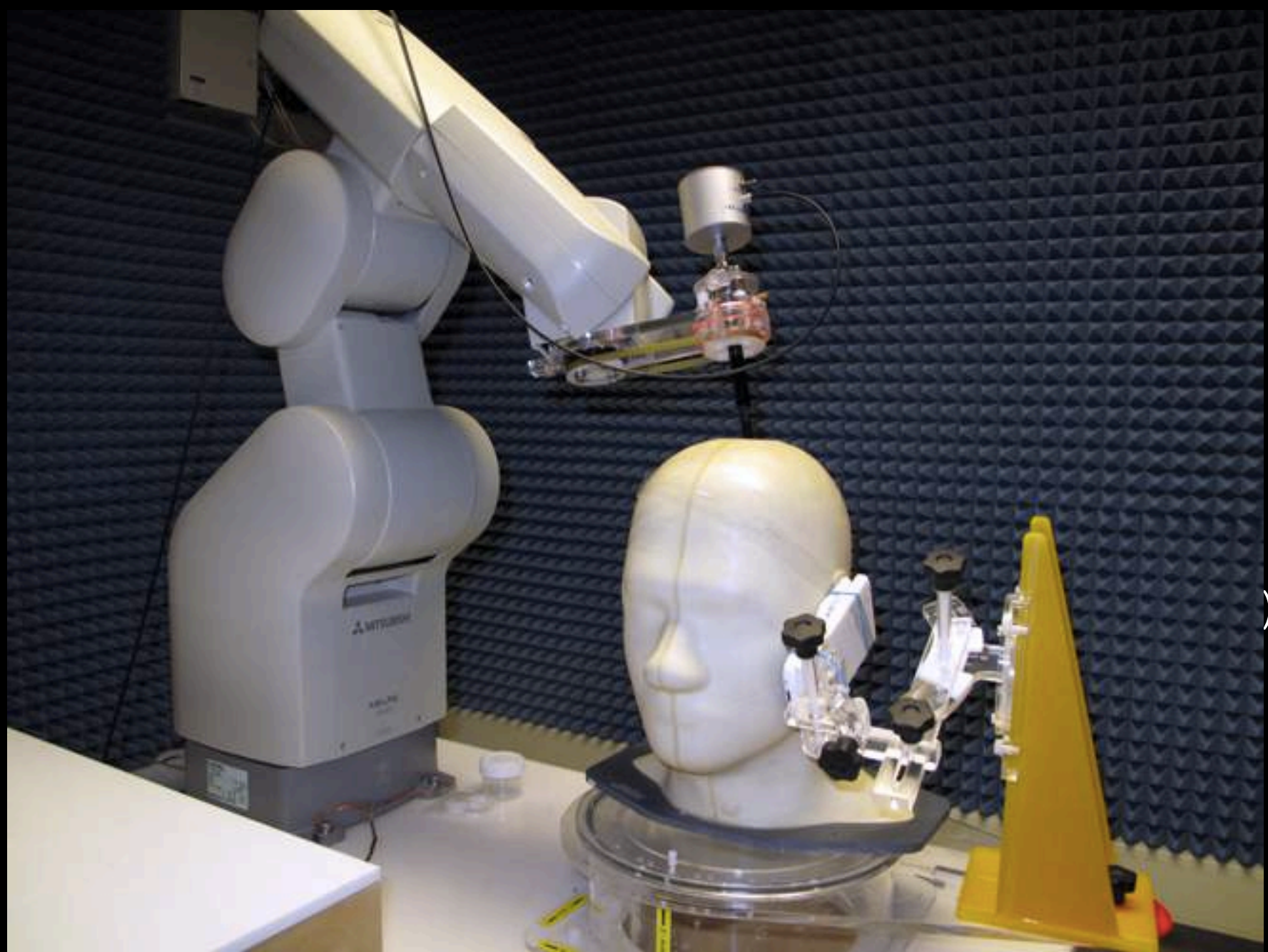
Maya Shetreat-Klein MD, FAPN

EMF, Sleep and Protecting the Brains of the Future

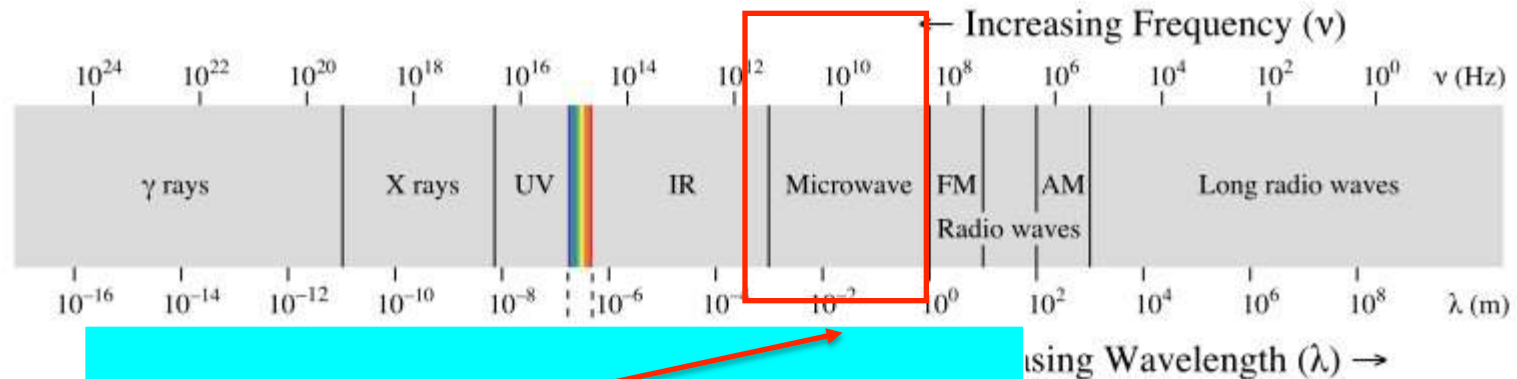
Introductory Presentation Overview

1. What is Wireless Radiation? How is it Tested?
2. Who is at Risk?
 - Brains – Child/Adult
 - Virtual Reality
3. What is the Problem?
 - Sperm
 - Pregnancy
 - Behavior
 - Cancer
4. Global Policy Responses

copyright@ www.ehtrust.org permission
granted only for limited use with
attribution to Environmental Health Trust
copy to info@ehtrust.org



Radiation Electromagnetic Spectrum

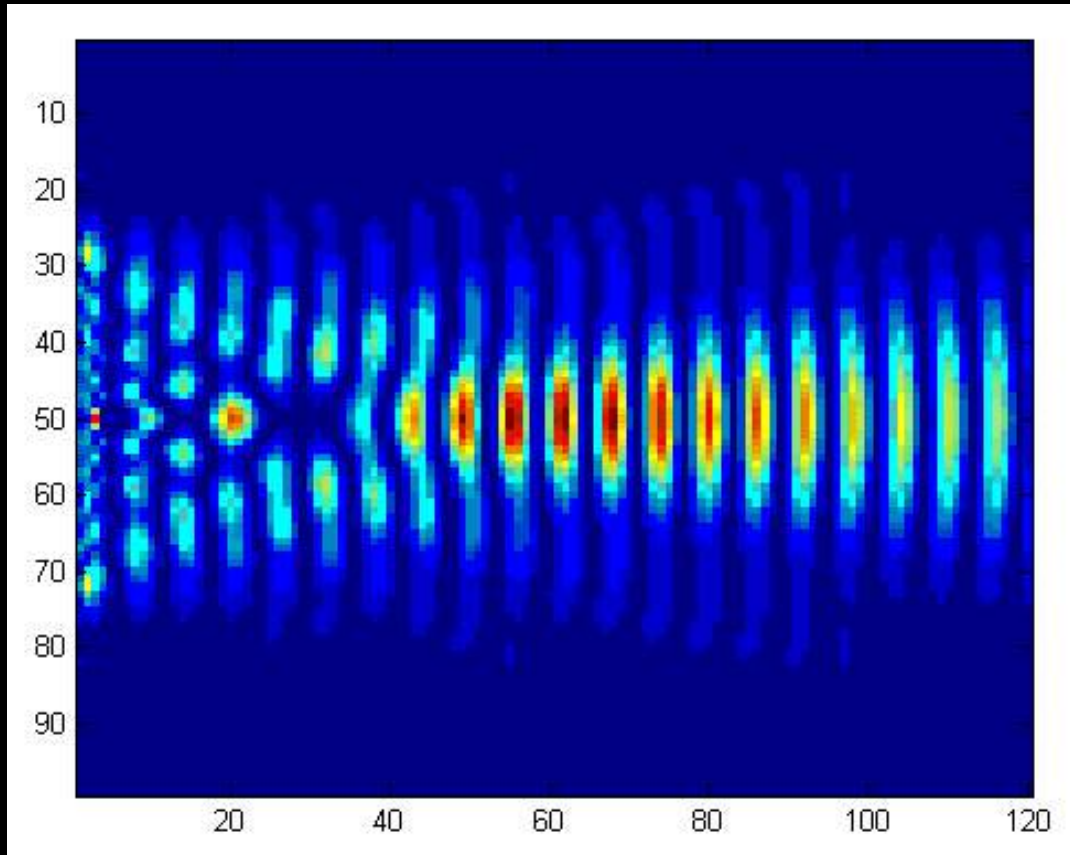


Microwaves:

- Ovens
- Cellphones (GSM-3G UMTS)
- Home Cordless phones
- Wi-Fi (WLAN)

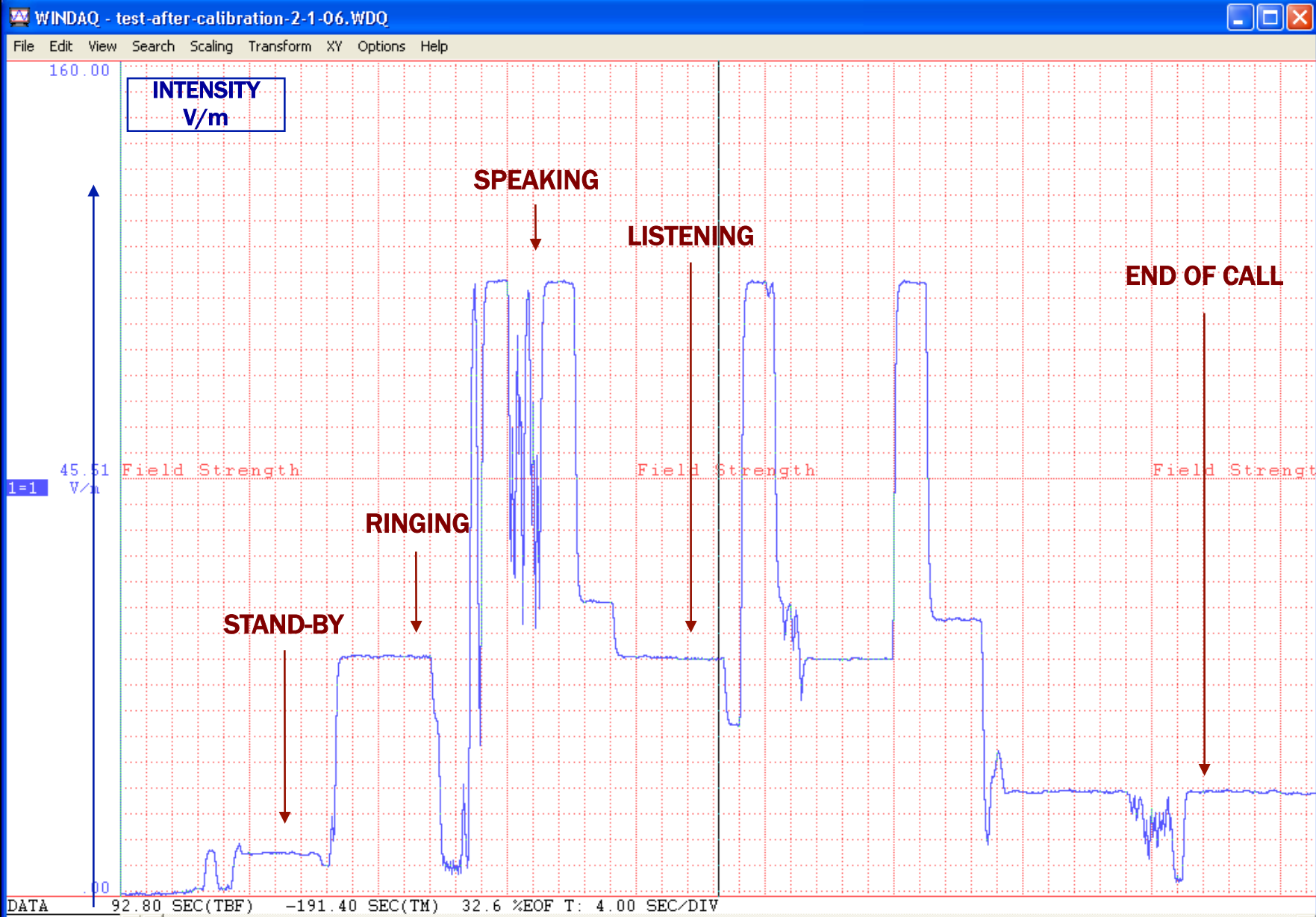
Cellphones Emit
Pulsed Microwave
(non-ionizing)
radiation

The impact of any form of radiation depends on the nature of the waves



- Frequency
- Amplitude
- Pulse
- Wavelength/
Form
- Information

Do not take without permission



Time 4 sec/division

Do not take without permission

**ENVIRONMENTAL
HEALTH TRUST**

Exposure is Distinct from Absorbed Dose



- Identical **sunlight exposure** results in **different UV dose** to my red-haired blue-eyed granddaughter and my darker daughter

Relatively Greater Absorption Into Faster Growing Brain Tissues of Children

- Thinner skulls
- Smaller heads (shorter distance to brain centers)
- Different dielectric properties (higher liquid content)
- Their brains are less myelinated and still developing.

“The average RF radiation energy deposition for children exposed to mobile phone RF is two times higher in the brain and 10 times higher in the bone marrow of the skull compared with mobile phone use by adults.”

- International Agency for the Research on Cancer Monograph on Radio Frequency Fields as a Class 2 B Carcinogen

American Academy of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

The AAP has supported the reevaluation of RF regulations, consumer disclosure and a national research program “to protect children’s health and wellbeing.”

“Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children.”

- [AAP Letter to the FCC In support of RF Review of Guidelines, 2013](#)
- [AAP Letter in Support of Cell Phone Right to Know Act](#)

Repeated calls for research on infants, toddlers, young children, pregnancy

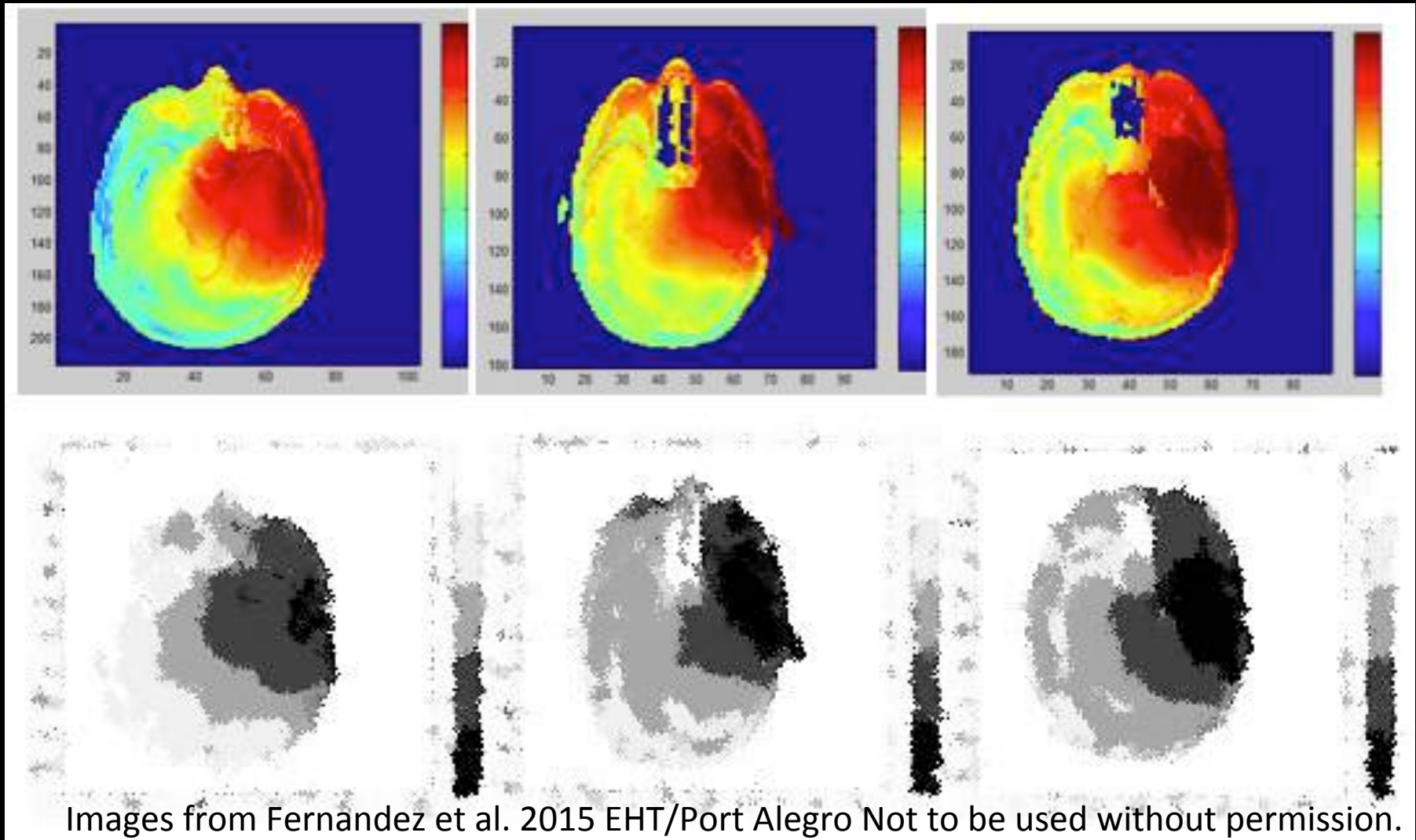


Peak Exposure to Cell Phone Radiation Occurs in Youngest Children (Image:SAR at Eyes Plane)

34 Yr old

6 yr old

3 yr old



Images from Fernandez et al. 2015 EHT/Port Alegro Not to be used without permission.

Kelloggs Offer on Virtual Reality



Virtual Reality Viewer

.....**FREE**
GET A
VIRTUAL REALITY
APP
AND VIEWER

Download the free Kellogg's® Marvel's Captain America: Civil War VR app and buy any three participating Cheez-It®, Keebler®, Kellogg's® or Pringles® products.



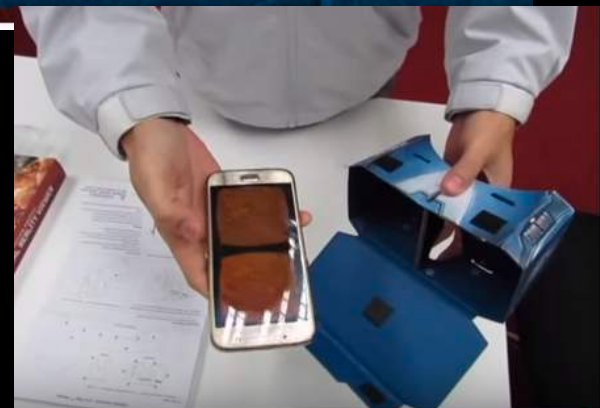
MARVEL
CAPTAIN AMERICA
CIVIL WAR
IN THEATERS MAY 6

© 2016 MARVEL

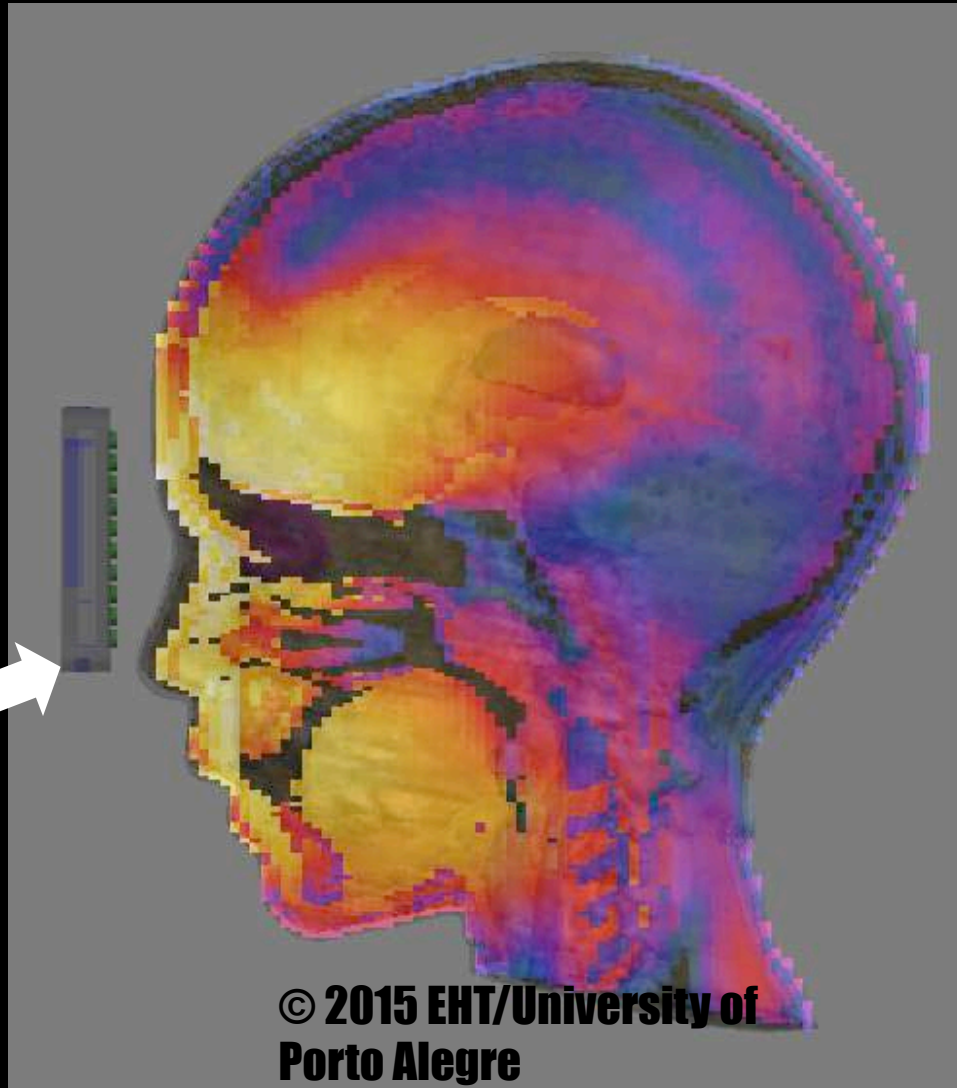
[See All Participating Products](#)

3 Purchases = 1 Viewer

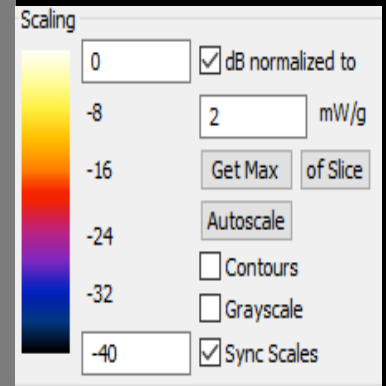
Viewers appropriate for ages 8 and up.



Microwave Radiation into the 6 Year Old Child From Virtual Reality Simulations



40dB color Scale.
Smartphone placed
in a position to the
eyes as it would be
placed using the
cardboard virtual
reality holder.

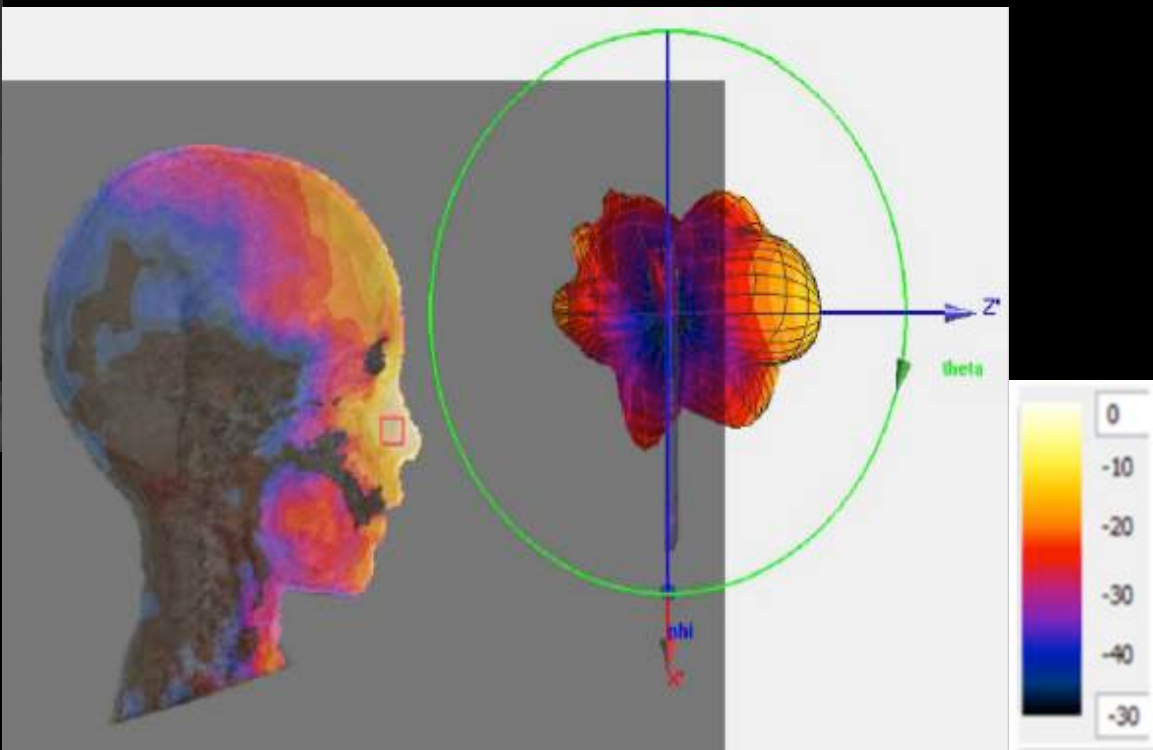


© 2015 EHT/University of
Porto Alegre

SAR in 6 Year Old from 2.45 GHz Wi-Fi Tablet



Tablet at 150 mm (5.9 inches)
from eye lens

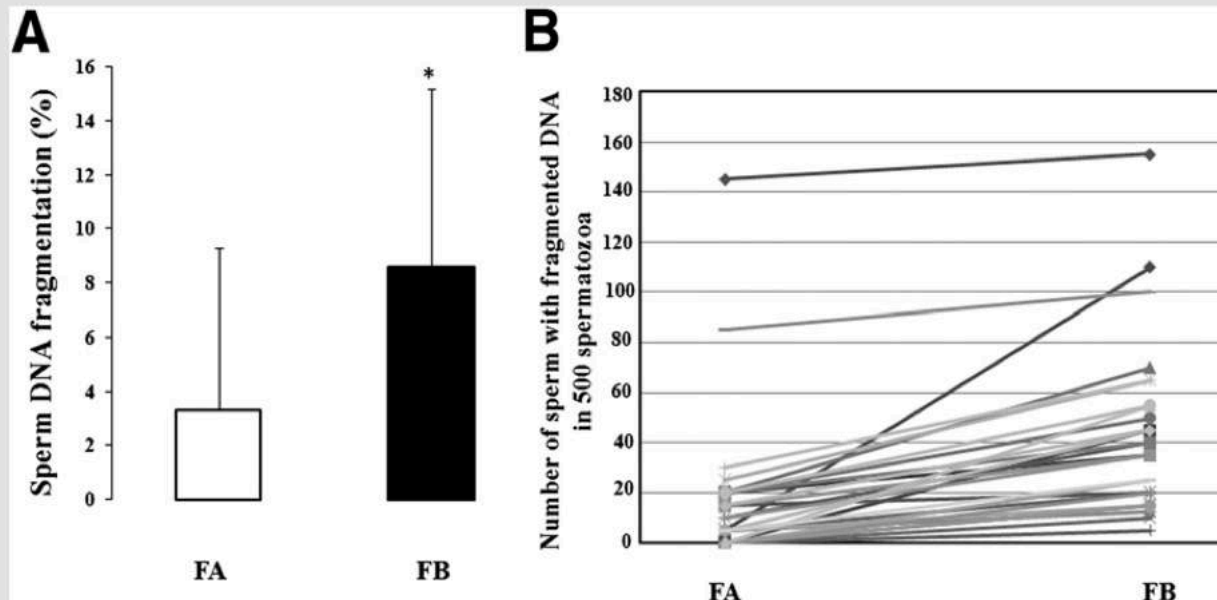


JULIANA BORGES FERREIRA, AND ALVARO AUGUSTO ALMEIDA DE SALLES (2015)

Fig. 7. Radiation pattern normalized to $0.0132 \text{ W/g} = 0 \text{ dB}$, with a 30 dB color scale, and SAR averaged over 1g cube of tissue.

Specific Absorption Rate (SAR) in the head of Tablet user's

Laptop Connected to Wi-Fi Damages Sperm



Laptop exposure and human sperm DNA fragmentation. Sperm suspensions were incubated under a laptop computer connected to the internet by Wi-Fi (FB) during 4 hours at 25°C. Aliquots of the same samples were placed outside of the reach of other computers or electronic devices, in a separate room (FA). (A) Sperm DNA fragmentation was increased after 4 hours of laptop exposure. In the test group, 8.6% ± 6.6% of the cells were fragmented, whereas only 3.3% ± 6.0% of the controls showed DNA fragmentation (* $P < .01$). (B) Plot of individual responses of sperm DNA fragmentation to laptop exposure. The number of sperm with fragmented DNA was evaluated in two aliquots of the same sample (500 cells/aliquot).

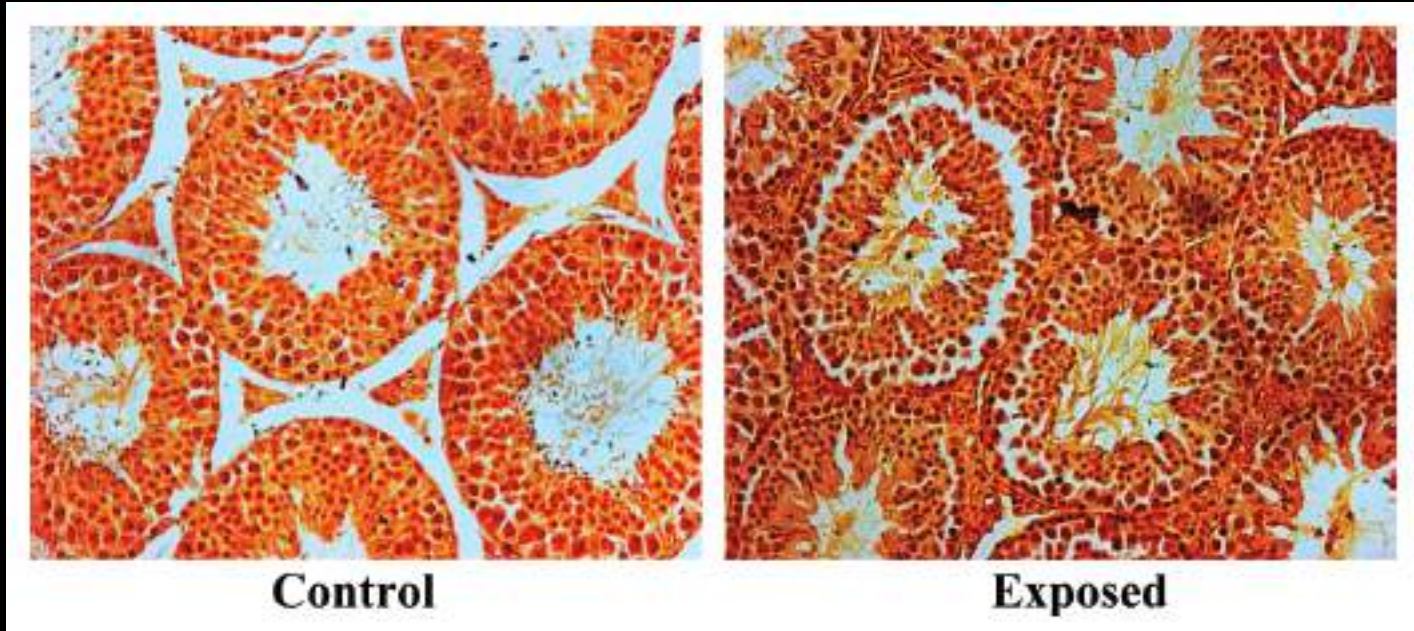
4 Hours of exposure

Decreased motility and induced DNA fragmentation by a non-thermal effect.

[Avendano et al. 2012](#)

Microwave radiation impairs male reproduction

Testis: Increased i-NOS immunostaining in the spermatogonial cells of seminiferous tubules



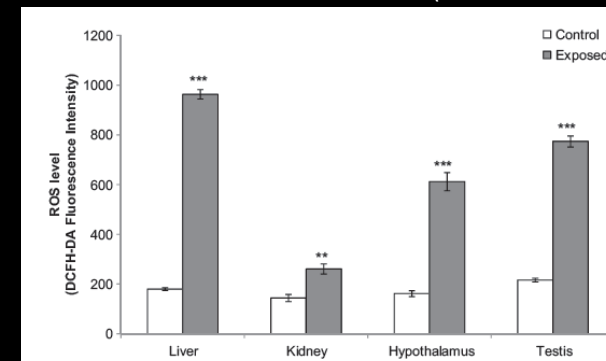
Mice exposed to nonthermal 2.45-GHz 2h/d x 30 d

↑ ROS in liver, kidney, hypothalamus, and testis

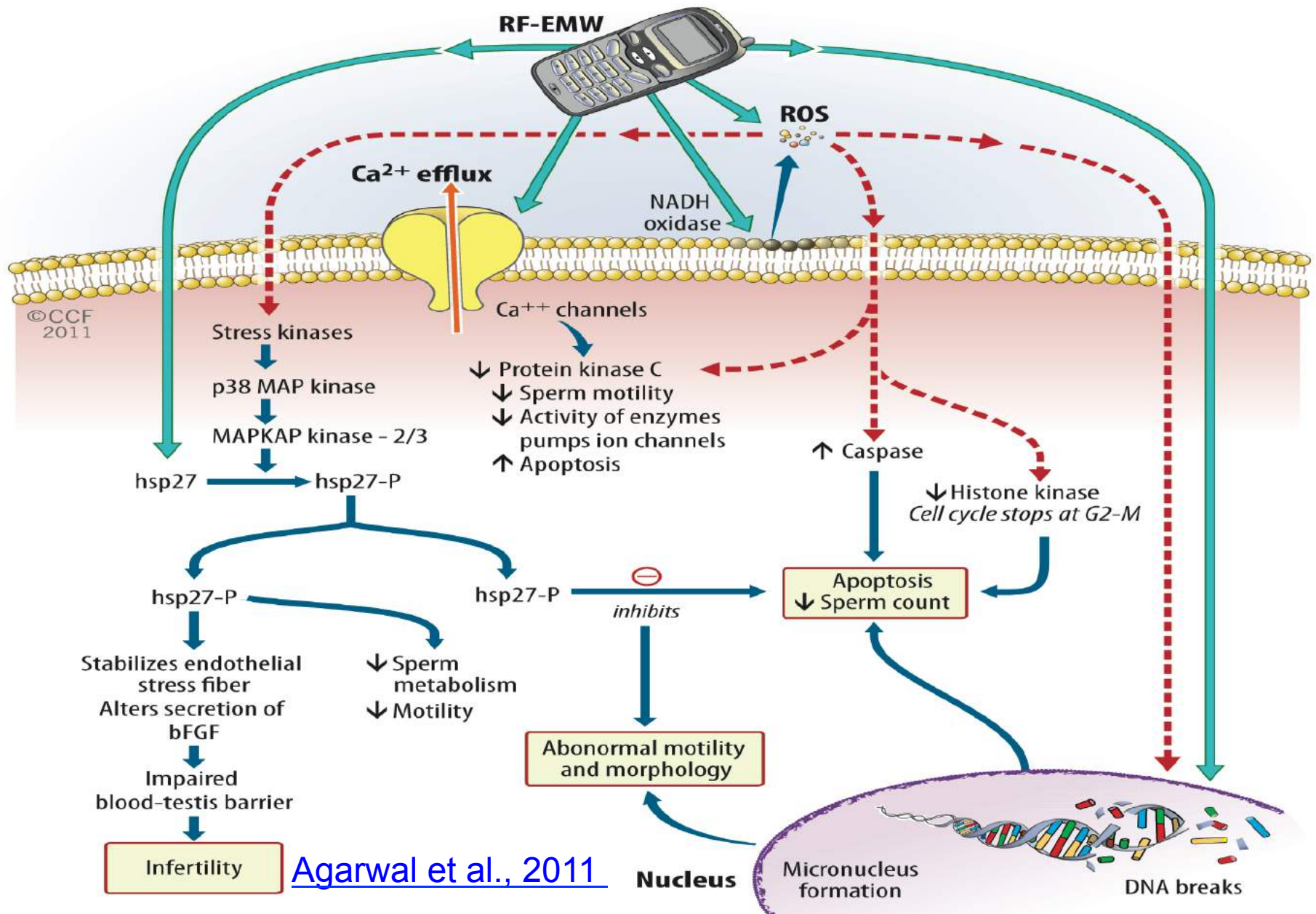
↑ RNS, lipid peroxidation

↓ Antioxidant capacity, % viable sperm

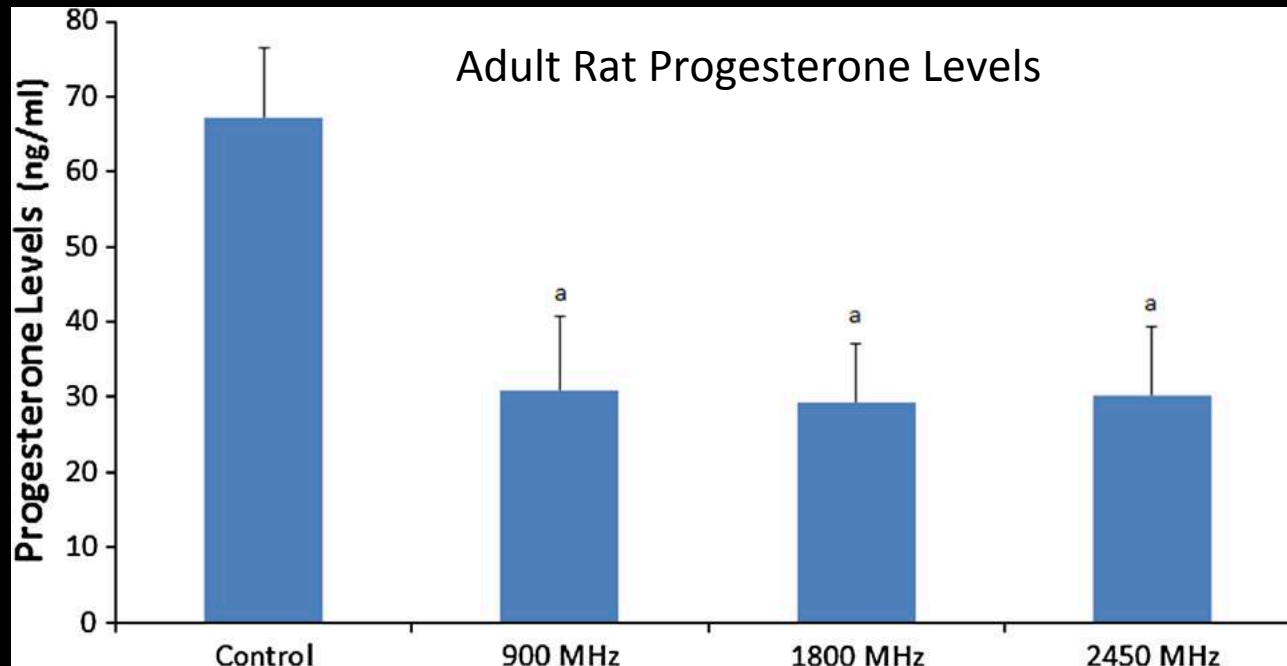
Increased DCFH-DA fluorescence (measure of ROS)



Oxidative Stress, Calcium Efflux and Other Mechanisms of Harm (sperm)



Mobile phone & Wi-Fi affect endocrine functions and uterine oxidative stress in 4 generations rats.



Exposures:
Control, 900 or
1800, 2450 MHz
During pregnancy
and growth

60 min/day/5 times
a week x 52
weeks (4
pregnancies)

Decreased prolactin, progesterone, estrogen
Increased oxidative stress in the uteri of maternal rats
during the development of offspring.

International Agency for Research on Cancer



World Health
Organization

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

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 cancer¹, associated with wireless phone use.

This classification applies to all RF-emitting devices, including WiFi.

- Robert A. Baan, PhD, IARC

- Studies used include: case-control, cohort, registries, and in vitro and in vivo toxicology



NTP
National Toxicology Program

NTP Radio Frequency Studies



Nonthermal Exposure:

Chronic long term- 9 hours a day for two years.

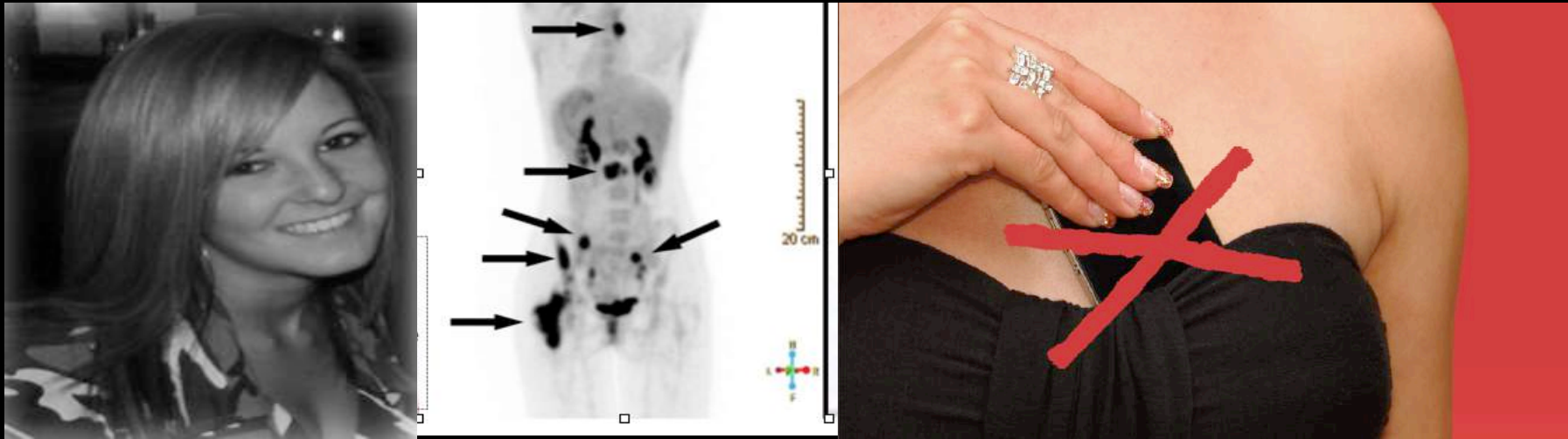
Endpoints: carcinogenicity, body weight, organ development, blood-brain barrier permeability, reproductive, and DNA strand breaks

Results:????

FDA nomination based on the following concerns:

“Current exposure guidelines are based on protection from acute injury from thermal effects; Little is known about the potential for health effects of long-term exposure”

Breast Cancer From Cell Phones in Bra



[Frantz No Cell Phone in the Bra Presentation Slides](#)

Tiffany Frantz

- Tumors found directly under the antennas of the cell phone that she kept in bra 12 hours a day for 5+ years.
- Diagnosed at age 21 [West et al 2013](#)
- Her breast cancer metastasized to her bones and liver.
- The younger the breast the greater fluid and fat which equals greater microwave absorption.
- Currently 38 + cases under investigation.

Consistently Increased Glioma risk in case-control studies

Study		Odds ratio
CERENAT 2014	≥896 h	2.89*
	≥18 360 calls	2.10*
	≥15 h/month	4.04*
2015 reanalysis	ipsilateral – cases only	2.40*
Hardell et al. Meta-analysis 2015	>25 y latency	3.0*
	>1y ipsilateral	1.8*
	first use <20 y old	1.8*
	first use <20 y old ipsilateral	3.1*

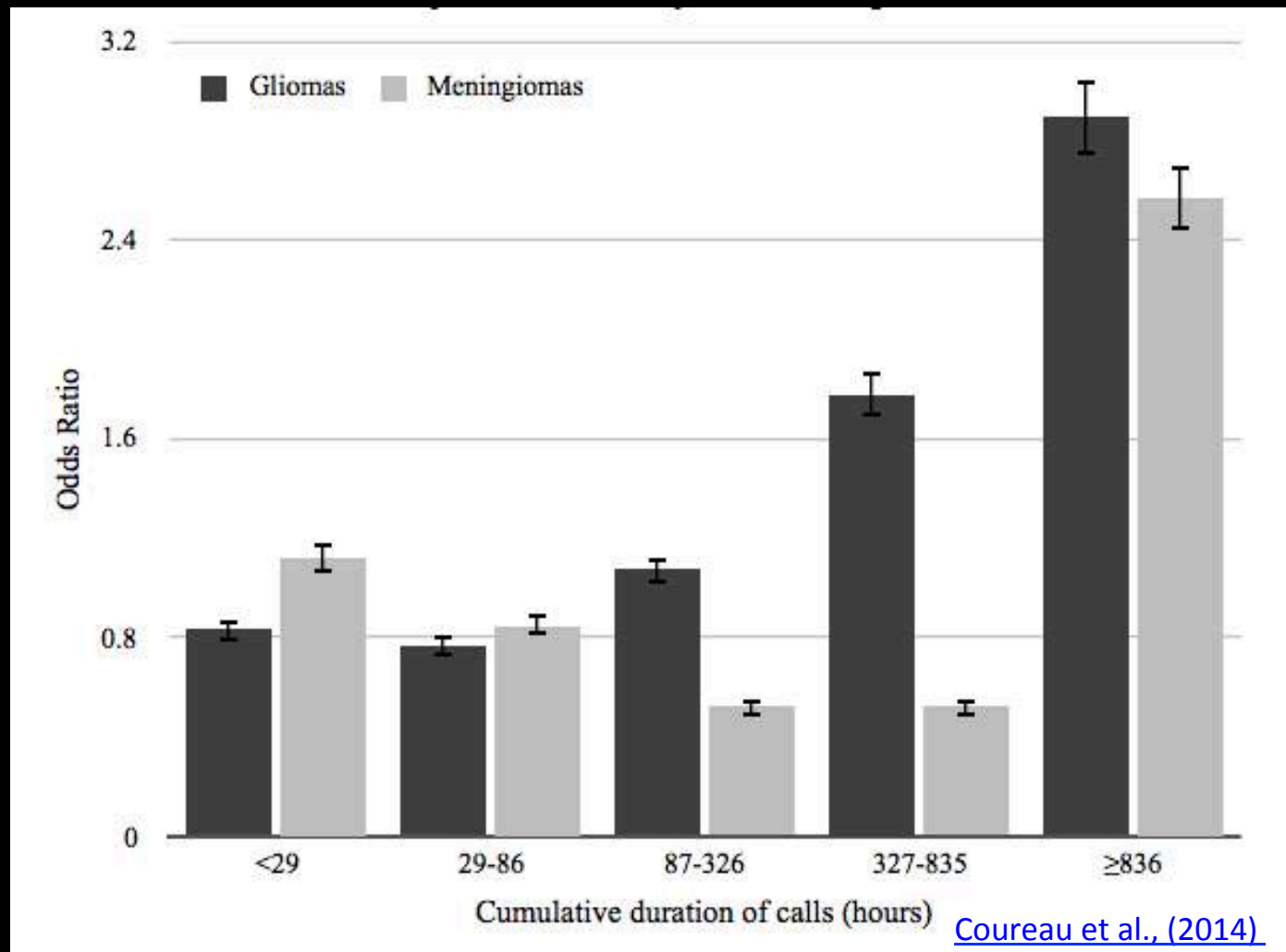
* Statistically significant (95%)

[CERENAT 2014](#)

[CERENAT 2015](#)

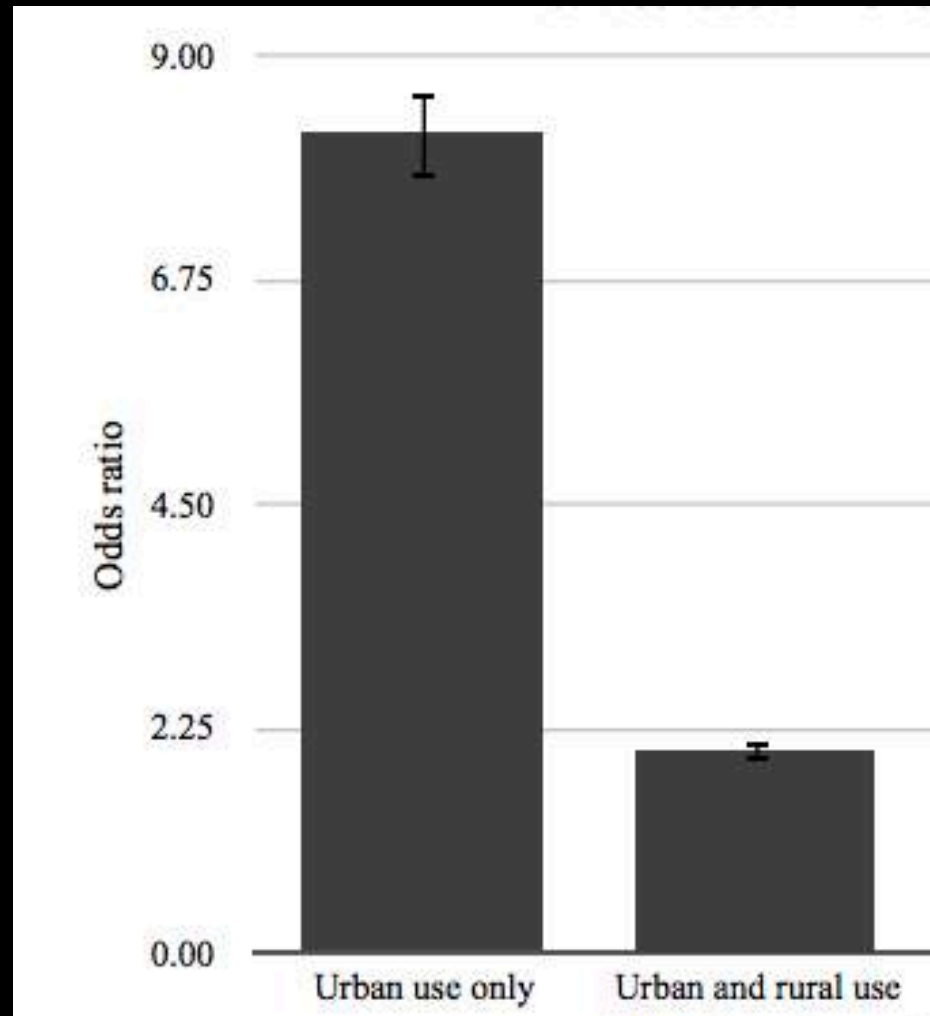
[Hardell et al. 2015](#)

French national study finds increased risk of brain tumors with heaviest users



Increased gliomas & meningiomas with cumulative hours of use

French national study finds increased brain cancer in urban users after 836 hours



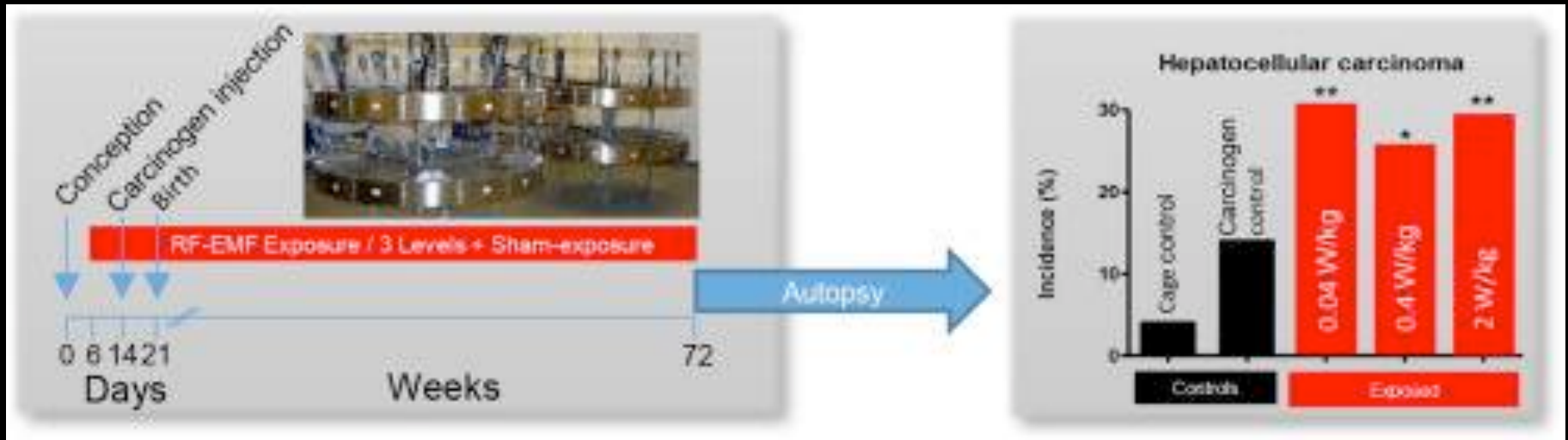
[Coureau et al., \(2014\)](#)

Residence: Urban

Urban/ Rural

RF Below Safety Limits Promotes Tumors

Mice: 24/7 RF Exposure, in utero ENU (a replication study)



- Higher liver and lung tumors
- 2.5 fold increases in Lymphoma
- Nonlinear effect “may be due to metabolic changes”

“Our findings may help to understand the repeatedly reported increased incidences of brain tumors in heavy users of mobile phones”

[Lerchl 2015](#)

Cell Phone Calls and ADHD

Potential of Lead Toxicity in Korean Children



“combined or cooperative toxic action of RF and lead on the developing brain.”

Byun et al. 2013 PLoS

2,422 children - 27 schools - 10 Korean cities - 2 y follow up
ADHD symptoms associated with voice calls, *only among children with higher blood lead values ($>2.35\mu\text{g}/\text{dL}$; comparable to U.S. BLLs)*

[Byun et al. 2013](#)

Synergistic effects of electromagnetic fields and chemicals

Medical applications to treat cancer are relying on interactions

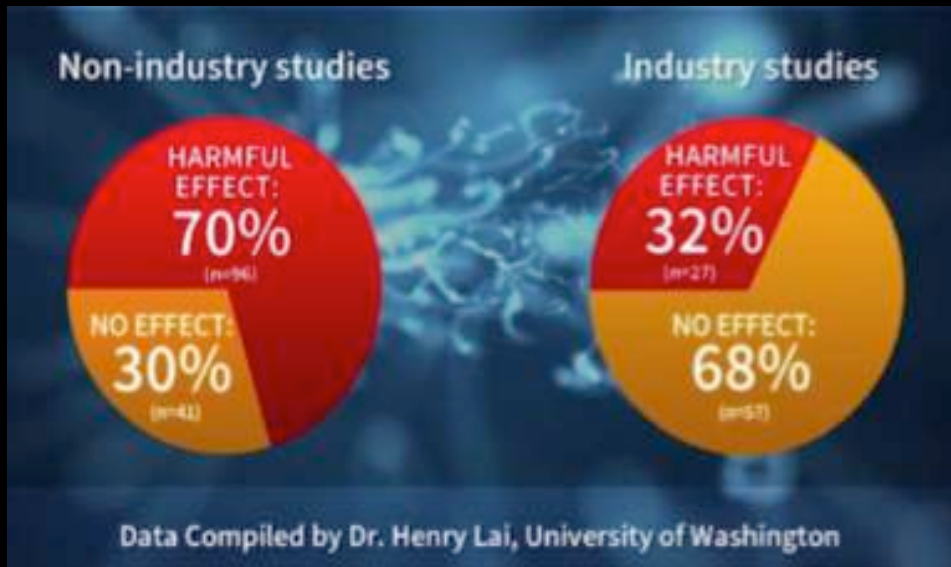
- (Kostoff and Lau, 2015)
- “Substantial credible scientific evidence” supports that RF results in synergistic effects-beneficial *and* adverse.
- RF changes biochemical markers of inflammation
- RF enhances carcinogenesis, cellular or genetic mutations, and teratogenicity.

Research *needed* on real world conditions: EMF + multiple exposures

[Technological Forecasting and Social Change \(2015\)](#)

Why So Many Inconsistent Results?

- Different cells studied, ie., adult lymphocytes compared to neuronal stem cells.
- Different exposures (CW/Digital)
- Lack of standard nomenclature
- Sponsorship bias can induce publication bias.

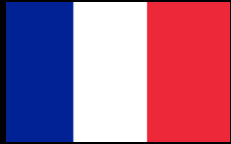


Huss 2007: Systematic review- industry funded studies 90% less likely (odds ratio 0.11) to report effect.

Valentini 2011: “the existence of sponsorship and publication biases should encourage WHO intervention to develop official research standards and guidelines.”



World Wide Precautionary Action



France: Phones sold with headsets. Wi-Fi Banned for Kindergarten/Wi-Fi off when not in use. New national law



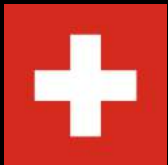
Belgium: Banned cell phones for children.



Israel: Wi-Fi to be removed from all Haifa schools as of April 2016, Health Ministry recommends lowering exposure at home and school.



Italy and Spain: Several local governments voted to declare precautionary principle: protect children and use wires.



UK, Switzerland, Australia, Germany, Canada: Health agencies recommend reduced cell phone exposures.



India: Exposure limits lowered to 1/10 of the ICNIRP level, recommendations to reduce cell phone exposure, SAR labeling on phones, some govs ban towers near schools.

Manufacturers' Fine Print Safety Advice On All Cell Phones and Wi-Fi Devices



*“ To maintain compliance with FCC’s exposure guideline, place the child unit at **least 20 cm (8 inches)** from nearby person’s”*

- First Years Baby Monitor Manual

Berkeley Cell Phone Right to Know Law Upheld by despite industry challenge, 2015

- For iPhone go to Settings/General/About/Legal/ Rfexposure
- For other phones go to Showthefineprint.org and for devices go to EHT Fine Print Webpage

Out of date

“Radiofrequency energy, unlike ionizing radiation, does not cause DNA damage that can lead to cancer. Its only consistently observed biological effect in humans is tissue heating. In animal studies, it has not been found to cause cancer or to enhance the cancer-causing effects of known chemical carcinogens.” [references studies published in 2006-2008]

[NCI Factsheet](#)

Acknowledgements

- Alvaro De Salles, Claudio Fernandez, PhD Brazil
- Lukas Margaritis, PhD, Greece
- Meg Sears PhD, Canada
- Theodora Scarato, MSW USA
- R.S. Sharma, MD PhD, India
- Sarina Scott, BS, USA

Slides for Discussion



Real versus Simulated Mobile Phone Exposures in Experimental Studies

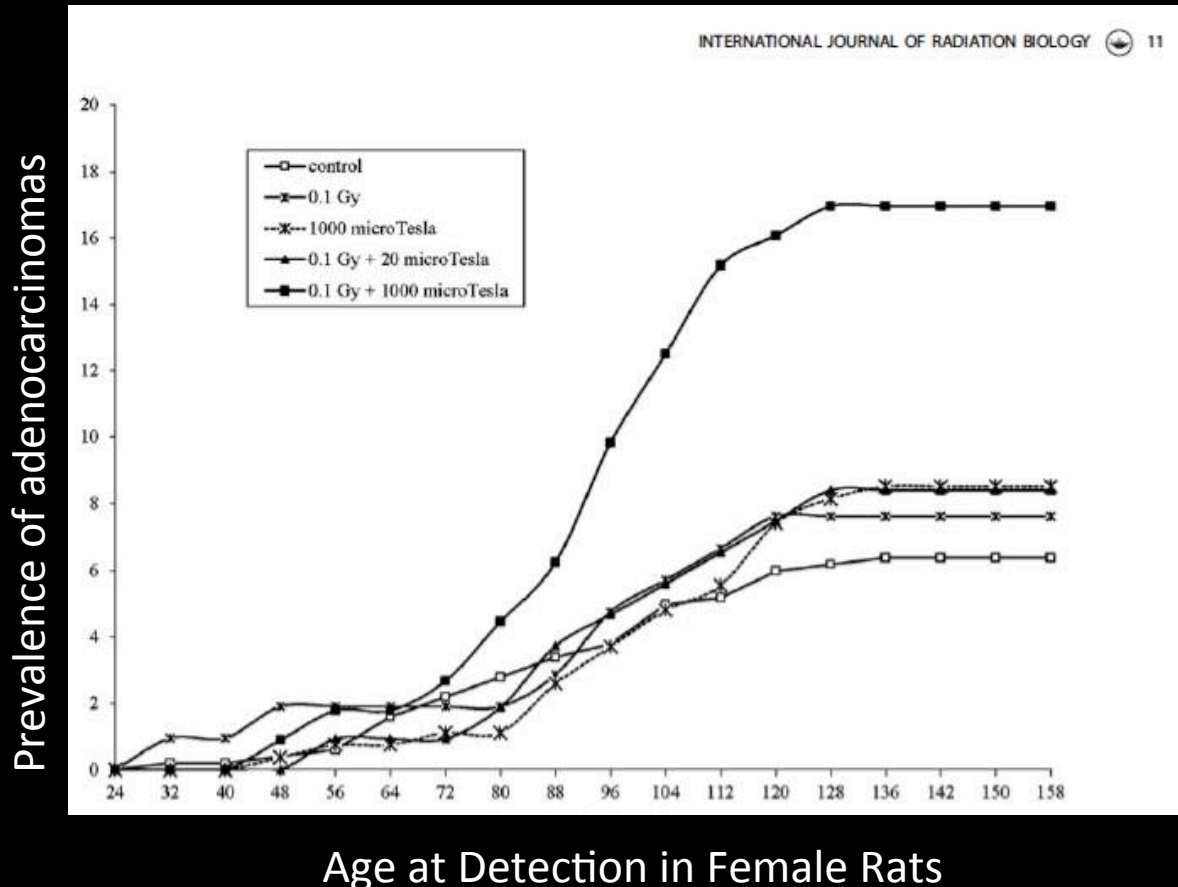
“Real mobile phone emissions are constantly and unpredictably varying and thus are very different from simulated emissions which employ fixed parameters and no variability. “

“This variability is an important parameter that makes real emissions more bioactive”

“Living organisms seem to have decreased defense against environmental stressors of high variability “

[Dimitris J. Panagopoulos, Olle Johansson, and George L. Carlo, Biomed Research International \(2015\)](#)

In lifetime cancer study EMF creates synergistic effects with ionizing radiation



650 Exposed / 1,001 controls

- Lifespan exposure from in Utero
- 50 Hz EMF (200 mG or 10 G)
- One time dose 0.1Gy at 6 wk

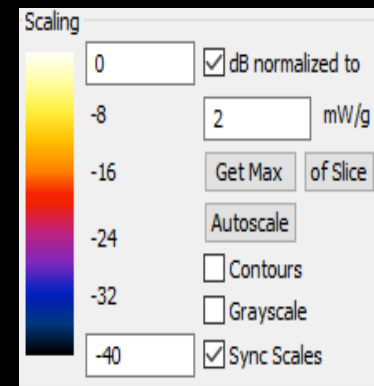
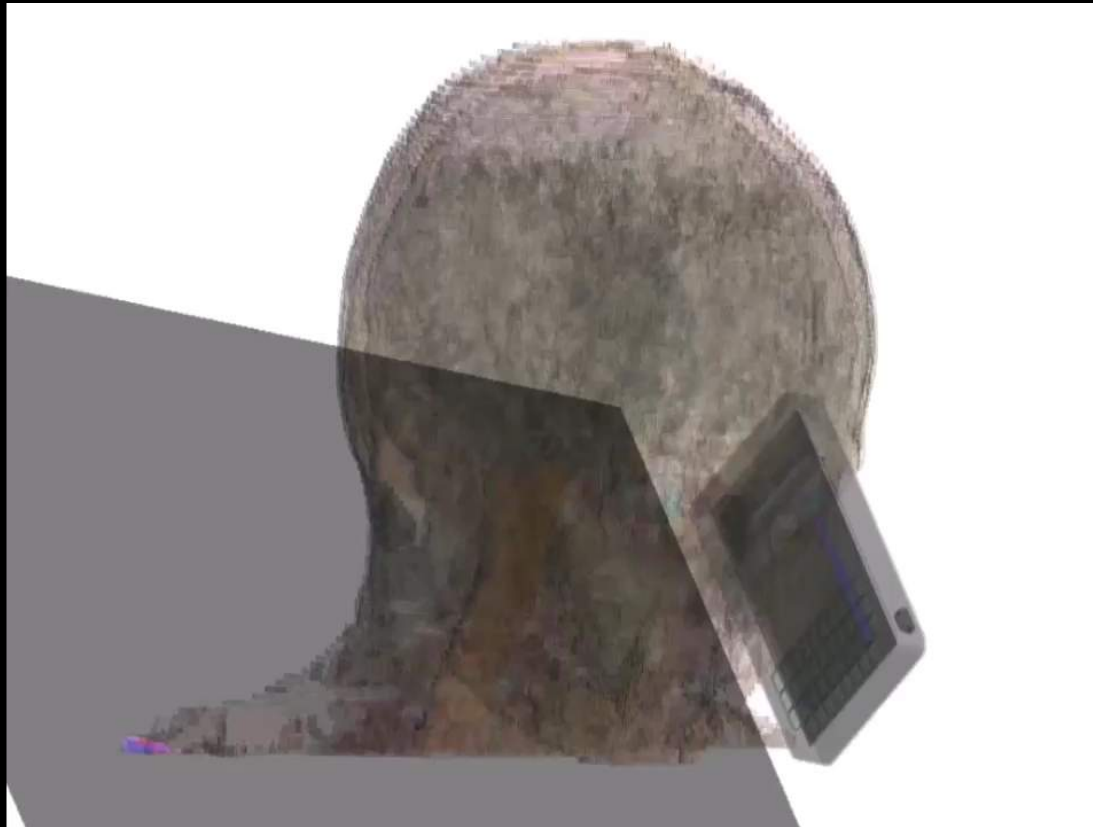
Results = Increased

- mammary adenocarcinomas (both sexes)
- incidence of heart malignant schwannomas (males)
- hematopoietic neoplasias [leukemia and lymphoma] in males treated at 1,000 μ T plus 0.1 Gy.

(Soffritti et al., 2016)

“These results call for a reevaluation of the safety of non-ionizing radiation.”

Video of coronal slices of microwave exposure In ten year old psSAR (Fernandez et al IEEE/Access 2015)



[Fernandez et al., IEEE ACCESS 2015](#)

California Medical Association

Wireless Standards Reevaluation Resolution 107-14

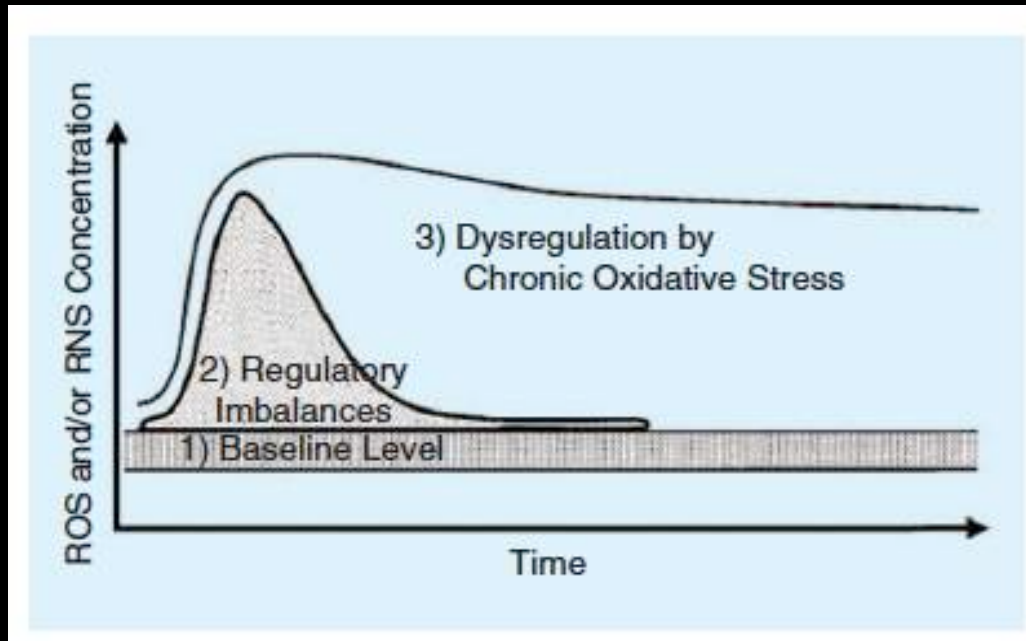


Resolved 1: That CMA supports efforts to reevaluate microwave safety exposure levels associated with wireless communication devices, including consideration of adverse *non-thermal* biologic and health effects ...

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

(Adopted 12/2014) [detailed in Santa Clara Medical Association Bulletin](#)

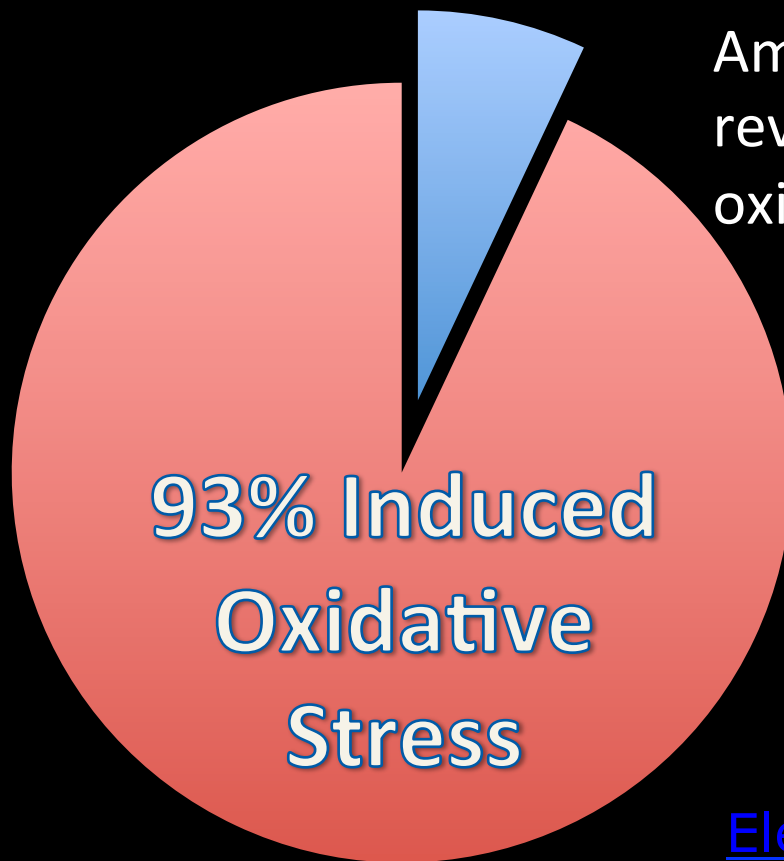
Effects of Weak Magnetic Fields on Biological Systems: RF fields can change radical concentrations and cancer cell growth rates



“Weak magnetic fields change the rate of recombination for radical pairs that are generated by the metabolic activity in cells, which, in turn, change the concentration of radicals such as O_2^- and molecules such as H_2O_2long-term exposure to elevated magnetic fields can lead to elevated radical concentrations and an association with aging, cancers, and Alzheimer’s.”

Increased Oxidative Stress After Radiofrequency Radiation Exposure

2015 Analysis of Peer-Reviewed Science



Among 100 currently available peer-reviewed studies dealing with RFR and oxidative effects:

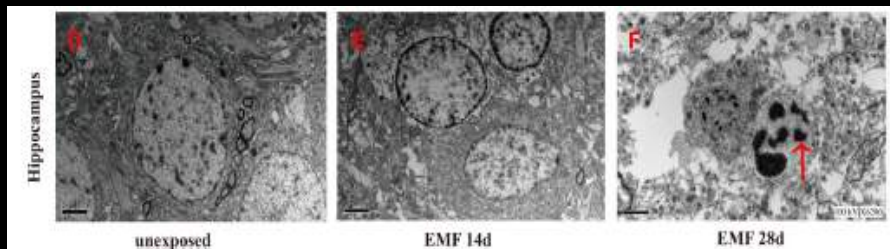
- 93% did induced oxidative stress
- 7% RFR did not induce oxidative stress

[Electromagnetic Biology and Medicine](#)
[Yakymenko et al., 2015](#)

900 MHz activates the mcp-1/ERK pathway and causes blood-brain barrier damage and cognitive impairment

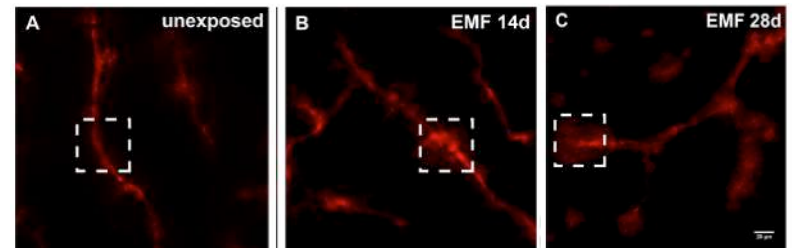
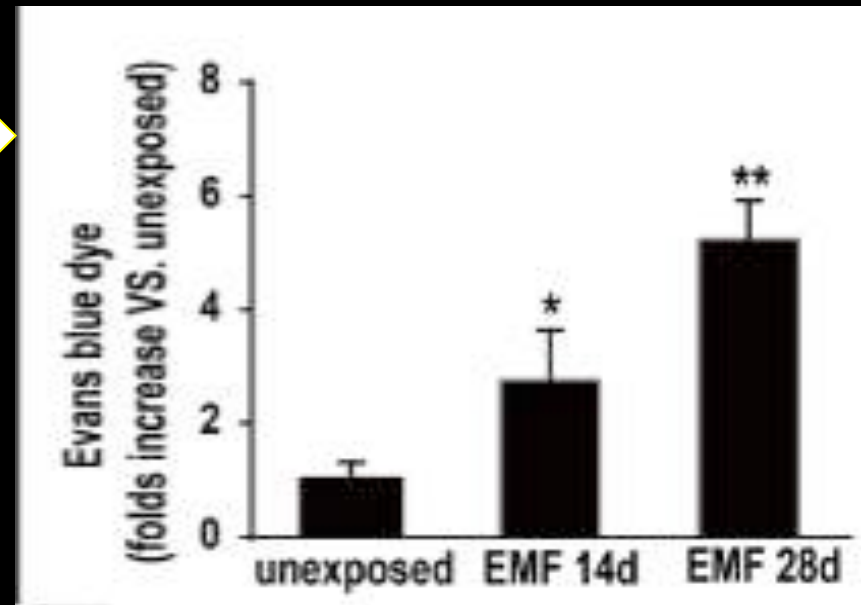
108 rats exposed to a 900MHz for 14 or 28 days (3 h per day).

Immunostaining of brain slices after Evans blue dye injection showed significantly higher brain–blood barrier permeability in exposed. →



Ultrastructural changes in the hippocampal region: Nerve fibers showed scant and empty areas, severe edema around blood vessels and neurons. Organelles of neurons were unclear, wrinkled, and dark in morphology.

[Tang 2015 in Brain Research](#)



Tang 2015 Replicates BBB Studies

Tang 2015: 28 days of EMF exposure induced cellular edema and neuronal cell organelle degeneration in the rat and damaged BBB permeability.

1975 Allan Frey-Annals of the New York Academy of Sciences- microwaves could induce “leakage” in BBB.

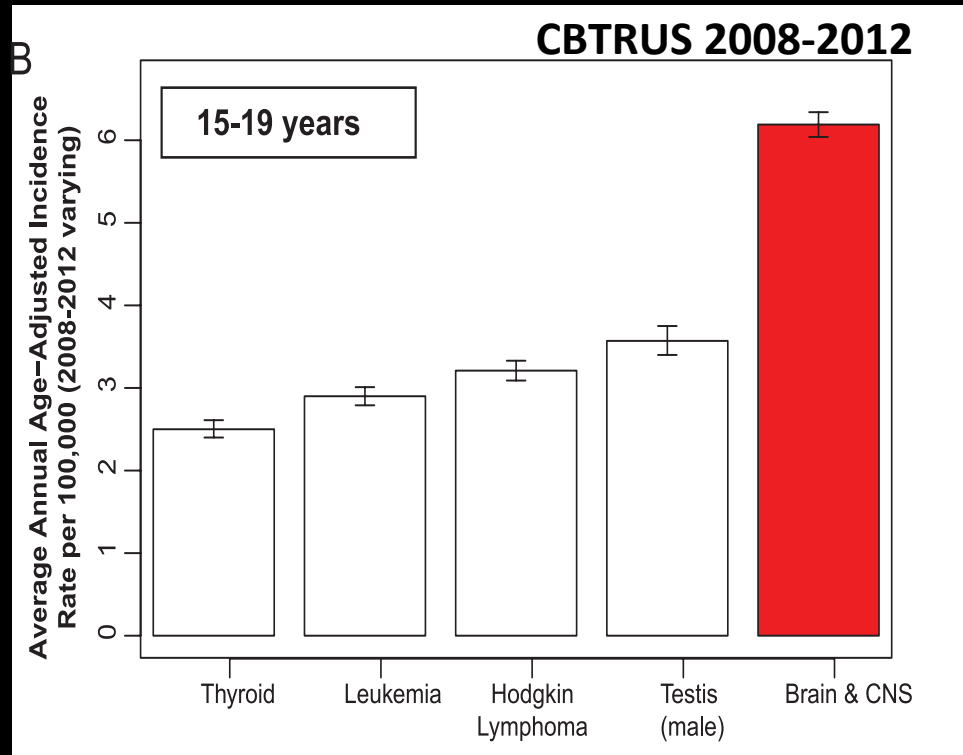
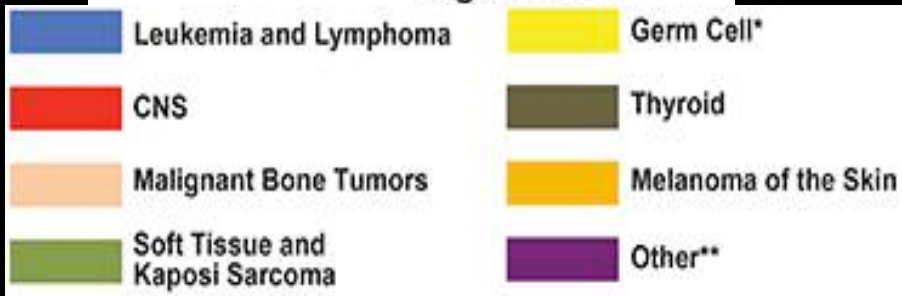
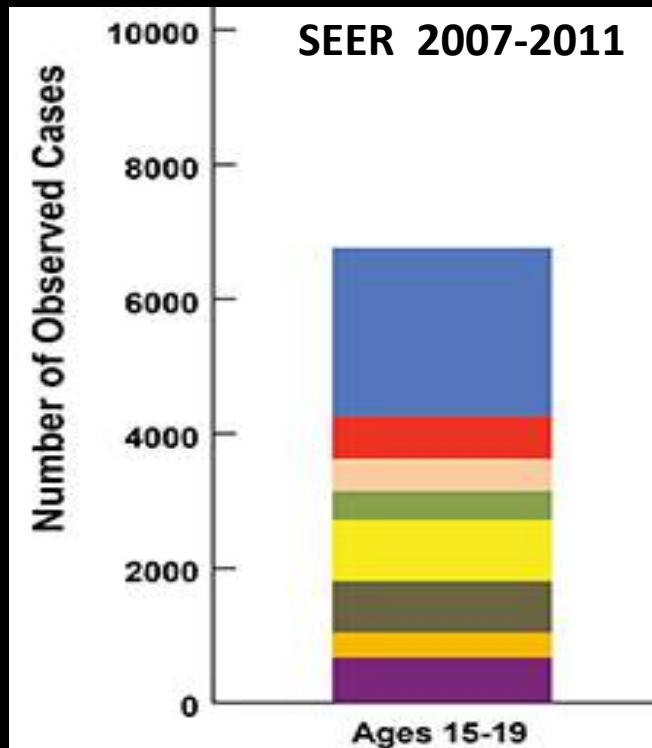
- (Nittby 2009) Increased blood-brain barrier permeability in mammalian brain 7 days after exposure to the radiation from a GSM-900 mobile phone.
- (Nittby 2008) Cognitive impairment in rats after long-term exposure to GSM-900 mobile phone radiation.
- (Belyaev 2006) Exposure of rat brain to 915 MHz GSM microwaves induces changes in gene expression but not double stranded DNA breaks or effects on chromatin conformation.
- (Salford 1994) Permeability of the blood-brain barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50, and 200 Hz.

2009, **Patrick Mason** et al., Air Force Research Laboratory failed to replicate Salford's research. (McQuade 2009) Two years later they admitted that the dye was injected into animals' bellies . (Frey's research dye into femoral vein).

Cancer Incidence in Adolescents – US

SEER (30% pop'n)

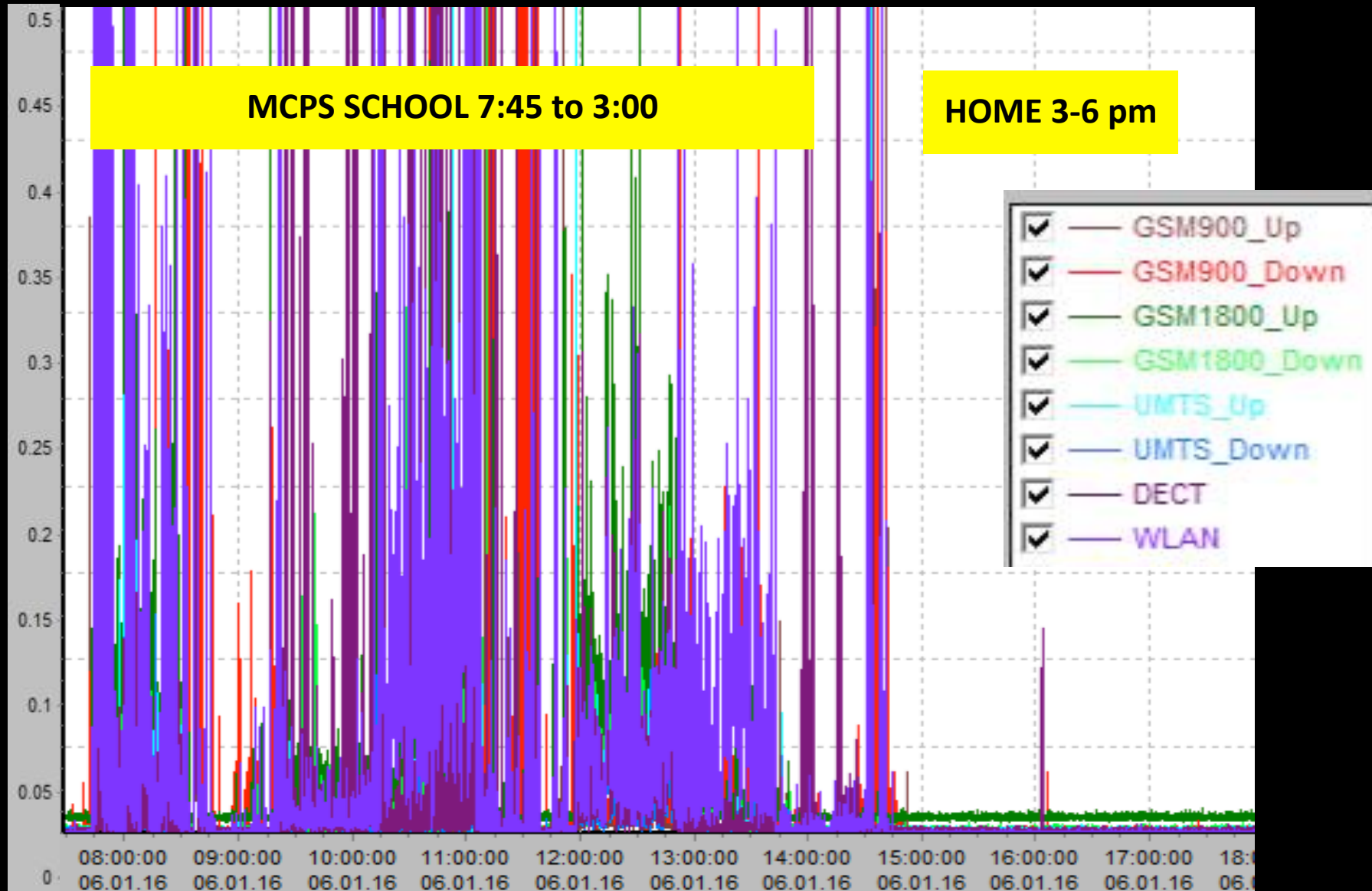
CBTRUS (99+% pop'n)



Brain tumors are the highest incidence cancers in US adolescents

Multiple Frequencies in a School Classroom Setting January 2016

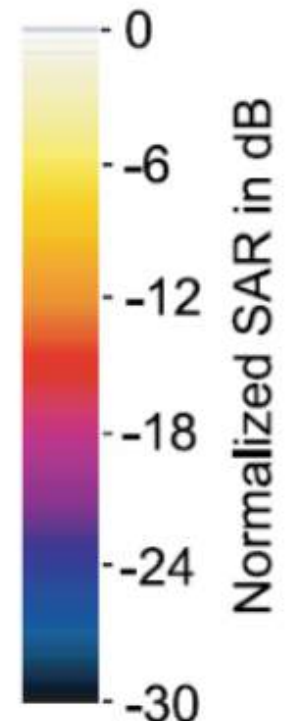
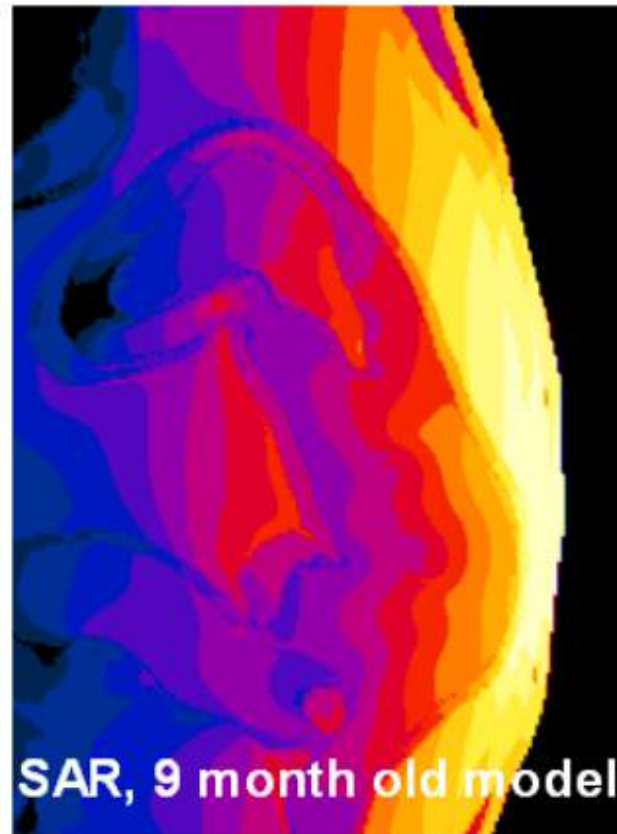
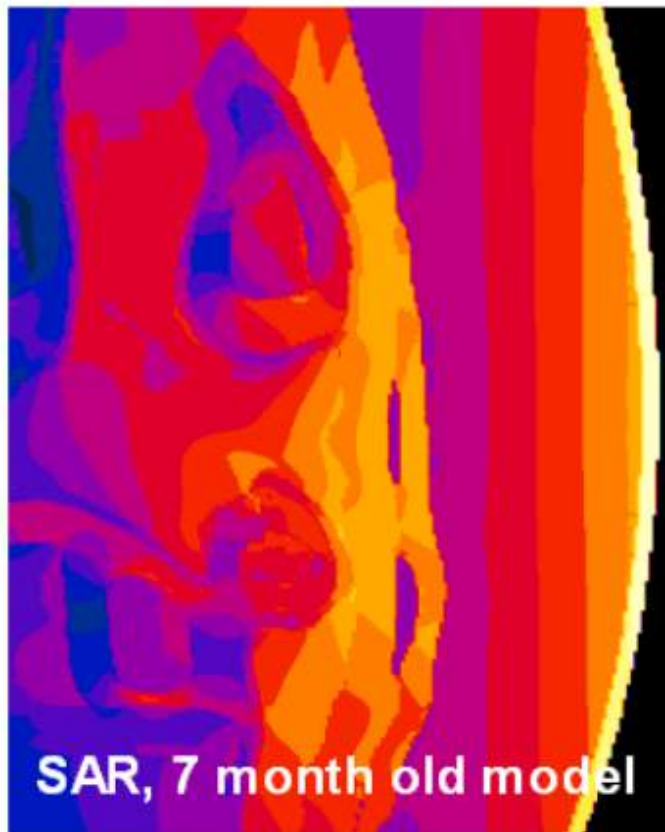
Graph goes up to .5 mW/m²



[Body Worn ESM 140 Dosimeter Maschek Elektronik](#) special thanks to Electromagnetic Health for facilitating measurements.

Greatest exposure occurs to fetal head/spinal cord

Normalized SAR when 7 and 9 mos fetus exposed to a dipole antenna in front of abdomen



Since 1997 Secondary Insurers do not cover health damages from wireless

Several Lloyds of London underwriters deny coverage for health damages from wireless devices.

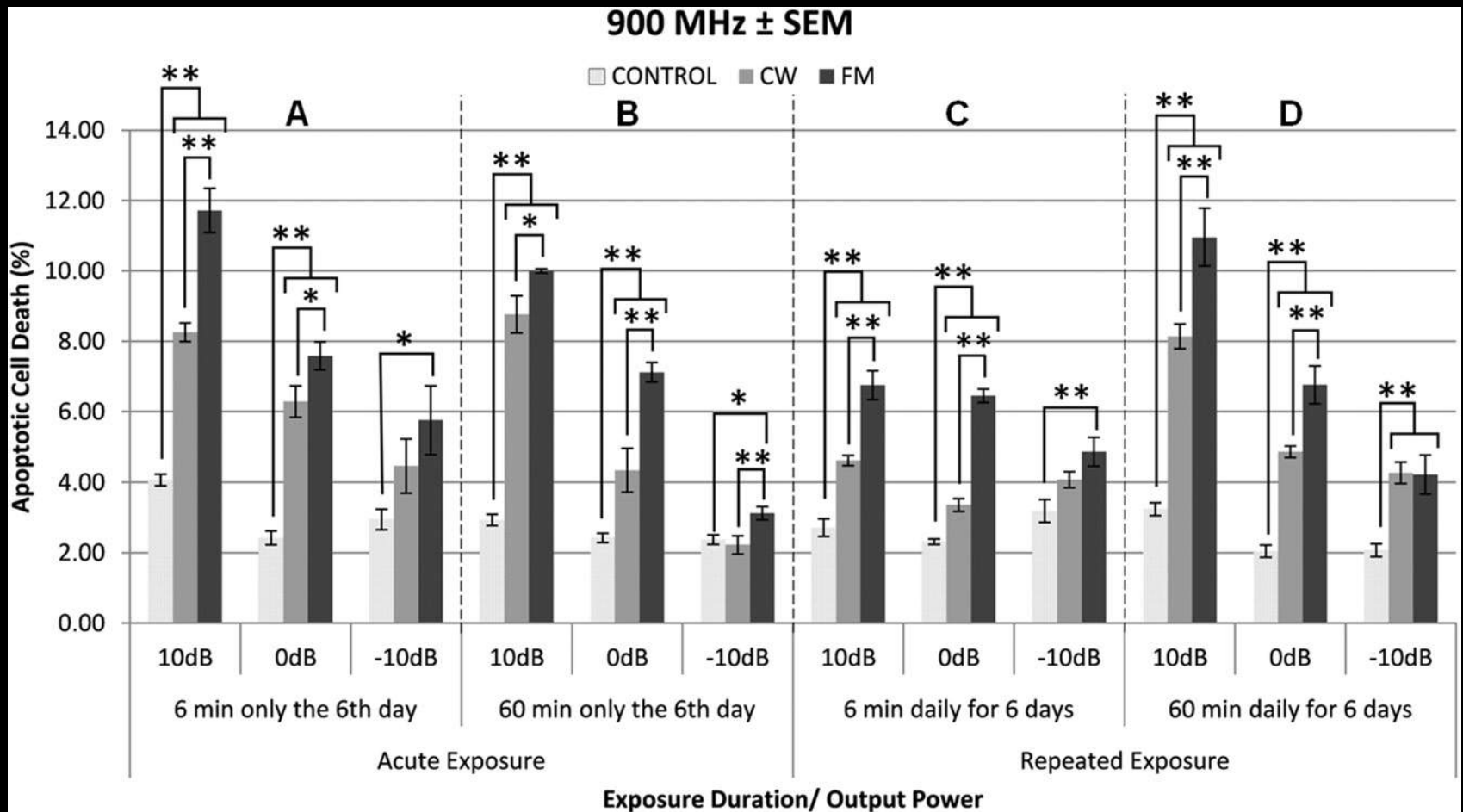
Swiss Re 2014 rates electromagnetic fields as one of the 6 top risks businesses face today, above things like Mad Cow Disease.

“Risk from dangers linked to EMF can be classified as an emergent risk”-- the same category once occupied by asbestos

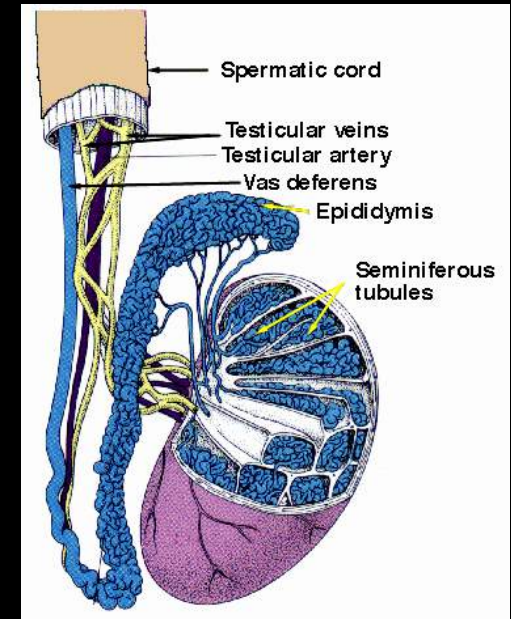
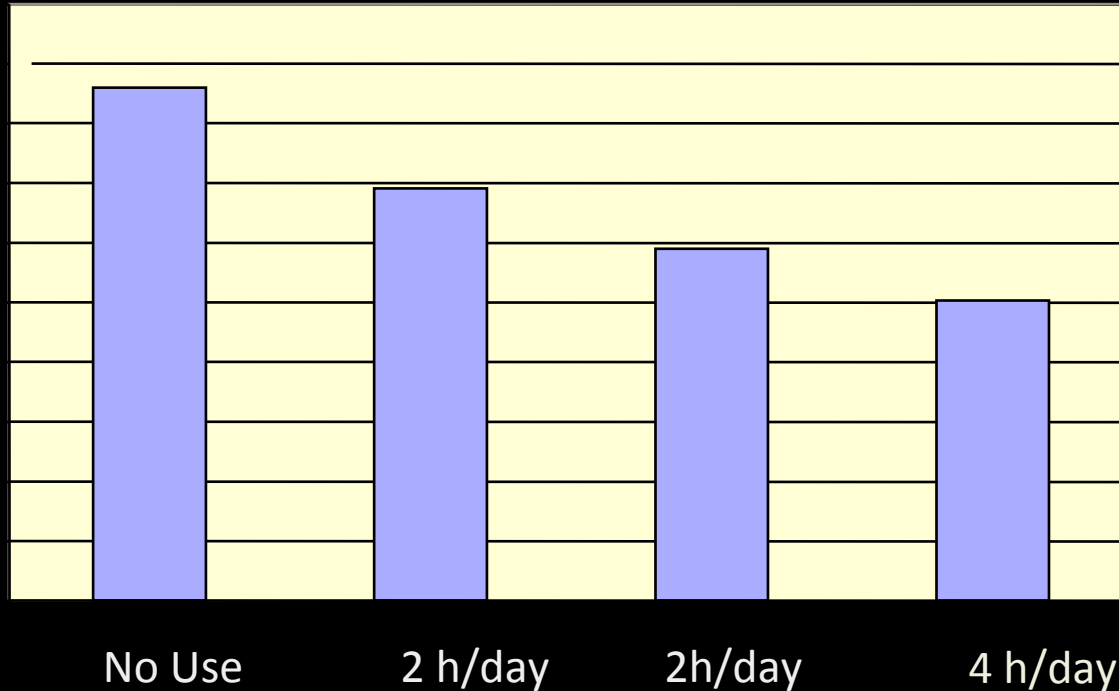
General Insurance Exclusions: Electromagnetic fields directly or indirectly arising out of, resulting from or contributed to by electromagnetic fields, electromagnetic radiation, electromagnetism, radio waves or noise.



Drosophila Oocyte Death Pulsed Signals Most Toxic



Heavier Cell Phone Users Have Reduced Sperm Count



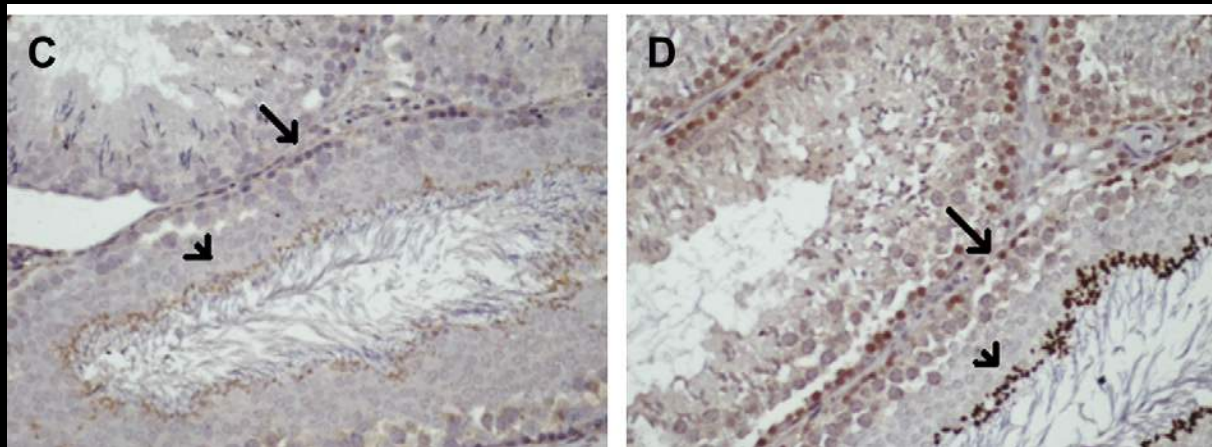
*Ashok Agarwal MD PhD, Cleveland Clinic, 2008;
and seven other studies*

Do not take without permission

Wi-Fi Increases Oxidative DNA Damage Testes Immunohistopathology

Control

Wi-Fi Exposed



Rats: Wi-Fi 24h/day x
20 days (802.11 standard)

Normal routine
histology

Diffuse and intense bead-like nuclear immunopositivity in the spermatocytic cells.

- ↑ Oxidative DNA damage (8-hydroxyguanosine nuclear positivity)
- ↓ Testicular biopsy score, glutathione peroxidase and catalase

Dielectric Properties of the Three Models - SAM, Duke and Thelonius.

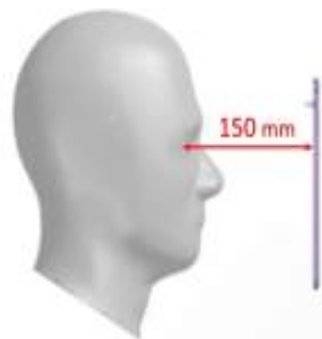
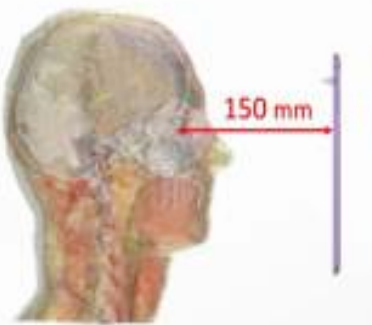


Fig 3. SAM phantom (homogeneous model) with Tablet.

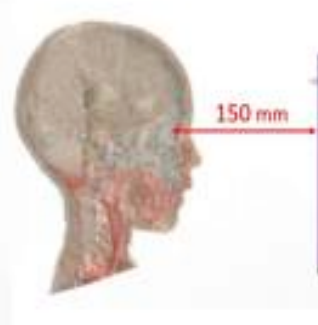
TABLE III. Dielectric Properties of the SAM Phantom following the IEEE 1528 Recommended Practice @ 2.45 GHz.

Material	σ [S/m]	ϵ_r
SAM shell	0.0016	5
SAM liquid	1.8	39.2

Homogenous liquid inside skull does not realistically represent brain and skull.



(a) 34 years old adult man (DUKE)



(b) 6 years old child (THELONIOUS)

TABLE IV. Dielectric Properties of the Heterogeneous Models Tissues @ 2.45 GHz.

Tissue	ϵ_r	σ [S/m]
Fat	0.104	5.280
Bone	0.394	11.381
Grey matter	1.807	48.911
White matter	1.215	36.167
Liquid Brain	66.243	3.457
Muscle	52.729	1.738
Aqueous Humor	68.208	2.478
Skin	38.007	1.464
Crystalline	44.625	1.504
Sclera	52.628	2.033
Vitreous Humor	68.208	2.478
Cerebellum	30.145	1.088
Nerve	30.145	1.088

With Anatomical Models Different Properties of Different Body Tissues are considered.



Prenatal 900 MHz EMF exposure decreased hippocampal granular cell number in the dentate gyrus of newborn rats

BRAIN RESEARCH 1238 (2008) 224–229



available at www.sciencedirect.com



www.elsevier.com/locate/brainres

**BRAIN
RESEARCH**

Research Report

Effects of prenatal exposure to a 900 MHz electromagnetic field on the dentate gyrus of rats: a stereological and histopathological study[☆]

Ersan Odaci^{a,*}, Orhan Bas^b, Suleyman Kaplan^c

^aDepartment of Histology and Embryology, Karadeniz Technical University School of Medicine, Trabzon, Turkey

^bDepartment of Anatomy, Afyon Kocatepe University School of Medicine, Afyonkarahisar, Turkey

^cDepartment of Histology and Embryology, Ondokuz Mayıs University School of Medicine, Samsun, Turkey

ARTICLE INFO

Article history:

Accepted 5 August 2008

Available online 16 August 2008

Keywords:

Electromagnetic field

Dentate gyrus

Granule cell

Stereology

Optical fractionator

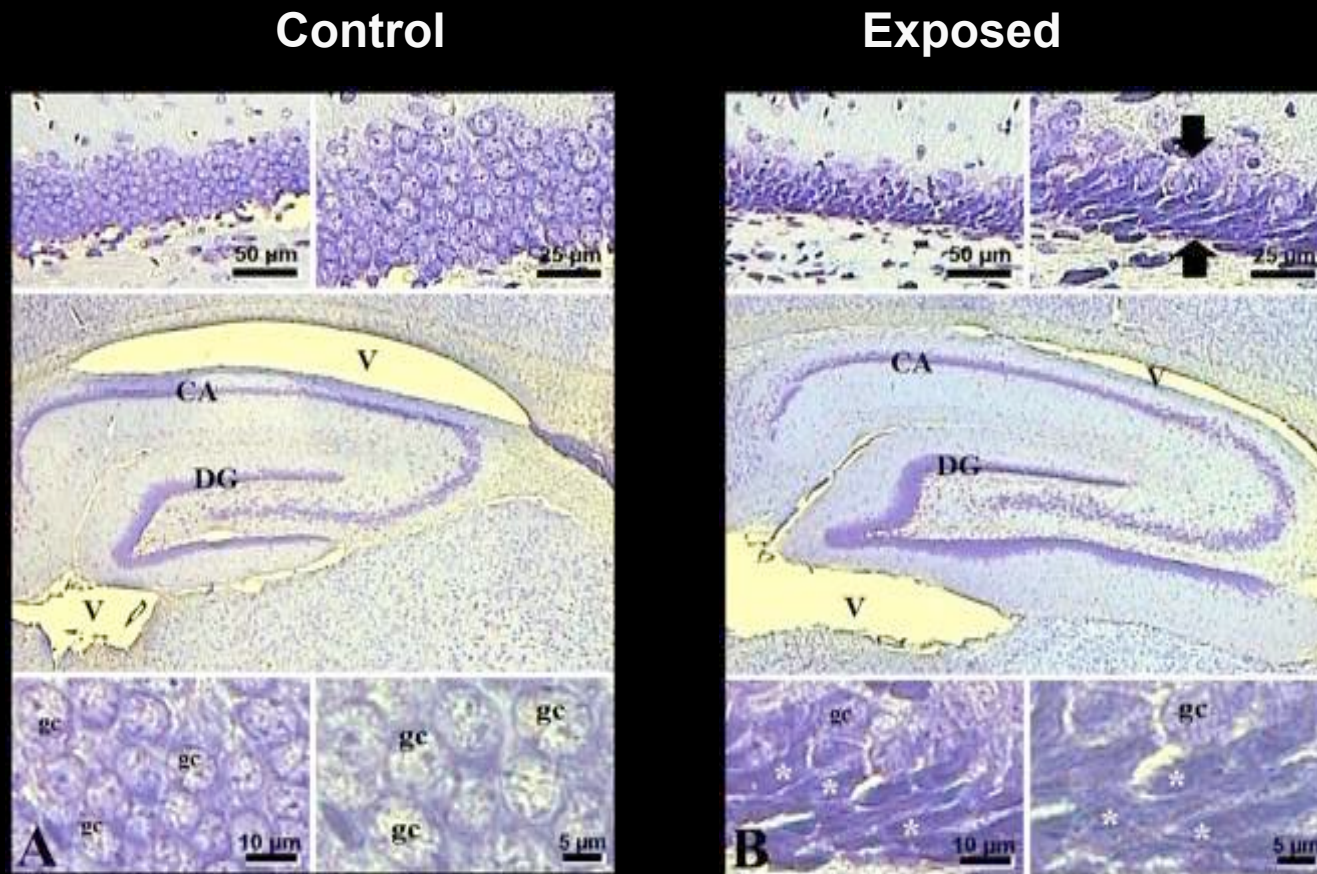
Rat

ABSTRACT

Electromagnetic fields (EMFs) inhibit the formation and differentiation of neural stem cells during embryonic development. In this study, the effects of prenatal exposure to EMF on the number of granule cells in the dentate gyrus of 4-week-old rats were investigated. This experiment used a control (Cont) group and an EMF exposed (EMF) group (three pregnant rats each group). The EMF group consisted of six offspring ($n=6$) of pregnant rats that were exposed to an EMF of up to 900 megahertz (MHz) for 60 min/day between the first and last days of gestation. The control group consisted of five offspring ($n=5$) of pregnant rats that were not treated at all. The offspring were sacrificed when they were 4 weeks old. The numbers of granule cells in the dentate gyrus were analyzed using the optical fractionator technique. The results showed that prenatal EMF exposure caused a decrease in the number of granule cells in the dentate gyrus of the rats ($P<0.01$). This suggests that prenatal exposure to a 900 MHz EMF affects the development of the dentate gyrus granule cells in the rat hippocampus. Cell loss might be caused by an inhibition of granule cell neurogenesis in the dentate gyrus.

© 2008 Elsevier B.V. All rights reserved.

Fewer, abnormal hippocampal granular cells in the dentate gyrus (DG) of newborn rats following prenatal 900 MHz EMF exposure



Representative photomicrographs and magnifications of the medial region of DG.

Control group granular cells normal; most in the EMF group abnormal, condensed. (arrows - dark-blue cells interspersed among normal nerve cells). Cresyl fast violet staining.

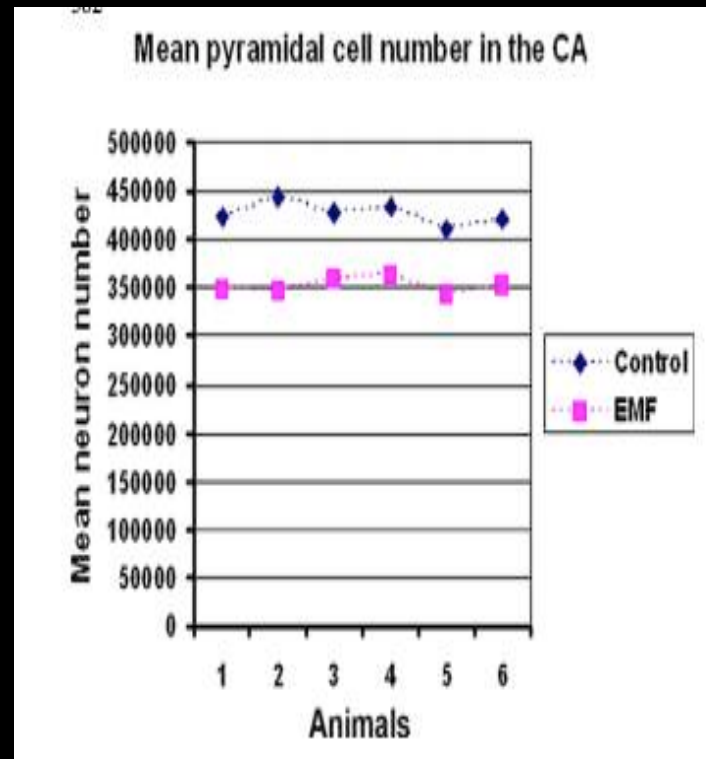
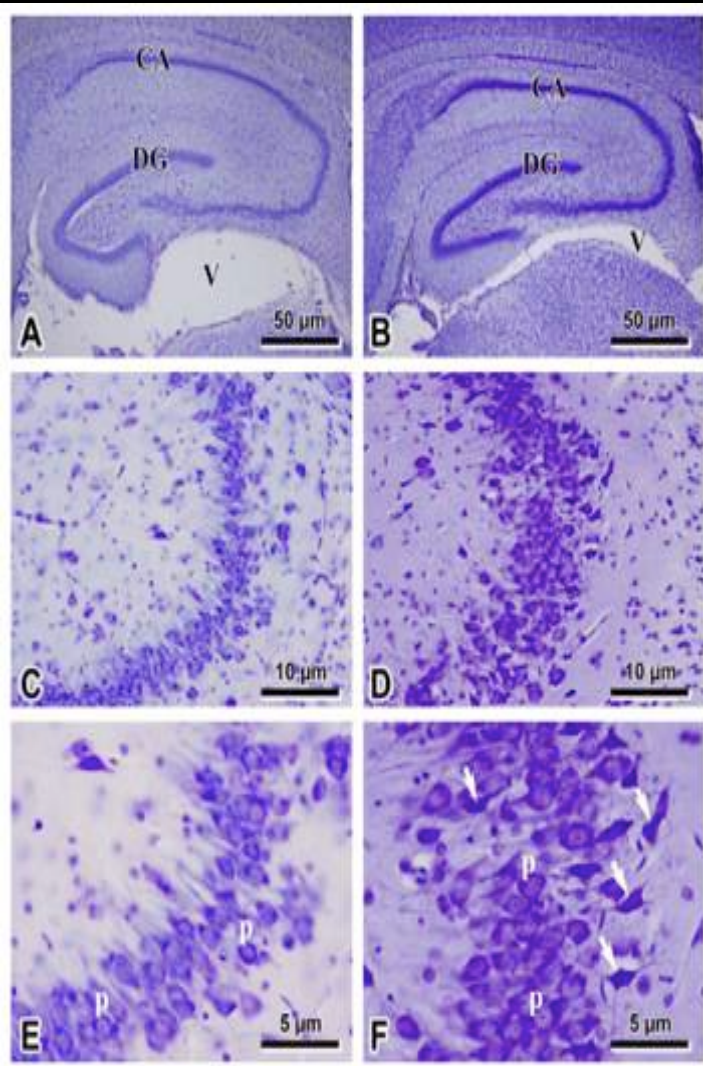
[Odaci E, Bas O, Kaplan S. \(2008\)](#)

Fewer pyramidal cells in pup hippocampus with 900 MHz RF prenatal exposure (1h daily x 19 days)

Control

Exposed

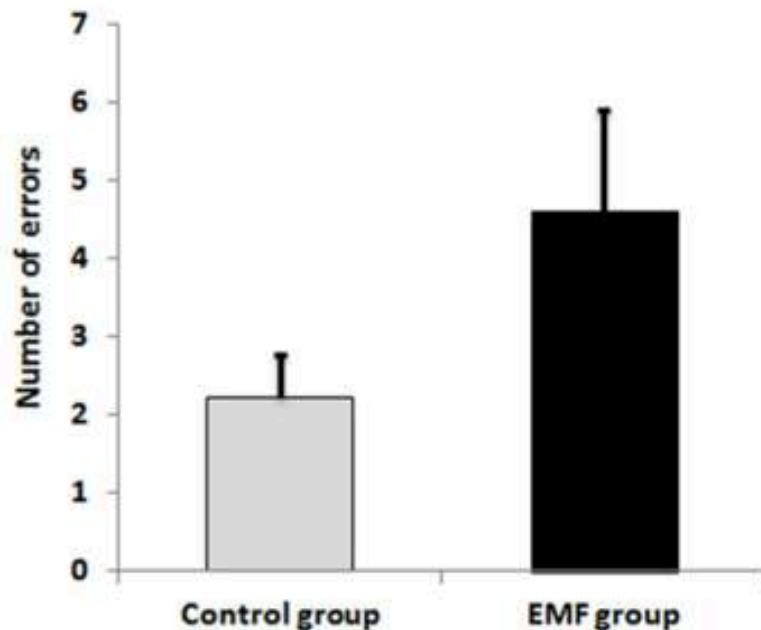
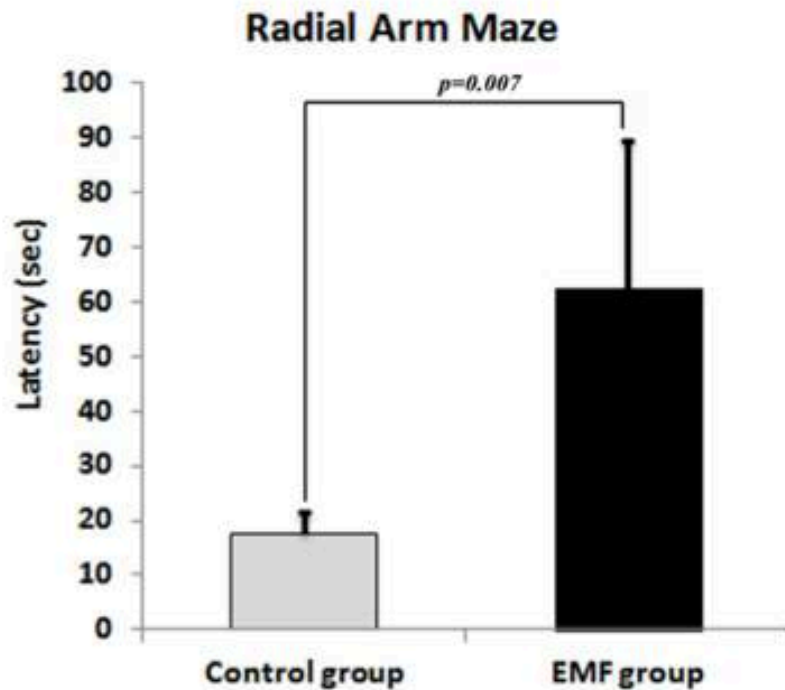
Hippocampus following prenatal EMF exposure:
More abnormal cells - black or dark blue, with shrunken morphology.



Significantly fewer pyramidal cells in the cornu ammonis with EMF exposure.

[Bas O, E Odaci, H Mollaoglu, et al. \(2009\)](#)

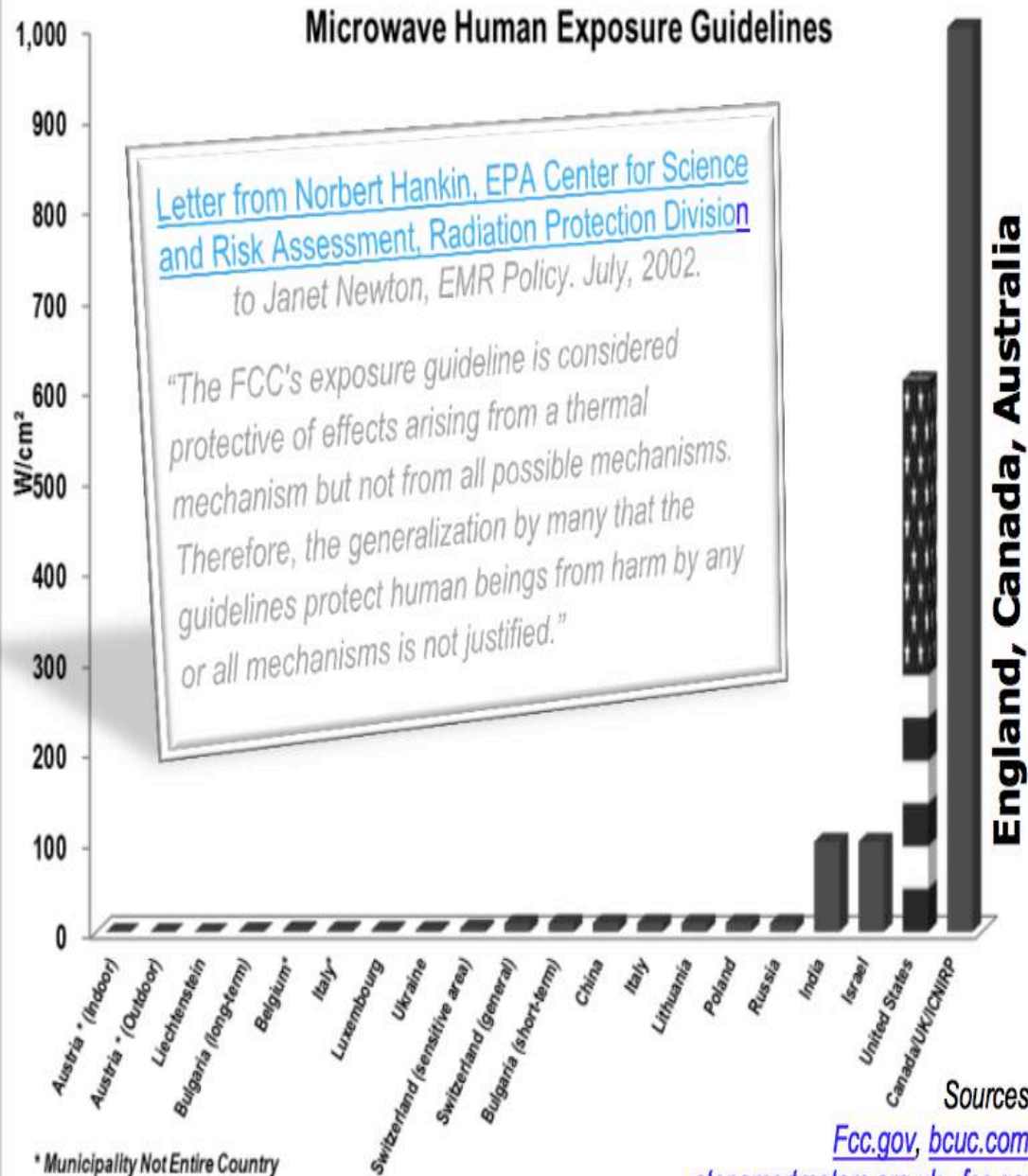
Prenatally Exposed newborns have impaired memory and learning



Radial arm maze test results from the newborn control and newborn electromagnetic field (EMF) groups.

Exposed newborns took three times as long to find their way out of an experimental maze and made twice as many errors ($p=0.007$)

FCC “guidelines”

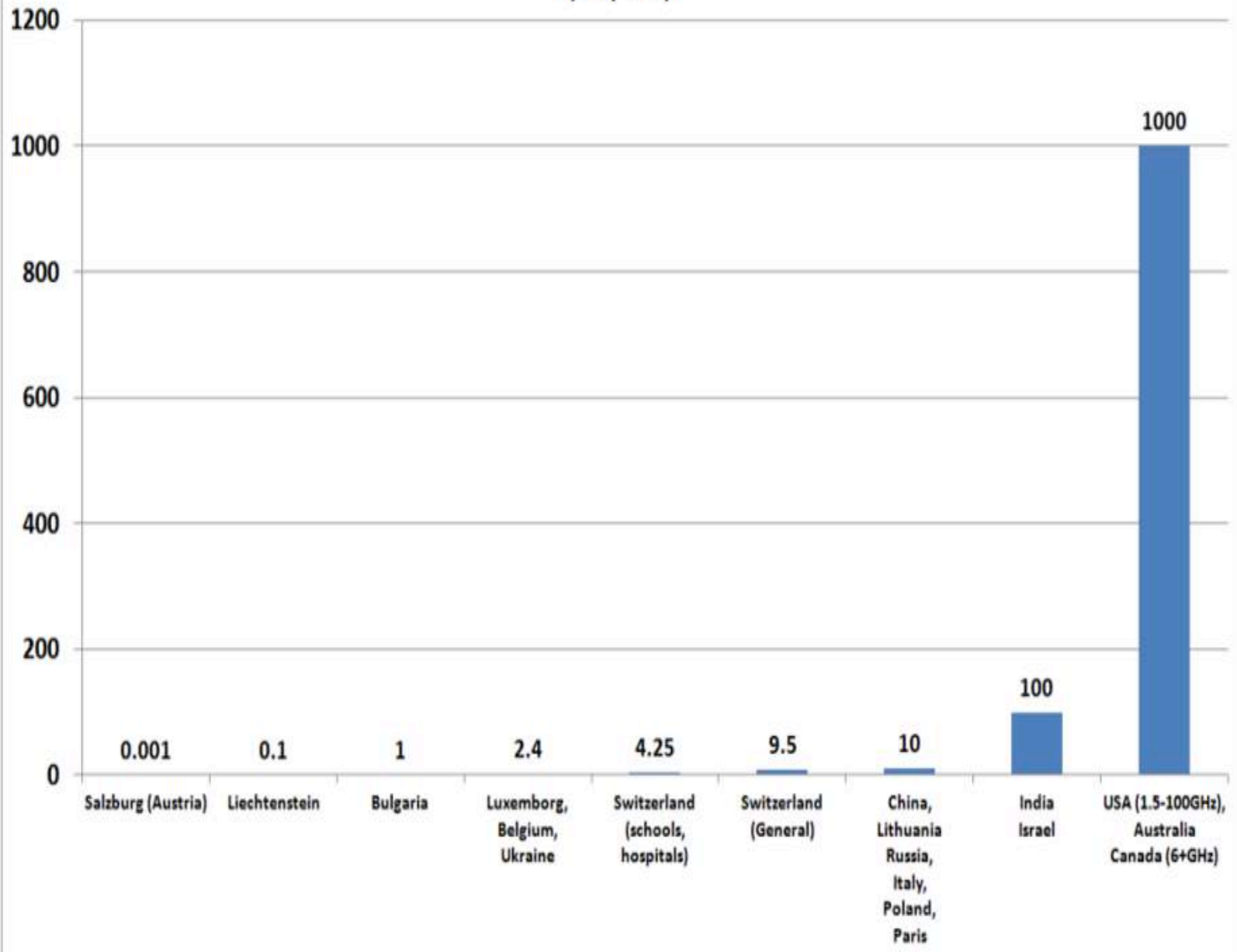


Sources:

Fcc.gov, bcuc.com,
stopsmartmeters.org.uk, fcc.gov

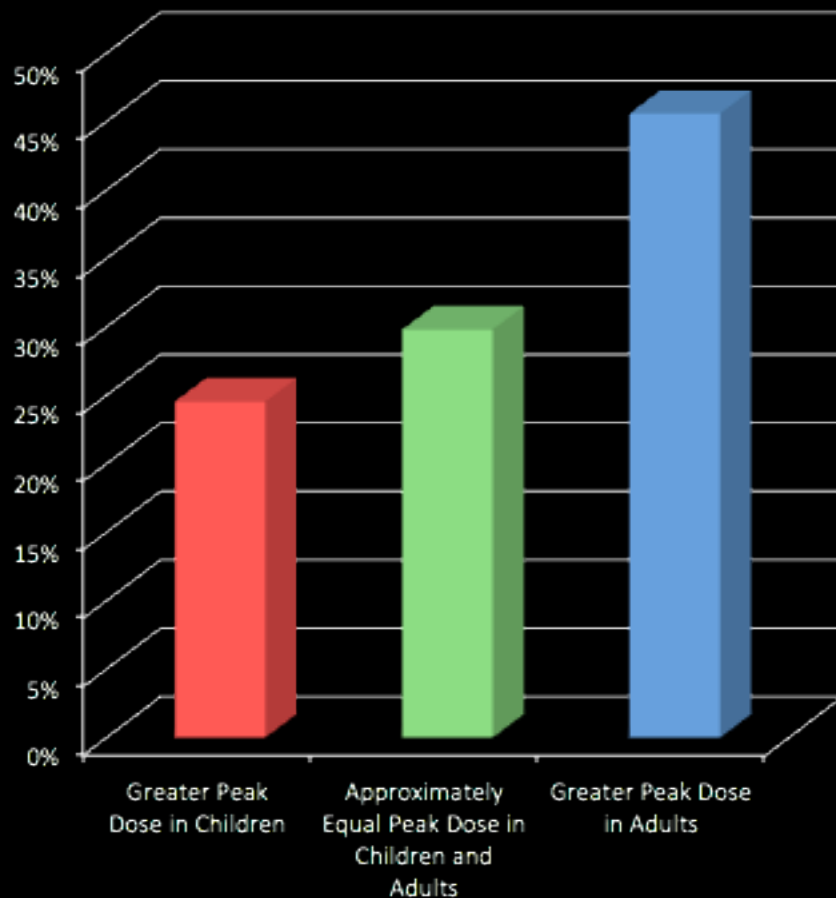
Outdoor Pulsed RF Radiation Limits - Other Countries

($\mu\text{W}/\text{cm}^2$)

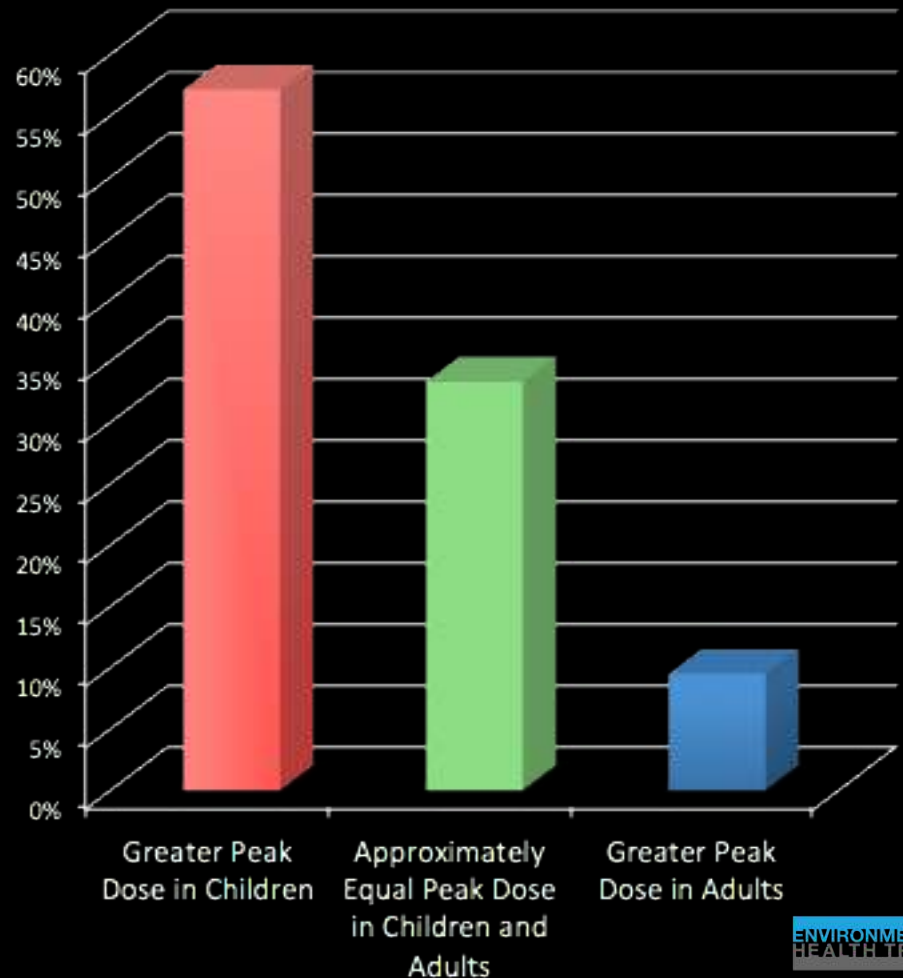


Morris et al, IEEE/Access, 2015 Call for Retraction of Foster & Cho Paper Claiming no difference between Adult and Child Absorption of head RF

Data Presented in Figure 1 by Foster and Chou



Study Summaries Quoted in Table 2 by Foster and Chou



Received August 20, 2014, accepted December 5, 2014, date of publication December 11, 2014, date of current version December 30, 2014.

Digital Object Identifier 10.1109/ACCESS.2014.2380135

Are Children More Exposed to Radio Frequency Energy From Mobile Phones Than Adults?

KENNETH R. FOSTER¹, (Life Fellow, IEEE), AND CHUNG-KWANG CHOU², (Life Fellow, IEEE)

¹Department of Bioengineering, University of Pennsylvania, Philadelphia, PA 19104, USA

²C-K. Chou Consulting, Fort Lauderdale, FL 33322, USA

Corresponding author: K. R. Foster (kfoster@seas.upenn.edu)

ABSTRACT There has been long-standing controversy, both among scientists and in the public, about whether children absorb more radio frequency (RF) energy in their heads than adults when using a mobile telephone. This review summarizes the current understanding of this issue, and some of the complexities in comparing the absorption of RF energy in different individuals from use of mobile phones. The discussion is limited to dosimetric issues, i.e., possible age-related differences in absorption of RF energy in the heads of mobile phone users. For most metrics of exposure, in particular those relevant to assessing the compliance of handsets with regulatory limits, there is no clear evidence for age-related differences in exposure. For two metrics of exposure, there is a clear evidence that age can play a factor: 1) the local specific absorption rate (SAR), in particular anatomically defined locations within the brain, will vary with head size and hence with age and 2) the SAR, in particular tissues, (e.g., bone marrow in the skull) can vary with age due to age-related differences in the dielectric properties of tissue. However, these differences involve SAR levels that are below the 1-g or 10-g peak spatial SAR (psSAR averaged over 1 or 10 g of tissue) and have no significance for compliance assessment. Age-related differences observed in worst case simulations such as presently considered are difficult to generalize to human populations under real-world exposure conditions due to many variables that determine SAR during realistic usages.

INDEX TERMS Mobile phone, radiofrequency, exposure, specific absorption rate, children.

I. INTRODUCTION

For the past two decades there has been a recurring controversy about whether children absorb more radiofrequency (RF) energy in their heads than adults from use of mobile phones. This issue is significant for several reasons. One is the need for manufacturers of mobile handsets to demonstrate compliance of their products with regulatory limits. Moreover, the exposure of an individual to RF energy from use of a mobile phone is relevant to the question of possible health effects of mobile phones.

Many websites and other media that address the general public state that children absorb more RF energy from mobile phones than adults, typically in support of arguments that mobile phones pose particular health risks to children. A search on the Internet using Google Search and the phrase “children absorb more RF than adults” or “children absorb more MWR [microwave radiation] than adults” together identified about 300 web pages; searching on variants of these phrases uncovered many additional web sites. By contrast there have been few if any recent critical examinations of

the claim that take into account the considerable technical complexity of the issue.

This review summarizes the current scientific evidence on this issue, focusing on studies that permit a direct comparison of SAR in heads of children and adults from use of a mobile phone. The discussion below is limited to dosimetric issues, i.e., possible age-related differences in absorption of RF energy in the heads of users of a mobile phone handset, principally in the context of assessment of compliance of handsets for regulatory approval. The larger issue, of whether the use of mobile phones poses health risks to their users, is beyond the present scope of this review.

The Specific Absorption Rate (SAR) in W/kg of body tissue is the fundamental dosimetric quantity that is used both by researchers and specified in national exposure limits (for a tutorial see [1]). The SAR represents the amount of power deposited per unit mass in tissue, and can be quoted as a value at any particular point in tissue, or as an average over a specified mass of tissue or over the entire body.

- This 2014 review examined 23 studies that used computer models to estimate and compare tissue dose to the heads of adults and children using wireless transmitting devices.
- The authors extracted the peak specific absorption rates (SAR) in children as compared to adults for a given exposure.
- The study concluded that “simple generalizations found on the Internet about kids absorbing more RF energy than adults from cell phones aren’t supported by available dosimetry studies.”

Table 2 from Foster and Chou, which quotes summary statements from each of the papers considered in their review.

TABLE 2. Publications on SAR in children and adults head models exposed to mobile phones.

Year	Reference	Model	Results
1994	Dimbylow and Mann [13]	Child head model scaled down from adult model; "generic mobile communication transceiver"; 900, 1800 MHz	"The SAR values, averaged over 10 g for the infant are comparable or in most cases lower than the values in the adult phantom."
1996	Gandhi et al. [5]	$\lambda/4$ and $3\lambda/8$ antennas, adult head from imaging; child head scaled down from adult head; 835, 1900 MHz	"Because of the deeper penetration of EM energy in smaller models, considerably higher internal tissue SAR's are obtained both at 835 and 1900 MHz. Also, higher 1-g SAR's are obtained at 835 MHz for both $\lambda/4$ and $3\lambda/8$ antennas."
1998	Schönborn et al. [10]	Adult and two child (3, 7 yr) head models from MRI scans; 0.45 λ dipole antenna; 900 and 1800 MHz	"The results revealed no significant differences in the absorption of electromagnetic radiation in the near field of sources between adults and children. The same conclusion holds when children are approximated as scaled adults."
2002	Gandhi and Kang [8]	Anatomically based model and two uniformly scaled models, scaled up by 11.1% or down by -9.1% from baseline adult head model; monopole and helix antennas; 835 and 1900 MHz	"larger peak 1 g SARs are obtained even for the body tissues and for the brain with reduced head size for adult models with peak 1 g SARs that may be up to 50-55% higher compared to SARs for the larger model, particularly for a PCS frequency of 1900 MHz. Also as expected, there is a deeper penetration of the absorbed energy, e.g. for the brain for smaller models."
2002	Lee et al. [14]	Adult Korean head from MRI and CT images and 5 scaled-down head models from 90-110% of baseline adult head model; also models with nonuniform scaling; simulated phone handset; 835 and 1765 MHz	"We investigated the effects of head size on specific absorption rate characteristics for two mobile phones operating at 835 MHz and 1765 MHz. Our results showed that a larger head produced a higher localized SAR at 835 MHz. However, at 1765 MHz the differences among the head models were insignificant since the superficial absorption was dominant over the effects of head shape and size."
2003	Anderson et al. [20]	Three layered spherical head model representing scalp, cranium, brain of different sizes; 0.4 λ dipole antenna; 900 MHz	"...the thickness of the ear, scalp and cranium do decrease on average with decreasing age, though individual variability within any age group is very high.... The model analyses revealed that compared to an average adult, the peak brain 10 g averaged SAR in mean 4, 8, 12 and 16 year olds is increased by a factor of 1.31, 1.23, 1.15 and 1.07, respectively."
2003	Wang and Fujiwara [18]	Child heads developed by nonuniform scaling of adult head model from MRI scans; 0.45 λ dipole and $\lambda/4$ monopole antennas; 900 MHz	"Compared to the local peak SAR in the adult head model, we found a considerable increase in the children's heads when we fixed the output power of the monopole-type antenna, but no significant differences when we fixed the effective current of the dipole-type antenna. This finding suggests that the contradictory conclusions drawn by the above two groups [Gandhi et al. [5], Schönborn et al. [10]] may be due to the different conditions in their numerical peak SAR calculations."
2004	Martínez-Búrdalo et al. [11]	Adult head model from MRI scans and downscaled adult head model to represent child head; $\lambda/2$ dipole antenna; 900 and 1800 MHz	"Results show that peak SAR(1 g) and peak SAR(10 g) all trend downwards with decreasing head size but as head size decreases, the percentage of energy absorbed in the brain increases."
2005	Bit-Babik et al. [12]	Nonuniformly scaled adult head models; dipole antenna, idealized handset, and commercial mobile phone; 835 MHz	"...peak local average SAR over 1 g and 10 g of tissue and the electromagnetic energy penetration depths are about the same in all of the head models under the same exposure conditions."
2005	Christ et al. [21]	MRI-based models adult male and female and 3 year old child; 4 idealized and commercial mobile phone phones; 900 and 1800 MHz	"...smaller heads do not result in increased SAR values and that all differences can be explained by differences in distance and anatomical variations in tissue structures. These findings contradict Gandhi et al. [5]"
2005	Hadjem et al. [15]	Two adult head models and two child head models, one a scaled down version of the adult head, other derived from MRI images of a child; two commercial mobile phones; 900 and 1800 MHz	"The peak SAR(10 g) in the brain of the CS or CL head [two child head models] is slightly more significant [higher] than that for the adult one."

TABLE 2. (Continued.) Publications on SAR in children and adults head models exposed to mobile phones.

2005	Keshvari and Lang [16]	Four MRI based head models of adults and children (3 and 7 yrs); $\lambda/2$ dipole antenna at 900, 1800, 2450 MHz	"The analyses suggest that the SAR difference between adults and children is more likely caused by the general differences in the head anatomy and geometry of the individuals rather than age. It seems that the external shape of the head and the distribution of different tissues within the head play a significant role in the RF energy absorption."
2005	Wart et al. [17]	Child head models from MRI scans and nonuniformly scaled adult head models; handset model with patch antenna; 900 MHz	"Dealing with the maximum SAR over 10 g, the observed differences are comparable to those observed using different adult heads. It is found in the analysis of the SAR induced in brain that the max SAR over 1 g in children brain is slightly more significant [i.e., higher] than the one for the adult, while it remains at a weak level of exposure."
2006	Beard et al. [19]	Three head models ("phantom" head model, MRI derived adult and child head models); generic mobile phone at 835 and 1900 MHz (14-center comparison trial)	"...the larger (adult) head produced a statistically significant higher peak SAR for both the 1- and 10-g averages than did the smaller (child) head for all conditions of frequency and position."
2006	De Salles et al. [9]	Child head scaled down from adult head; planar patch antenna and $\lambda/4$ monopole antenna; 850 and 1850 MHz	"... under similar conditions, the 1g-SAR calculated for children is higher than that for the adults. When using the 10-year old child model, SAR values higher than 60% than those for adults are obtained."
2008	Wart et al. 2008 [22]	Seven child and six adult head models based on MRI scans; dipole, generic and commercial mobile handsets; 900, 1800, 2100 and 2400 MHz	"...the differences between the maximum SAR over 10 g estimated in the head models of the adults and the ones of the children are small compared to the standard deviations. But they indicate that the maximum SAR in 1 g of peripheral brain tissues of the child models aged between 5 and 8 years is about two times higher than in adult models."
2009	Peyman et al. [27]	2 child (3 and 7 yrs) and 2 adult head models from MRI scans, simulated exposure from walkie-talkie (446 MHz)	"The results obtained were then used to calculate the SAR values in children of age 3 and 7 years when they are exposed to RF induced by walkie-talkie devices. No significant differences between the SAR values for the children of either age or for adults were observed"
2010	Christ et al. [23]	2 adult and 4 child head models from MRI scans, 2 generic and one commercial phones; 900 and 1800 MHz	"The results show that the locally induced fields in children can be significantly higher (> 3 dB) in subregions of the brain (cortex, hippocampus and hypothalamus) and the eye due to the closer proximity of the phone to these tissues. The increase is even larger for bone marrow (> 10 dB) as a result of its significantly high conductivity. Tissues such as the pineal gland show no increase since their distances to the phone are not a function of age. This study, however, confirms previous findings saying that there are no age-dependent changes of the peak spatial SAR when averaged over the entire head."
2010	Christ et al. [32]	1 adult and 2 child (6, 11 yr) child heads based on MRI scans, 2 generic mobile phones, 1800 MHz	"The numerical exposure analysis showed that the reduced distance due to the pinna compression can increase the maximum 10 g pSAR by approximately 2 dB for adults and children, if the exposure maximum is associated with the upper part of the phone."
2010	Hadjem et al. [41]	Adult, 2 child head models (9, 15 yr), 3 bands 835-2100 MHz	"The comparison of the maximum SAR over 10 g between the different heads models (9 and 15 year olds and adult) shows that results were nearly similar"
2011	Keshvari and Heikkilä [24]	2 adult (female, male) 2 child (3, 7 yr) head models based on MRI scans; 2 commercial phones (900, 1800, 1900 MHz)	"...from a volume averaged SAR point of view, no systematic differences between child and adult heads were found"
2011	Wart et al. [42]	3 children (5,8,12 yr), adult, fetus models, 4 bands 900-2400 MHz and whole body exposure	"compliance methods used nowadays to certify phones are valid for children.... specific tissues such as peripheral brain tissues can have higher exposure with children than with adults."
2012	Lu and Ueno [25]	1 adult, 2 child (6, 11 yr); generic mobile phone; 1750 MHz	"The results show that the SAR distributions in the human brain are age-dependent, and there is a deeper penetration of the absorbed SAR in the child's brain. The induced SAR can be significantly higher in subregions of the child's brain."

United Nations International Appeal on EMFs

Over 220 Scientists from 42 Nations

“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.”

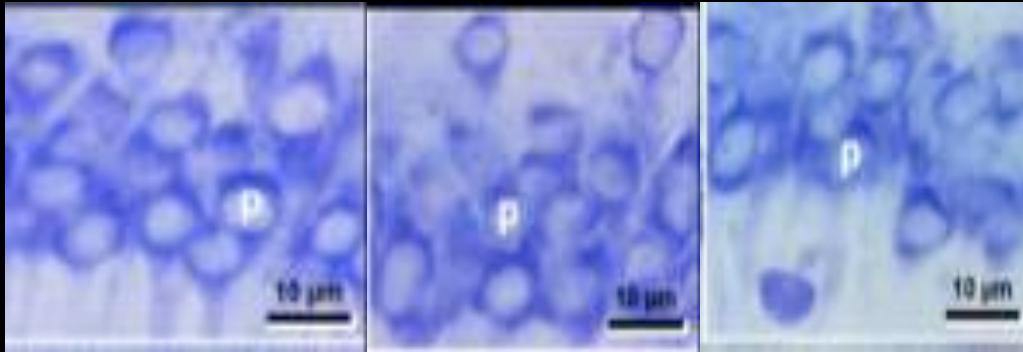


EMFScientist.org

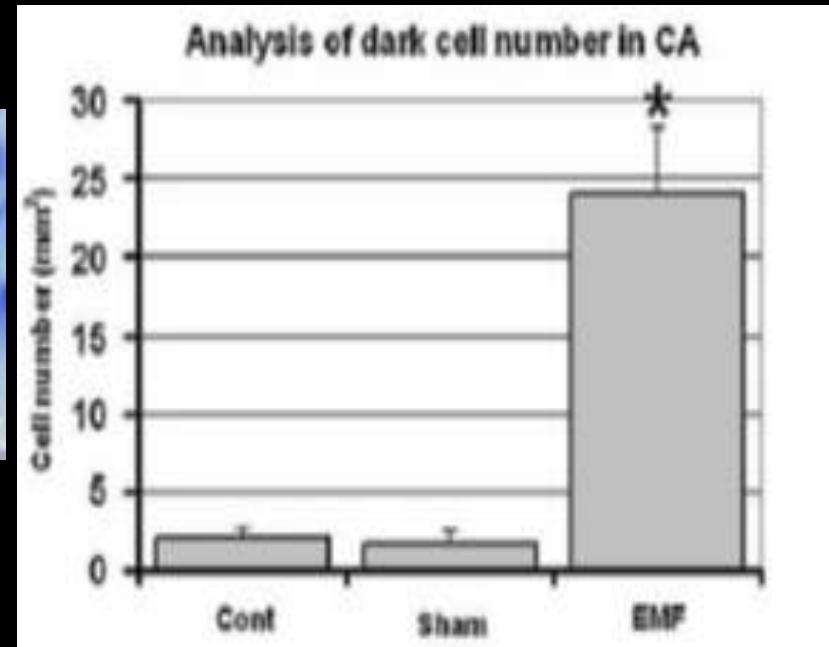
- “Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines.
- “Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans.”

900 MHz electromagnetic field exposure affects hippocampal pyramidal cells in adult female rats

1h/day x 28 days; 16 wk females

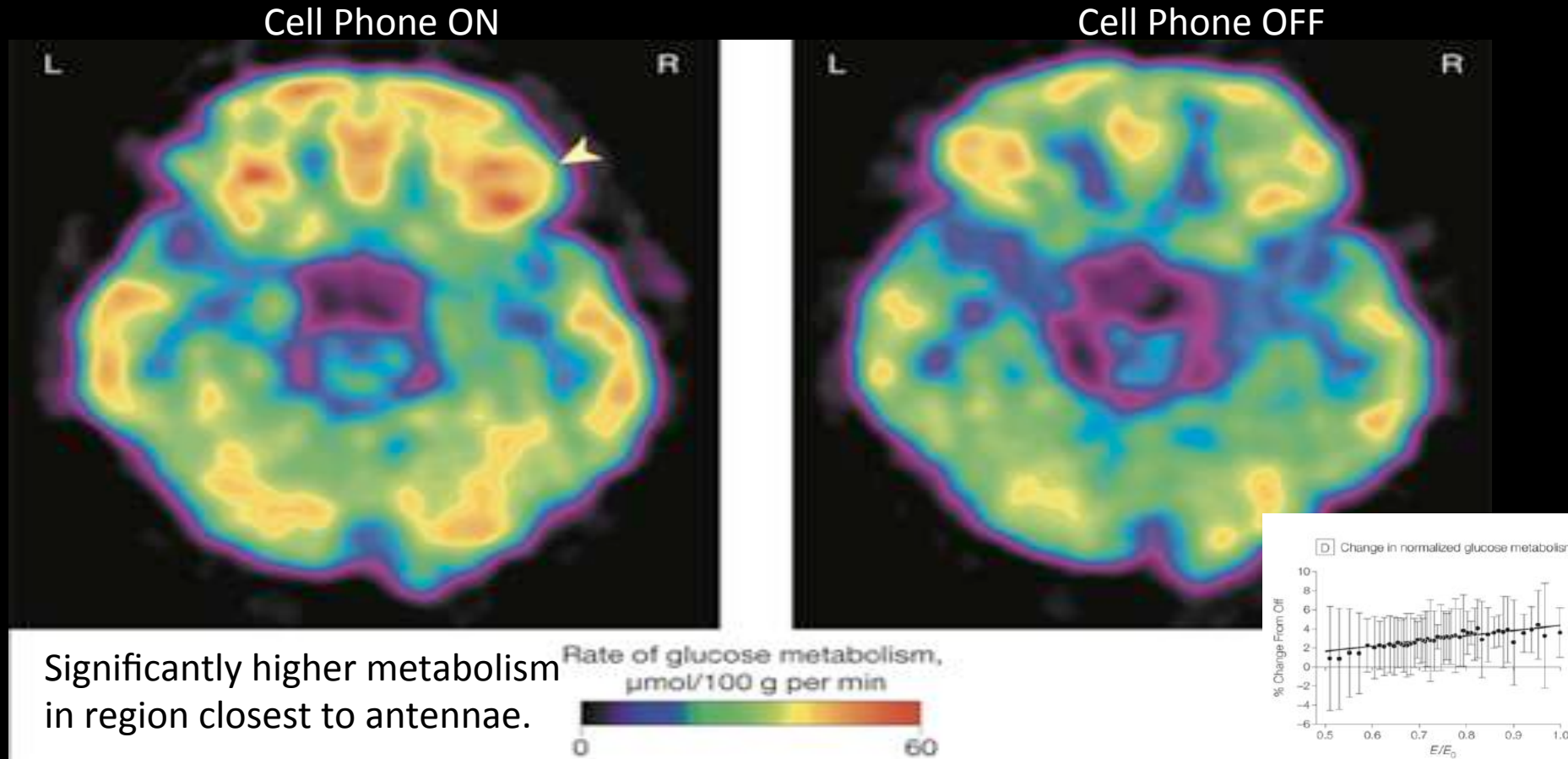


Postnatal EMF exposure caused a significant decrease of pyramidal cells in the Cornu ammonis of the EMF group.



Significantly more dark cells compared with both the control and sham Mean \pm SEM * $p < 0.01$.

50 minutes with a cell phone turned on against the ear significantly alters cerebral glucose metabolism



"Even though the radio frequencies that are emitted from current cell phone technologies are very weak they are able to activate the human brain."

-Nora D. Volkow, M.D. Director of the National Institute on Drug Abuse at the National

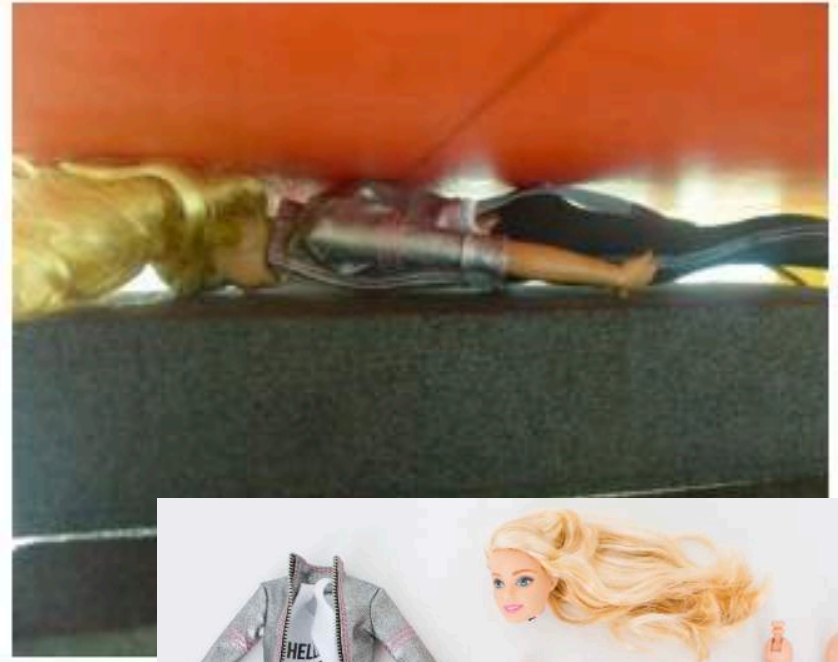
Hello Barbie: RF Exposure Testing

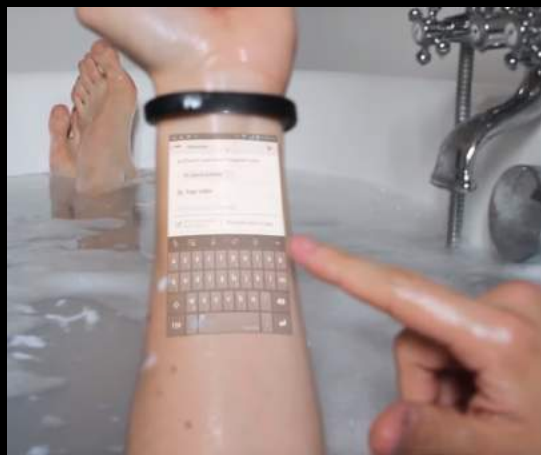
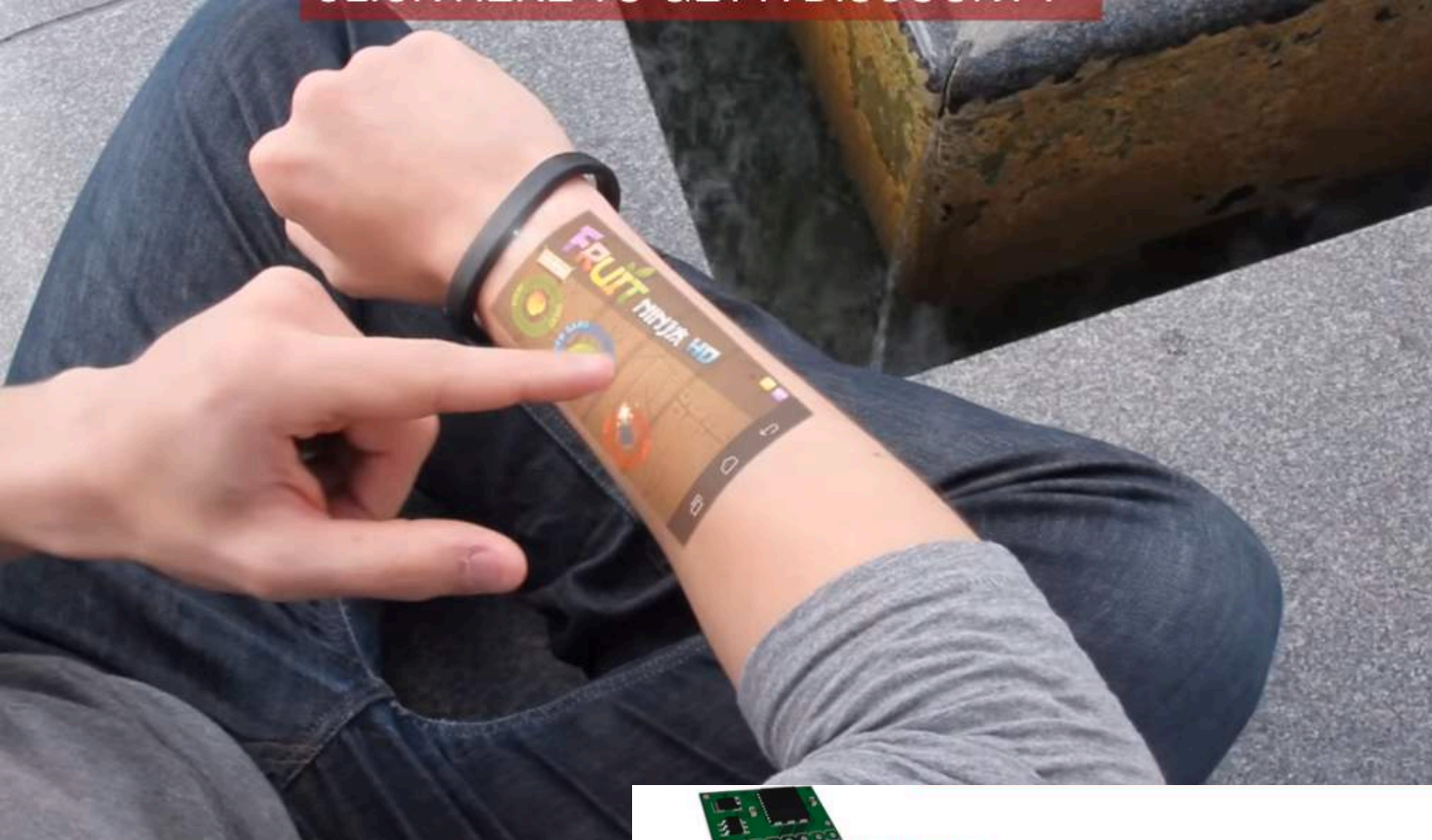
3. Photographs of EUT test position

Photo 2: Front side 0 mm



Photo 3: Back side 0 mm

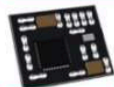




ACCELEROMETER



MEMORY CARD + ROM



PROCESSOR



VIBRATOR



MICRO USB PORT



BATTERY



PROXIMITY SENSOR LONG RANGE



PICO-PROJECTOR



BLUETOOTH LOW ENERGY



WIFI COMPONENT



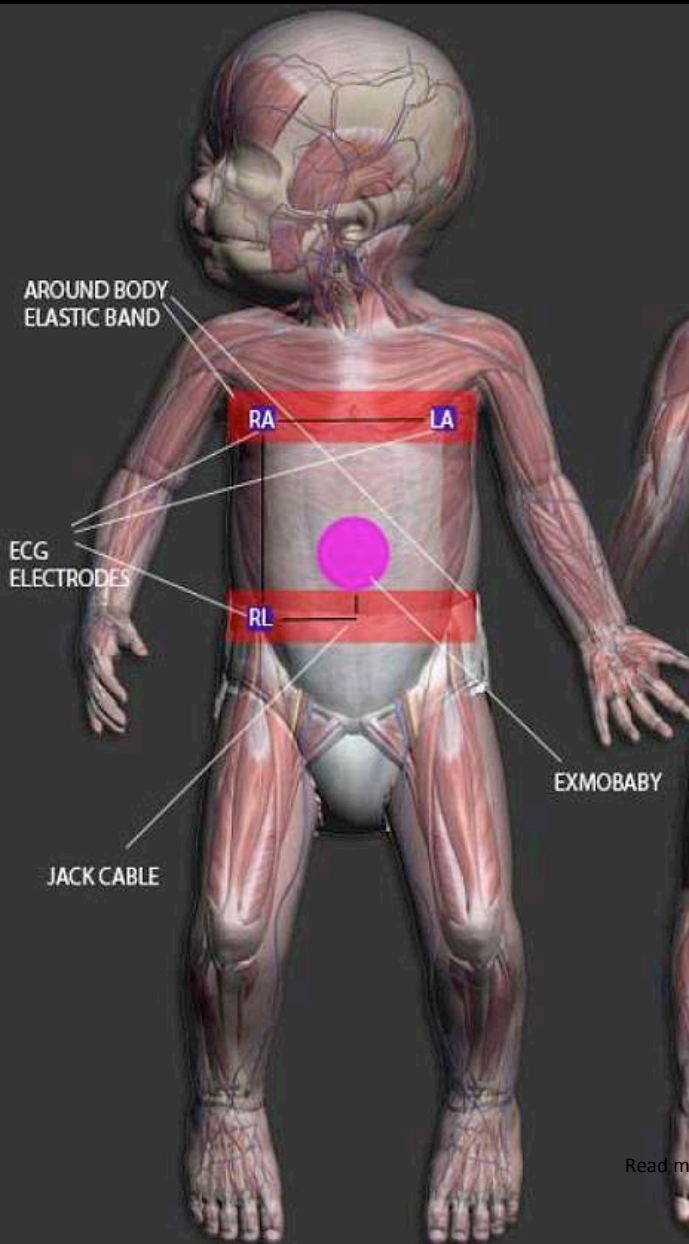
LED



SNAP BUTTON



WIRELESS BABY SUIT



The Exmobaby Suit

A Wireless body suit with a thermometer, heart rate monitor and movement sensor built into the fabric.



The suit transmits a burst of data once a minute, connecting to the parent's smartphone or computer wirelessly.

It can also sense moisture and tell parents when it's time to change their baby.

Read more

<http://www.dailymail.co.uk/sciencetech/article-2310599/New-smart-baby-suit-contains-sensors-tell-baby-crying.html#ixzz3wvEnkGan>

Haifa, Israel Will *Remove* School Wireless Networks April 2016



“Regarding anything that relates to our children, if there is doubt- there is no doubt. We must take extra precaution.” Haifa Mayor Yona Yahav.

900 MHz electromagnetic field exposure affects hippocampal pyramidal cells in prepubescent male rats

Exposure: 1h/day x 30 days; 8 wk males

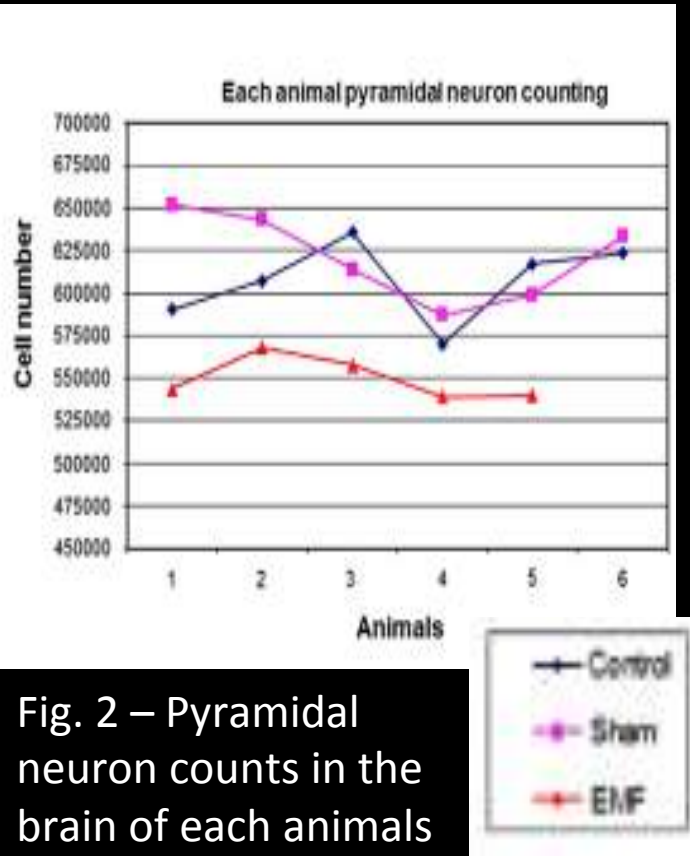
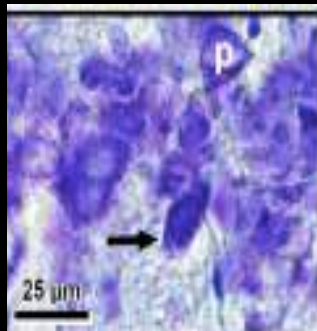
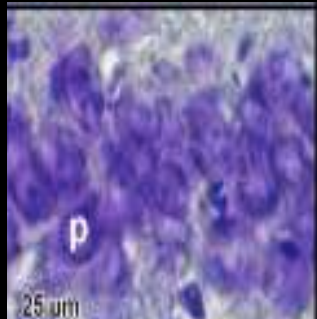
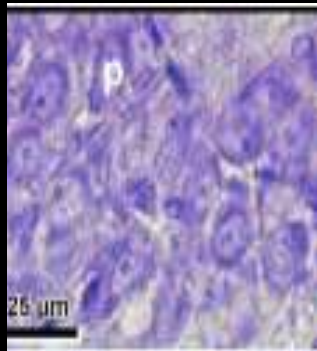


Fig. 2 – Pyramidal neuron counts in the brain of each animals show marked neuron loss in EMF exposed.

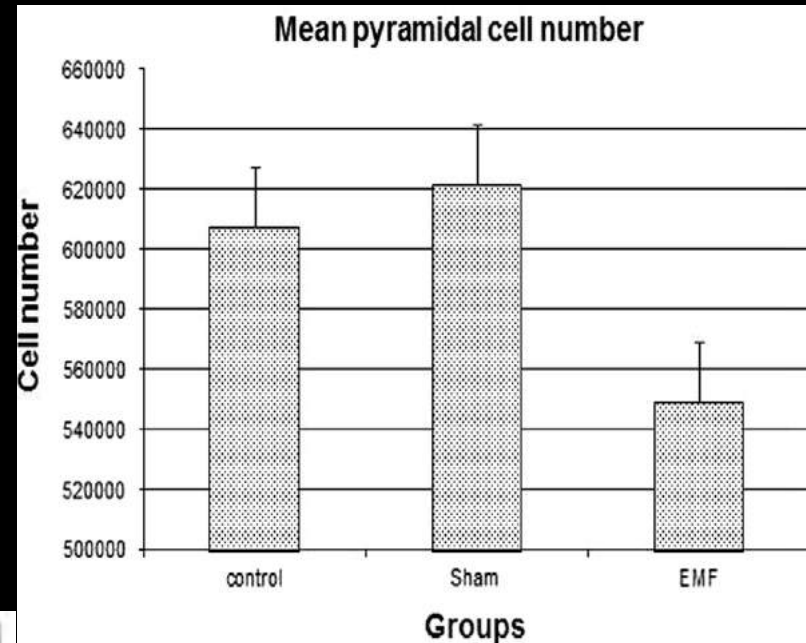


Fig.1 Lower mean number of pyramidal neurons in exposed group than in the control and sham.

[Sahin A, Aslin A, Bas O, et al. \(2015\)](#)



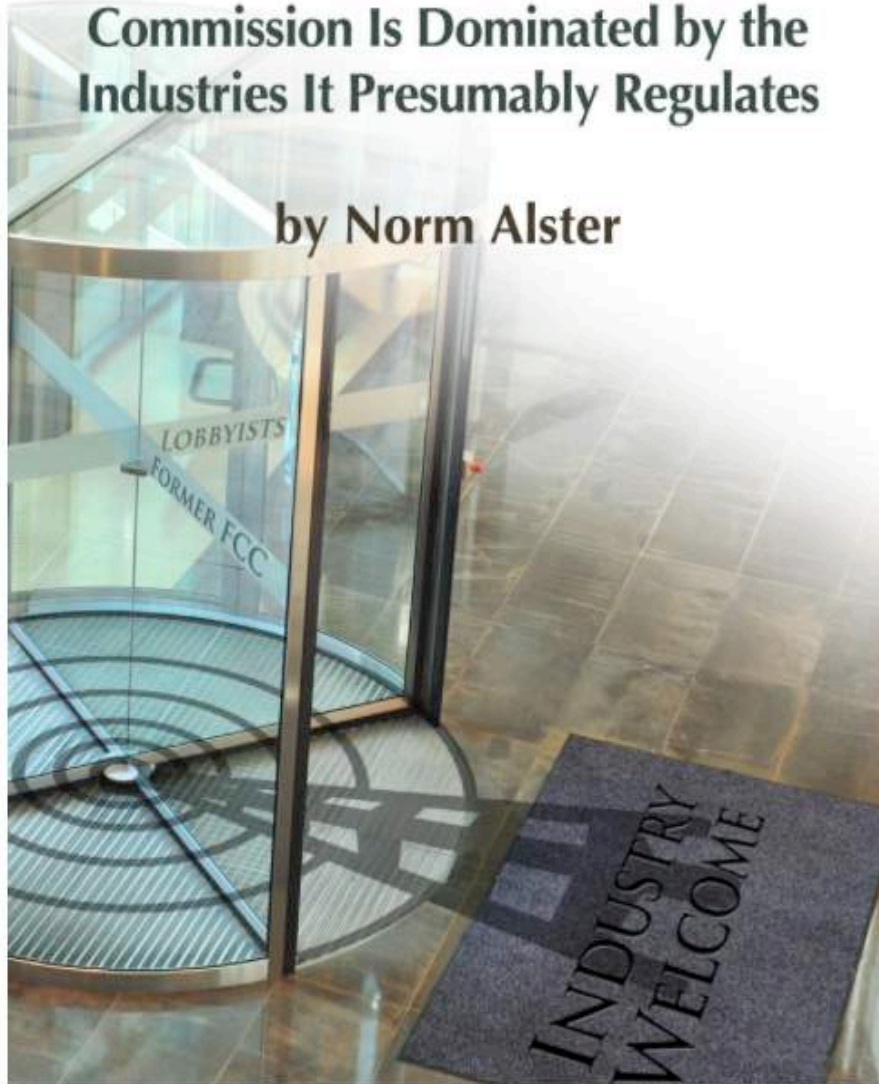
- “Try to keep the phone away from your head and body. That is particularly important when the cellular signal is weak—when your phone has only one bar, for example—because phones may increase their power then to compensate.
- Text or video call when possible.
- When speaking, use the speaker phone on 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.”

[November Report 2015](#)

Captured Agency:

How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates

by Norm Alster



www.ethics.harvard.edu

Industry Influence

“...consumer safety, health, and privacy, along with consumer wallets, have all been overlooked, sacrificed, or raided due to unchecked industry influence.”



HARVARD UNIVERSITY
Edmond J. Safra
Center for Ethics

Recommendations

1. Avoid carrying your cell phone on your body (e.g. in a pocket or bra).
2. Avoid holding any wireless device against your body when in use.
3. Use your cell phone on speaker setting or with an “airtube” headset.
4. Avoid using your wireless device in cars, trains or elevators.
5. Avoid cordless phones, especially where you sleep.





How to Practice Safe Tech

#PracticeSafeTech

6. Whenever possible, connect to the internet with wired cables.
7. When using Wi-Fi, connect only to download, then disconnect and disable Wi-Fi.
8. Avoid prolonged or direct exposure to nearby Wi-Fi routers.
9. Unplug your home Wi-Fi router when not in use (e.g. at bedtime).
10. Sleep as far away from wireless utility meters (i.e. “smart” meters) as possible.

How to Protect Your Family

Choose wired over wireless

- Get a corded landline phone and forward cell phones to it.
- Use corded plug-in (non-wireless) connections for printer, mouse, internet, gaming, and routers, etc.—with all wireless functions OFF.

Safeguard sleep

- Stop use of and power off computers, tablets and phones one hour (or longer) before bedtime.
- Do not sleep with a cell phone, tablet or laptop.

Maximize distance from self and others

- Radiation decreases as you move away from the source.
- Locate devices away from laps, bras and pockets, as the radiation can damage sperm and may be linked to breast cancer.
- Use air tube headset or use speaker phone at maximum distance from head and body.

Protect children

- Children are particularly vulnerable and should not use cell phones except in an emergency.
- If children are using a phone or other device for work or play, select all 3 of the following settings to turn off the radiation from cell phones and wireless devices:
Airplane mode ON, and Wi-Fi OFF, and Bluetooth OFF.
- Don't use a mobile device while a child is on your lap or in your arms.

Power off in vehicles

- Mobile devices distract drivers, emit more intense radiation during travel, and metal surroundings create radiation hot-zones.

more & news
EHTrust.org

Doctors' Advice to Patients & Families

Wireless & Health: Simple Precautions Make Sense



This pamphlet reviews
precautionary advice
by Doctors and governments to
reduce exposure to wireless radiation.

 **ENVIRONMENTAL
HEALTH TRUST**

Brought to you by: Physicians, biomedical scientists, and neurosurgeons—including Charles Teo, MD; Martha Herbert, MD, PhD; Anthony B. Miller, MD; Süleyman Kaplan, PhD; Annie J. Sasco, MD, PhD; Stephen T. Sinatra, MD; Dr. Erica Mallery-Blythe, BMBS; Devra Lee Davis, PhD, MPH

Educate Parents on Ways to Reduce Exposure at Home



- Choose Wired over Wireless (computers, gaming devices, baby monitors, routers, printer, mouse and keyboard)
- Get A Corded Landline
- Create A Sleep Sanctuary: No Cell Phones or Electronics in Bedroom
- Maximize Distance Between Cell Phone, Wifi Devices and Body
- Protect Children
 - Turn Devices on Airplane Mode for Them
 - Keep Transmitting Devices At a Distance From Babies and Children
- Power OFF in Cars (higher radiation)

MOBILE PHONE INFORMATION.

The radiation from mobile phones or smartphones is most likely not as safe as responsible thing and inform the Austrian as cell phone providers claim it to be. Therefore, the Ärztekammer Wien [Vienna Medical Association] has decided to do the public about possible adverse effects from a medical perspective.



10 MEDICAL RULES FOR A SAFER USE OF MOBILE PHONES!

- In general, keep calls short and as few as possible. Use a landline or write an SMS. Children and teenagers under the age of 16 should carry mobile phones for emergencies only!
- "Distance is your friend." Keep the phone away from your body and head during dialing and maintain at least the minimum distance recommended in the user guide. Take advantage of the built-in speakerphone or use a headset!
- Do not keep the phone directly on your body when using a headset or the built-in speakerphone. Pregnant women should be especially cautious. In men, mobile phones are a risk to their fertility when carried in the pant pocket. Persons with electronic implants (pacemaker, insulin pump, etc.) must pay particular attention to distance. If no other option is available, use the outer coat pocket, a backpack or a purse/handbag to carry the phone!
- Do not use in vehicles (car, bus, train). Without an external antenna, the radiation inside the vehicle is higher. In addition, the user is distracted and becomes a nuisance to others on public transport!
- No texting while driving – ever! The distraction causes you to become a danger to yourself and a danger to other road users!
- Make phone calls at home and at work via a hardwired network. Internet access via a hardwired connection such as LAN (e.g. via ADSL, VDSL, fiber optics) does not emit radiation; it is fast and secure. Constantly radiating DECT cordless phones, Wi-Fi access points, data sticks and LTE modems should be avoided!
- Work offline more often or put your phone in airplane mode. For functions such as listening to music, camera, alarm clock, calculator or offline games, you do not always need an Internet connection!
- Fewer apps means less radiation. Minimize the number of apps and disable the most unnecessary background services on your smartphone. Disabling "mobile services"/"data network mode" turns the smartphone into a conventional mobile phone. You can still be reached, but you avoid a lot of unnecessary radiation from background data traffic!
- Avoid making calls in places with poor reception (basement, elevator and the like). In such instances, a mobile phone increases its transmission power. When there is poor reception, use a headset or the speakerphone instead!
- Buy mobile phones with a very low SAR value and an external antenna connector, if possible!

10 MEDICAL RULES FOR SAFER USE OF MOBILE PHONES Vienna Medical Association

Make calls as short and little as possible - use a landline or write SMS.

Children and teenagers under 16 years old should carry cell phones *only for emergencies!*

Distance is your friend- Keep the phone away from body

When using headsets or integrated hands-free, do not position mobile phones on body.

Not in vehicles (car, bus, train) calls - without an external antenna.

During the car when driving should be an absolute ban on SMS and internetworking.

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)

Constant radiation emitters like DECT cordless telephones, WLAN access points, data sticks and LTE Home base stations (Box, Cube etc.) should be avoided!

Go offline more often or use Airplane mode
Fewer apps means less radiation

Avoid Mobile phone calls in places with poor reception (basement, elevator etc).

“School environments play an important role in the health and academic success of children. Children spend 90% of their time indoors and much of that time is spent in school.”

“To foster children's health and academic achievement, healthy school environments must be addressed and integrated within the education system.”

-The EPA

[Executive Summary of State School Environmental Health Guidelines](#)



Collaborative For High Performance Schools has Low EMF Classroom Criteria

Hard-Wire the Devices

“It is important in school environments with children to apply the precautionary principle “as low as reasonably achievable (ALARA)” by providing low-EMF classrooms, specifying low-EMF IT equipment and wired Internet access network technology, and establishing low-EMF user practices.”



2014 US-CHPS

Criteria

New Construction
and Renovation

[CHPS Low- EMF Criteria](#)

Best Practices For Schools

Wired LAN and Corded Phones

USA Collaborative for High Performance Schools Criteria

Low-EMF Best Practices in the INDOOR ENVIRONMENTAL QUALITY Section (USA)

EQ 15.2.2 Wired local area network (LAN) to reduce RF EMF

· **Install a wired local area network (LAN) for Internet access throughout the school.** Provide wired network connections for desktop computers, laptops, notebooks, and tablets. All wireless transmitters shall be disabled on all Wi-Fi-enabled devices. Provide wired input devices for computer workstations.

EQ 15.2.3 Wired Phones to reduce RF EMF in classroom

· **Install easily accessible hard-wired phones** for teacher and student use and prohibit installation and use of standard DECT cordless phones and cordless phones operating at 2.4 GHz and 5.8 GHz unless they have been laboratory tested to demonstrate that the cordless phone base station and handsets (whether placed in the charging station or not) do not emit RF EMF emissions in standby mode.

· **Prohibit the use of cell phones and other personal electronic devices in instructional areas / classrooms.** Additionally, they shall be required to be powered off or be in airplane mode (sleep mode is not sufficient) except during fire-life-safety drills and incidents.

Ashland Massachusetts Public Schools

Best Practices

Posted
in
Every
Classroom

Best Practices for Mobile Devices

- ❖ Turn off the device when not in use.
- ❖ Turn wifi on only when needed.
- ❖ Always place the mobile device on a solid surface.
- ❖ Viewing distance should be a minimum of 12 inches from the screen.



Israel

Israel 2014 Ministry of Health Report

- “Precautions should be strictly enforced with regard to children, who are more sensitive to developing cancer.”

Recommendations on Cell Phones

- Use a speaker or hands-free phone
- Reduce the amount and duration of calls
- Reduce calls when weak reception
- Turn phones OFF in cars because of amplified exposure.

Schools:

- “Wireless communication networks in schools should be reduced.”
- Wired classroom computers recommended
- No WiFi in kindergartens
- Limits set on hours with wireless on for upper grades

TNUDA Website of The [National Information Center for Non-Ionizing Radiation](#)

- A public education website to guide the public and decision-makers on “the educated use of technology”.

Spain

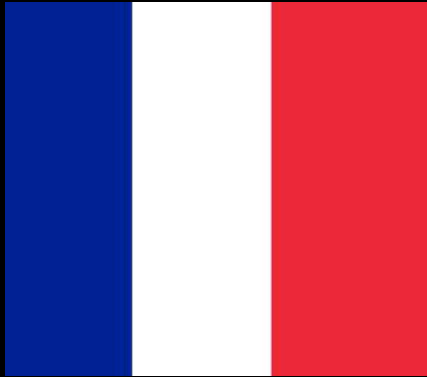


The Parliament of Navarra voted to urge removal of WIFI in schools and to apply the precautionary principle .

The Vitoria City Council approved a precautionary approach.

- a. Citizens will be informed of the location of wireless transmitters are in civic centers and municipal buildings.
- b. Recommended that children's spaces such as playgrounds and family libraries, will be free of WiFi or have decreased wifi and wifi free zones will be established in playgrounds and building entrances.
- c. **The Basque Parliament** joined the resolution of the Parliamentary Assembly of Council of Europe in 2011

"Recommends the implementation of information campaigns and portable devices that emit microwaves, and prioritizes the use of cable connections in schools."



France

2015 National Law:

- WiFi banned from nursery schools.
- WiFi routers to be turned off in school classrooms (default setting) unless necessary for specific instruction.
- Cell Phone Ads *must* recommend headsets to *reduce* radiation to the head, or a 75,000 Euro fine.
- Towns with cell towers may request RF levels and levels will be publicly available.

2013 French Agency for Food, Environmental and Occupational Health & Safety

- Report recommends “limiting exposure to radiofrequencies, especially for the most vulnerable populations”

2011 Cell Phone Statute:

- Merchants must display Phone SAR .
- All phones must be sold with a headset.
- Ban on cell phone ads aimed at children younger than 14.
- Phones made for children under 6 are banned.





Save the Boys!

The Facts:

Cell Phones emit microwave radiation.

Research shows:

- Damaged Sperm
- Reduced Sperm Count
- Erectile Dysfunction

Read the Fine Print: All wireless device manufacturers advise that devices should be a distance away from human bodies and brains because of the radiation.

Know how to reduce your exposure.

More at
ehtrust.org
#PracticeSafeTech

**ENVIRONMENTAL
HEALTH TRUST**

Doctors' Recommendations

1. Protect Your Body

Airplane mode ON with WIFI OFF stops the radiation. Do not carry cell phones in your pockets or bra. No laptops or tablets on your lap.

2. Practice Safer-Phone

Prefer a corded landline phone. Hold cell phones away from the head and body by using speakerphone.

3. Protect Your Fertility & Your Pregnancy

No wireless devices near reproductive organs or near a pregnant woman's abdomen.

4. Practice Safe Tech

Turn off WiFi and use cords to connect routers, phones, computers and other devices.



Save the Girls!

Cell Phones and Breast Cancer

Women are developing breast cancer in the exact same place they kept cell phones in their bras, according to an increasing number of medical reports.

Fact: Cell phones emit microwave radiation, known to damage DNA.

Cell phone manuals state in fine print that cell phones are to be some distance away from the body.

Learn how to reduce your exposure. Do not carry your cell phone in your bra.

More at
ehtrust.org
#PracticeSafeTech

**ENVIRONMENTAL
HEALTH TRUST**

Doctors' Recommendations

1. Protect Your Body

Airplane mode ON with WIFI OFF stops the radiation. Do not carry cell phones in your pockets or bra. No laptops or tablets on your lap.

2. Practice Safer-Phone

Prefer a corded landline phone. Hold cell phones away from the head and body by using speakerphone.

3. Protect Your Fertility & Your Pregnancy

No wireless devices near reproductive organs or near a pregnant woman's abdomen.

4. Practice Safe Tech

Turn off WiFi and use cords to connect routers, phones, computers and other devices.

At Home
Get a Corded Landline



At Home Connect With Wires

Two black Ethernet cables are shown, each with a clear plastic RJ45 connector. The connectors are positioned side-by-side, showing the internal gold-colored contacts and the color-coded wiring (blue, orange, green, red) inside. The cables are slightly curved, and the background is a plain, light-colored surface.

Computers
Tablet
Gaming devices
Routers
Printer
Mouse
Keyboard