



ENVIRONMENTAL
HEALTH TRUST



In Vivo and In Vitro Toxicology of Mobile Phone Radiation

Finnish Institute for Occupational
Health

Devra Lee Davis, PhD, MPH

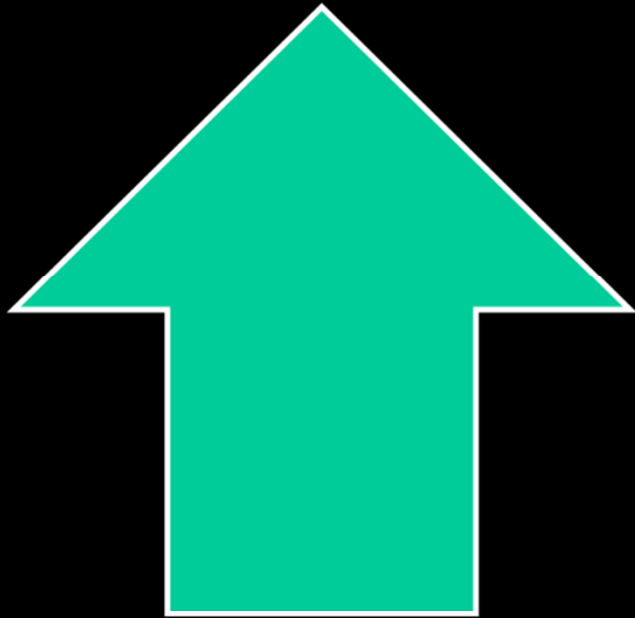
November 23, 2012

Thank You! Collaborators

- Ashok Agarwal, Cleveland Clinic
- Igor Belyaev, National Cancer Institute of *Slovakia/Institute* of General Physics, Russian Academy of Science, Moscow, Russia
- Andreas Christ, formerly with IT'IS, Switzerland
- Alvaro DeSalles, University of Porto Alegre
- Suleyman Kaplan, Ondokuz Mayıs Medical Univ.
- Lukas Margaritis and Adamantia Fragopoulou, University of Athens, Greece
- Nesrin Seyhan, Gazi University, Ankara
- Hugh Taylor, Yale University
- Nora Volkow, NIMH



Microwave/RF Radiation



Positive Impacts

Treats liver cancer

Stops bleeding

Enhances uptake of drugs to brain

Detects cancer



Negative Impacts

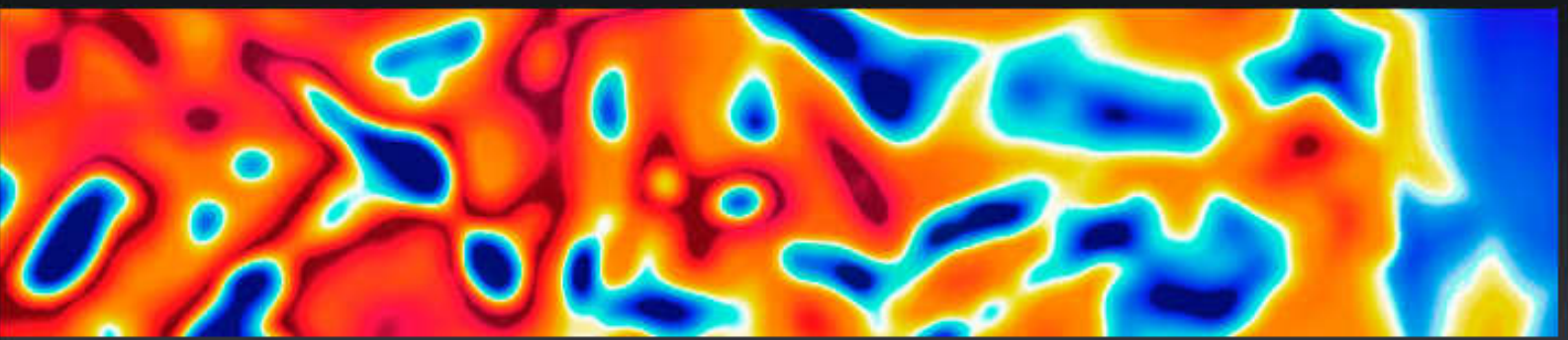
Damages DNA

Disrupts blood brain barrier

Weakens & damages sperm

Changes brain metabolism

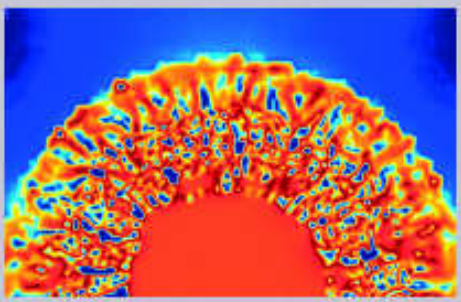
CANCER RESEARCH



Overview - Cancer Research

Cancer is one of the most prevalent and complex diseases. As a multifactorial and constantly evolving disease, conventional treatments, such as radio/chemotherapy, often have limited effectiveness. Alternative cancer-specific and cost-effective treatments are needed to complement these established techniques.

The IT'IS Foundation explores and optimizes current and evolving cancer therapies and diagnostic approaches related to our core areas of expertise. Our leading edge research focuses on computational life sciences and engineering as well as areas that will provide clinically relevant insights and discoveries that could potentially accelerate the development of effective cancer therapies.



OTHER NEWS

Parents back to school: kids take over 08/11/2012

IT'IS PAPERS

ELF Exposure System fo Live Cell Imaging 01/11/2012

Boris Pasche: FDA approval to treat metastatic cancer w EMF

- Amplitude-modulated electromagnetic field as a novel therapeutic approach in humans
- J Exp Clin Cancer Res. 2009; 28(1): 51.
- Published online 2009 April 14. doi: [10.1186/1756-9966-28-51](https://doi.org/10.1186/1756-9966-28-51)
- [Alexandre Barbault](#)^{1,2}, [Frederico P Costa](#)³, [Brad Bottger](#)⁴, [Reginald F Munden](#)⁵, [Fin Bomholt](#)⁶, [Niels Kuster](#)⁷ and [Boris Pasche](#)^{1,8}

What's the Problem? Marketing to Five Year Olds



Baby iPhone Rattle Case

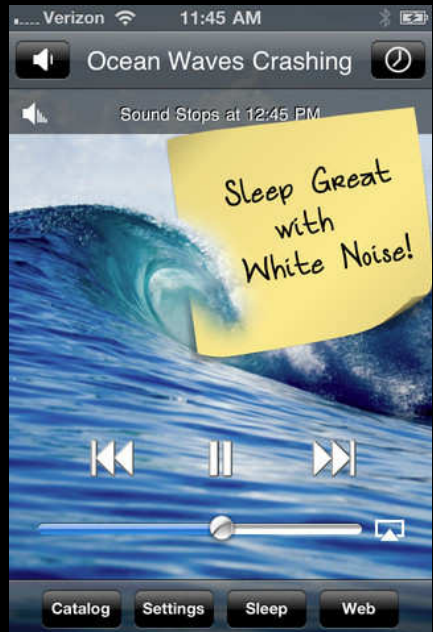


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Notice the cell phone is placed directly over the child's developing reproductive organs

Some other bad ideas Apps for Babies

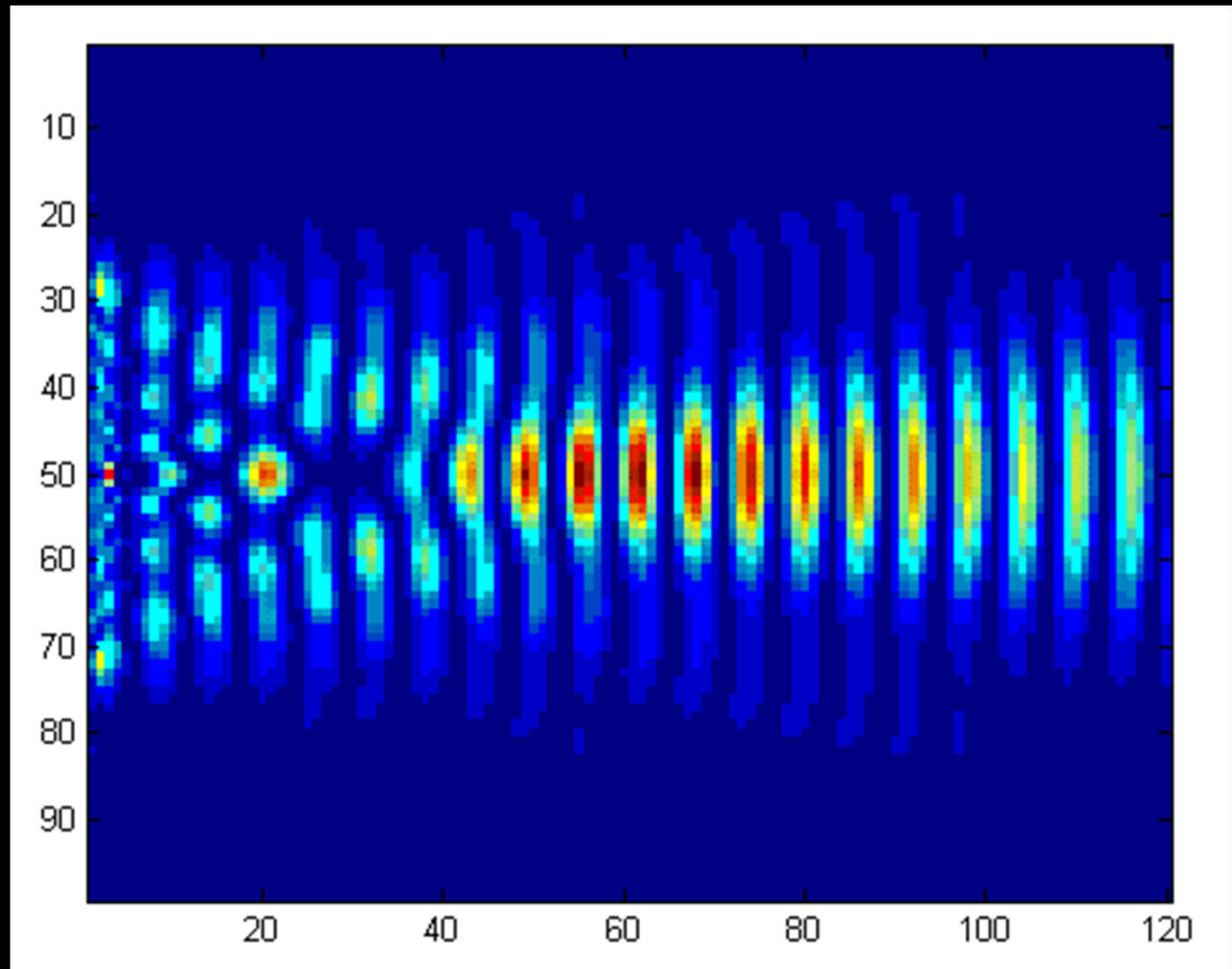
- iPhone baby monitor app plays Mom's voice
<http://www.youtube.com/watch?v=nkpa4uLvJeg>



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

- Frequency (pace)
- Amplitude (power)
- Pulse (beats)
- Intensity (power density)
- Polarity
- Information content

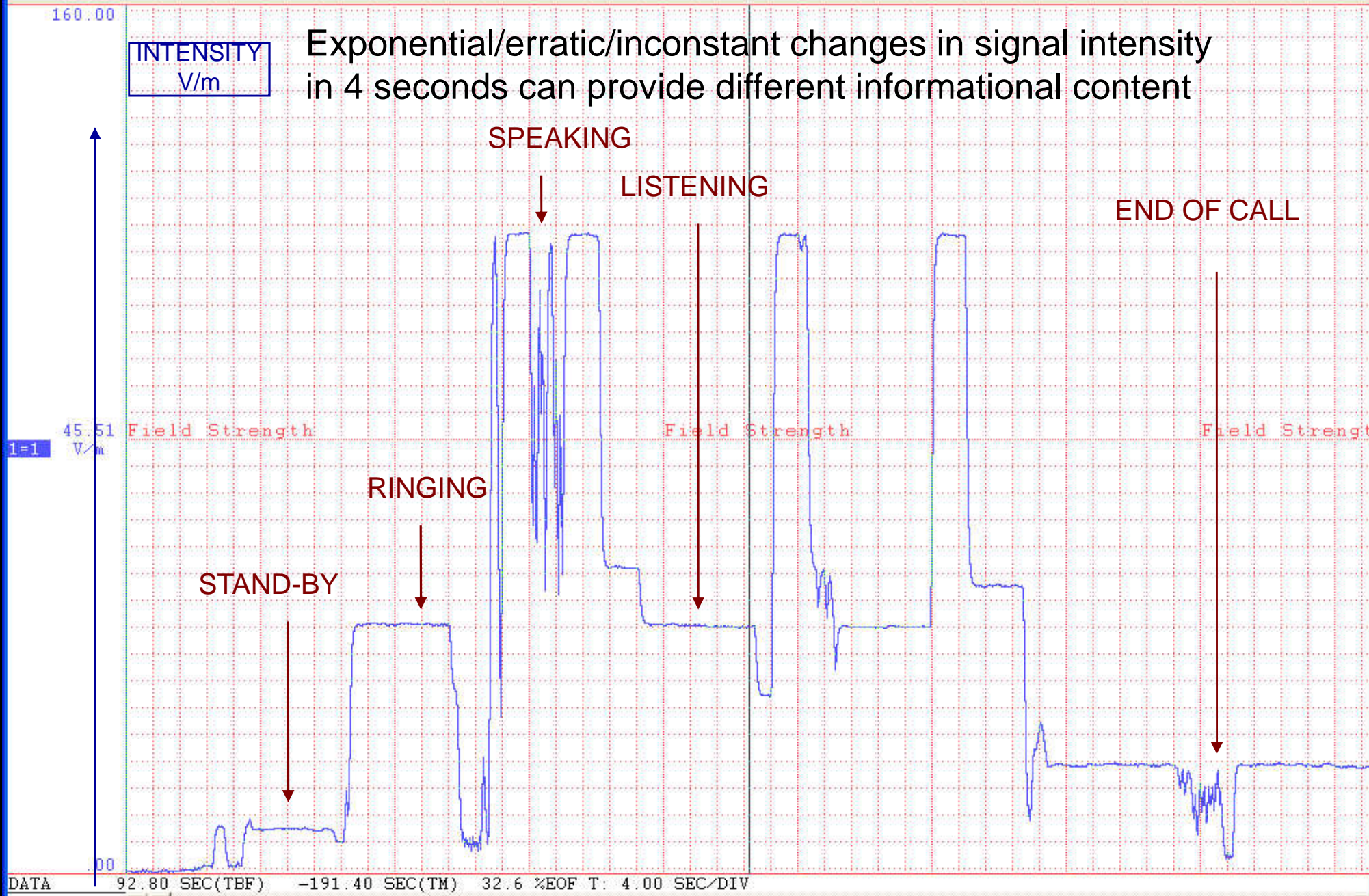
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Do not take without permission Courtesy of Margaritis et al



Exponential/erratic/inconstant changes in signal intensity in 4 seconds can provide different informational content



DATA 92.80 SEC(TBF) -191.40 SEC(TM) 32.6 %EOF T: 4.00 SEC/DIV

Time 4 sec/division

During a single call, GSM users are exposed to microwaves at different frequencies

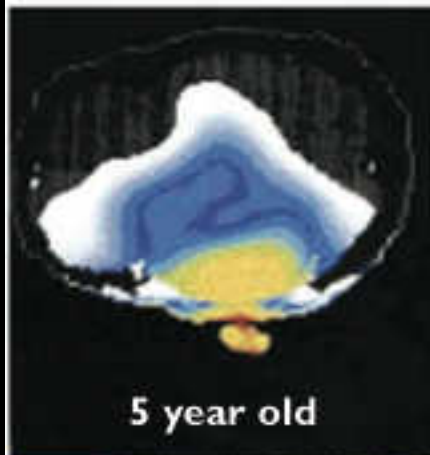
- There are **124 different channels/frequencies** which are used in GSM900 (Global System for Mobile Communication). They differ by 0.2 MHz in the frequency range between 890 MHz and 915 MHz. Frequency is supplied by base station to a mobile phone user depending on the number of connected users.

Many challenges in mimicking cellphone radiation in vivo

- ~~Must avoid thermal effects
- ~Traditional dose/response toxicology may not be relevant
- ~signal characteristics may be more important than total dose or average
- ~Q.E.D. we are conducting an uncontrolled experiment with 5.5 billion cellphones

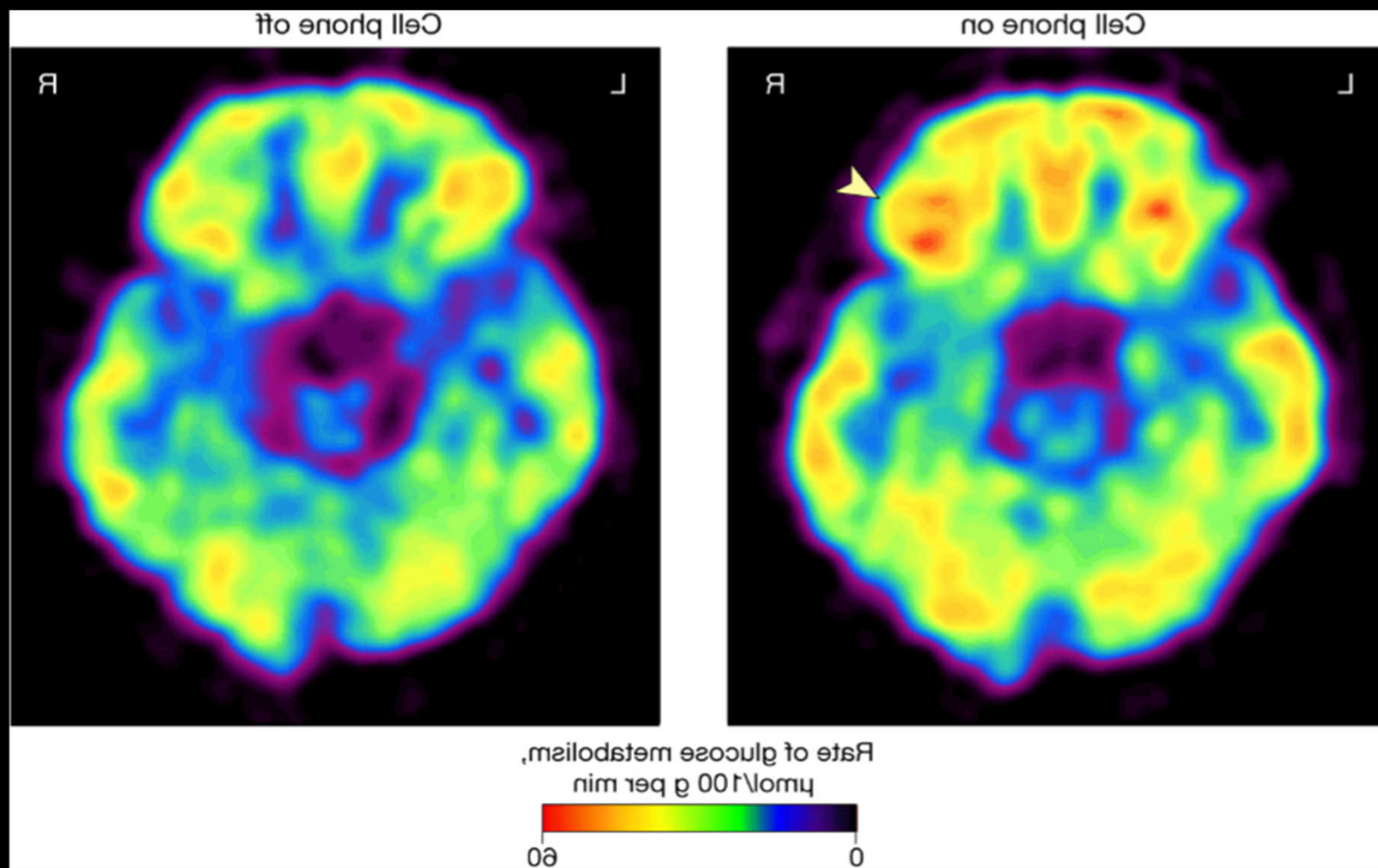


Who's Most At Risk?



These computer models from the University of Utah show how radio-frequency radiation from cell phones passes further into the brain of a child than that of an adult. Research that Dr. Om P. Gandhi and Dr. Devra Davis are currently working on indicates that children may be exposed to twice as much radio-frequency radiation from a cell phone as an adult.

Source: Brain graphics courtesy of Professor Om P. Gandhi, Univ. of Utah; photos from iStockPhoto.com

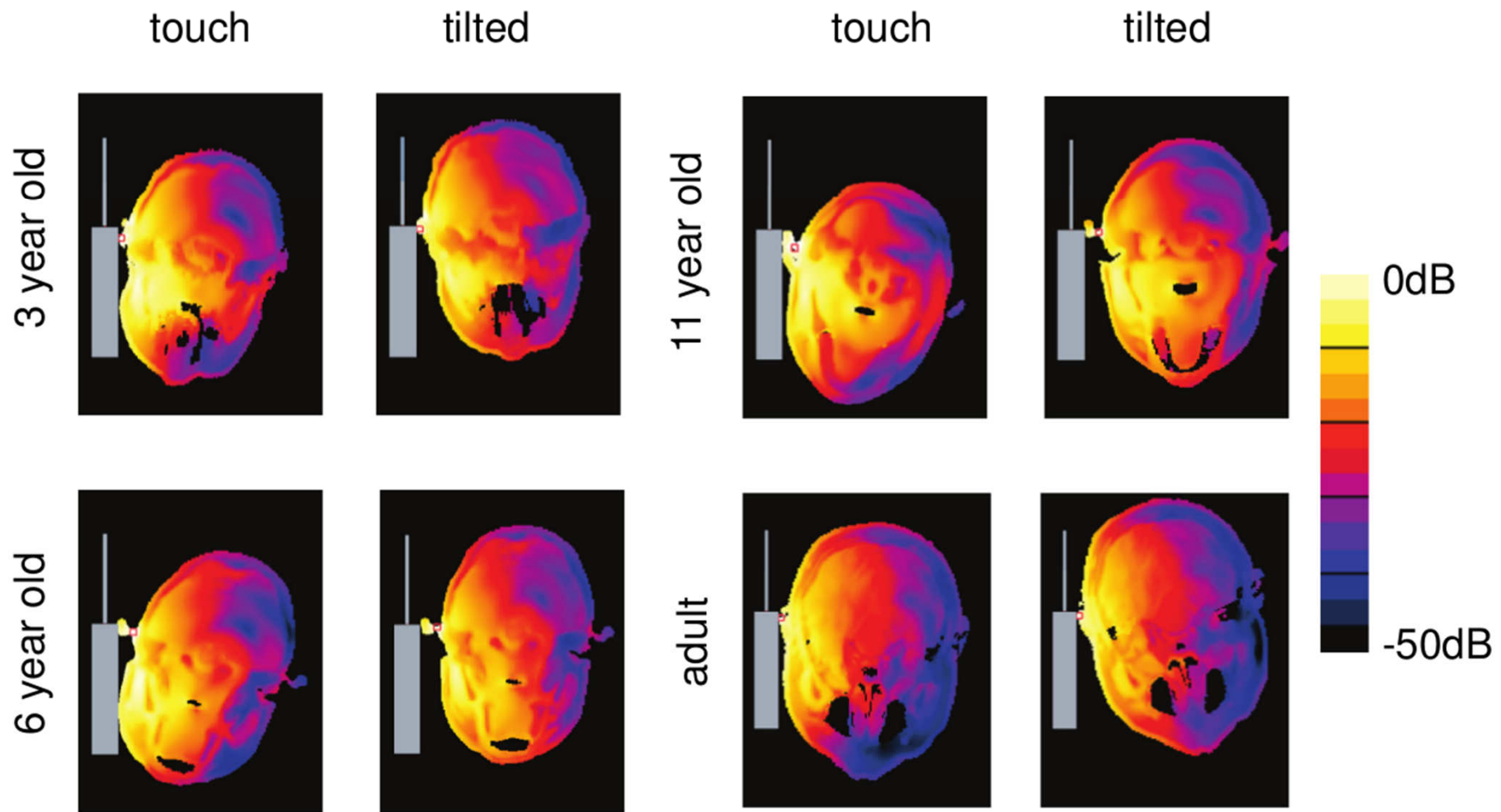


Spending 50 minutes with a cellphone turned on against the ear significantly alters cerebral glucose metabolism

JAMA, , Feb. 23, 2011, Vol. 305, p. 808 © 2011 American Medical Assn.

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SAR Distribution in the Head Models at 900MHz

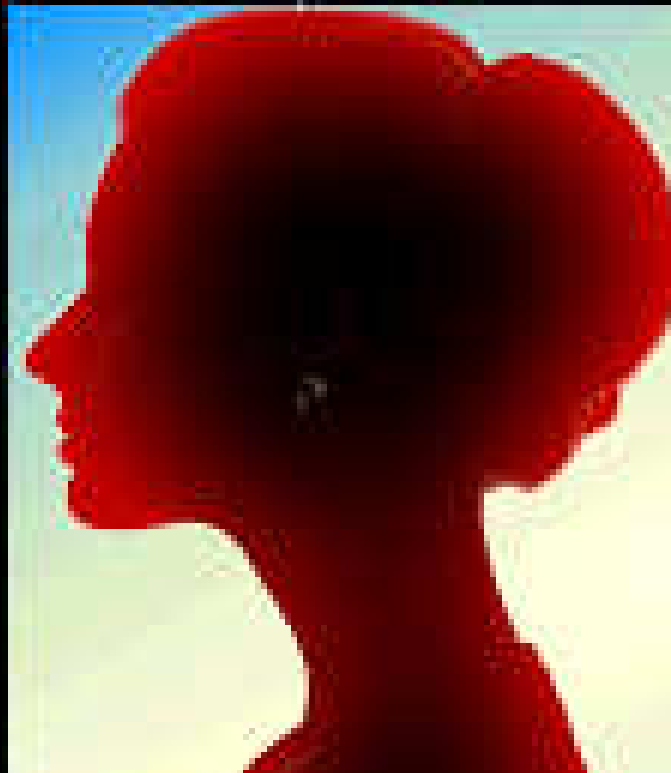
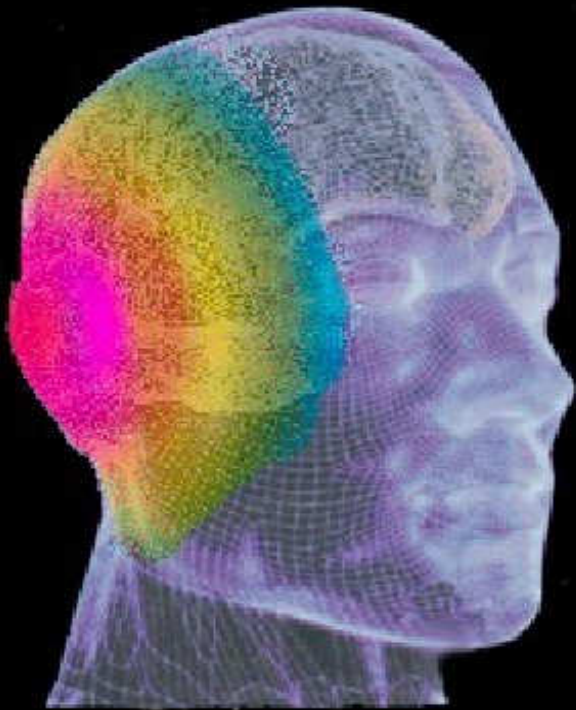


Possible NIR absorption in the head

Head Penetration

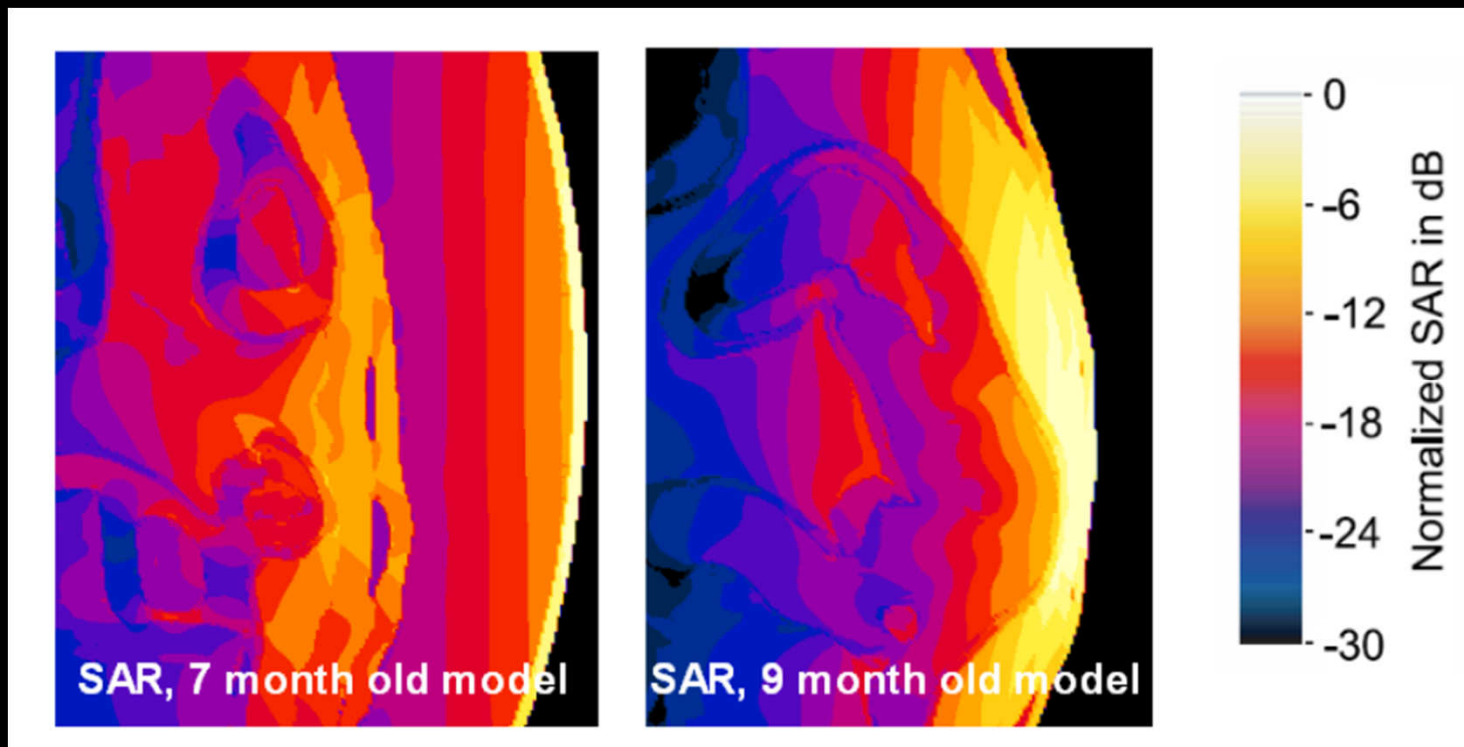
Surface Absorption

Hot Spots



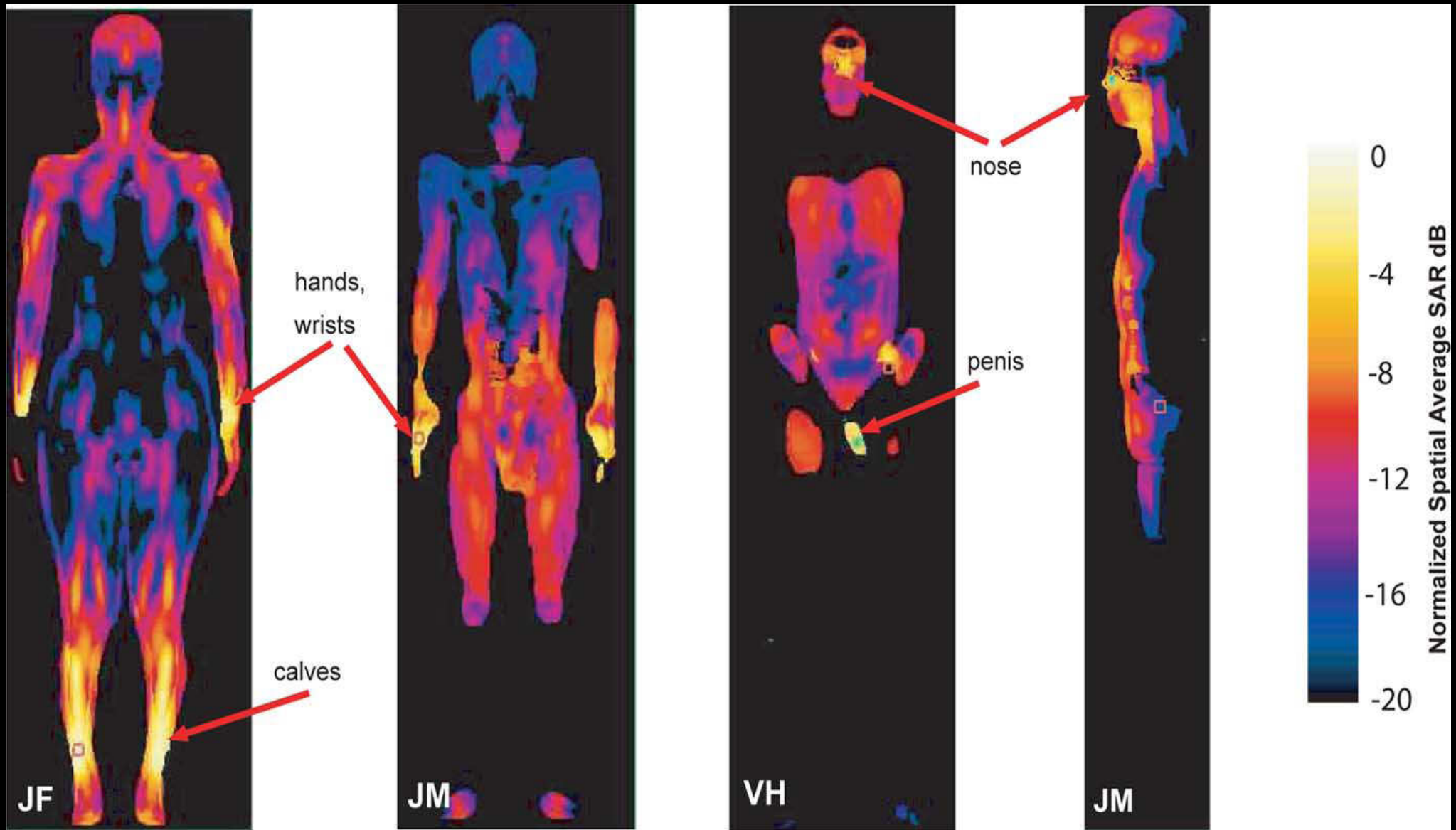
Source: Alvaro DeSalles

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Normalized SAR for the mother and the fetus exposed to a dipole antenna in front of the abdomen (frequency is 450 MHz because of larger penetration depth (courtesy Andreas Christ))

Penis gets highest exposure



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TOXICOLOGY STUDIES ON RF

IARC reviewed 900 studies for the pending monograph, most non-U.S.

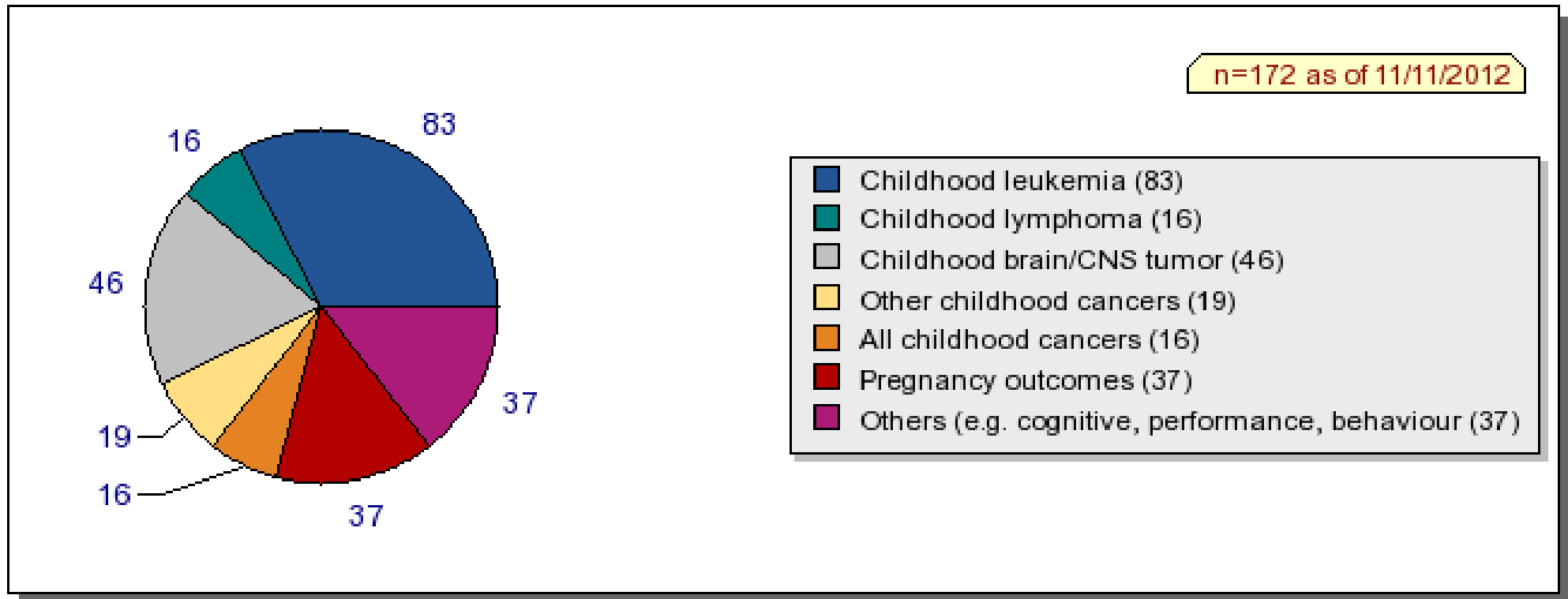
RF affects cellular structure and/or function

In vivo/rodents, rabbits, insects, c. elegans

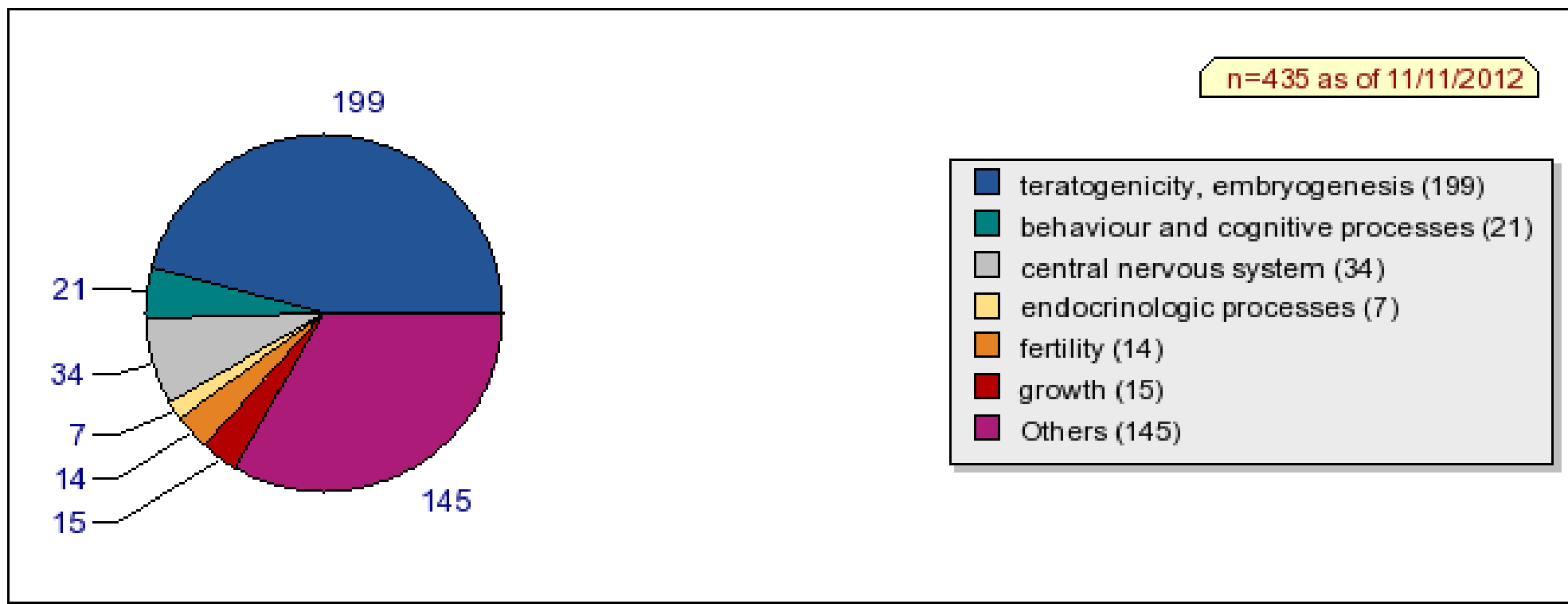
In vitro/animal human

Clinical/ in vivo/in vitro

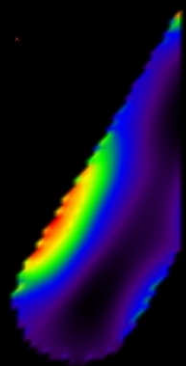
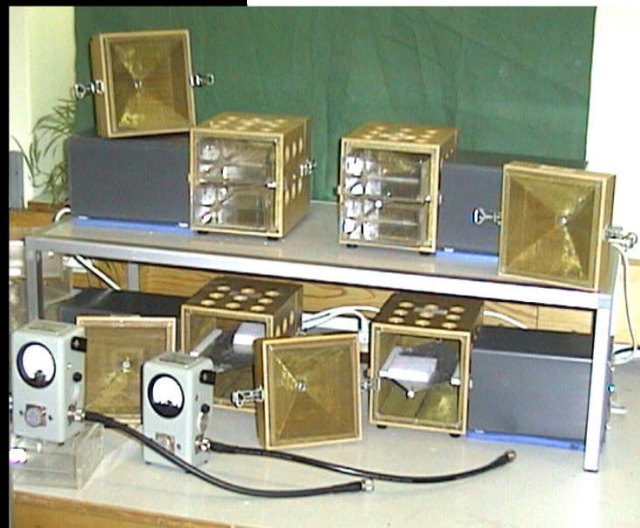
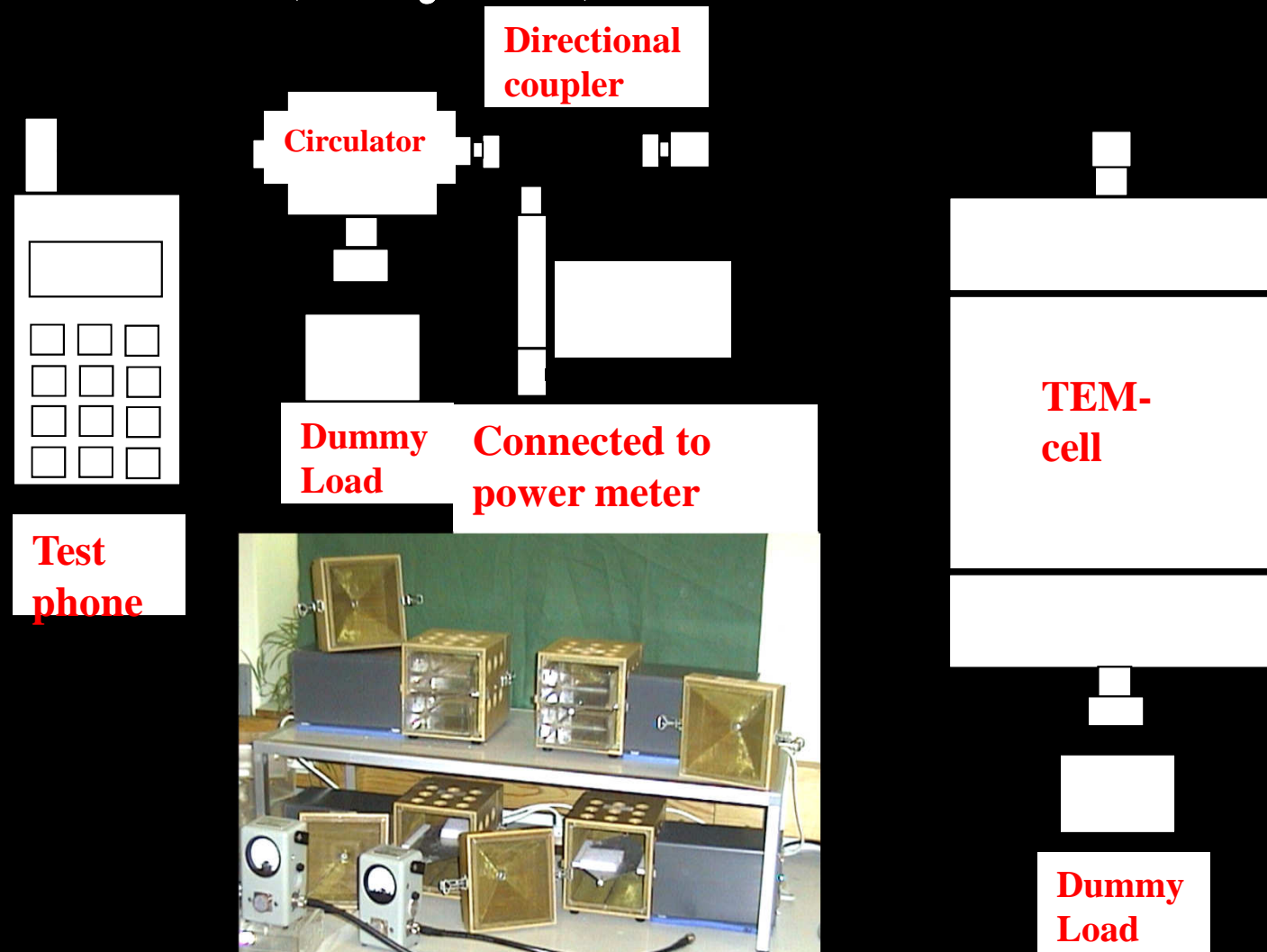
Total number of studies of children's health and cellphones (EMF Portal, 2012)



Total number of studies of young animals (source: EMF Portal, 2012)



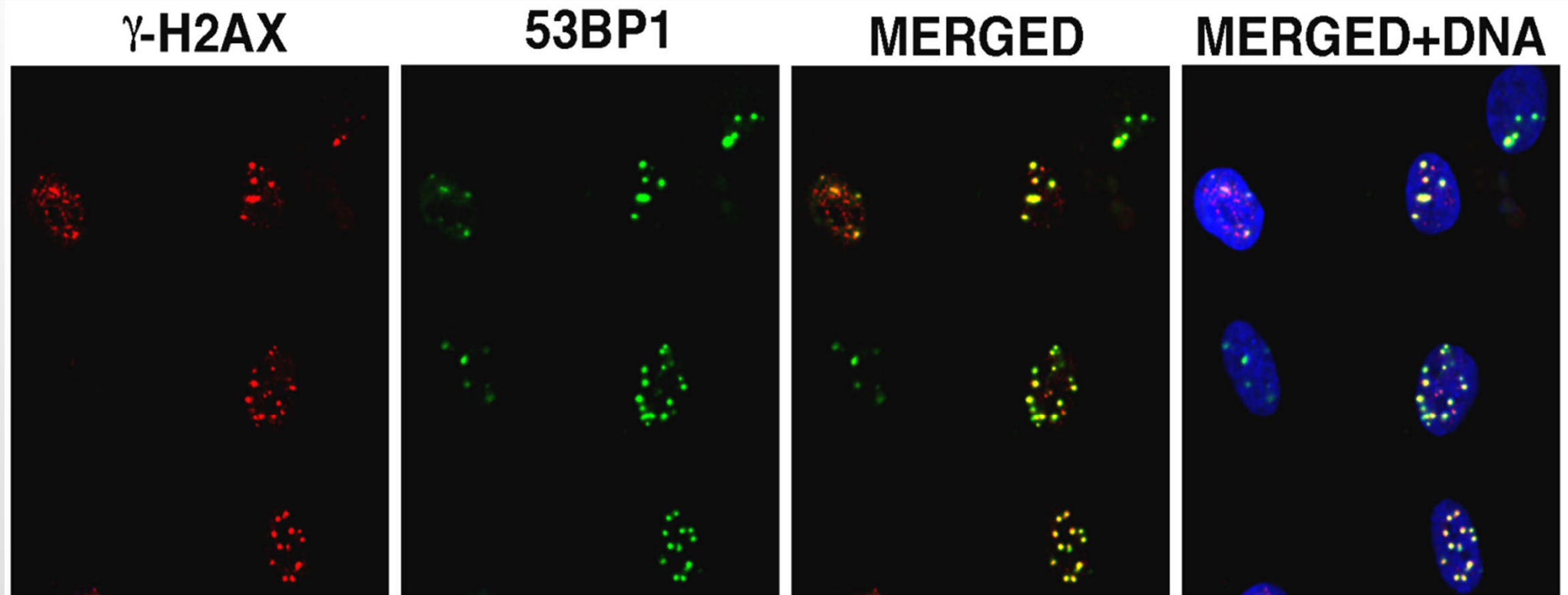
Non-thermal microwave exposure of human differentiated and stem cells in different frequency channels (Belyaev)



1.00E+000 W/kg Max SAR Displayed
Spatial location (mm) (202.77, 104.02, 107.14)
Cell location (272, 144, 145) (0, 0)
MaxSAR: 0.00 W/kg (4.3%)

Distribution of specific absorption rate (FDTD-METHOD)

Molecular markers (γ -H2AX, 53BP1) of DNA double-strand breaks (DSB), which are used to visualize and quantify double strand breaks (DSB) by enumeration of DNA repair foci by means confocal laser microscopy and immunofluorescence



VH-10 cells, 12 h following irradiation with 3 Gy

E. Markova, N. Schultz, and I. Y. Belyaev, *Int J Radiat Biol*, vol. 83, pp. 319-329, May 2007.

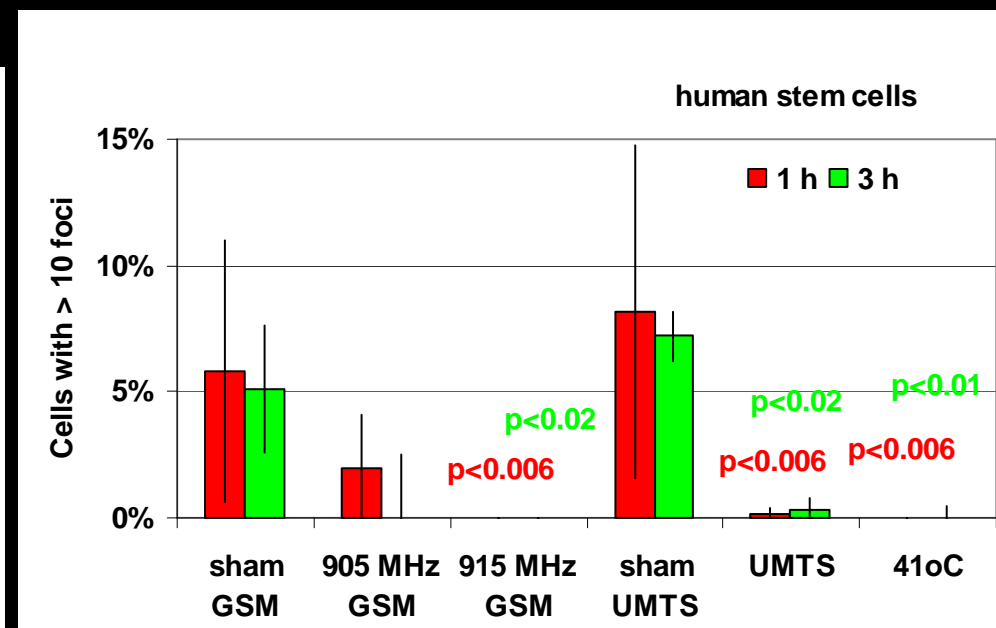
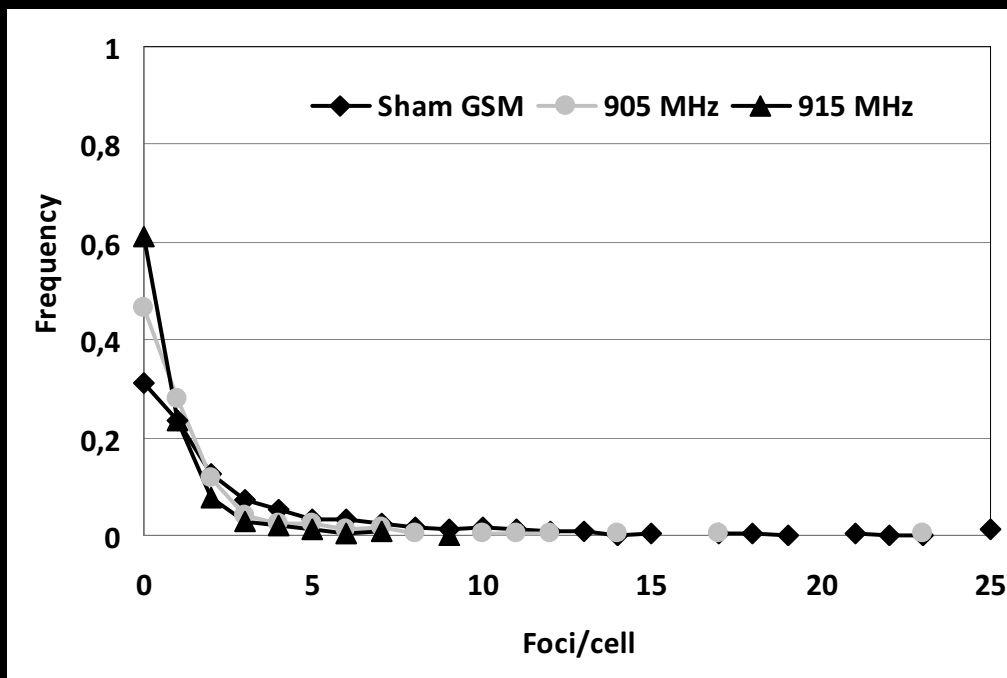
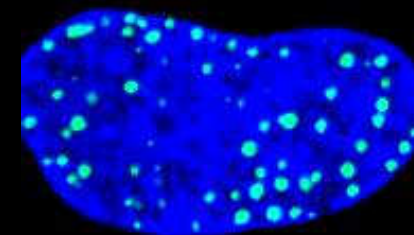
Alexandra Markova, Igor Belyaev

Studying effects on hemoatopoetic stem cells

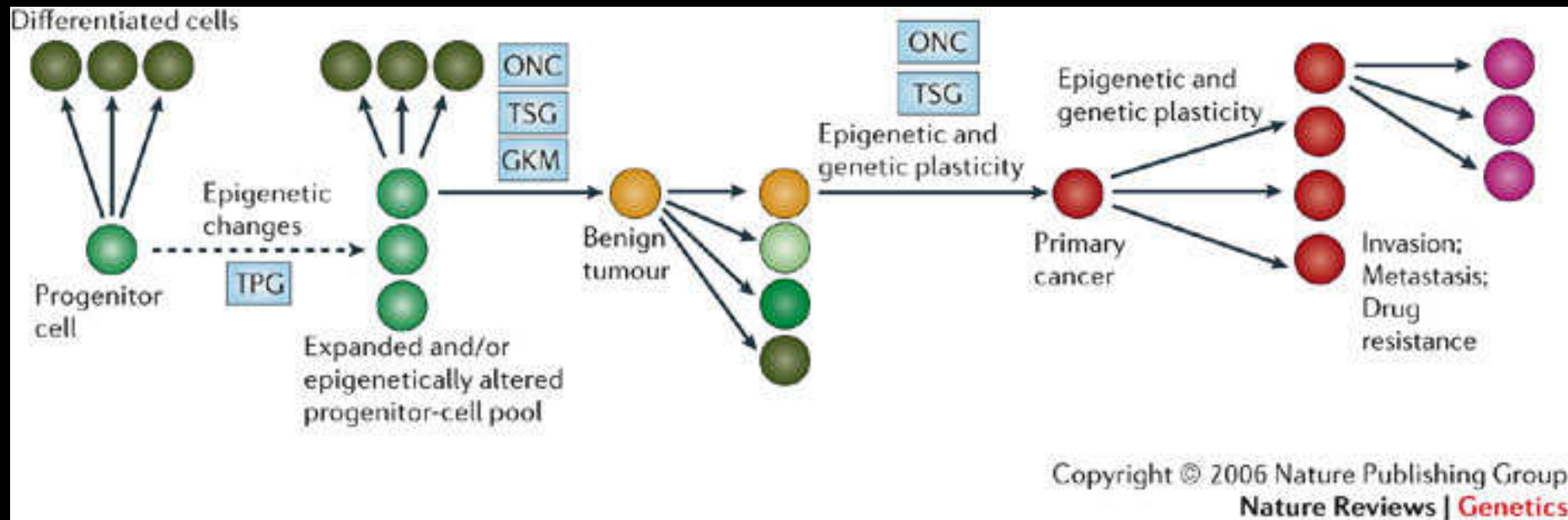
- Radiofrequency (RF) and ELF EMF inhibit DSB repair focus formation in primary human lymphocytes (Belyaev et al. 2005).
- Imbalance between cellular repair systems and DNA damage after EMF exposure may lead to formation of cancer.
- Human mesenchymal stem cells and lymphocytes are more sensitive to EMF exposure than fibroblasts (Markova et al. 2010).

Microwaves completely blocked DNA repair foci in stem cells with multiple DNA damage

(Belyaev)



Results with stem cells may be especially important because different cancer types (tumors and leukemia) originate from stem cells by well-known genetic and recently suggested epigenetic mechanisms



Fetal Programming Evaluated
Hugh Taylor MD, Chairman
Obstetrics/Gynecology
Yale University Medical Center, 2012



Radiation

gnant mice

Fetal Radiofrequency Radiation Exposure From 800-1900 Mhz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice

- Tamir S. Aldad, Geliang Gan, Xiao-Bing Gao
- & Hugh S. Taylor
- Scientific Reports 2, Article number: 312 doi:10.1038/srep00312
- Published 15 March 2012

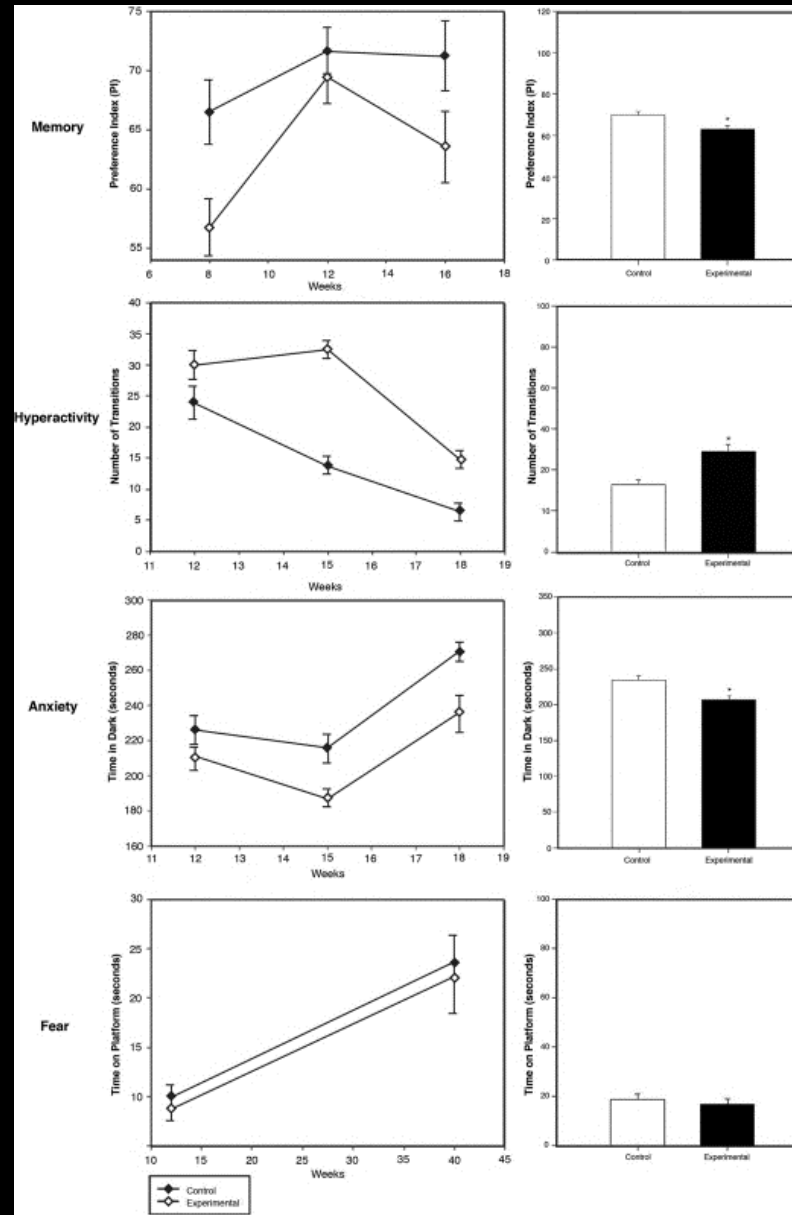
Fetal Programming Evaluated

Radiation



gnant mice

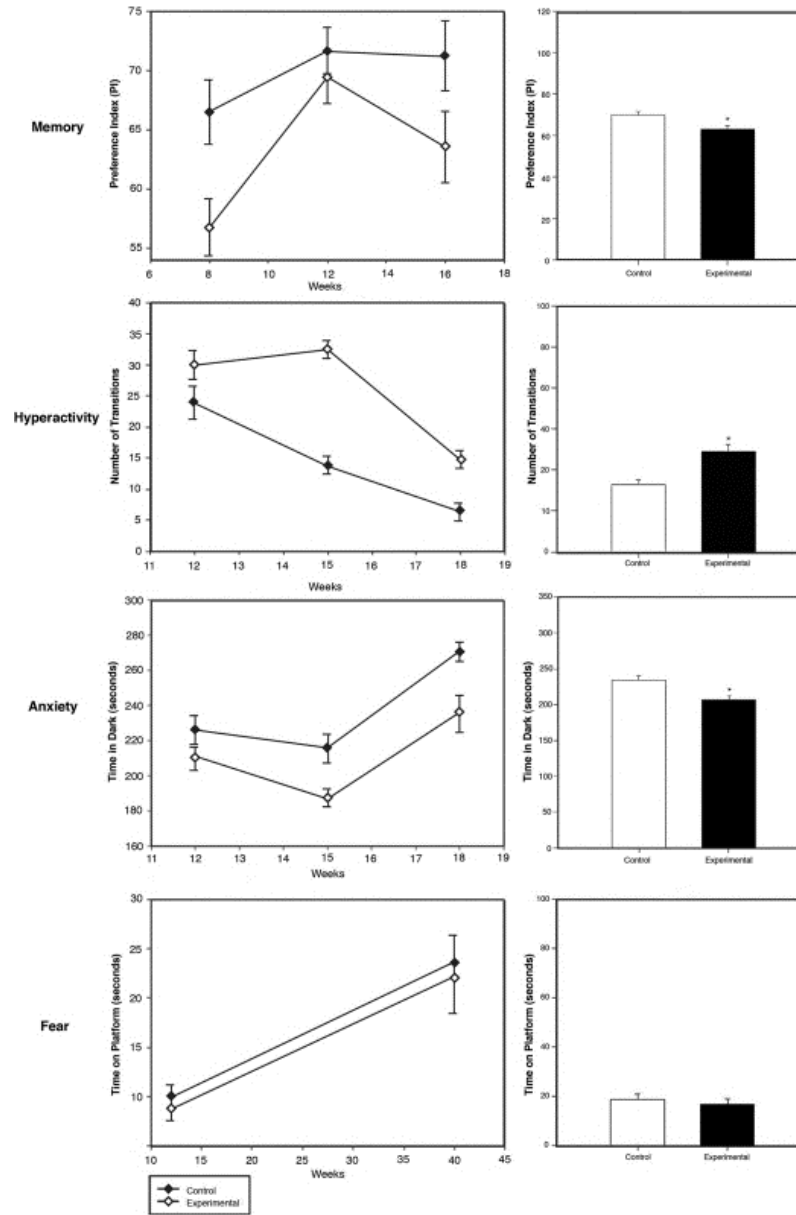
Hyperactivity, Diminished Memory and Reduced Anxiety



Human Implications



Hyperactivity, Diminished Memory and Reduced Anxiety



Controlled Experiments with Human Material-- sperm

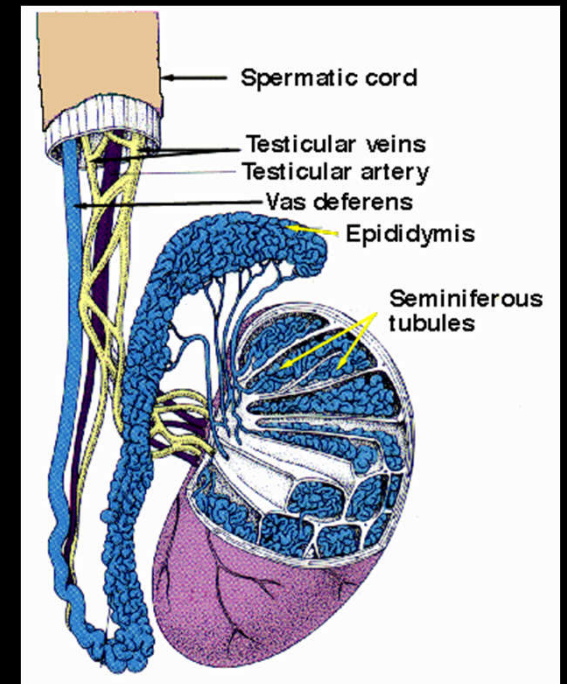
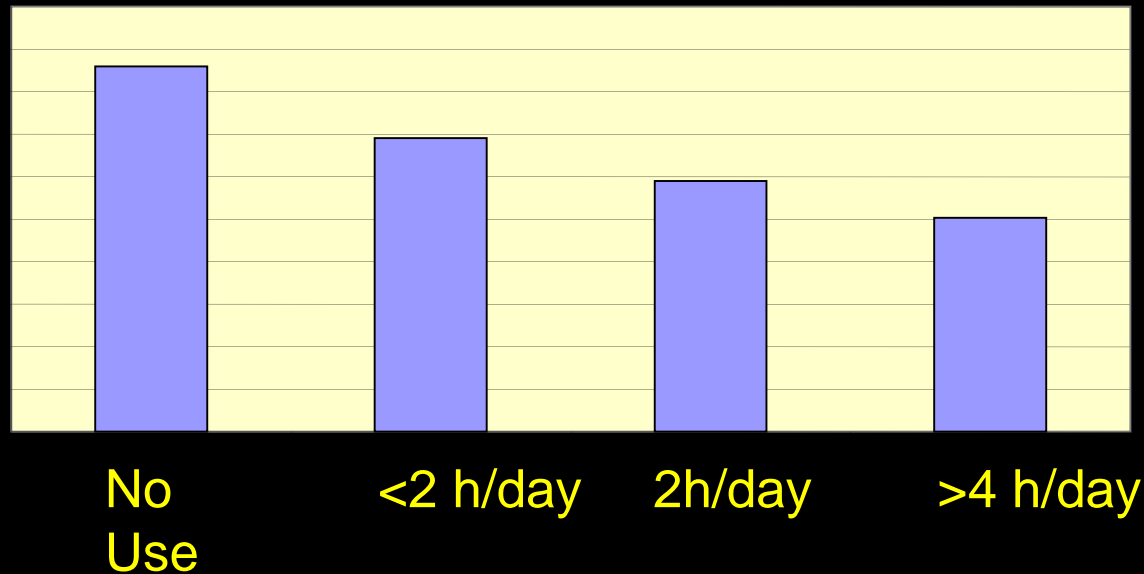
Cell Phone Exposed

Not Exposed



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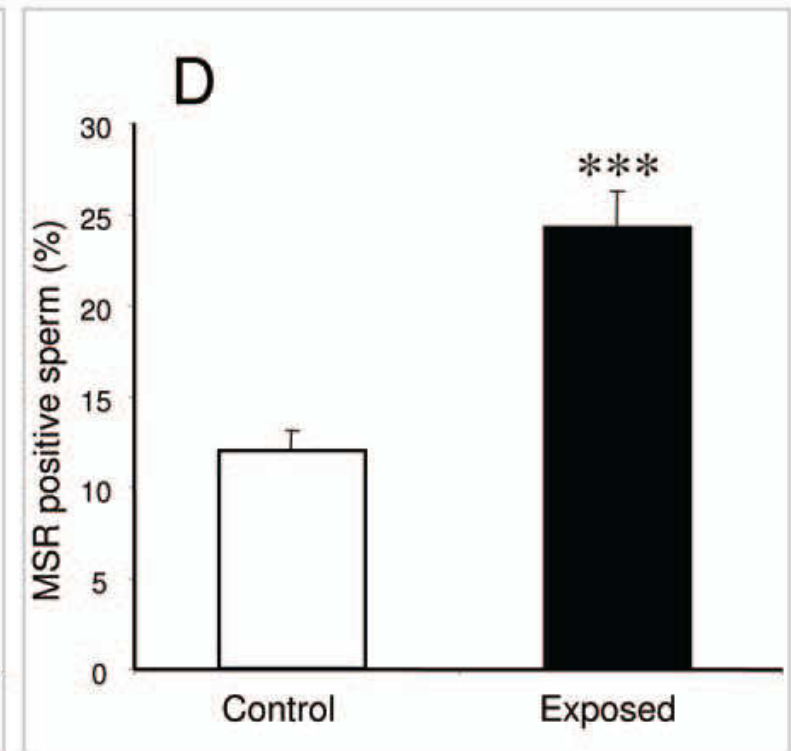
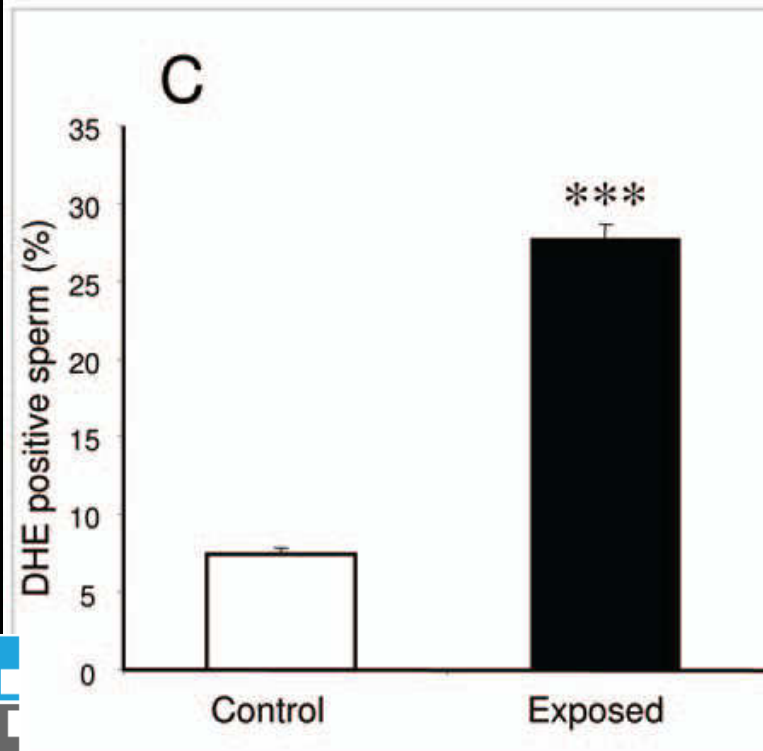
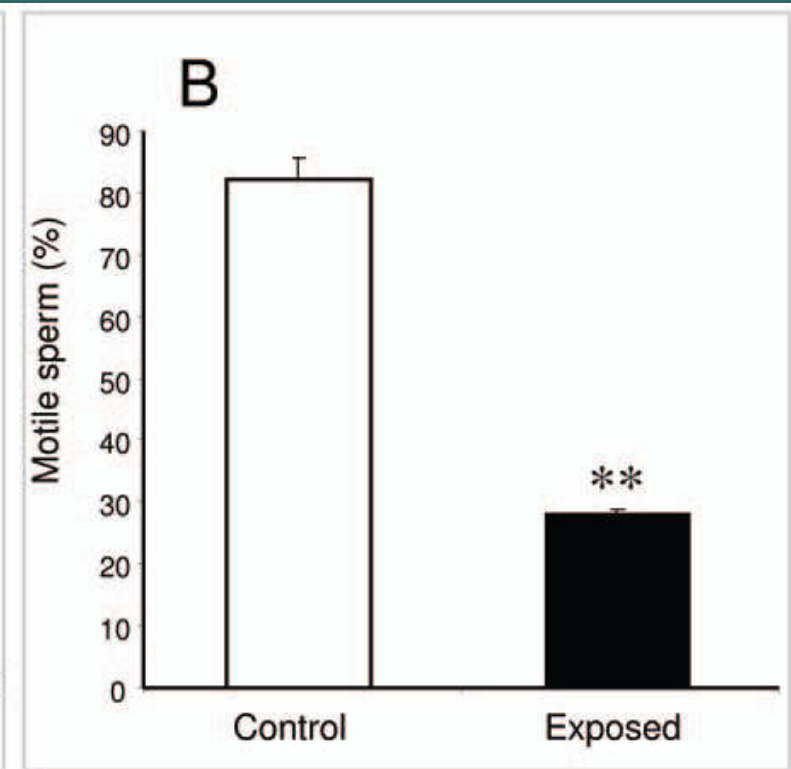
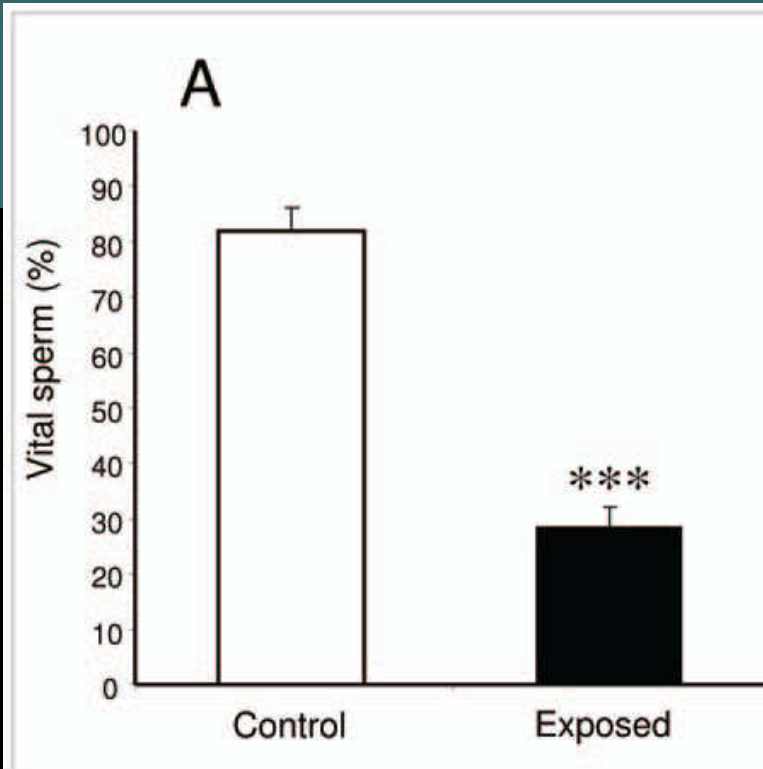
Cross-sectional analysis finds Reduced Sperm Count in Heaviest cellphone users



Agarawal, Cleveland Clinic, 2008; and 4 other studies

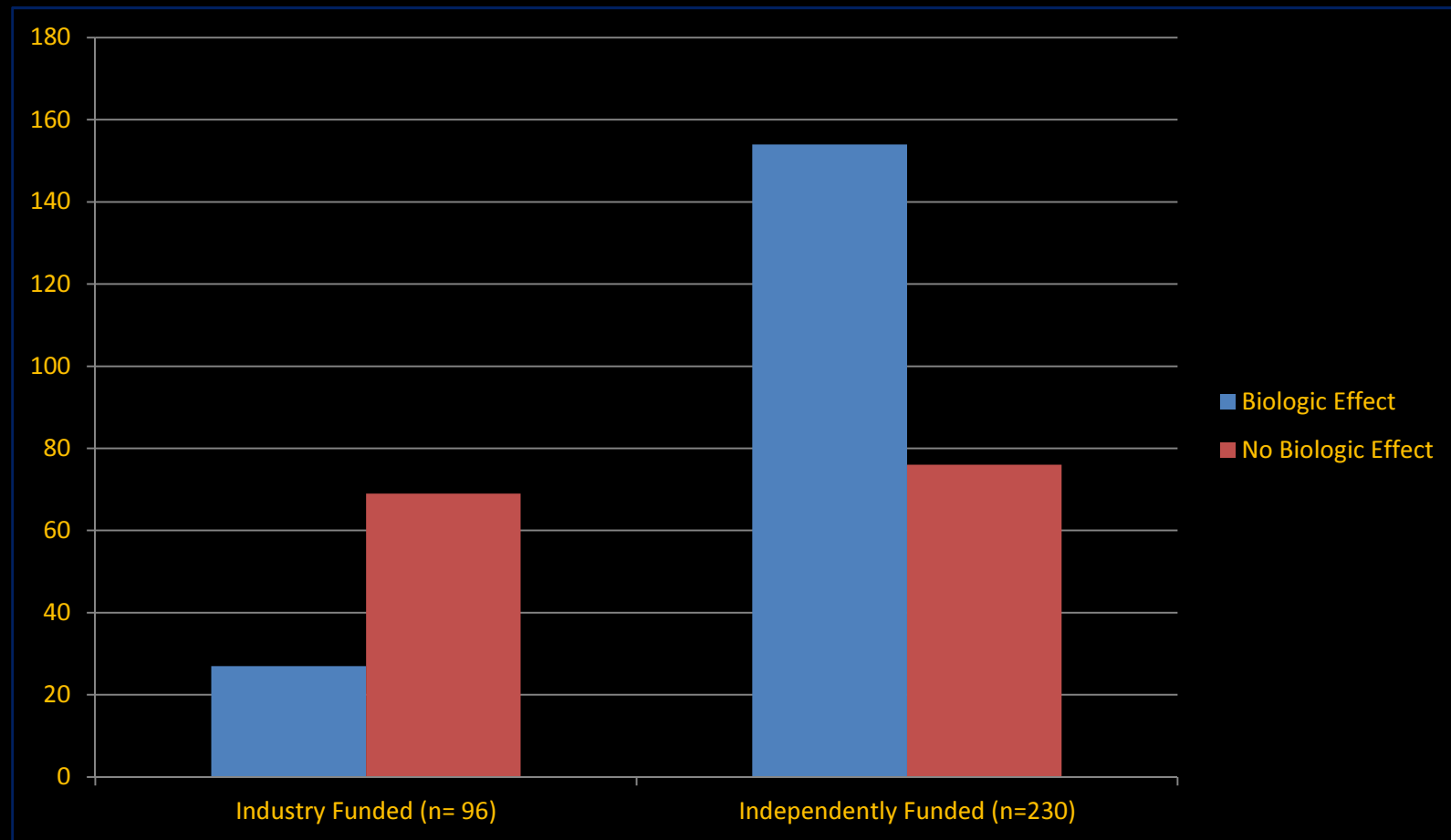
Laureate
Professor
John Aitken

Exposed
Sperm were
Significantly
Reduced
& damaged



Explanation for some negative experimental results

There is evidence of sponsorship bias (Lai, 2008)



SCIENCE UPDATE: CELL PHONES AND HEALTH

23 May 2011, İstanbul

**Investigation of EMF effects on the
cell number of hippocampus and
cerebellum using stereological
techniques**

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Department of Histology-Embryology

Medical School

Ondokuz Mayıs University

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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

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Keywords:

Electromagnetic field

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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.

The research question:

Do electromagnetic fields (EMFs) inhibit the formation and differentiation of neural stem cells during embryonic development in the hippocampus.

MATERIAL and METHODS:

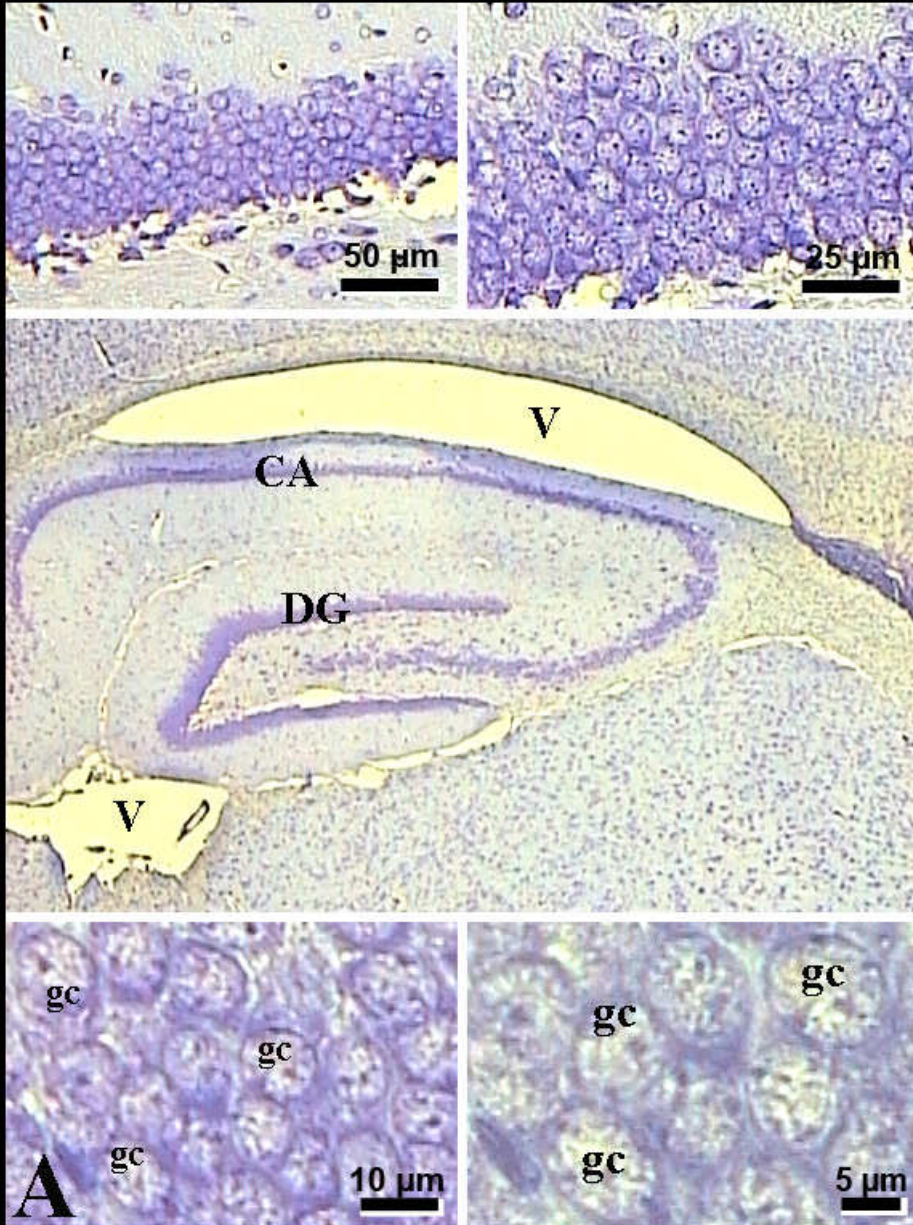
In EMF group rats, the specific energy absorption rate (SAR) varied between 0.016 (whole body) and 2 W/kg (locally in the head).

All of the rats were sacrificed at the end of the experiment (16th week).

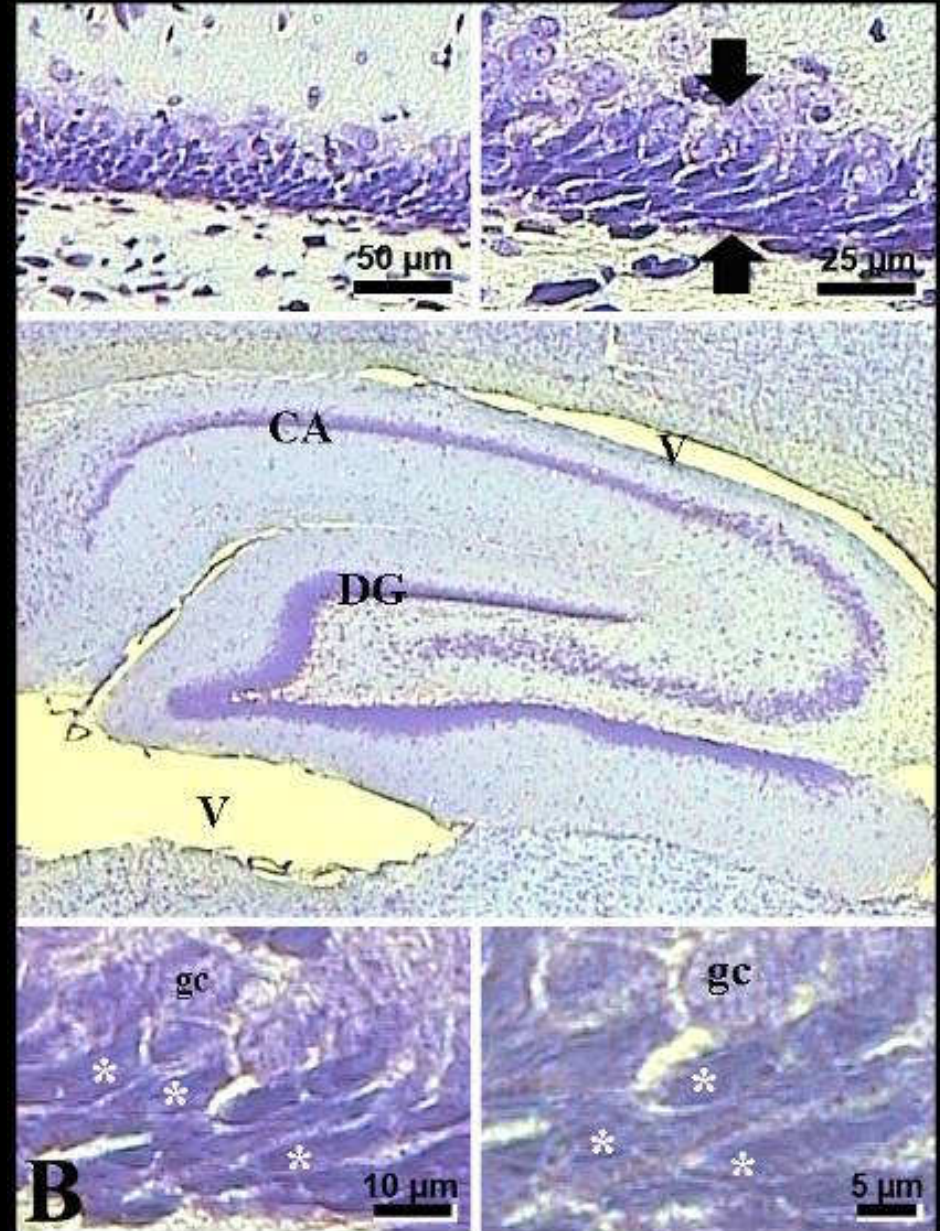
The number of pyramidal cells in the CA of hippocampus was estimated using the optical fractionator technique.

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

Controls



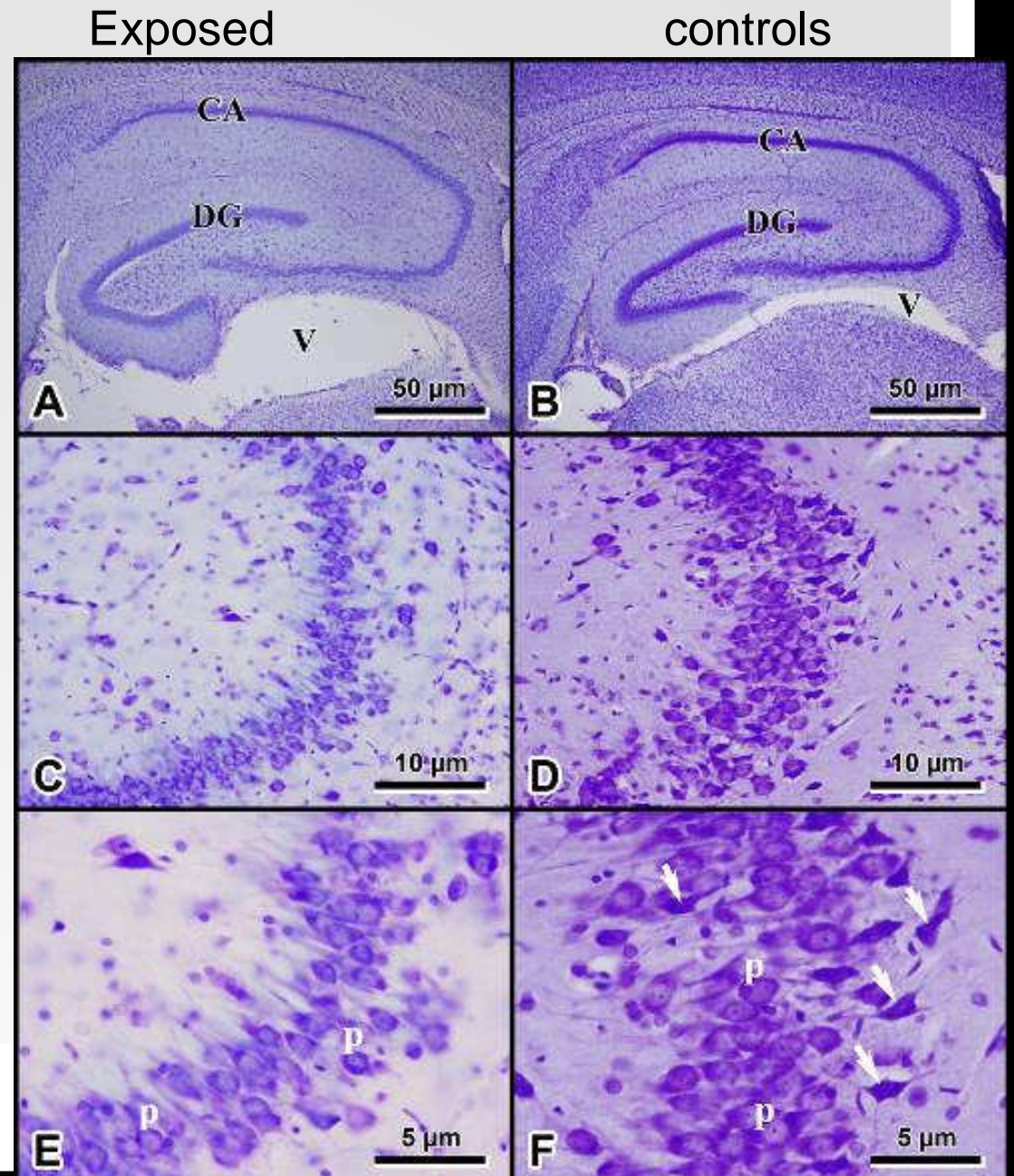
Exposed



Prenatal exposure of 900 MHz EMF induces pyramidal cell loss in the hippocampus of newborn rats

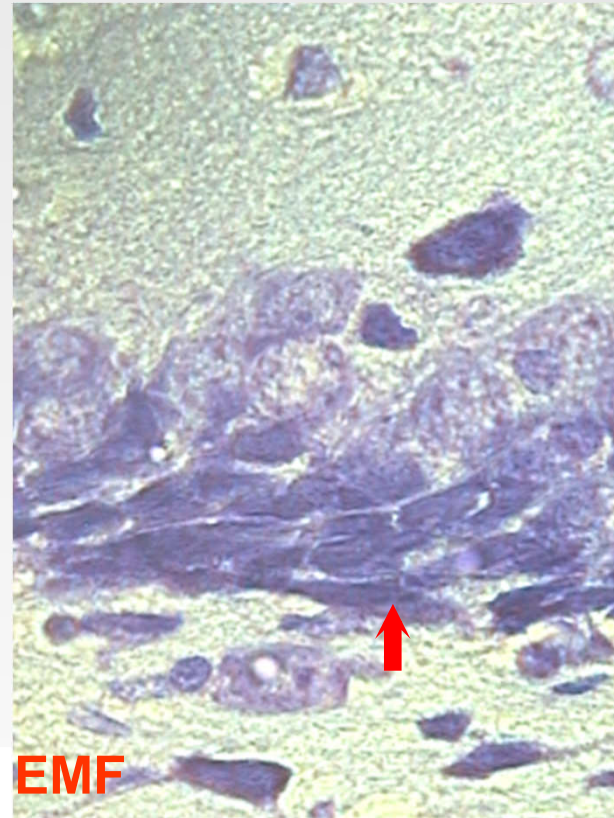
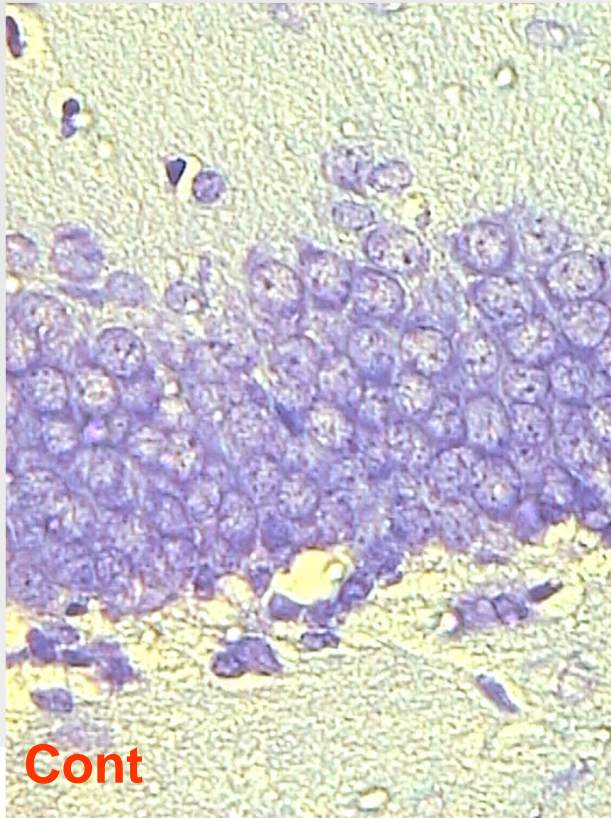
RESULTS:

Prenatal exposure of 900 MHz EMF induces pyramidal cell loss in the rat hippocampus



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

Granular cell loss might be caused by an inhibition of granule cell neurogenesis in the dentate gyrus during prenatal life as well as in the postnatal.





GAZI NON-IONIZING RADIATION PROTECTION CENTER (GNRK)
&
GAZI BIOPHYSICS DEPARTMENT



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www.gnrk.gazi.edu.tr

Experimental Studies of RF/Microwave Radiation from Mobile Phones

Nesrin Seyhan, Ph.D.

**GAZI UNIVERSITY
FACULTY OF MEDICINE
BIOPHYSICS DEPARTMENT**

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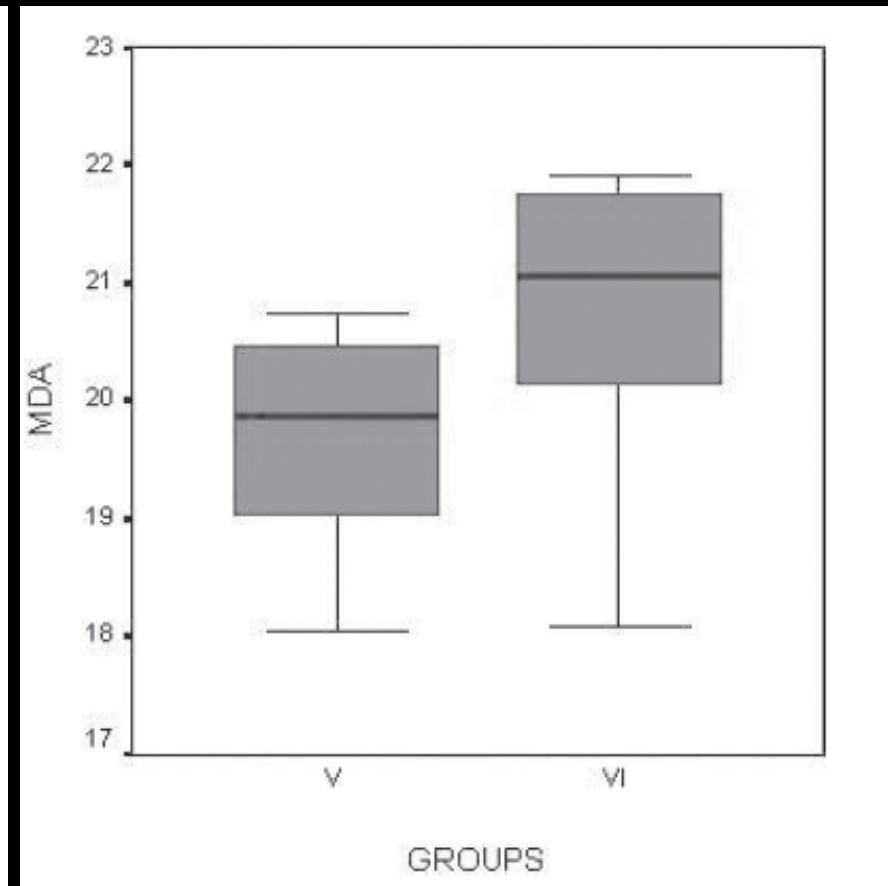
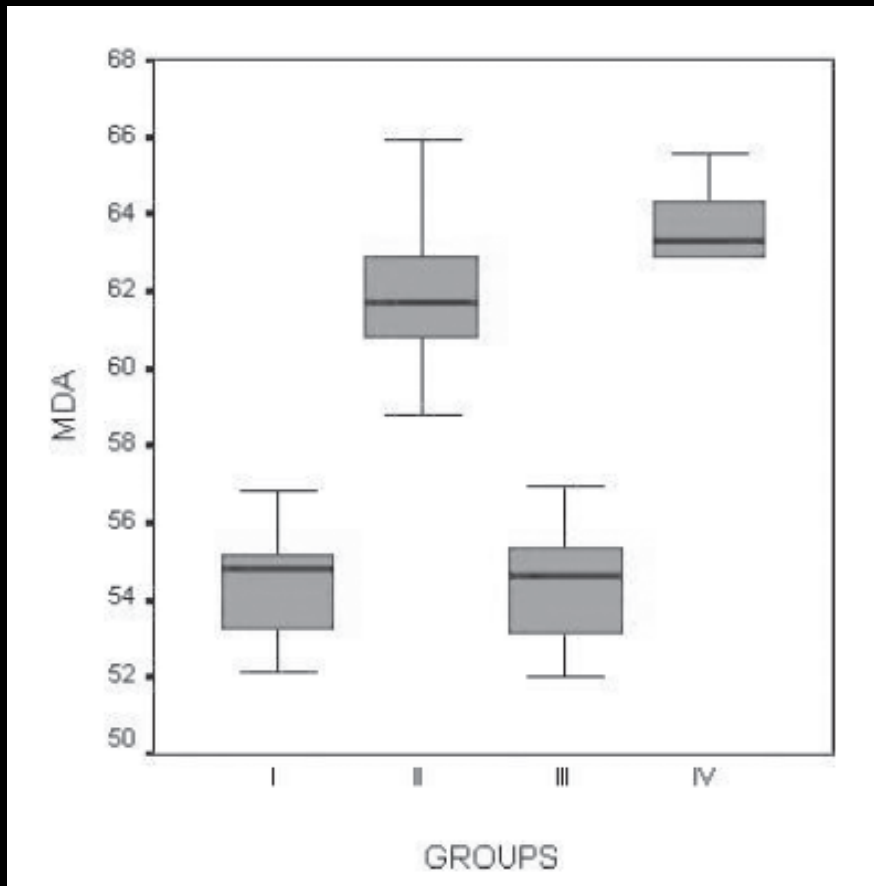
RF Effects on Nonpregnant & Pregnant Animals, Newborns & Infants

N.SEYHAN, G.GÜLER, A. TOMRUK*, E.OZGUR

Gazi University Faculty of Medicine Biophysics Department, Ankara, TURKEY

OXIDATIVE STRESS PARAMETER- MDA LEVEL

1800 MHz GSM-like RF radiation for 15min/day, 7 days.



Increased DNA base
modifications and free radical
formations in brain tissues of
adult rabbits & newborns

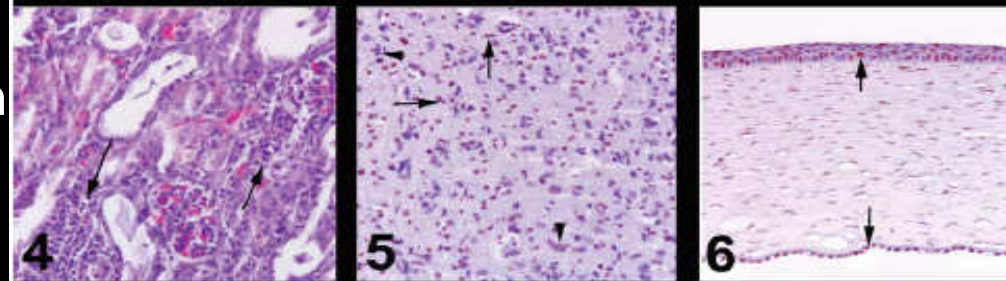
RF prenatally exposed rabbits

Gliosis in the brain



cornea degeneration

Epithelial degeneration



Apoptotic cells in cornea

Control cornea,



Apoptotic changes in the lens

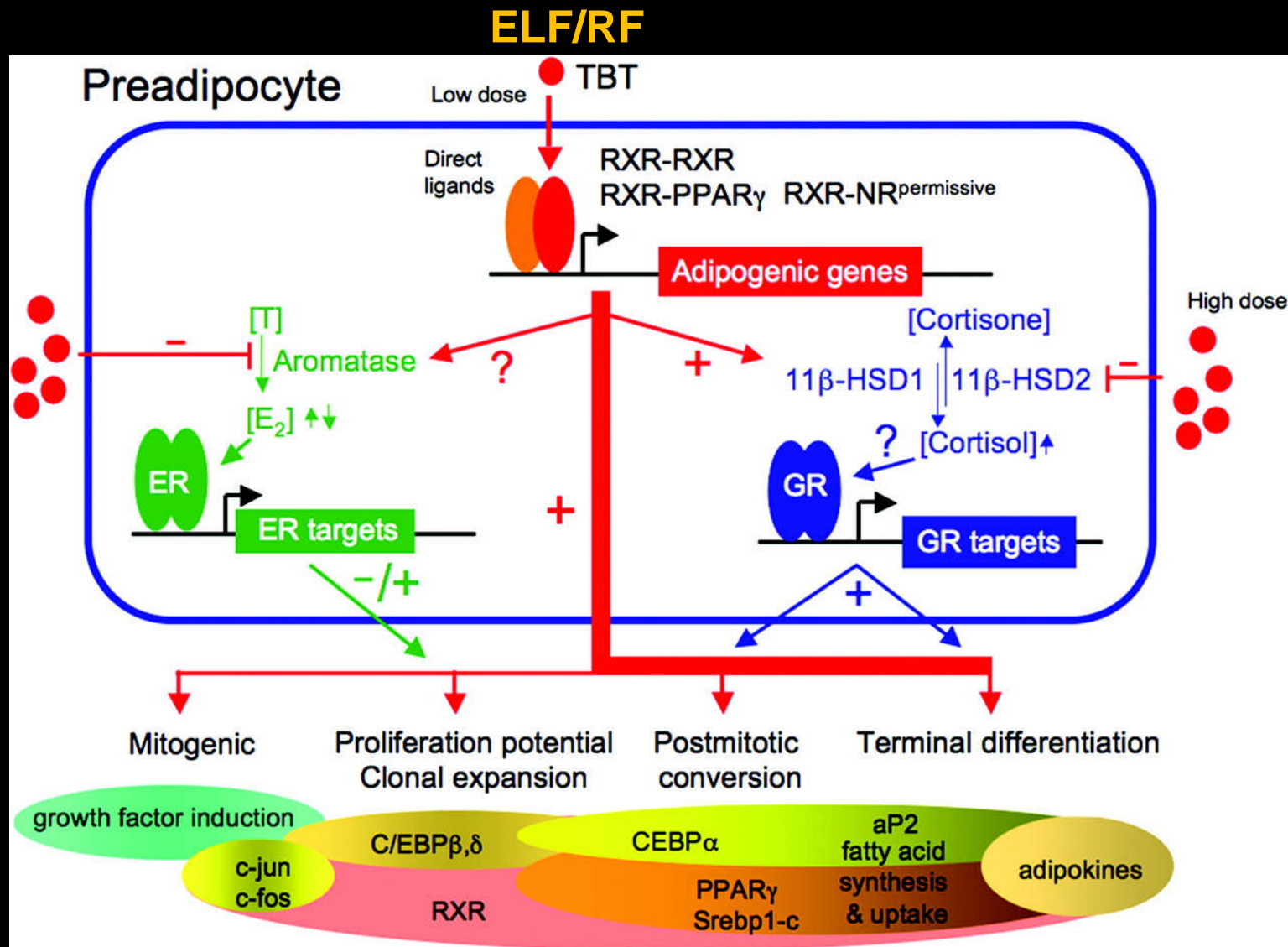
Figs 1-9. Histopathologic and TUNEL staining results of rabbits RFR exposed or control. 125 x.

1. Gliosis in the brain (arrows), HE.
2. Epithelial degeneration and oedema in cornea, HE.
3. Hydropic degeneration in hepatocytes, HE.
4. Interstitial settled mononuclear cell clusters (arrows) in the kidney, HE.
5. Apoptotic neurons (arrowheads) and glial cells (arrows) in the brain, TUNEL staining.
6. Apoptotic cells in cornea (arrows), TUNEL staining.
7. Control cornea, TUNEL staining.
8. Apoptotic changes in the epithelial cells of the anterior lens (arrows), TUNEL staining.
9. Apoptotic changes in the lens fibers (arrows), TUNEL staining.

Environmental Obesogens/Diabetes Hypothesis

Early life and young life exposures to metalloestrogens
pesticides, electromagnetic fields
and other endocrine disruptors
activate fat receptors and stimulate fat cells
that predispose to obesity and/or related metabolic
disorders (diabetes)

Known and potential pathways that prenatal exposure to ELF/RF or chemicals might affect obesity



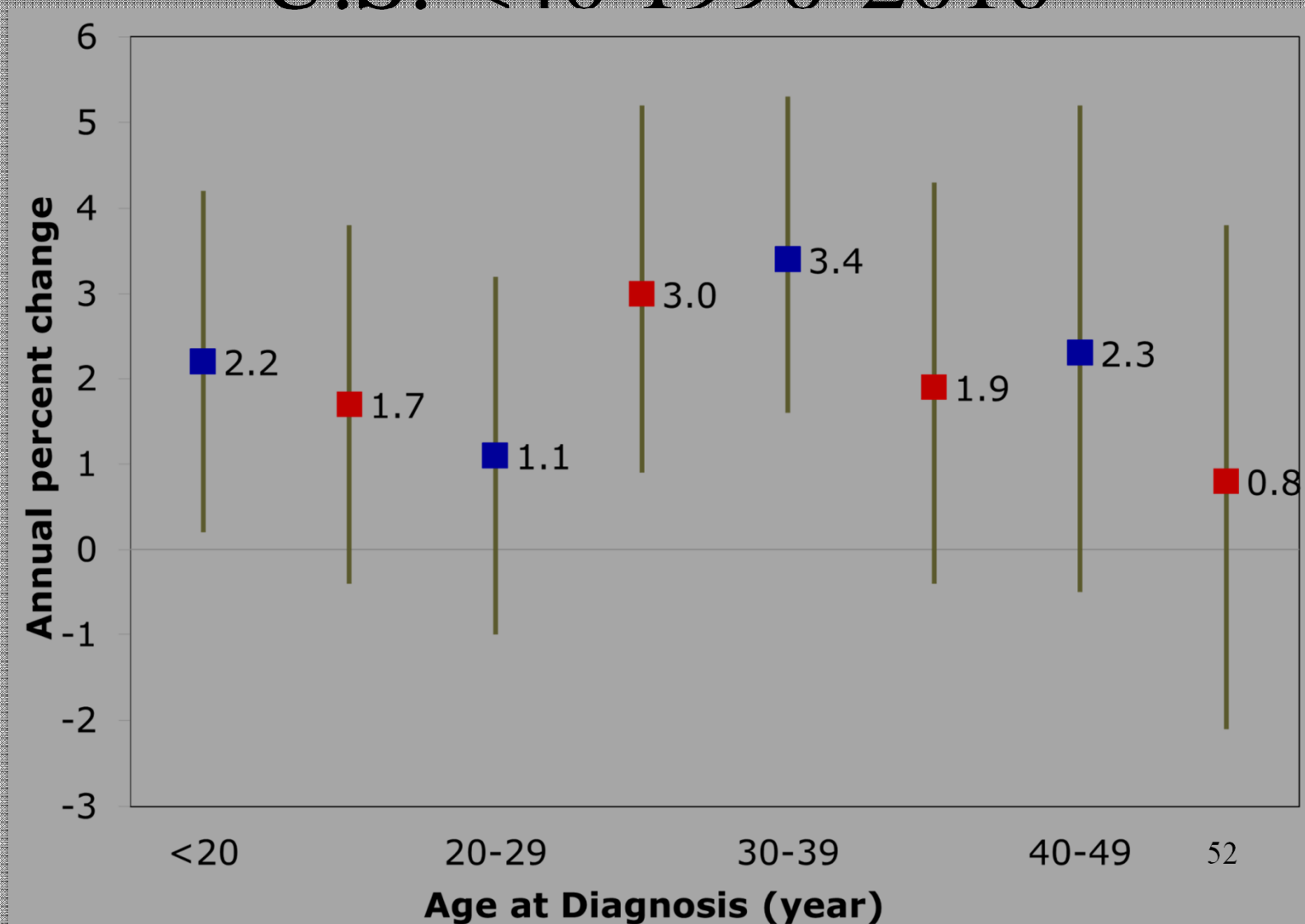
Felix Grün and Bruce Blumberg, 2006

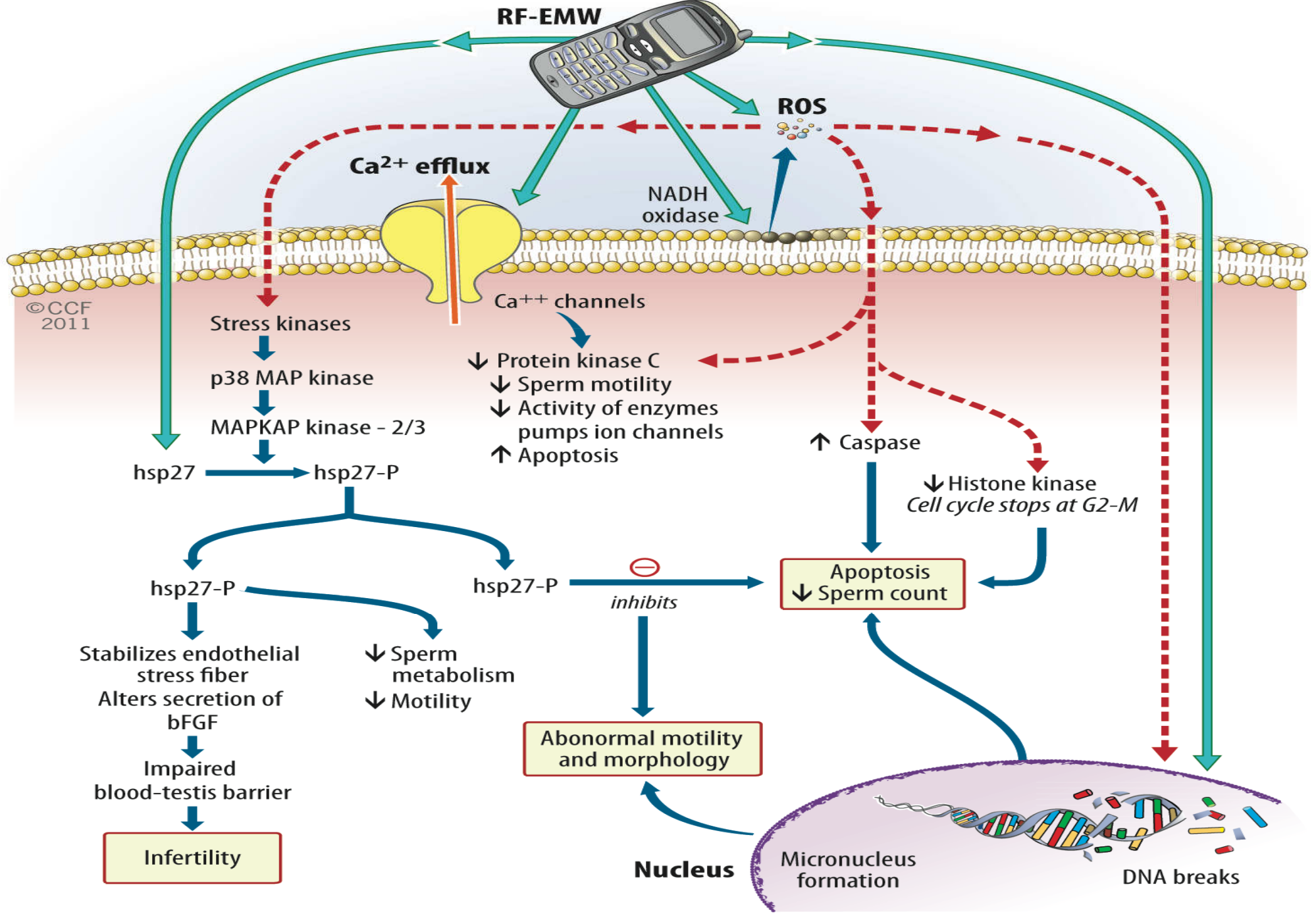
Endocrinology

Prenatal exposures to EMF affect childhood obesity/asthma

- Prospective study of pregnant women
- EMF measured with EMDEX during pregnancy
- Children had higher rates of asthma and obesity with higher prenatal EMF exposures
- De-Kun Li, California Health Department

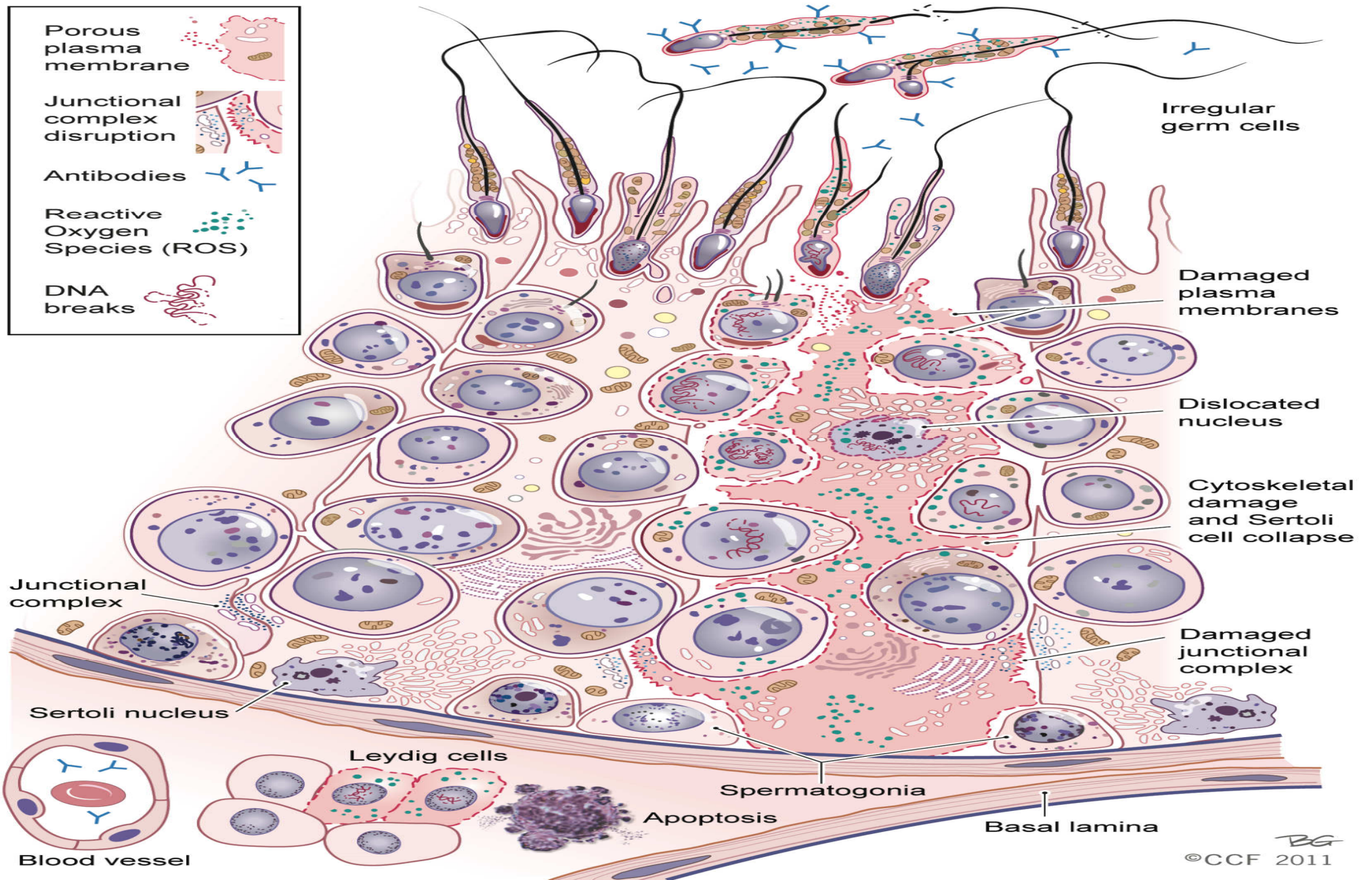
American Public Health Association, Han et al,
2012, Increasing GBM incidence in
U.S. <40 1990-2010





Hamada et al., 2011

- Meanwhile, altered calcium homeostasis due to low frequency EMW exposure leads to plasma membrane weakening. Negatively charged phospholipid bilayer of the cell membranes binds to divalent cations, such as calcium, which fit between phospholipid molecules and prevents them from repelling each other. Consequently, calcium helps to stabilize and strengthen cell membranes [11-13]. Many studies showed that under induced alternating voltage across the cell membrane, submembrane calcium ions are displaced on and off the cell membrane.



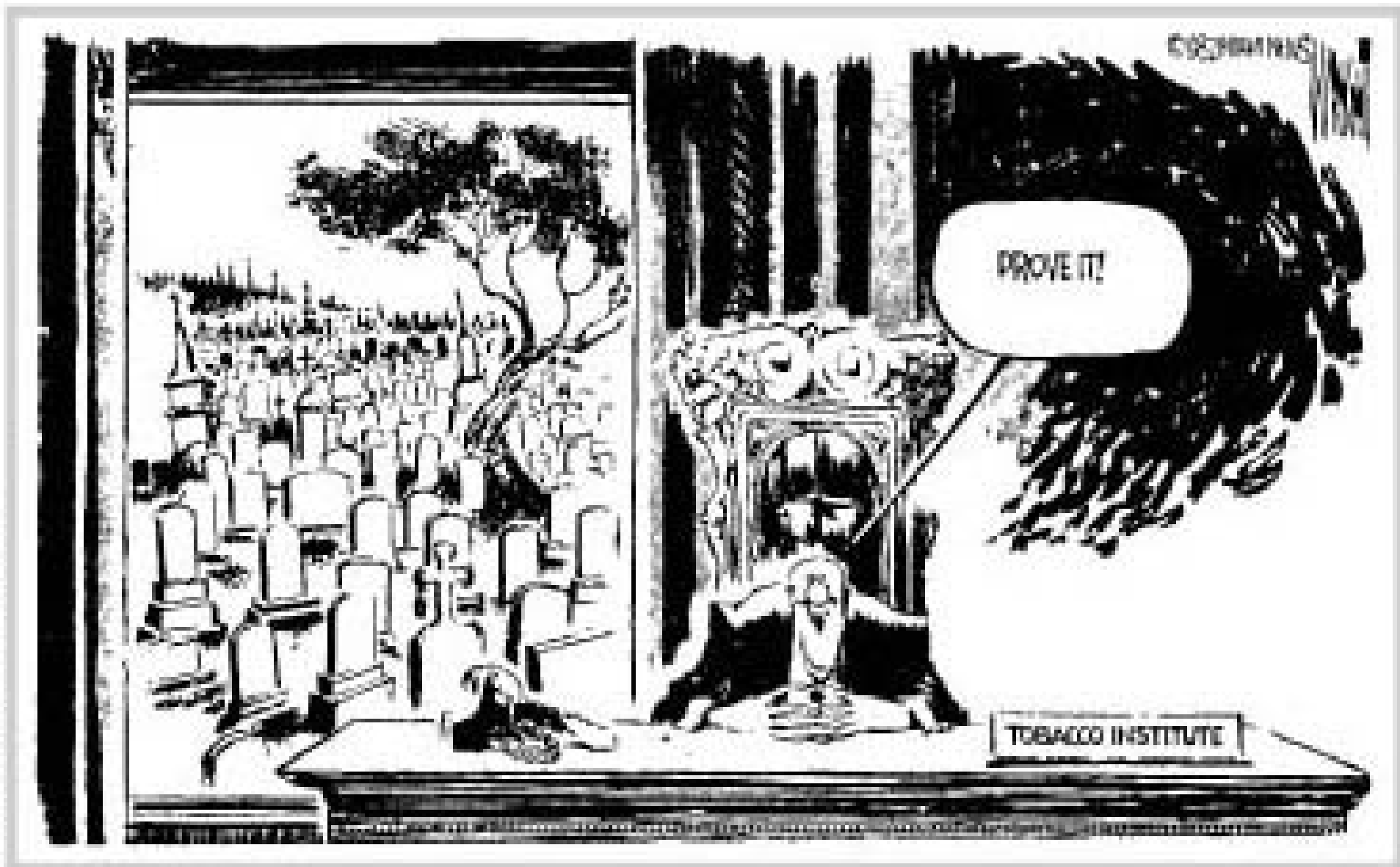
Danish Cancer Society Report: Doubled Brain Cancer in a Decade, November 8, 2012

The number of men who are diagnosed with the most malignant form of brain cancer (glioblastoma), has almost doubled over the past ten years.

Skovgaard Poulsen, MD Danish Cancer Society

To make the future better than the past,
study the past--Spinoza

Don Wright, *Minnow News*



Atomic Bombs in Japan, 1945



No increase in brain tumors was found in survivors **until 40 years later**

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In most epidemiological studies, cell phones do not increase brain cancer

Until after at least ten years
of heavy use

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Israeli Warning Label Passed first reading of law March 1, 2012

- One in every five rare malignant tumors of the cheek occurs in someone under age 20
- Young people should limit direct exposure of the head to microwave radiation from cell phones



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Fine Print Warnings (iPhone 4)

For optimal mobile device performance and to be sure that human exposure to RF energy does not exceed the FCC, IC, and European Union guidelines, always follow these instructions and precautions: When on a call using the built-in audio receiver in iPhone, hold iPhone with the dock connector pointed down toward your shoulder to increase separation from the antenna. When using iPhone near your body for voice calls or for wireless data transmission over a cellular network, 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 iPhone and the body.

iPhone's SAR measurement may exceed the FCC exposure guidelines for body-worn operation if positioned less than 15 mm (5/8 inch) from the body (e.g., when carrying iPhone in your pocket).

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The world is not dangerous because of those who do harm but because of those who look at it without doing anything.

•Albert Einstein

www.ehtrust.org

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How to Protect Your Family

- France, Finland, Israel, and the European Environment Agency advise cellphone precautions
 - Use speakerphone
 - Use earpieces
 - Do not keep phone on body/in pocket
 - Avoid use in areas of weak signals
 - Protect abdomens--pregnant, adolescent and men wishing to become fathers

Your future is in your hands

Medical experts are warning men not to keep their mobile phones in their pockets as this can have a direct effect on their fertility.



www.radiationresearch.org

**SAVE
THE
MALE**

© RADIATION RESEARCH

The Big Question

Is microwave radiation from
mobile devices dangerous?



With
a New
Afterword

The Truth About
Cell phone Radiation,
What the Industry
Is Doing to Hide It,
and How to Protect
Your Family

Disconnect

Devra Davis

Foreword by DAVID SERVAN-SCHREIBER,
author of *Anticancer*

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LE PROGRÈS



Let's keep them healthy, away from mobile phones!

- Mobile phone use: the city of Lyon teaches a lesson

"For the first time in France, a major city is launching a campaign to discourage the use of mobile phones among children."

"The really new, in fact unusual, factor is that this action is not being promoted by the city itself but by a political group, the Green Party, of which Mireille Roy, the council officer in charge, is a member. It's taking place in an interesting context. If the question focuses on a matter of public health, the real issue is a political one."

"Neither the body of law authorised by the Council of State nor any other legal or regulatory directives allow local authorities any real freedom of action in this domain.

But in the face of mounting pressure, something had to be done.

Thus the moment was ripe for this campaign, even though it would be possible for those who are concerned to bring a group action in court."

French Government Restrictions on Cell Phones, January, 2009

- Ban advertising directed at children under 12
- Ban design of phones to be used by those under six.
- Handsets all sold with phones w SAR posted
- City of Lyon official advertising campaign to discourage the use of the phones by children.

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Aaron ECKHART Maria BELLO Adam BRODY Sam ELLIOTT Katie HOLMES Rob LOWE William H. MACY and Robert DUVAL

Nick Naylor doesn't
hide the truth...
he filters it.



THANK YOU FOR SMOKING

Based on the best-selling novel

FOX SEARCHLIGHT PICTURES AND WOOD 3 ENTERTAINMENT PRESENT A DAVID E. SACKS PRODUCTION IN ASSOCIATION WITH CINECITIZEN & JASON BEITMAN WITH AARON ECKHART
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www.foxsearchlight.com SPRING 2006 "FRAY" E. SACKS "DODDLE" JASON BEITMAN

Truth is Stranger Than Fiction

- “Gentlemen, practice these words in front of the mirror: Although we are constantly exploring the subject, currently there is no direct evidence that links cell phone usage to brain cancer.”

Social Media

- @saferphones
- @DevraLeeDavis
- Ehtrust.org
- Facebook/CampaignforSaferPhones
- Facebook/EnvironmentalHealthTrust



Campaign for Safer Cell Phones—under development

- Warning labels for cell phones
- Use an earpiece or speakerphone
- Don't keep phone on and on the body
- Text message rather than talk
- Ban apps to be played next to babies' heads
- Promote and generate funding for major independent research programs

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Environmental Health Trust*

non-profit research and policy
organization promoting environmental wellness

- Educating communities & health professionals
 - Conducting basic and applied research
 - Developing local & national policies
- to reduce avoidable environmental health risks.

current priority: Cell Phones

* Devra Lee Davis Charitable Foundation DBA Environmental Health Trust
IRS EIN 501c3 207498107



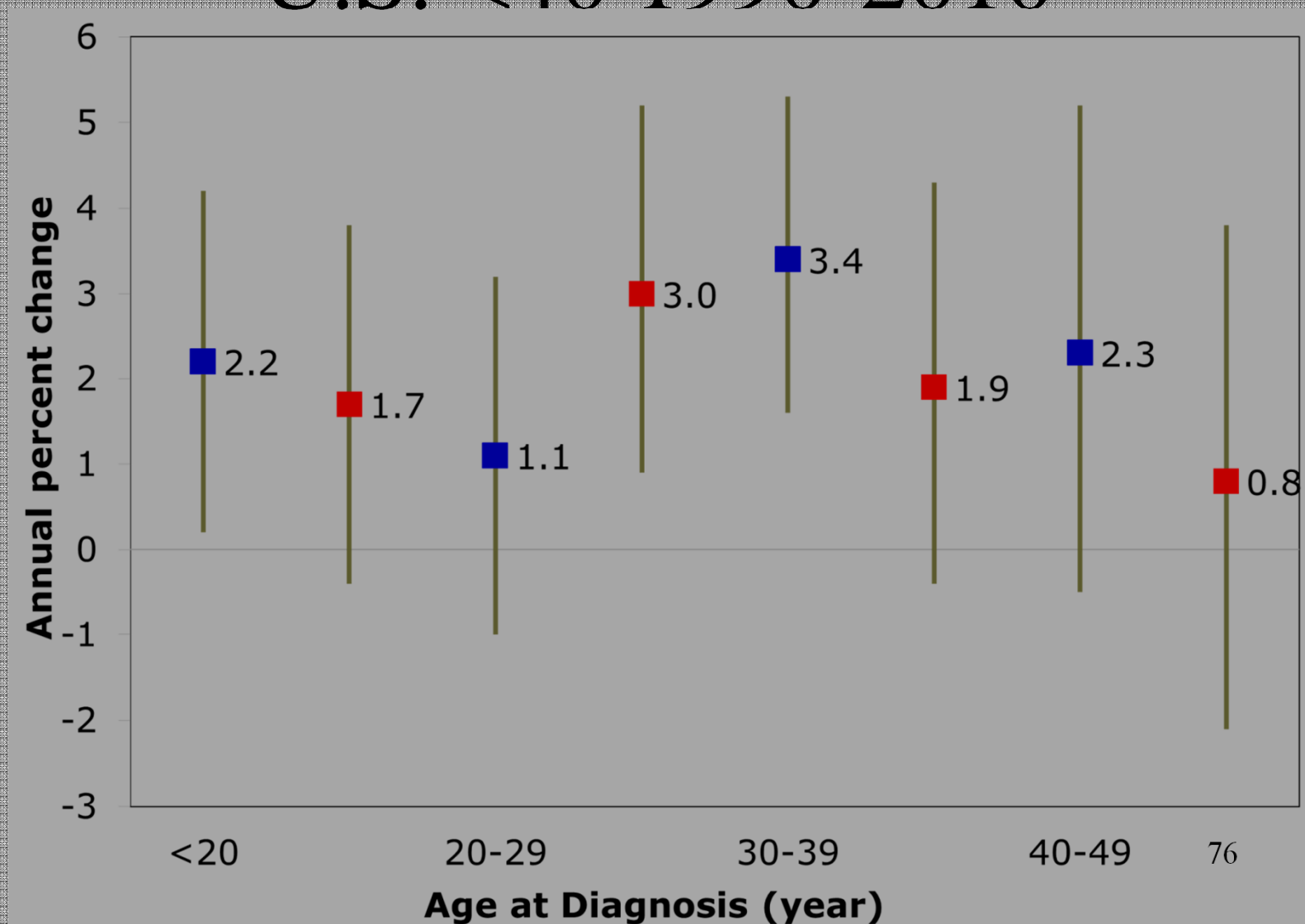
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Danish Cancer Society Report: Doubled Brain Cancer in a Decade, November 8, 2012

The number of men who are diagnosed with the most malignant form of brain cancer (glioblastoma), has almost doubled over the past ten years.

Skovgaard Poulsen, MD
Danish Cancer Society

American Public Health Association, Han et al,
2012, Increasing GBM incidence in
U.S. <40 1990-2010





- apply “as low as reasonably achievable” (ALARA) principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

- 6 May 2011

<http://assembly.coe.int/Main.asp?link=/Documents/WorkingDocs/Doc11/EDOC12608.htm>