

Cell Phone Radiation and Breast Cancer - a review of the evidence

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Environmental Health Trust

www.ehtrust.org

Foundations for Identifying Cell Phone Radiation as an Avoidable Cause of Breast Cancer

- Unusual clinical case reports
- Exposure modeling
- Toxicology
 - in vitro with human and animal cells
 - in vivo
- No epidemiology available*

*therefore critical need to acquire solid history regarding cell Phone use, placement, type, etc.

Emmy winning video featuring collaborators
Lisa Bailey, MD John West MD, brave sentinel
cases, Donna Jaynes, Tiffany Frantz

- <http://www.ktvu.com/videos/news/special-report-keeping-cell-phone-in-bra-may-lead/vhPF8>

Phones in bras around the world



4

Dominican Republic, Credit Thos Robinson, 2010

Marketing for Cell Phones and Gear in Bras



Brazil



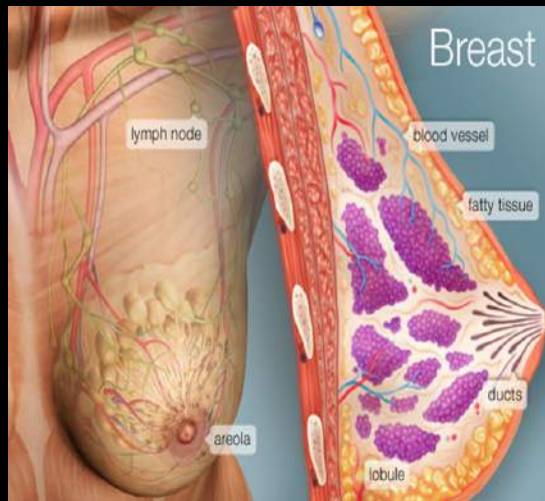
TECHNOLOGY

OMG

**Bra That Holds Your Cell
Phone Is Every Woman's
Dream**



Risk of Breast Cancer tied with cell phone radiation

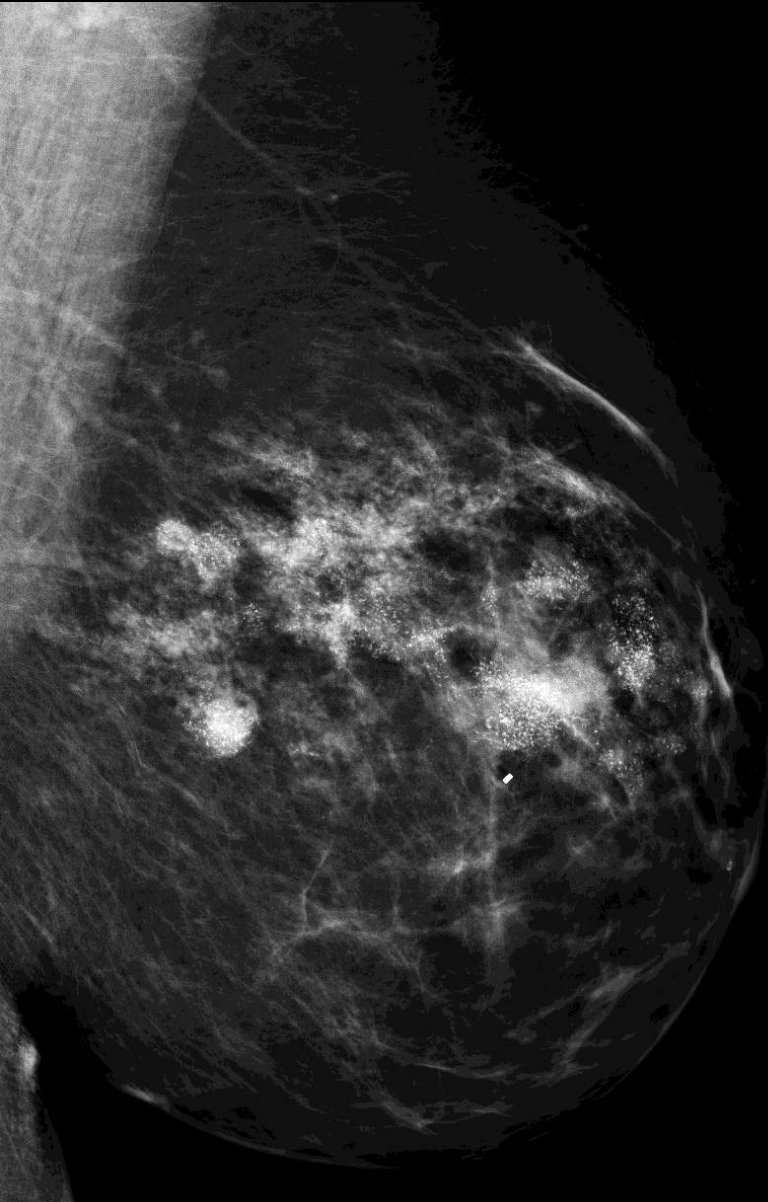


The younger the breast the greater fluid and fat which equals greater microwave absorption



Five Premenopausal Breast Cancers located where cell phones were stored

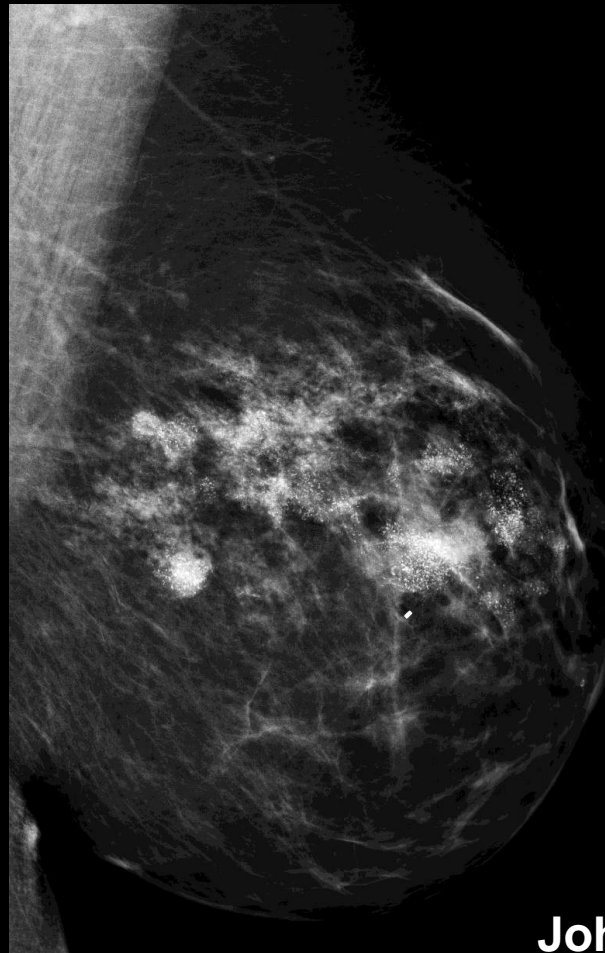
Caveat - first case report, 2009



Invasive multiple primary tumors in 34 year old, avid runner Chinese-American woman who used cell phone 4 hours a day in her bra for 10 years —reported by Robert Nagourney, MD, PhD

Now 5 Case Reports -

Two cases = Age 21 with multi-focal tumors tied with cell phones kept in bra from age 13-21, 2012



John West et al

Case Reports - 21 yr old multi-focal tumors tied with cellphones kept in bra

3D DYN 20CC OPTIMARK
Img: (28/56) T: (2/5)
Ax: H 0.7 cm
512 x 512

21 years, 2/25/1991 F 40349
Center
12/13/2012 2:04:01 F

Mag: 1.00 x

R

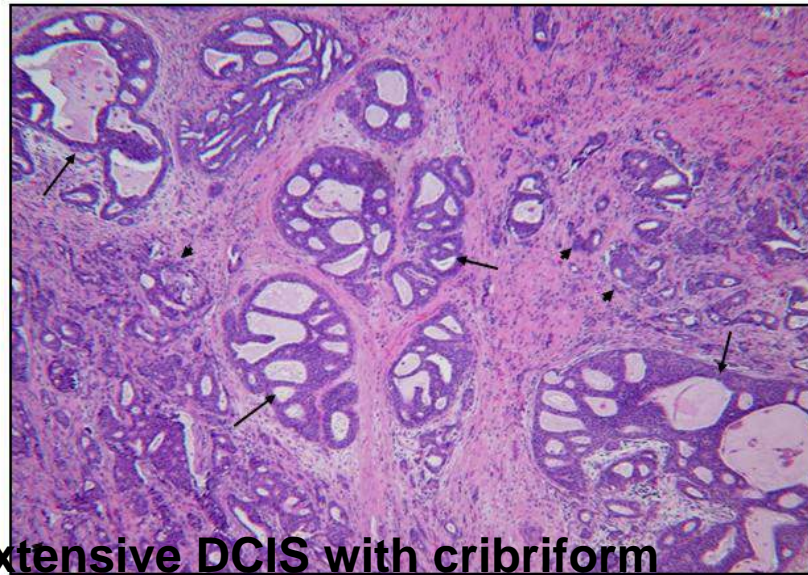
3.00 mm
GR
TR: 6 TE: 1 TI: 40 FA: 10
20CC OPTIMARK
W: 453 L: 226

Wash-In / Wash-Out
(PV: 59.00 %, 20.00 %, 20.00 %, 20.00 %)

DFOV: 40.3 x 27.8 cm
(L5.6, A13.9, H7.3) in mm 0 = :

10 cm

Typical Pathology of Cell Phone Related Breast Cancer



extensive DCIS with cribriform configuration (arrow). The multiple foci of invasion (arrowhead) occur in between the DCIS (magnification x 100).

Summary of 5+ Cases

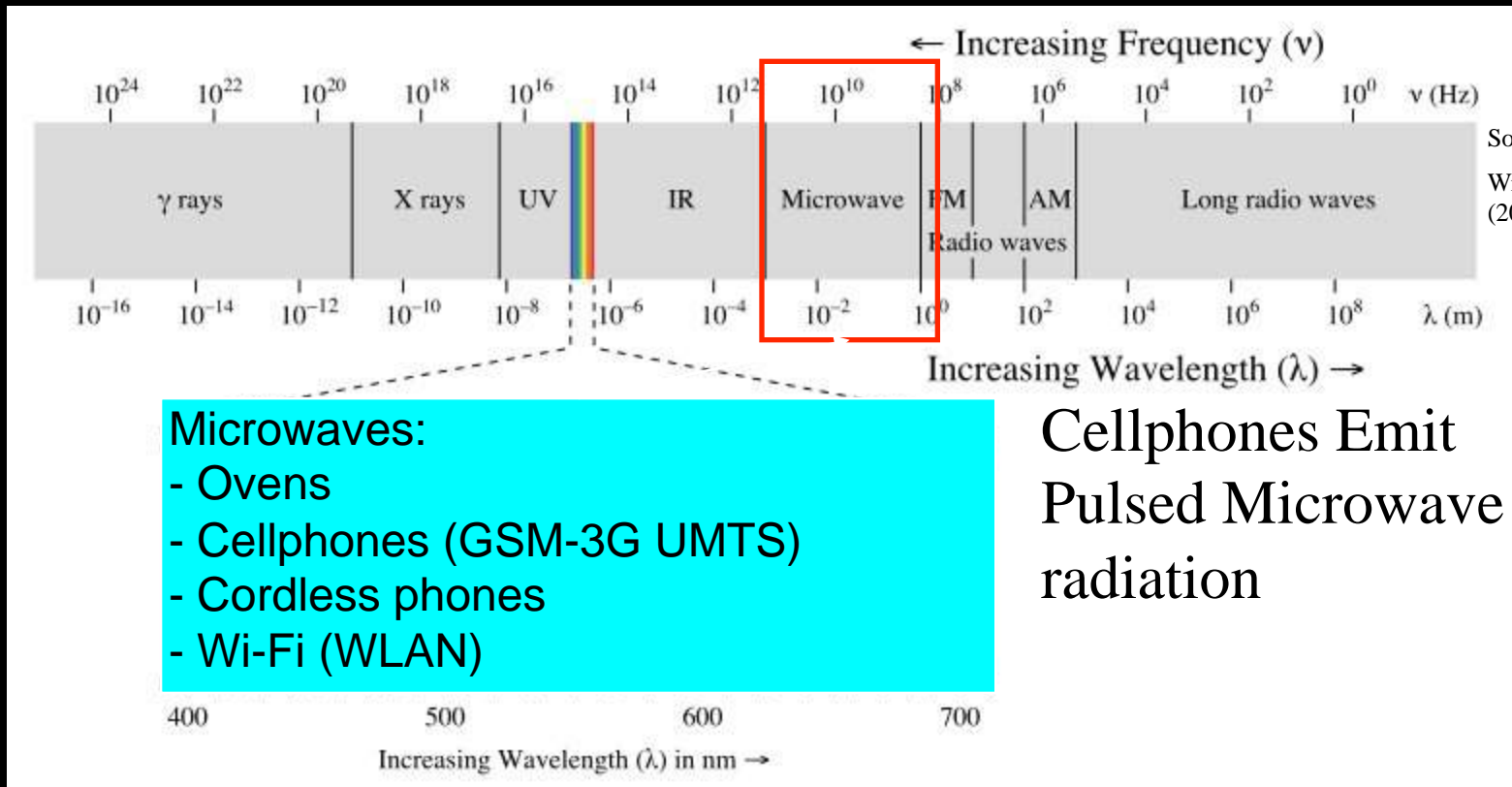
- Negative for BRCA1/2
- No family history or other risk factors
- Unusual location of multi-focal tumors where phones were kept with mix of tubular/solid patterns of identical nuclear morphology & grade
- No significant histology in ductal and lobular units away from the areas of cellular phone use
- Two with mets

Reasons for deducing that non-ionizing radiation is (an epigenetic) breast carcinogen

- Exposure Information
- In vitro toxicology
 - RF stimulates apoptosis in normal fibroblasts
 - RF impedes efficacy of tamoxifen
 - RF interferes with melatonin
 - Q.E.D. RF is a xenoestrogen?
- In vivo toxicology studies

Radiation

- Electromagnetic Spectrum

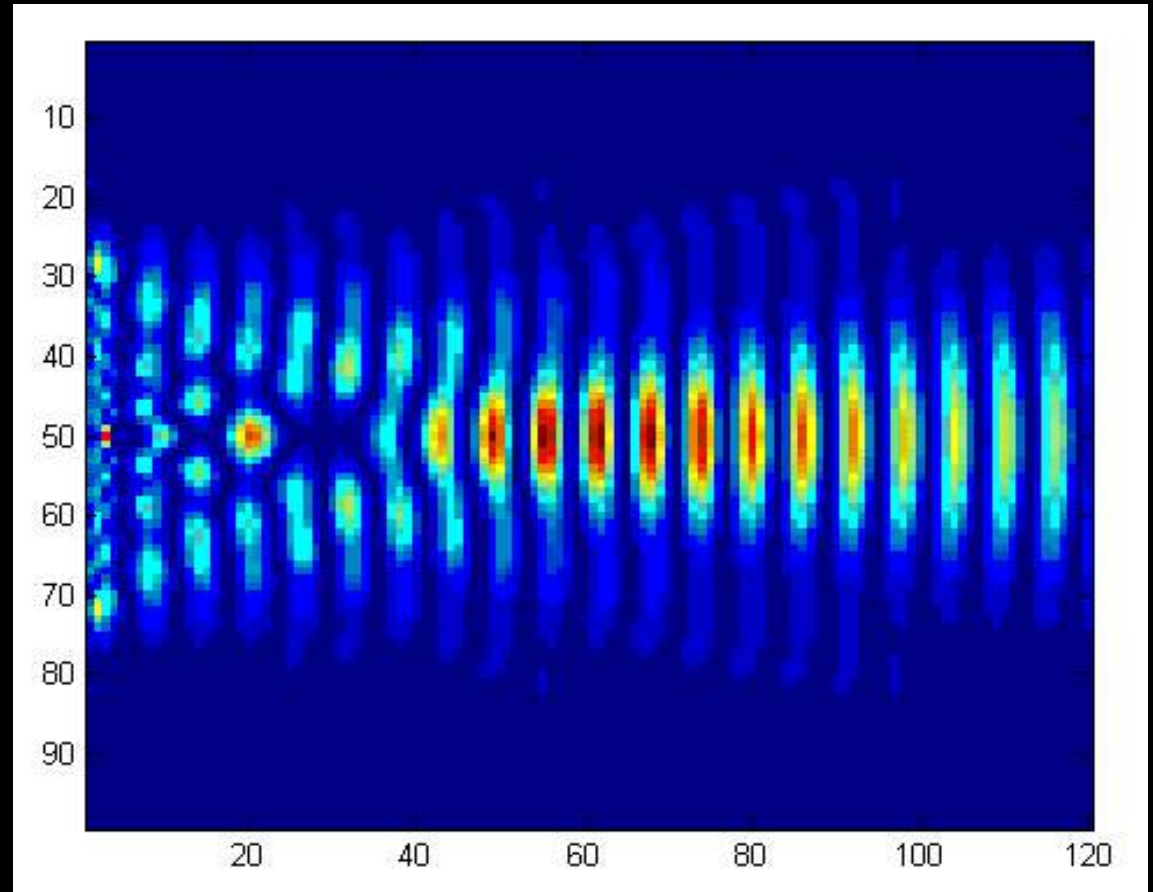


<http://www.hese-project.org/hese-uk/en/niemr/ecologsum.php>

Do not take without permission <http://www.bioinitiative.org>

The impact of any form of radiation depends on signal properties

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



160.00

INTENSITY
V/m

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

SPEAKING

LISTENING

END OF CALL

45.51
1=1
V/m

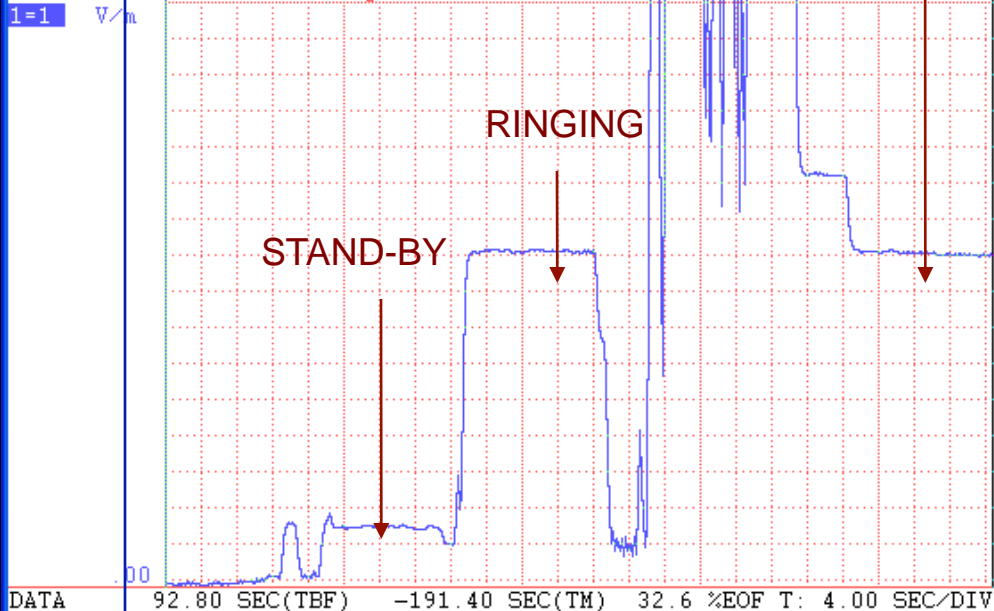
Field Strength

Field Strength

Field Strength

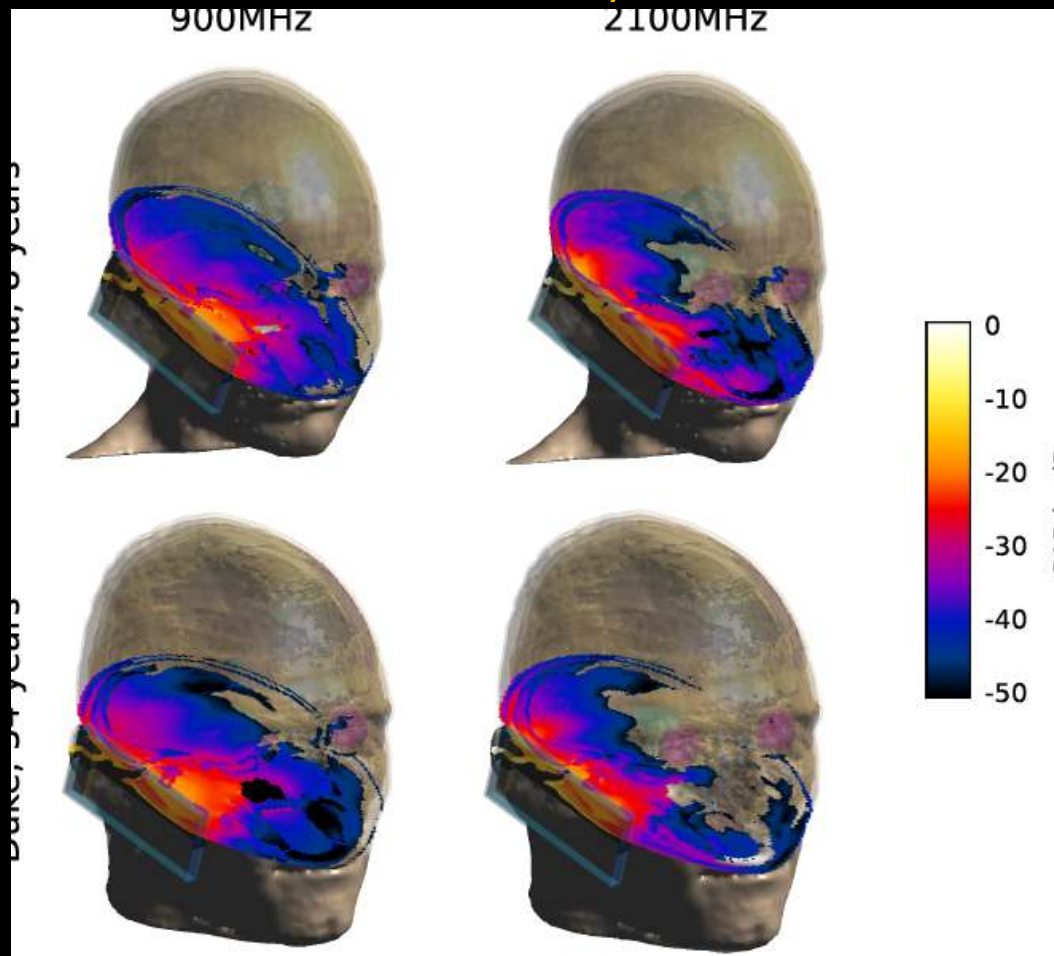
RINGING

STAND-BY



Time 4 sec/division

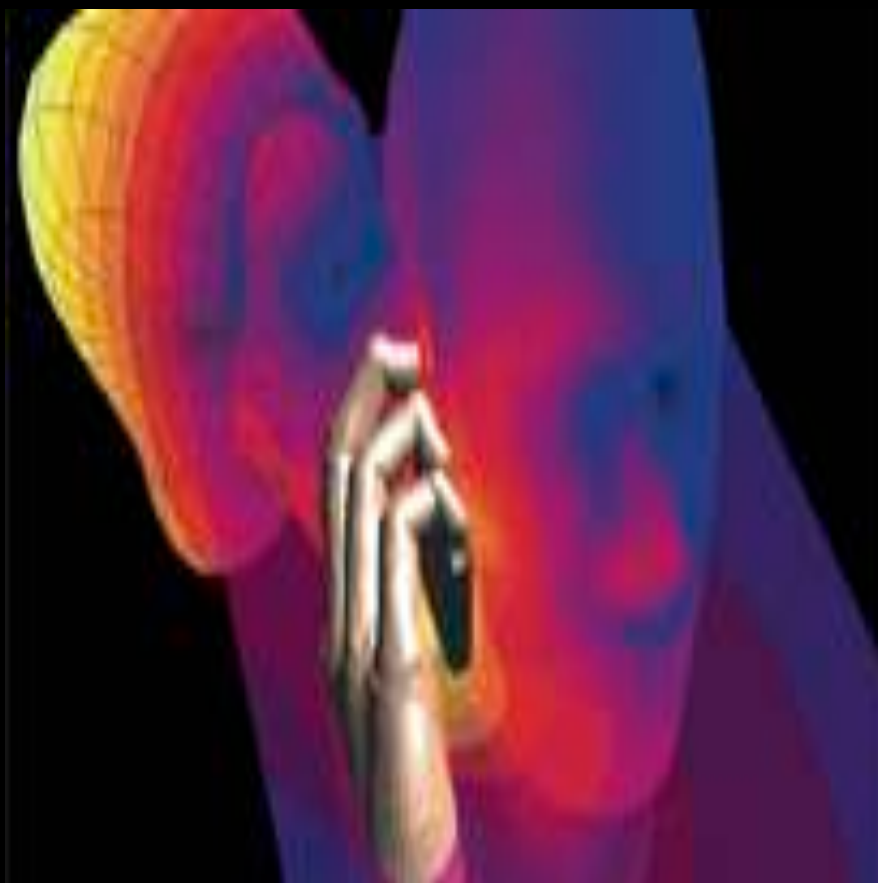
Microwave radiation absorption from cell phones in 8 & 34 year old heads (Fernandez, 2013)



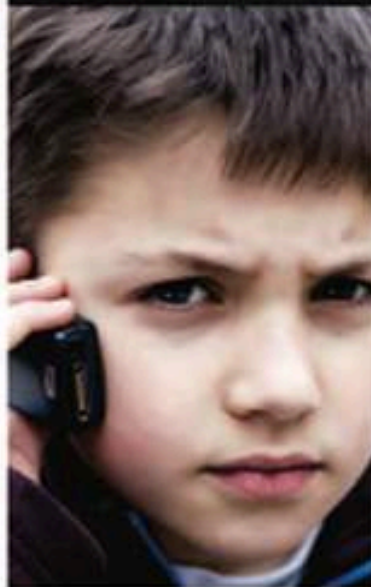
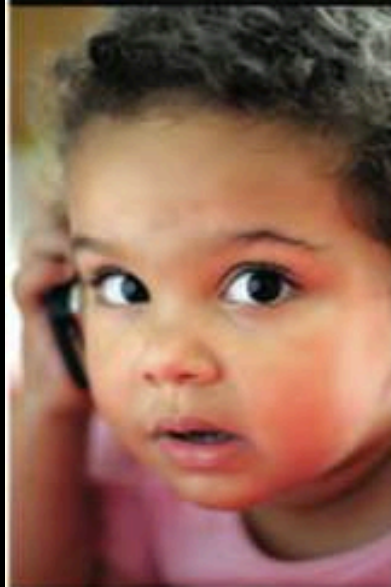
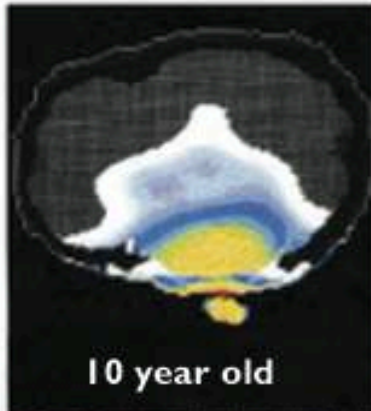
900 MHz

2400 MHz

Modeling of brain absorption



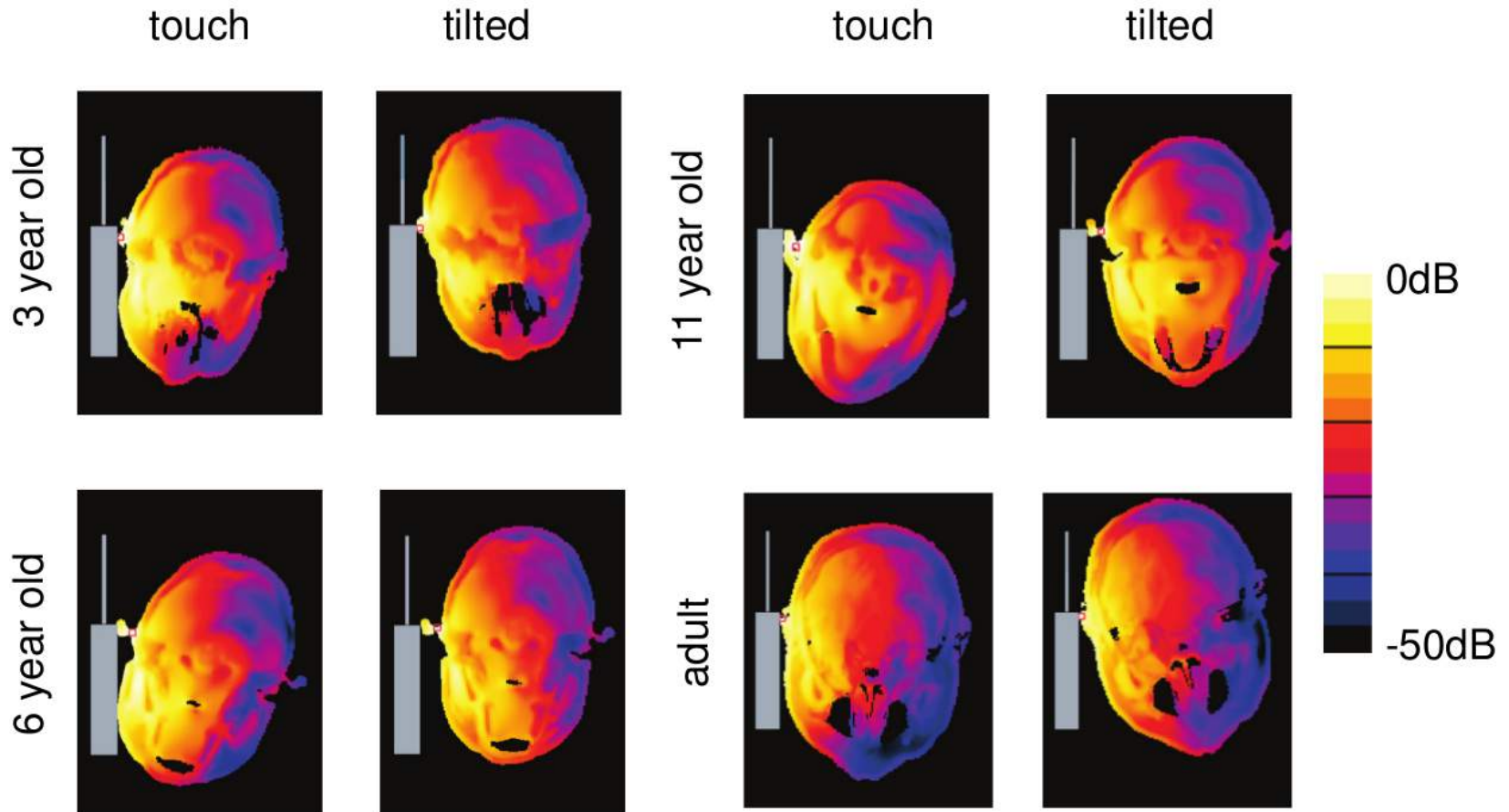
Who's Most At Risk?



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

SAR Distribution in the Head Models at 900MHz



Andreas Christ, 2012

The biological impact of non-ionizing radiation varies with

Host conditions:

Cell types

Age, ethnicity, diet & other co-factors

Tissue exposed

Intracellular signaling

(MAPK transcription, mRNA, mDNA,
microenvironment)

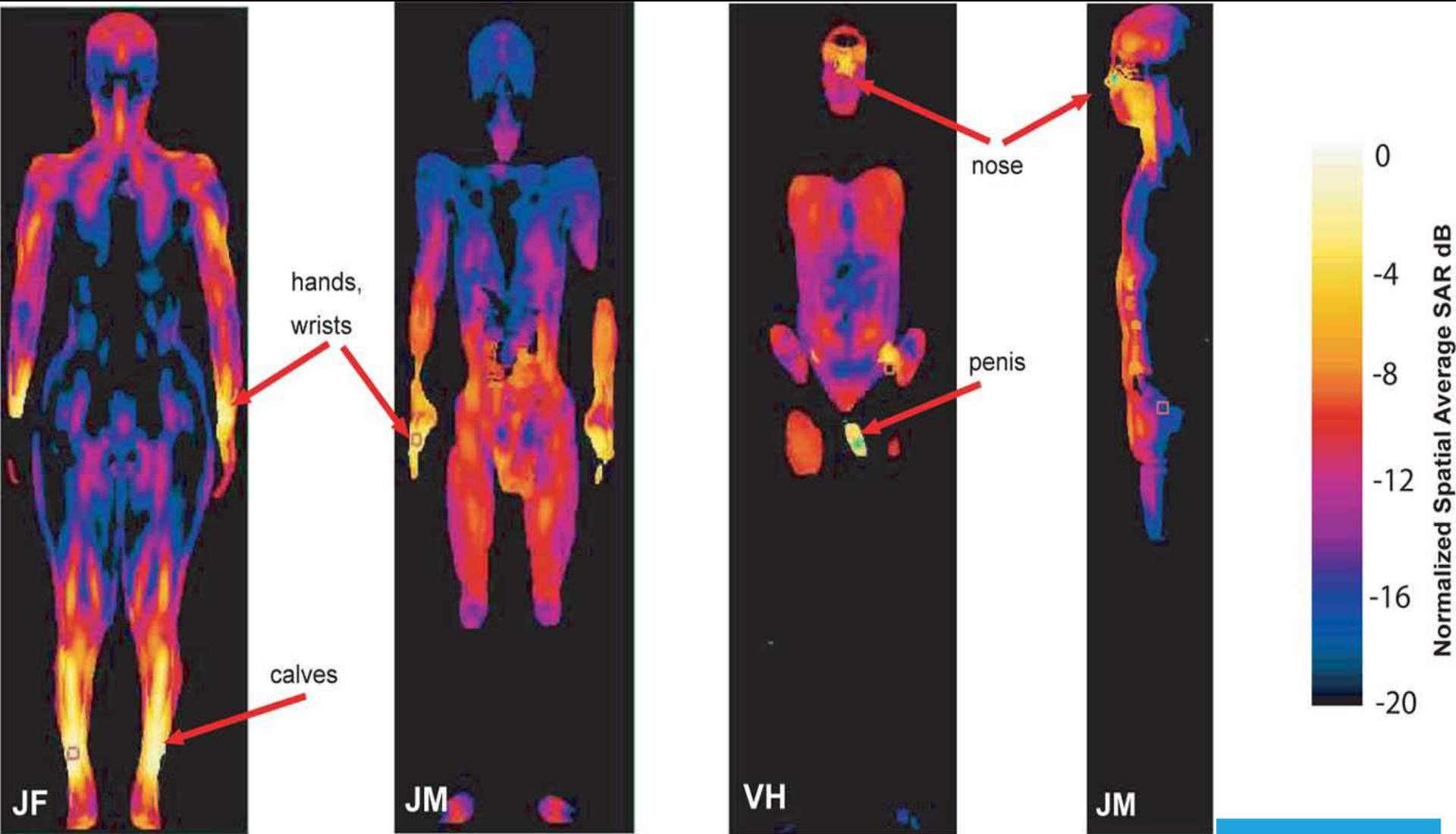
Signal characteristics:

continuous v. modulated

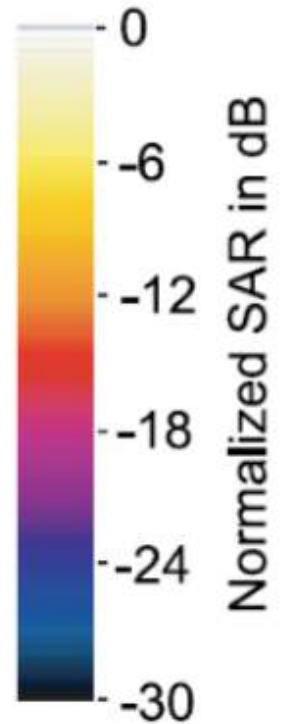
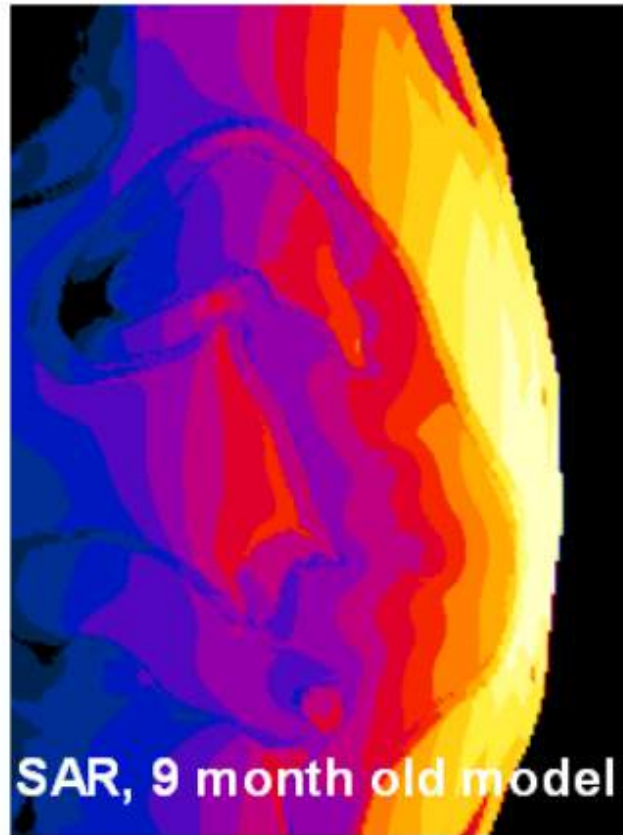
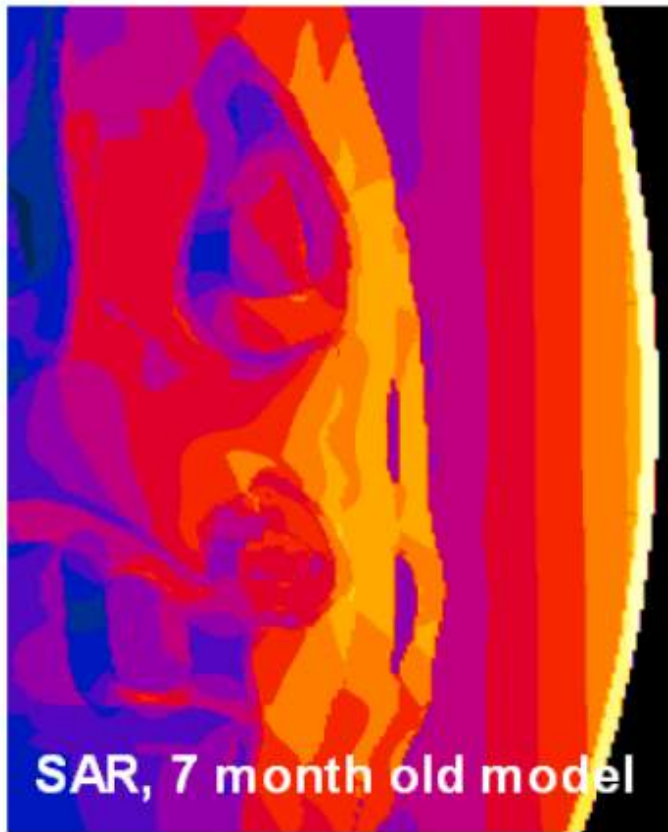
Power Density

Information Content

Penis Receives Highest Exposure



Workplace exposures, Gosselin et al, 2009 IEEE Transact.



Normalized SAR for the mother and the fetus exposed to a dipole antenna in front of the abdomen (courtesy Andreas Christ, IT'IS, 2013)

Dielectric Constant of Human Breast Indicates High RF Absorption

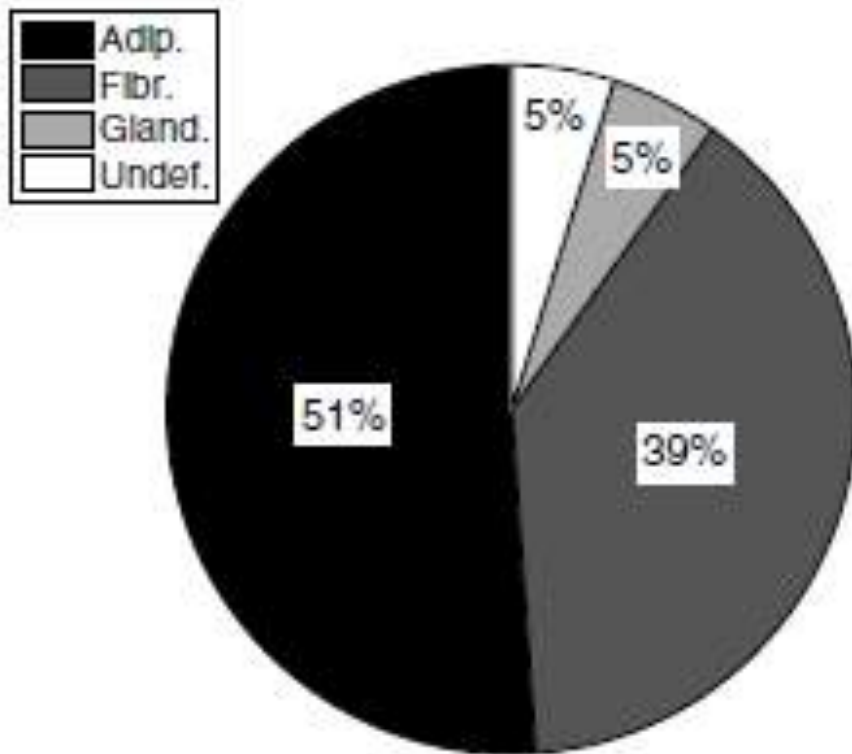
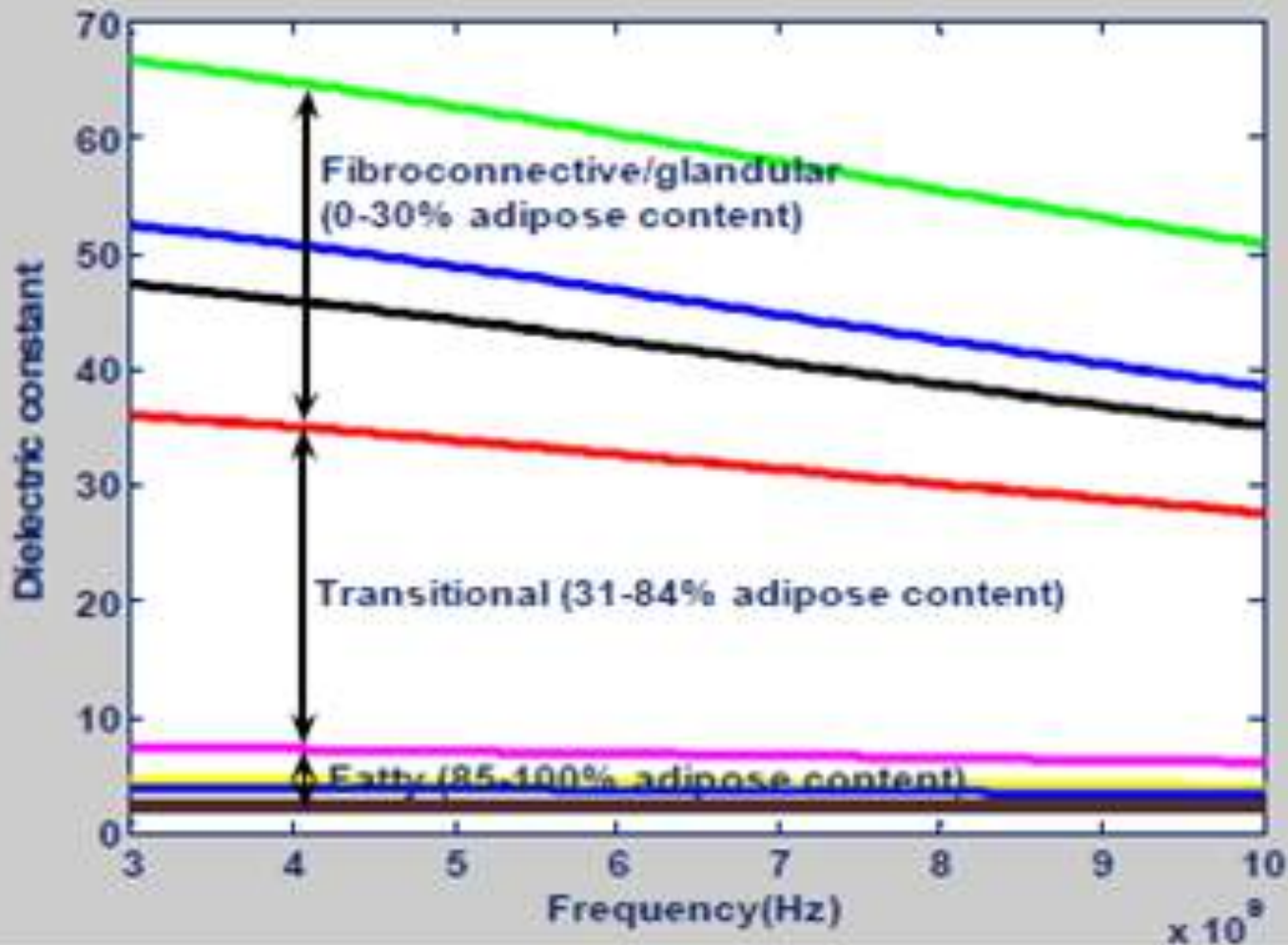


Figure 4. Distribution of dominant tissue below the black ink. 'Adip.': adipose tissue, 'Fibr.': fibroconnective tissue, 'Gland.': glandular tissue, 'Undef.': undefined, which refers to cases where the tissue in the histology slide was too heterogeneous to determine the dominant type below the black ink.

Dielectric Constant of Breast Declines with Adiposity



RF Induces Apoptosis in Normal Breast Fibroblasts

- Studies from Laboratory of Nesrin Seyhan, PhD
- Meric Eskayada, PhD
- Gazi, Department of Biophysics
- Consistent with studies of Tisty on Carcinoma Associated Fibroblasts (CAF) altering extracellular matrix/ mesenchymal morphology



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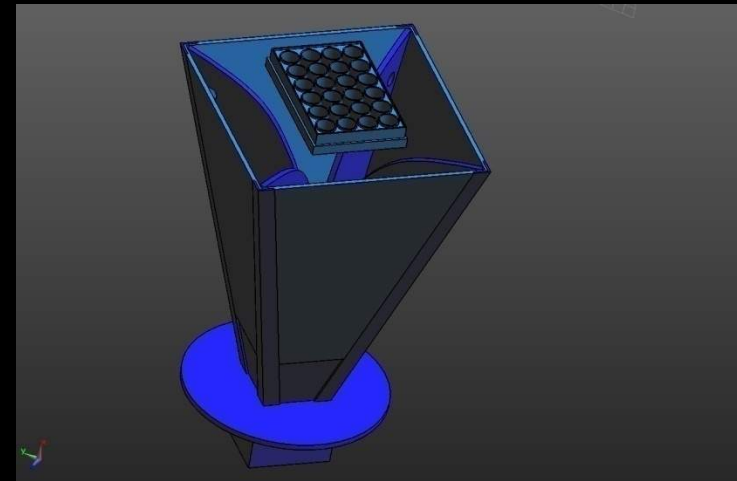
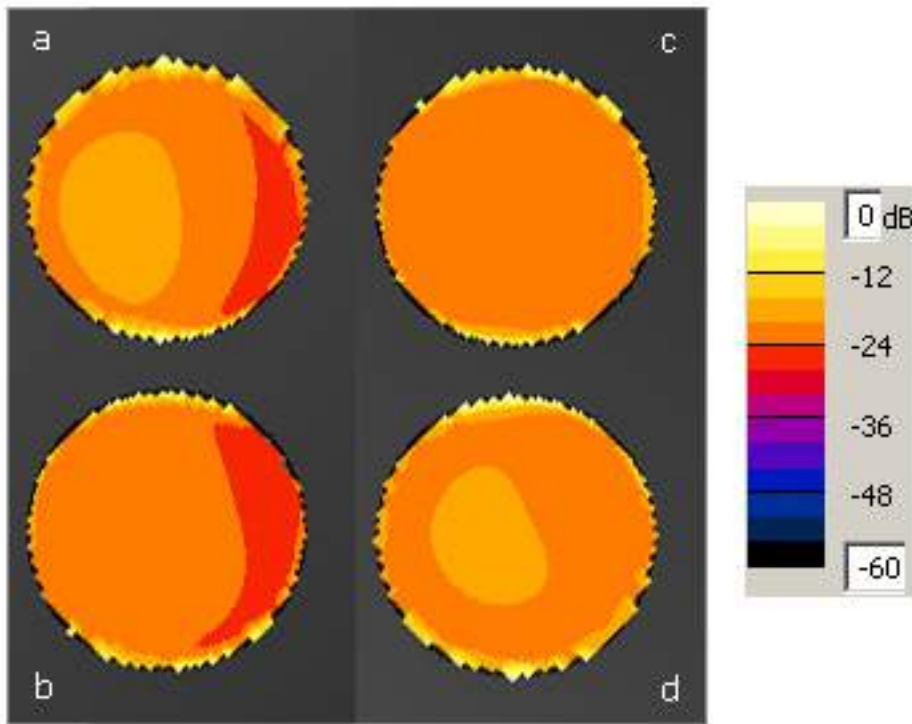
www.gnrk.gazi.edu.tr



**RF alters Mitochondrial Membrane
Potential ($\Delta\Psi_m$)
in Human Breast Fibroblast cells
(in vitro study)—
in press Meric Eskayada et al, 2013**

Exposure

- 2.1 GHz, 3G Modulated RF Exposure
- 4h & 24 h
- SAR: 0.607 W/kg-
Healthy Fibroblast cells



- Simulated SAR distribution:
- a and b top view,
 - c and d bottom view
of the cell cultures



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Analyzed Parameters:

- ❑ **The cell viability:**
MTT test (Elisa reader)
- ❑ **Apoptosis:**
Annexin V-FITC and PI staining (flow cytometry)
- ❑ **Mitochondrial Membrane Potential ($\Delta\Psi_m$):**
JC-1 staining (flow cytometry & fluorescence microscopy)



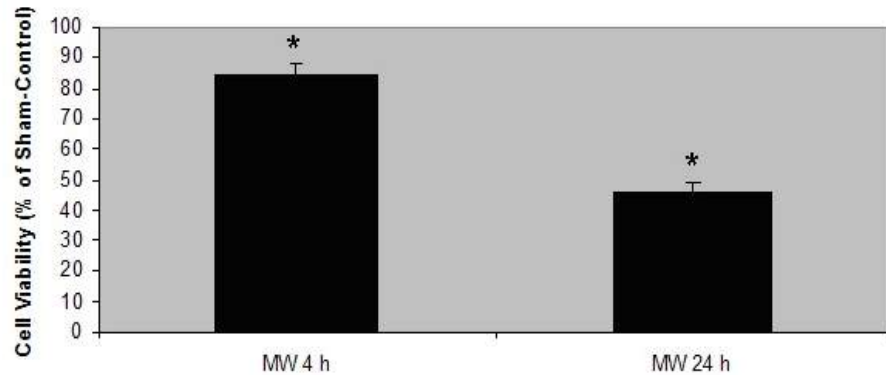
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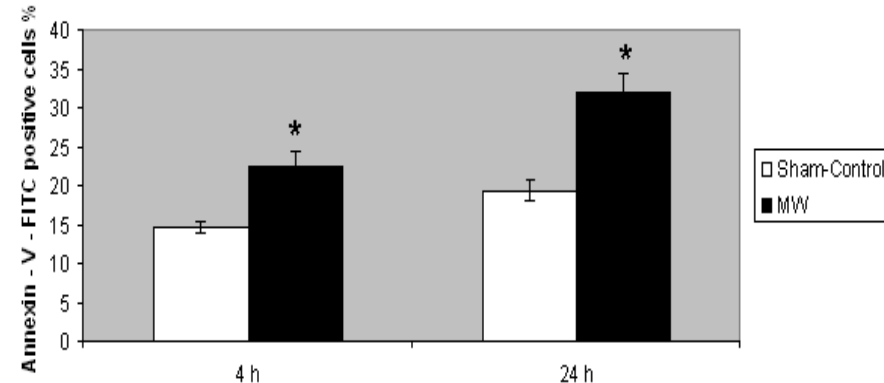
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Cell Viability of Breast Fibroblast Cells



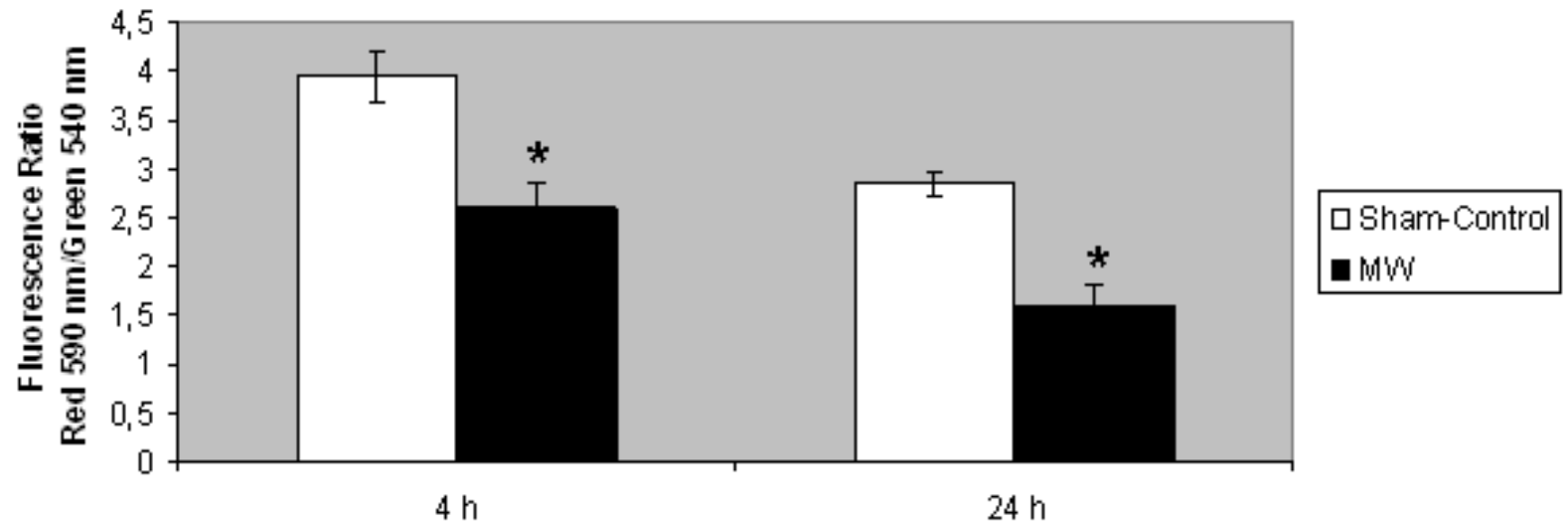
Apoptosis



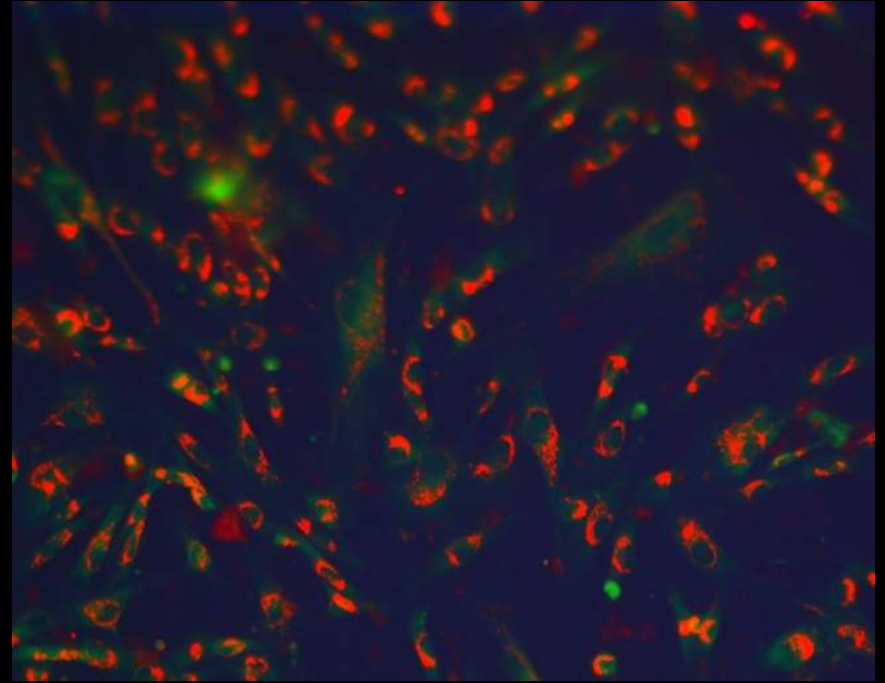
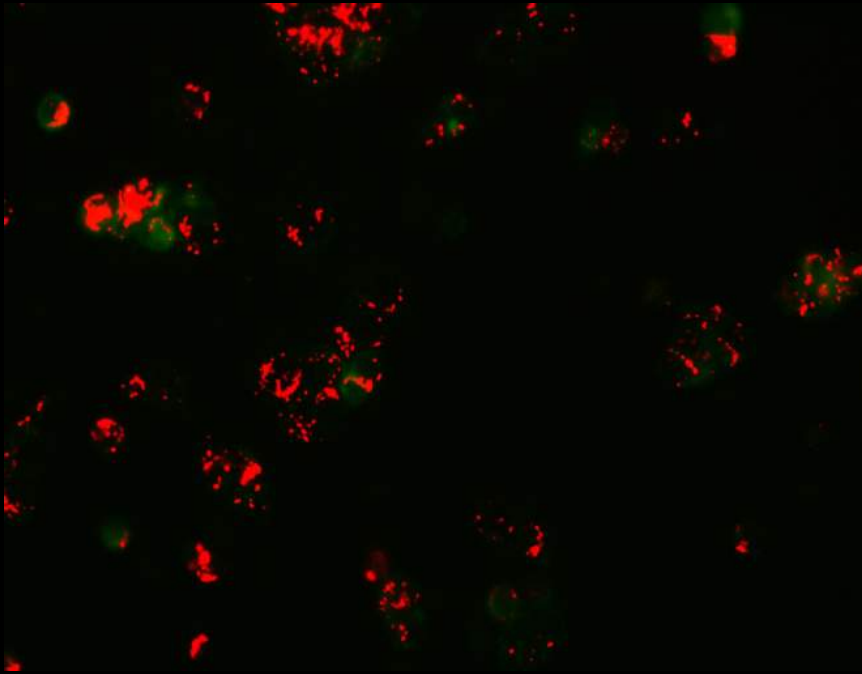
□ cell viability ↓

□ apoptotic activities ↑

Mitochondrial Membrane Potential



□ Time dependent reduction of $\Delta\Psi_m$.



Fluorescence pictures of human breast fibroblast cells exposed to 2.1 GHz RF for 4 and 24 h and stained with JC-1 (green staining indicates the loss of mitochondrial membrane potential)



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Results MW radiation affects fibroblasts

The cell viability- significant decrease ↓

Apoptotic cells- significant increase ↑

Mitochondrial Membrane Potential ($\Delta\Psi_m$):

- Significant decrease ↓ (depolarization) & could Play a role in carcinogenesis



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Summary, Eskayada et al, in press, 2013

- 2.1 GHz 3G modulated RF induced mitochondrial depolarization which leads to apoptosis.
- 24 hour RF creates more depolarization & apoptosis than 4 hour indicating greater impact on extracellular matrix

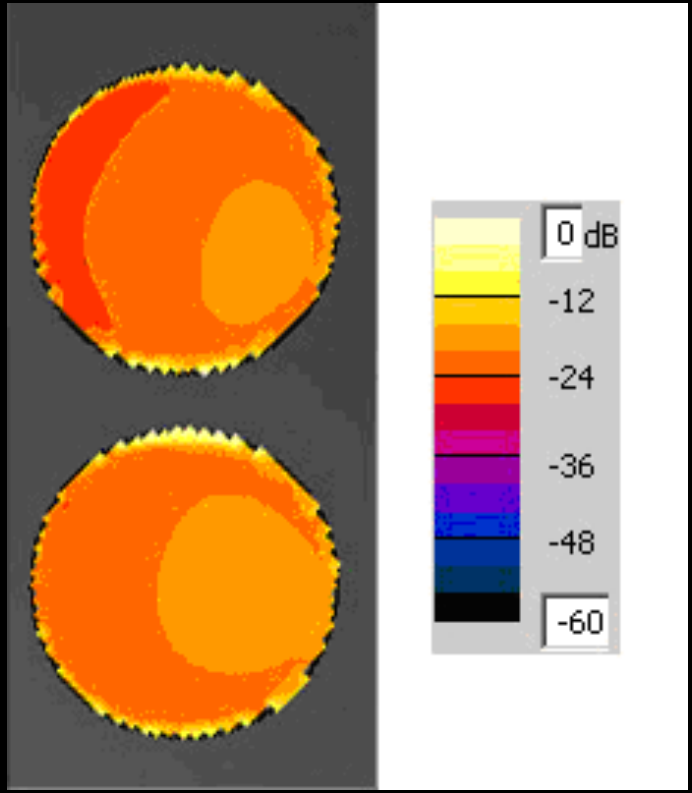
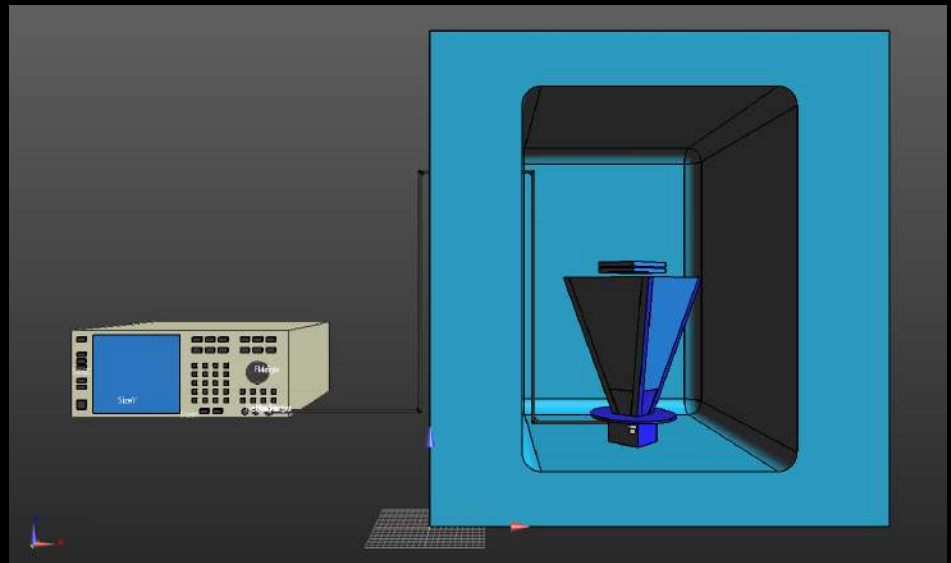
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**Mitochondrial Hyperpolarization
and Cytochrome-c Release
in RF Exposed MCF-7 (human breast
adenocarcinoma) cells**



- 2.1 GHz, 3G modulated RF exposure
- 4h & 24 h
- SAR : 0.528 W/kg- Breast Cancer cells



SAR distributions for cell cultures that were exposed to 2.1 GHz RF exposure at 1W input power.

Analyzed Parameters:

- ❑ The cell viability:
MTT test (Elisa reader)
- ❑ Apoptosis:
Annexin V-FITC and PI staining (flow cytometry)
- ❑ Mitochondrial Membrane Potential ($\Delta\Psi_m$):
JC-1 staining (flow cytometry & fluorescence microscopy)
- ❑ Cytochrome c Level:
Elisa Reader



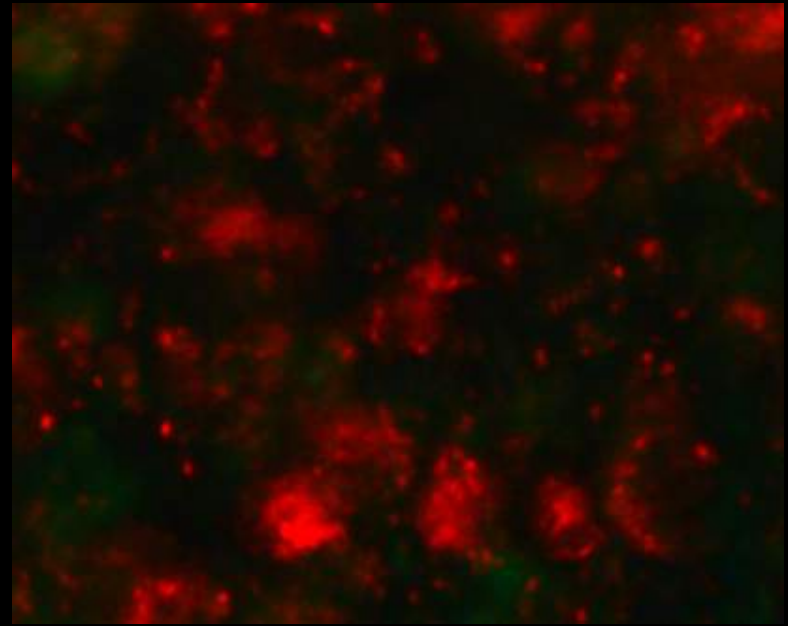
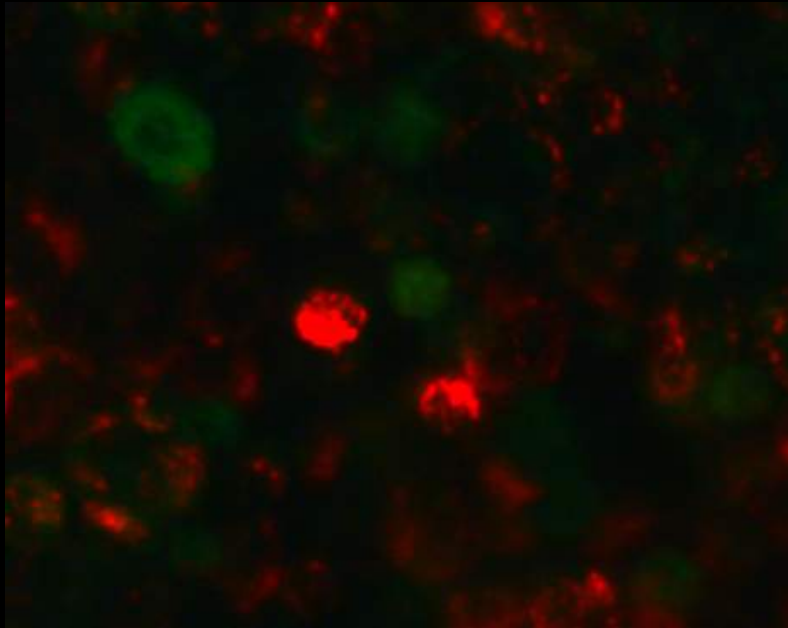
Results

The cell viability- significant decrease ↓

Apoptotic cells- significant increase ↑

Mitochondrial Membrane Potential ($\Delta\Psi_m$)-
significant increase ↑

Cytochrome-c level- significant increase ↑



(high amount of red staining indicates hyperpolarization of mitochondria)



SUMMARY

- 2.1 GHz RF leads to hyperpolarization of mitochondria and the induction of apoptosis in Breast Cancer Cells.
- Whereas same exposure resulted in depolarization in Healthy Breast Cells which might also lead to apoptosis



Research Team of Gazi Biophysics

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Assoc. Prof. Ayşe G. CANSEVEN KURŞUN

Assoc. Prof. Göknur GÜLER ÖZTÜRK

Assist. Prof. Bahriye SIRAV

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Res. Assist. Arın TOMRUK, PhD Student

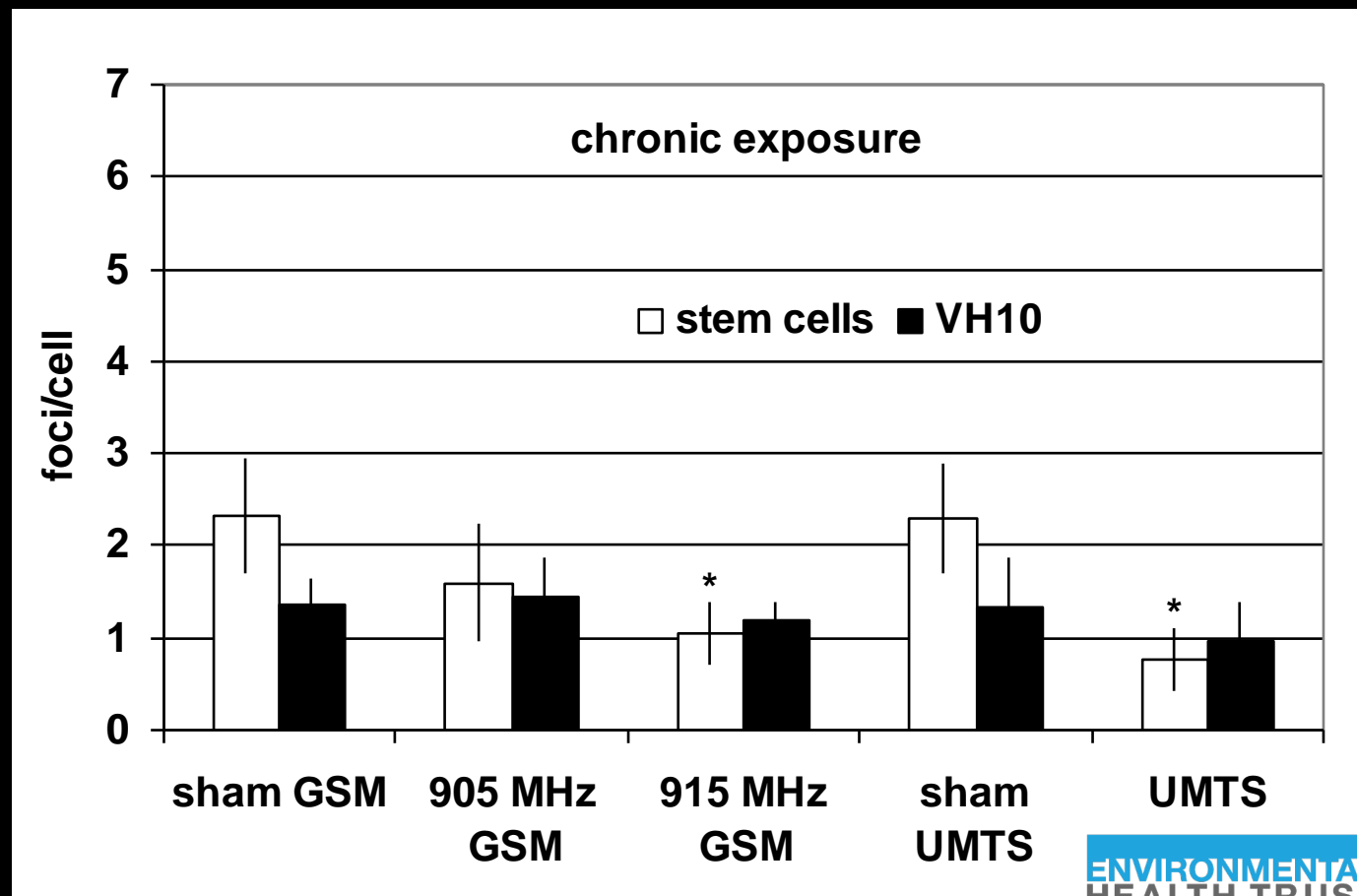
Res. Assist. Meriç Arda EŞMEKAYA, PhD Student

Res. Assist. Mehmet Z. TUYSUZ, PhD Student

Dr. Semra TEPE ÇAM, Postdoctoral Scientist

Human mesenchymal stem cells did not adapt to effects of MW during chronic exposure (Belyaev et al, 2009)

Exposure 2 weeks, 1 hour daily w GSM phone



Animal Carcinogens Cause Cancer in Humans

- Every compound known to cause cancer in humans
- Also causes it in animals when adequately studied.
- Therefore any animal carcinogen should be treated as a human carcinogen*
- *IBM Think Magazine, 1983, also preface to International Agency for Research on Cancer Monographs, World Health Organization

IARC, Mammary Carcinogens

International Agency for Research on Cancer,
World Health Organization

Aromatic hydrocarbons

Benzene
Benzo[a]pyrene
Dibenz[a,h]anthracene
Dibenzo[a,e]pyrene

Nitrosamines

N-nitrosodiethylamine
N-Nitrosodi-*n*-butyl-amine

Aliphatic compounds

Acrylamide
Acrylonitrile
1,3-Butadiene
Isoprene
Nitromethane
Propylene oxide
Urethane
Vinyl chloride

Arylamines and nitrenes

4-Aminobiphenyl
Nitrobenzene
***Ortho*-Toluidine**

Human Studies

- Trends in rates over time
 - Racial and ethnic differences
 - Patterns of different age groups
 - Studies in twins
- Case comparison/control studies of risk factors
- Geographic patterns
- Studies in workers

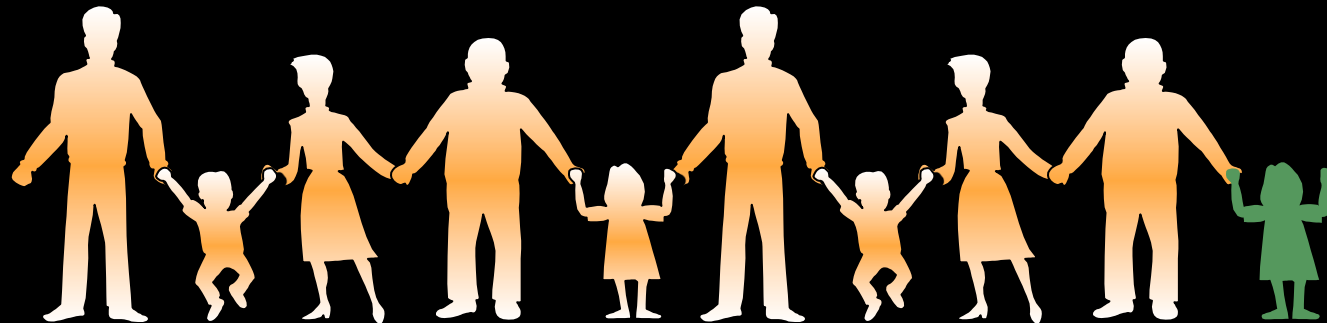
Epidemiological Reasons Why “Environment” is a Cause of Cancer

- **Cancer risk of adopted children mirrors that of their adopted (NOT their biologic) parents**
- **Fewer than half of identical twins get the same cancer**
- **Migrants develop risks of their new countries**
- **Workers have higher rates**
- **Patterns remain unexplained**

Reasons Why “Environment” is a Cause of Cancer

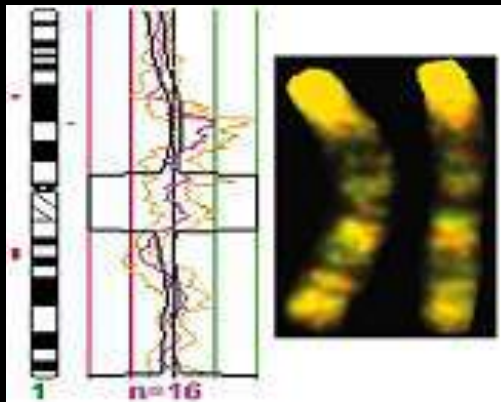
Fewer than 1 in 10 cases of
breast cancer arises in women
born with genetic defects

National Cancer Institute

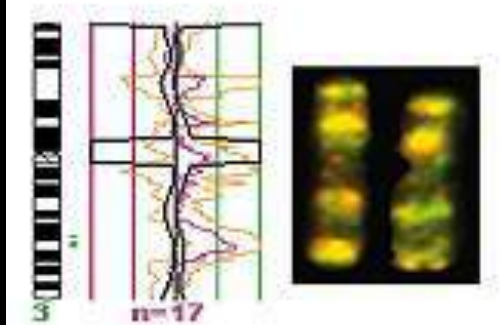


Identical twins don't have identical chromosomal banding pattern

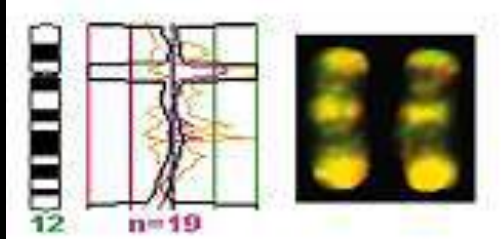
Chromosome 1



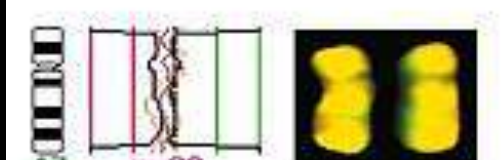
Chromosome 3



Chromosome 12



Chromosome 17

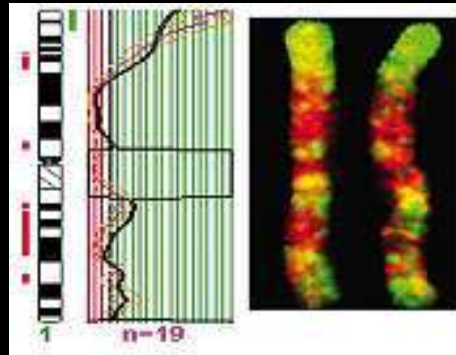


3 year old twins

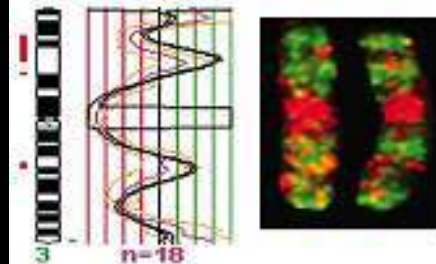
Fraga, Mario F. et al. (2005) Proc. Natl. Acad. Sci. USA 102, 10604-10609

As identical twins age, their chromosomes look less similar

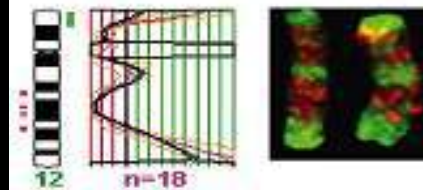
Chromosome 1



Chromosome 3



Chromosome 12



Chromosome 17



50 year old twins

Environmental links to breast cancer

- Scandinavian Twins Study

- Most cancer is not inherited
- Evaluated inherited vs. environmental breast cancer risk factor
 - Inherited factors, 27% of risk
 - Environmental factors, 73% of risk
 - Concluded that environmental factors play a major role in determining breast cancer risk

Personal Risk Factors for Breast Cancer

Use of HRT or LATE
MENOPAUSE

Early life
RADIATION

ALCOHOL

Family
HISTORY

LACK OF
EXERCISE/obesity

LATE OR NO
PREGNANCY

EARLY
MENSES

*Higher Total Lifetime Exposure
to
Unbound Steroid Hormones
Binding Globulin (SHBG)*



*Is the Common Link Between
Most Known Risk Factors*

Environmental Risks for Breast Cancer



Pesticides

Solvents

Metals

Paints

Plastics

Jobs with Increased Risk of Breast Cancer



- Solvent workers
- Chemists
- Nurses/Dentists
and Physicians

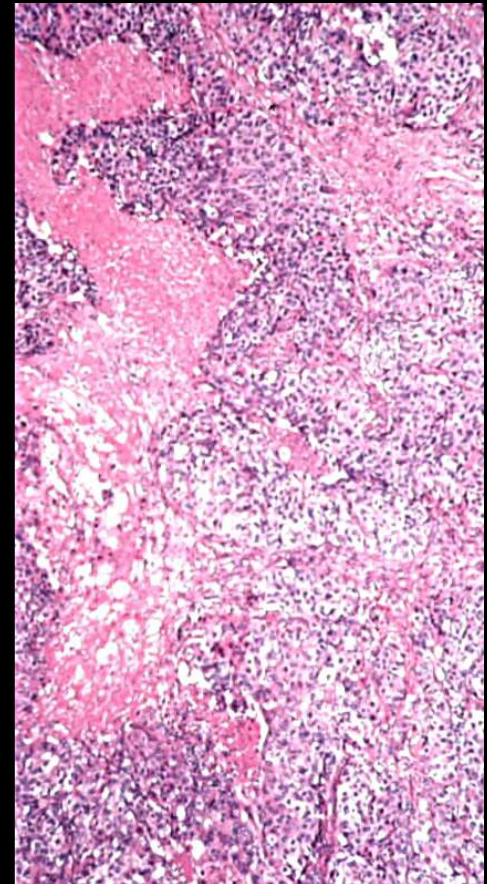
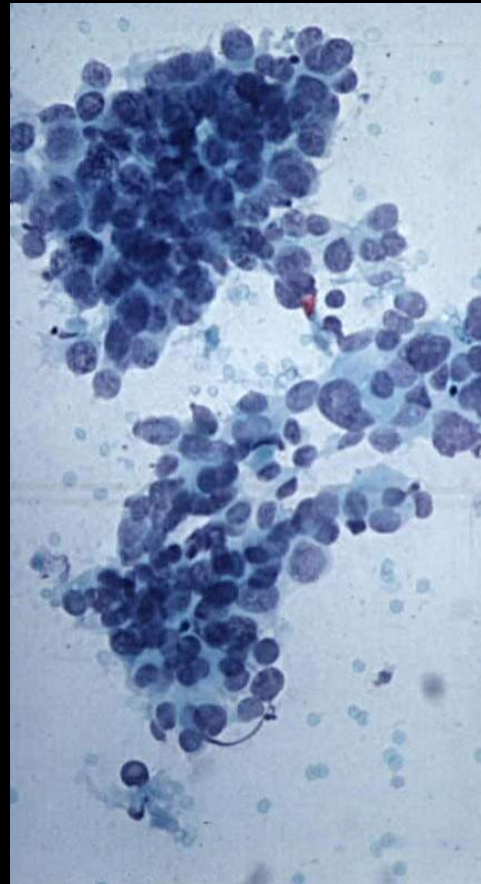
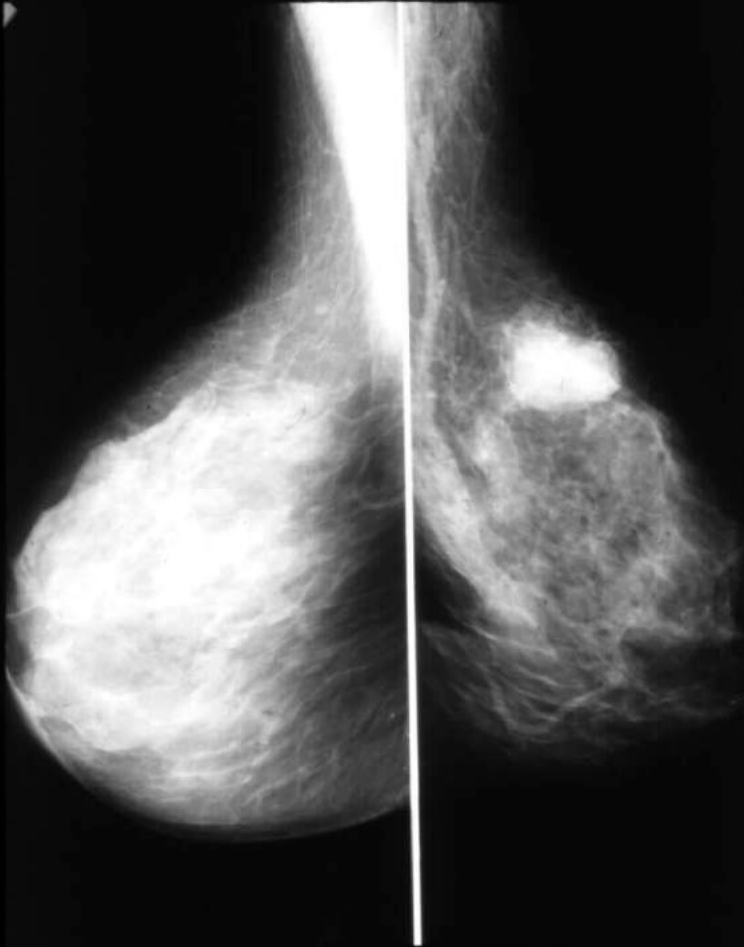
- Painters
- Hair Dressers

Cadmium Exposure and Breast Cancer Risk

- Case-control study found that breast cancer cases had higher urinary levels of creatine-adjusted cadmium
- OR = 2.29 95% (CI = 1.3 to 4.2) (p .01)
- Cadmium, like tin, is a metallo-estrogen

56 yo female presents with firm mass

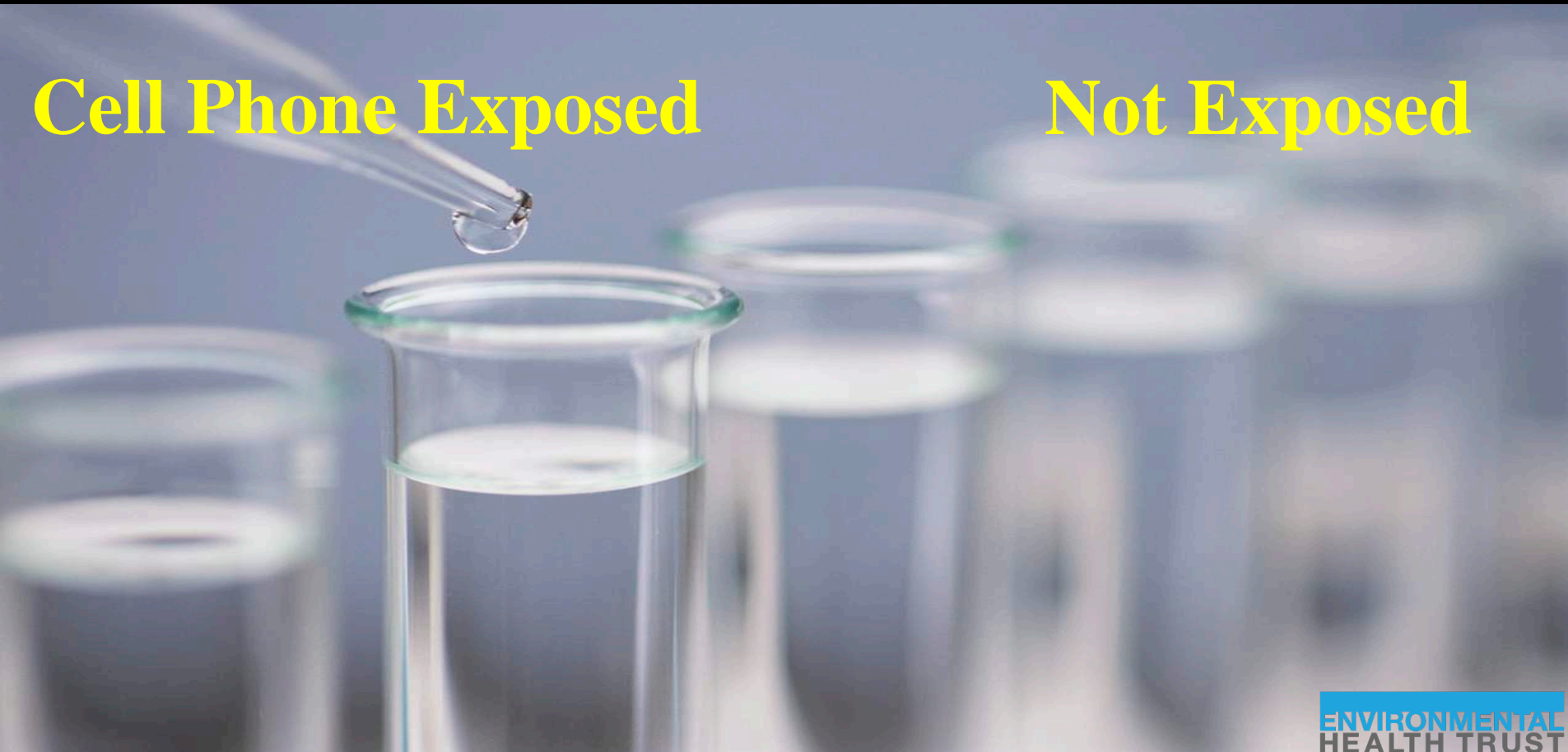
Chemist working with benzene for many years
without a hood



Controlled Experiments with Human Material – Sperm

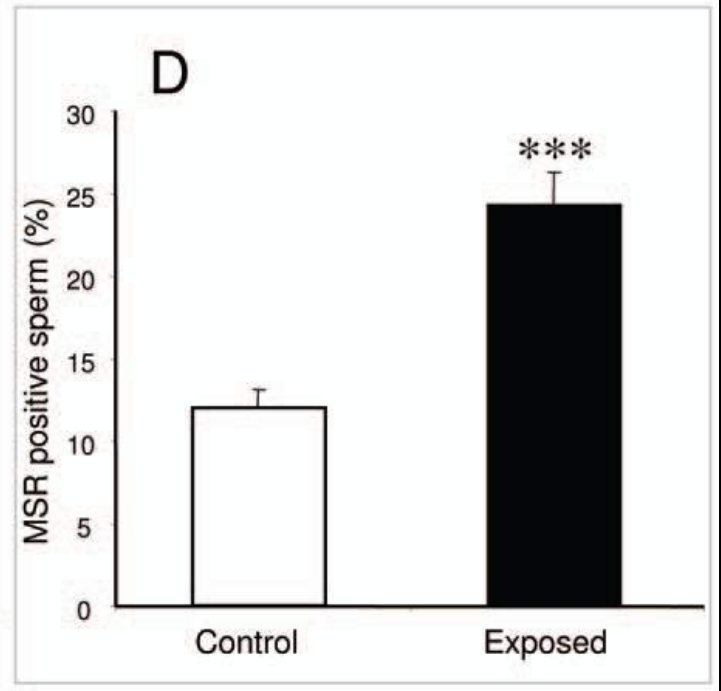
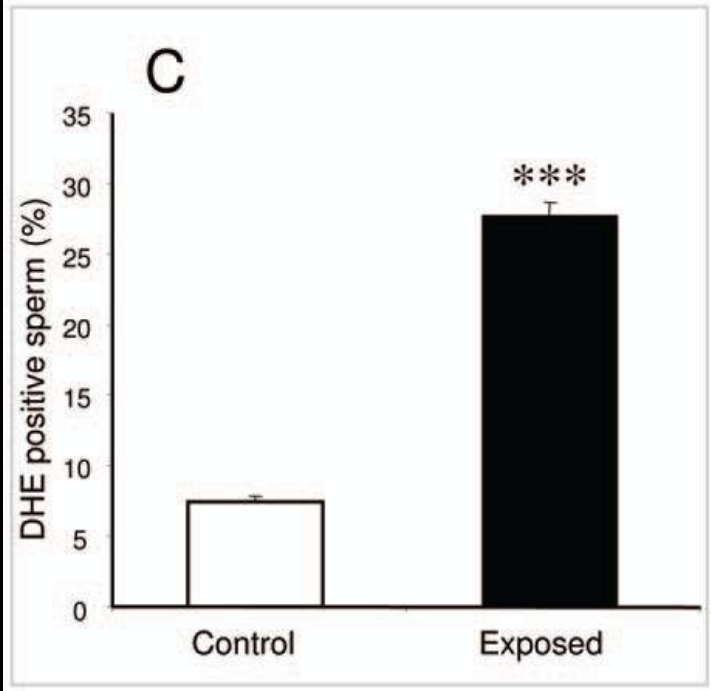
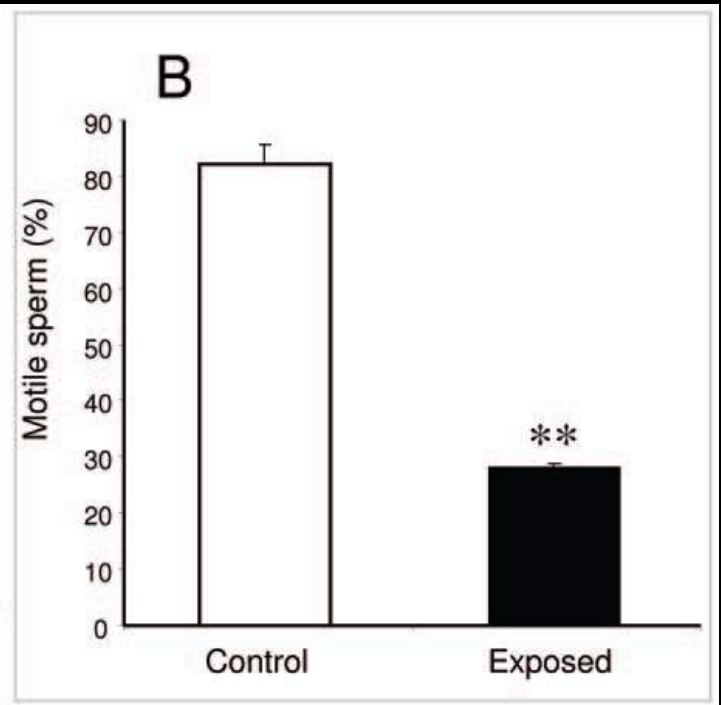
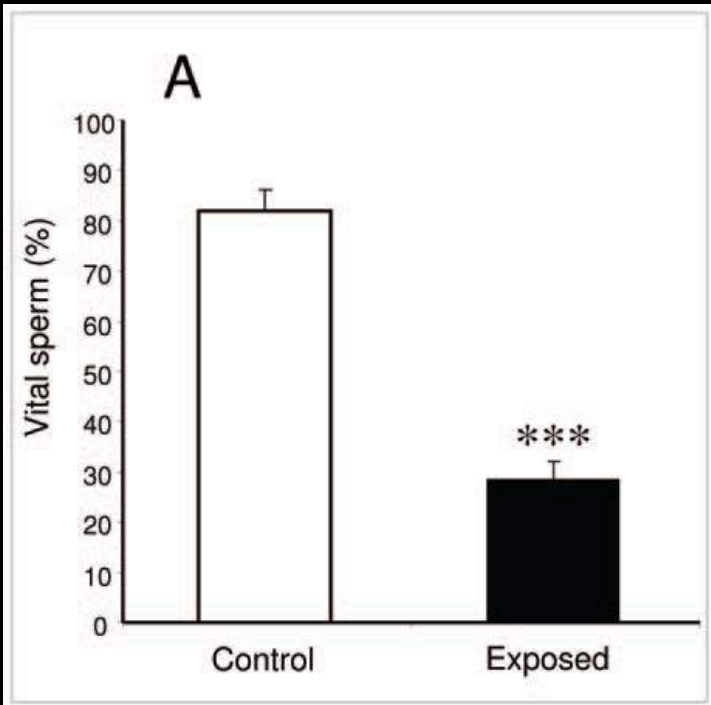
Cell Phone Exposed

Not Exposed

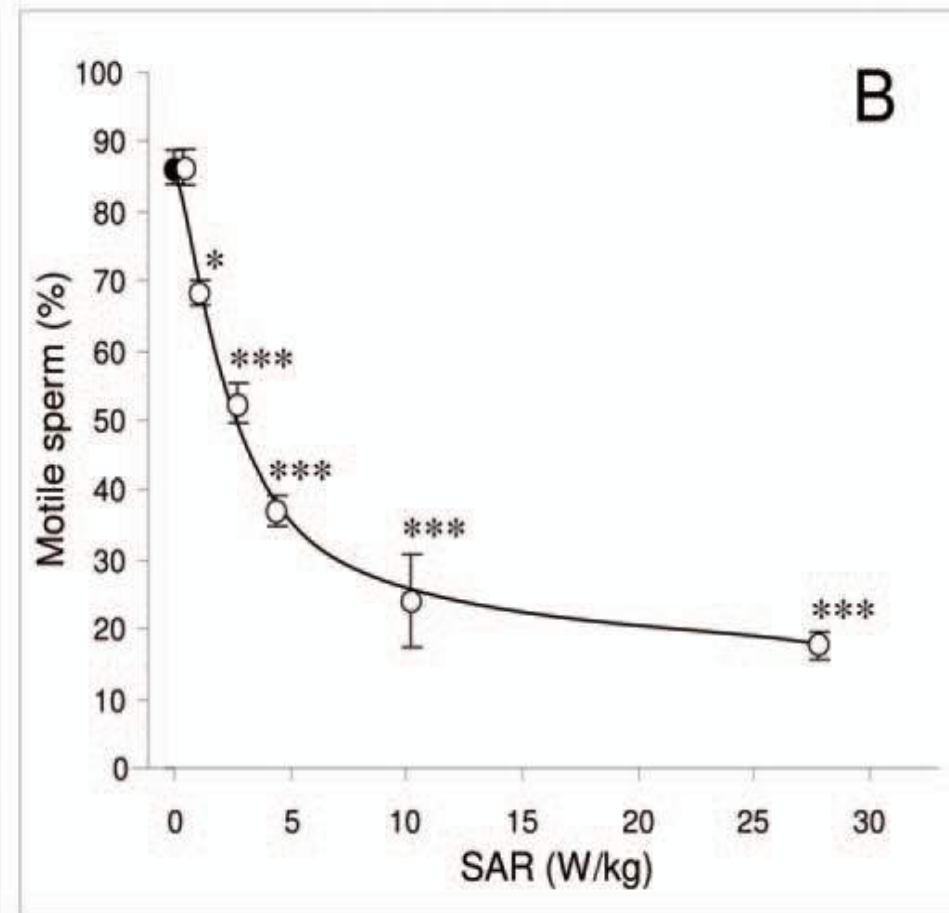
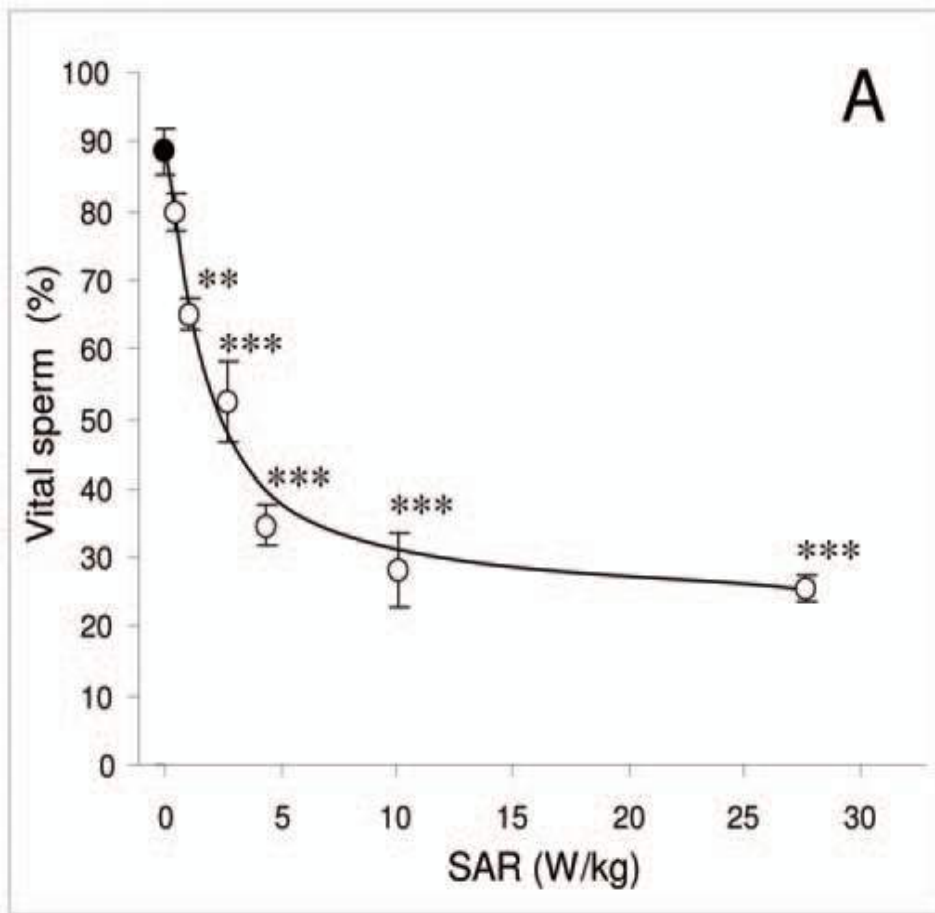


*Laureate
Professor
John Aitken*

**Exposed
sperm were
significantly
reduced
& damaged**



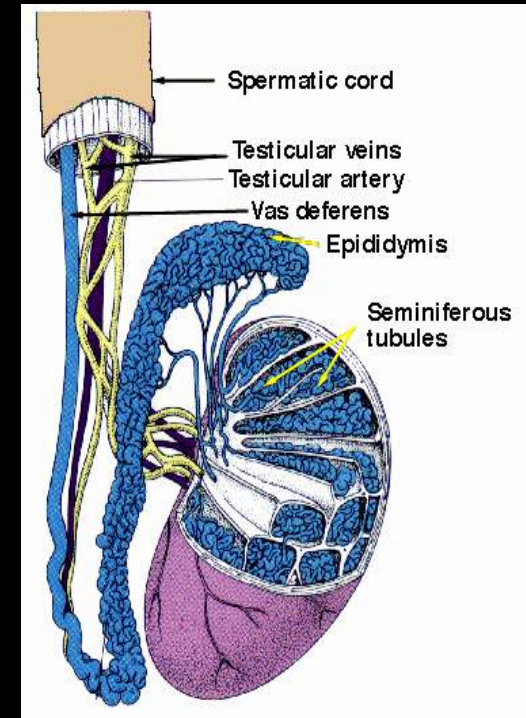
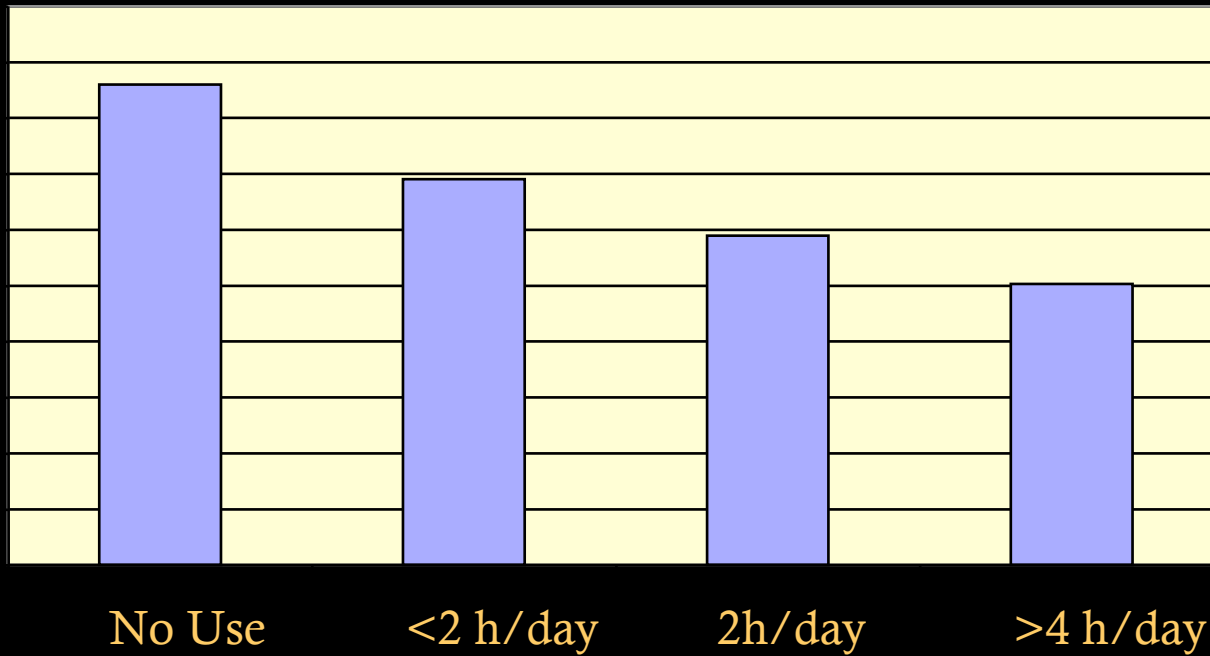
Controlled Experiments Find Sperm Count and Vitality Significantly Worsened by RF



Aitken group, 2009, PLOS

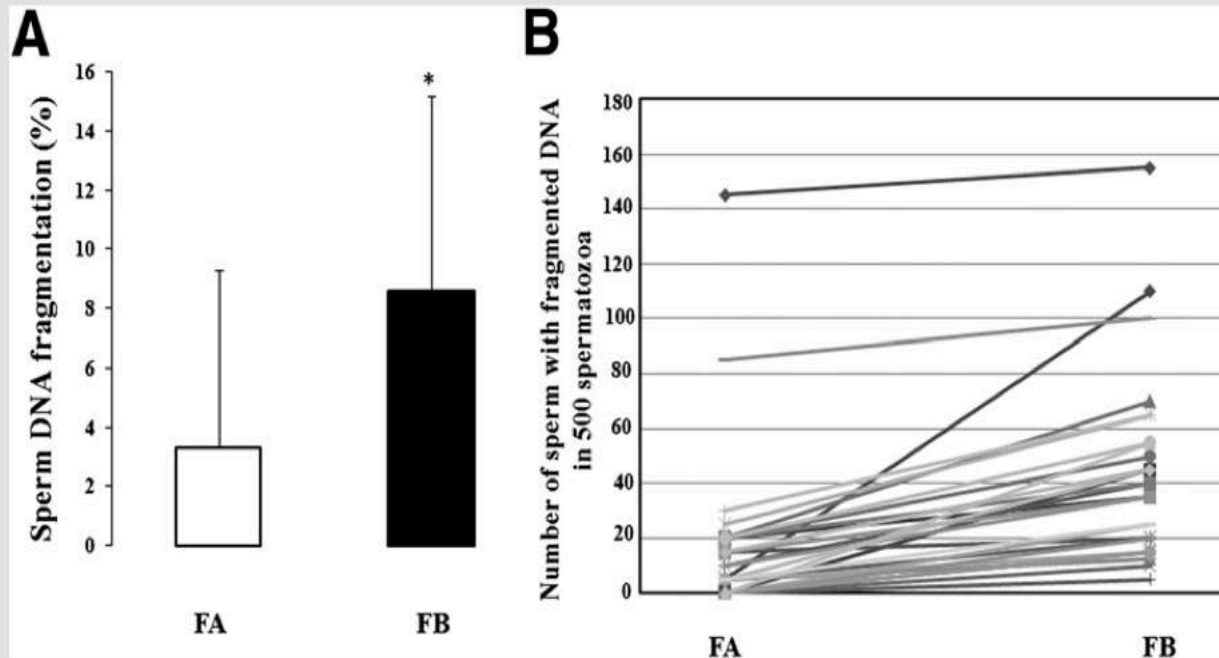
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2714176/pdf/pone.0006446>

Heavier Cell Phone Users Have Reduced Sperm Count



Agarawal, Cleveland Clinic, 2008; and seven other studies

Wifi Interferes with 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).

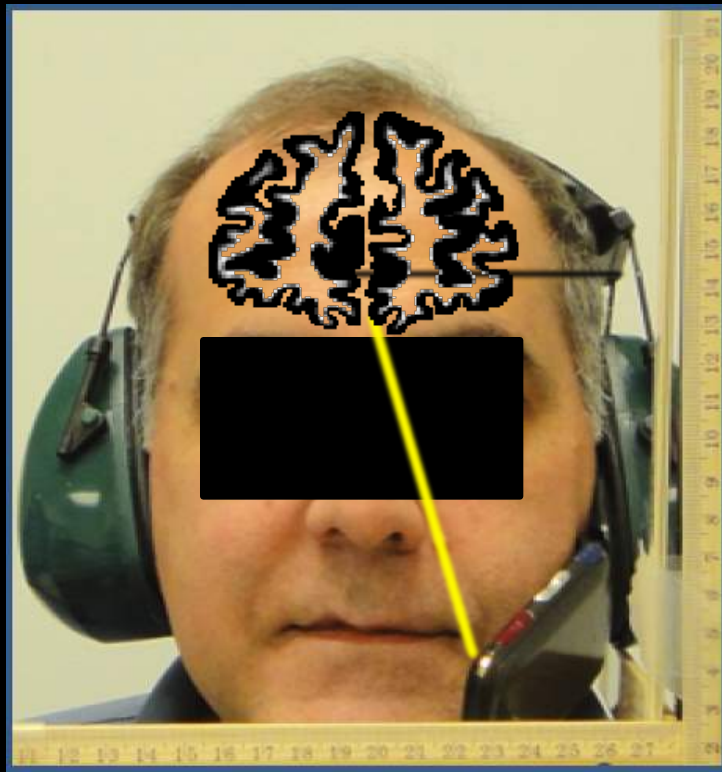
Avendano. Laptop usage and sperm quality. Fertil Steril 2012.

Effects of Cell Phone Radiofrequency Exposure on Human Brain Glucose Metabolism

ND Volkow, D Tomasi, G-J Wang, P Vasca ,
JS Fowler, F Telang, D Alexoff, J Logan, C Wong



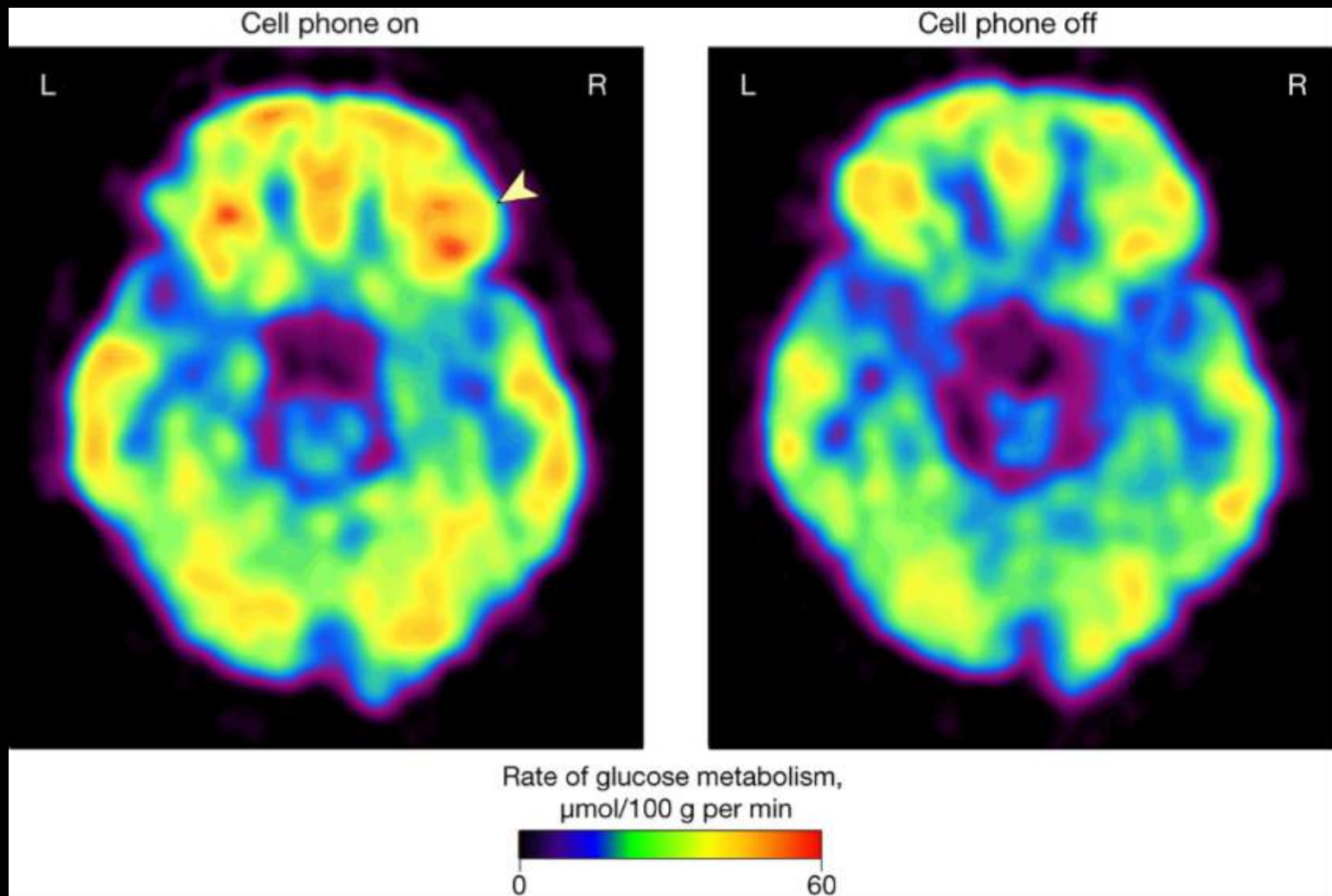
Position of the CP in the Head and Regions in the Brain Closest to the Cell Phone's Antenna



Orbitofrontal cortex



Temporal pole



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.

Summary

- Brain metabolism was significantly higher with than without CP exposure in brain regions closest to the antenna (orbitofrontal cortex and temporal pole).
- Metabolic increases with CP exposure were significantly correlated with intensities of the estimated electromagnetic field amplitude in the radiofrequency bandwidth of the phones.

Volkow JAMA 2011 Conclusions

- These results provide evidence that the human brain is sensitive to MW from cell phones.
- The dependency of brain activation on distance from the antenna suggests that the use of a wired ear-piece or speakerphone would prevent this effect.
- The impact of chronic CP exposure on the brain merits investigation.

Mobile-phone Exposures Damage Human/ Other Tissues that can easily be studied

- Sperm--reduced count, motility, morphology, morbidity (Agarwal et al)
- Salivary changes--increased micronuclei, reduced amylase, albumin, salivary flow, and other measures of DNA damage (Kundi et al)
- Oto-acoustic impacts, i.e., tinnitus, **hearing loss**
- Nerve conduction velocity impacts
- Hippocampus/neurogenesis impeded
- Response time
- Memory

Mobile-phone Exposures Damage Human/ Other Tissues

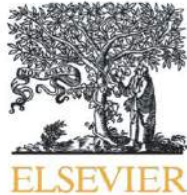
Other (rodents, rabbits, insects, C. elegans) (Margaritis)

- Weakening blood brain barrier (Salford)
- Increasing Reactive Oxygen Species (Goodman and Blank)
 - Altered calcium transport (Belyaev)
- Prenatally induced damage to DNA repair, neural stem cell formation, hippocampus/cerebellum (Kaplan)

IARC reviewed 900 studies --most non-U.S.

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[☆]

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^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

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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.

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**ENVIRONMENTAL
HEALTH TRUST**

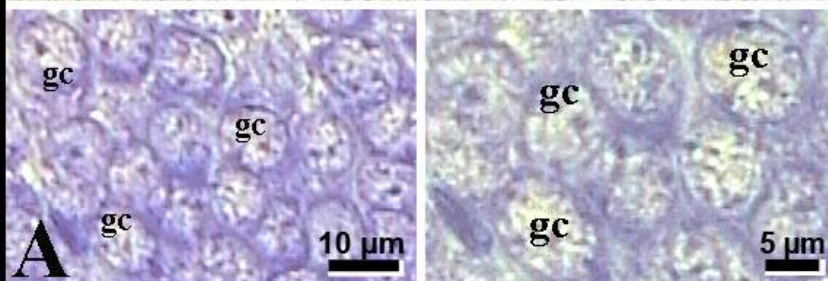
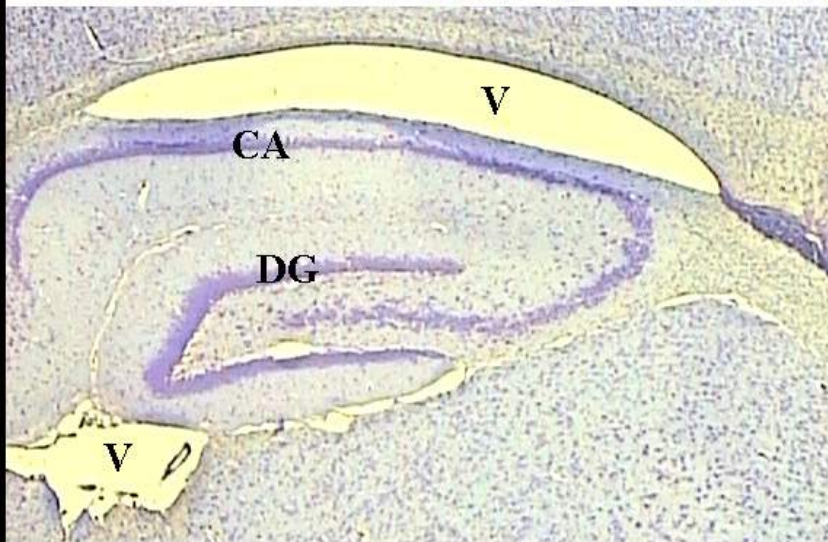
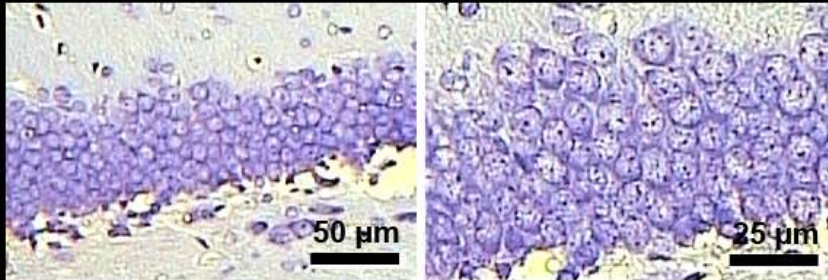
Prenatal 900 MHz EMF Exposure Decreased Hippocampal Granular Cell Number in the Dentate Gyrus of Newborn Rats

The research question:

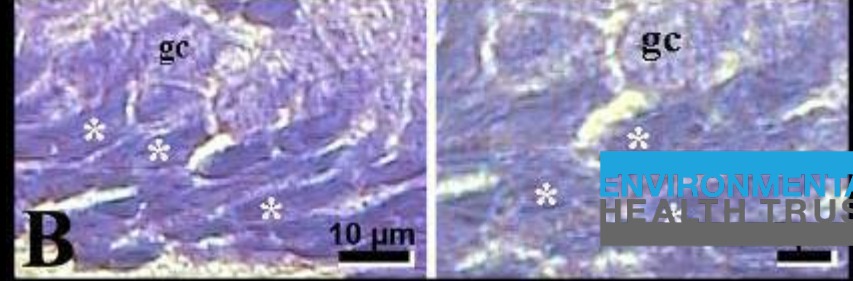
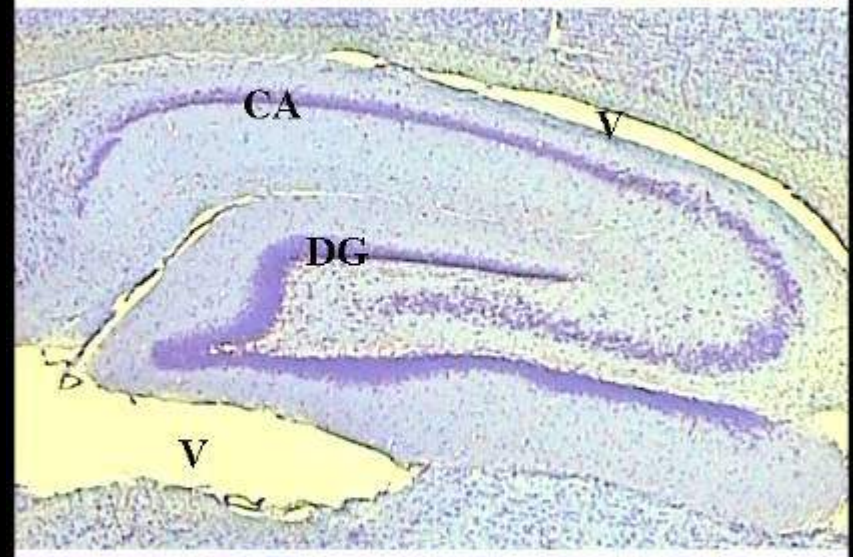
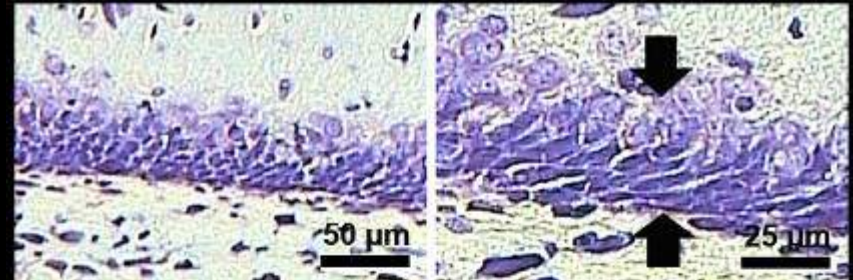
Do electromagnetic fields (EMFs) inhibit the formation and differentiation of neural stem cells during embryonic development in the hippocampus.

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

Controls

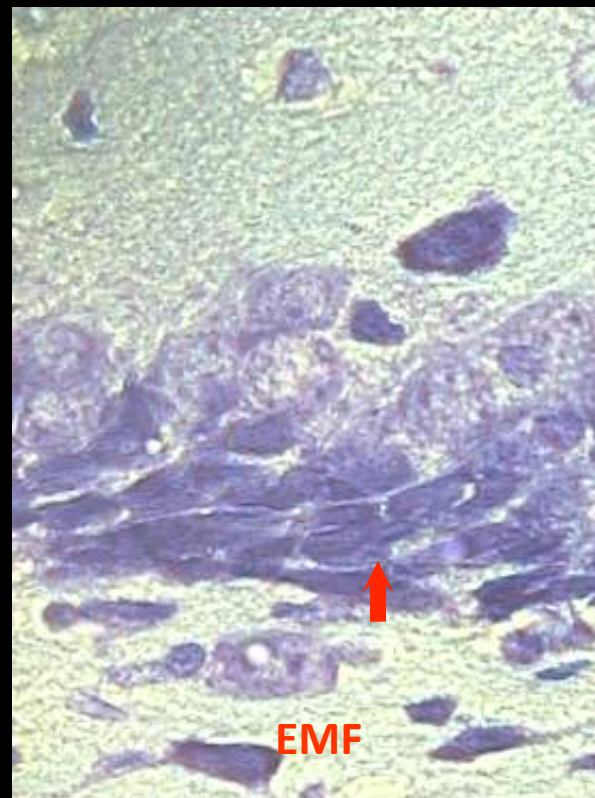
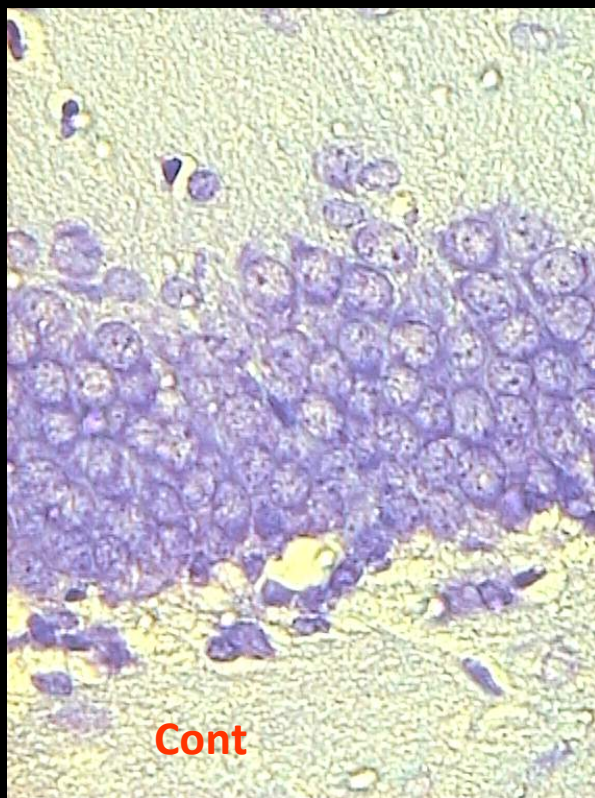


Exposed



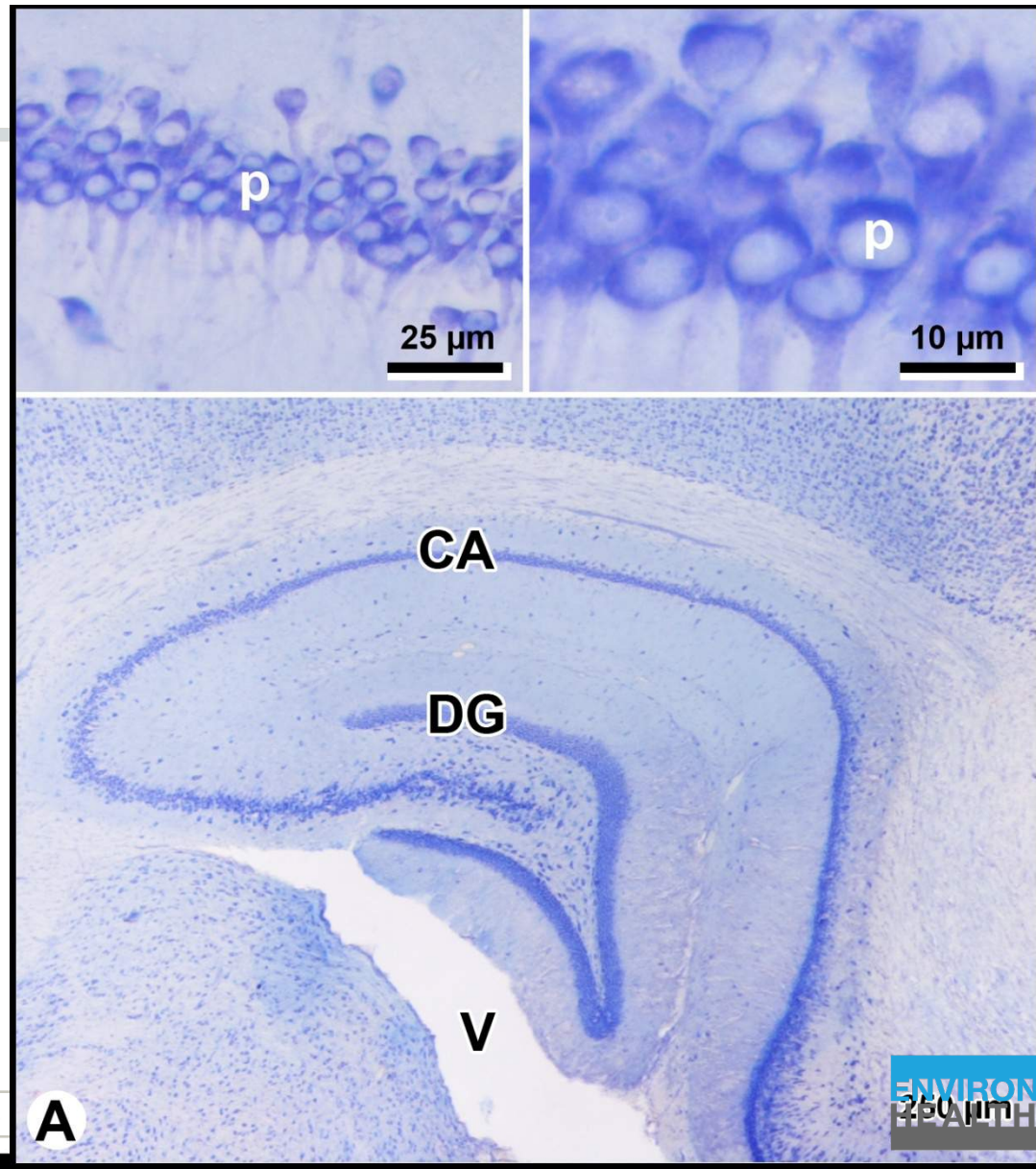
Prenatal 900 MHz EMF exposure decreased hippocampal granular cell number in the dentate gyrus of newborn rats

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.



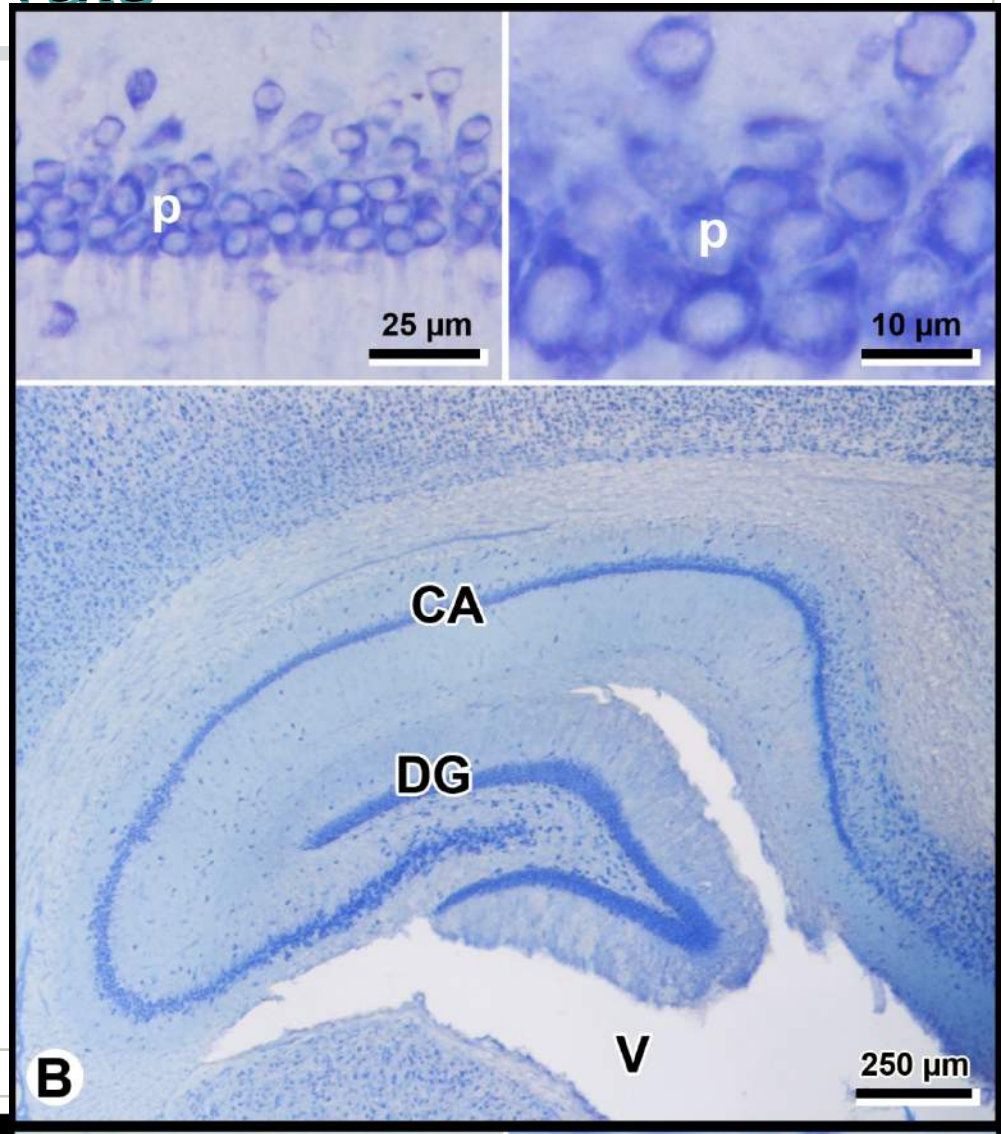
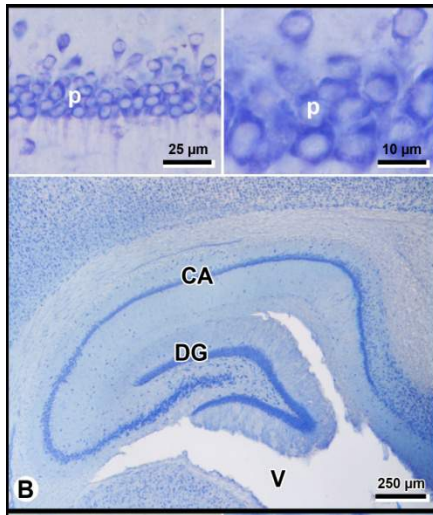
RESULTS

Panoramic views of the Cont (A), Sham (B) and EMF (C) groups. There may not be easily seen a distinct difference among groups in the panoramic pictures of them. Difference between EMF and the Sham or Cont groups can be observed when density of pyramidal cell is compared between groups in the magnified views of group (the right pictures of A-C). As stated in the result section postnatal EMF exposure caused a significant decrease of the pyramidal cell number in the CA of the EMF group in comparison with the Sham or Cont groups.

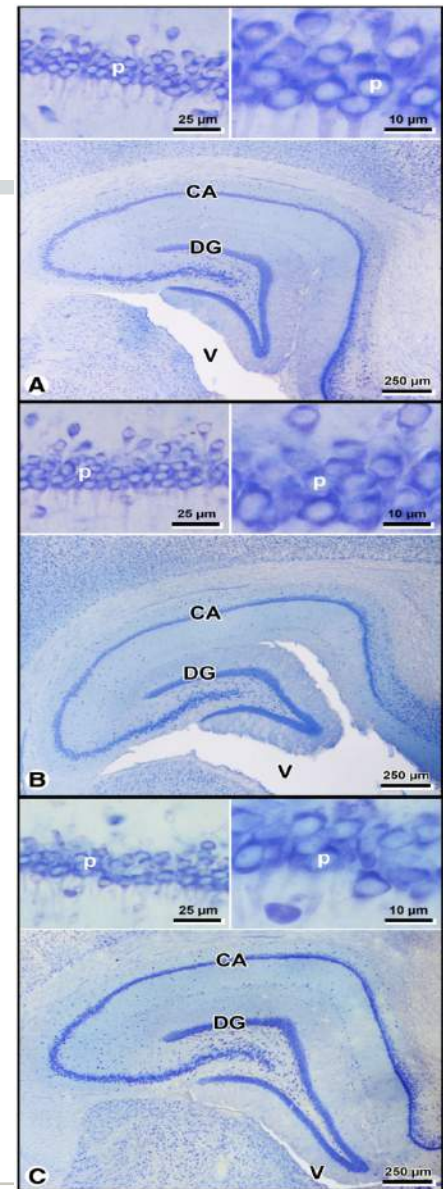


Exposure of 900 MHz EMF induces pyramidal cell loss in the hippocampus of adult female rats

RESULTS:

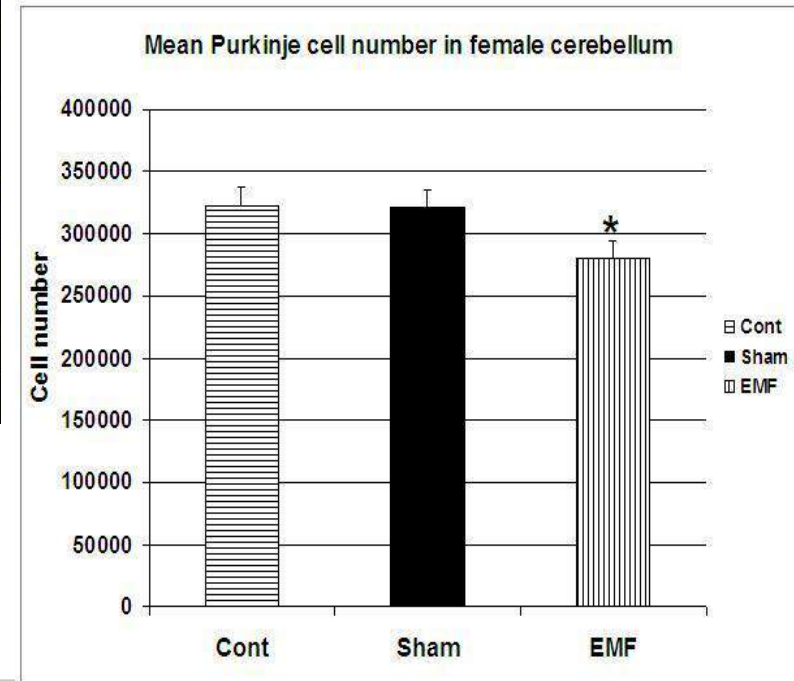
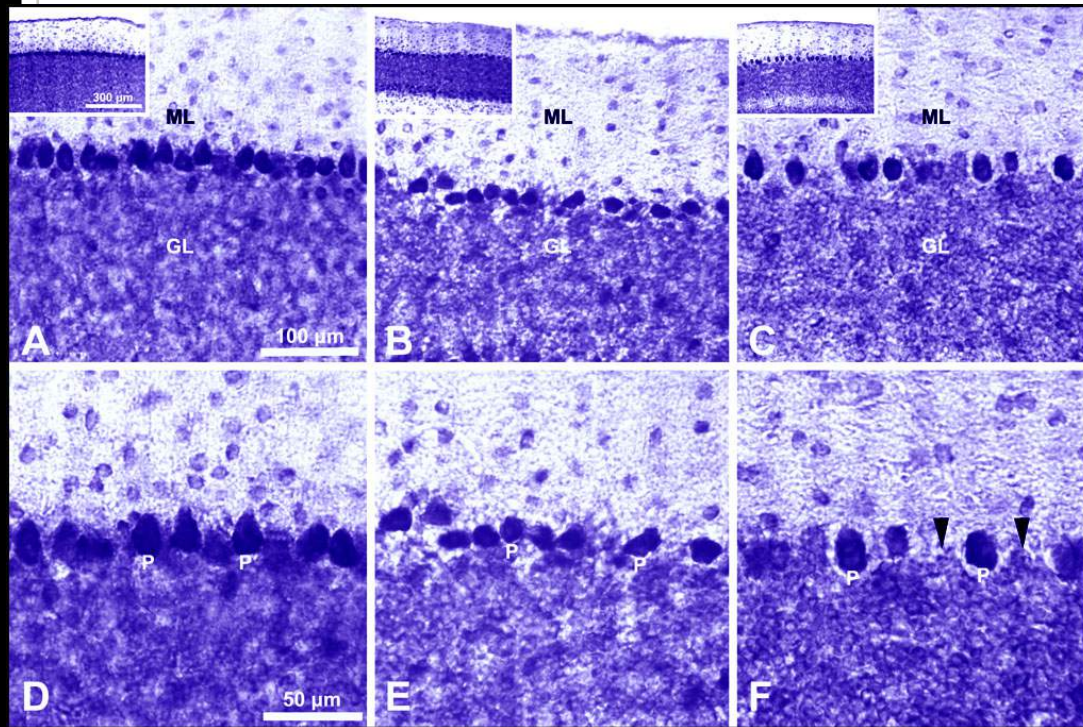


Exposure of 900 MHz
EMF induces pyramidal
cell loss in the
hippocampus of adult
female rats



Exposure of 900 MHz EMF induces Purkinje cell loss in the cerebellum of adult female rats

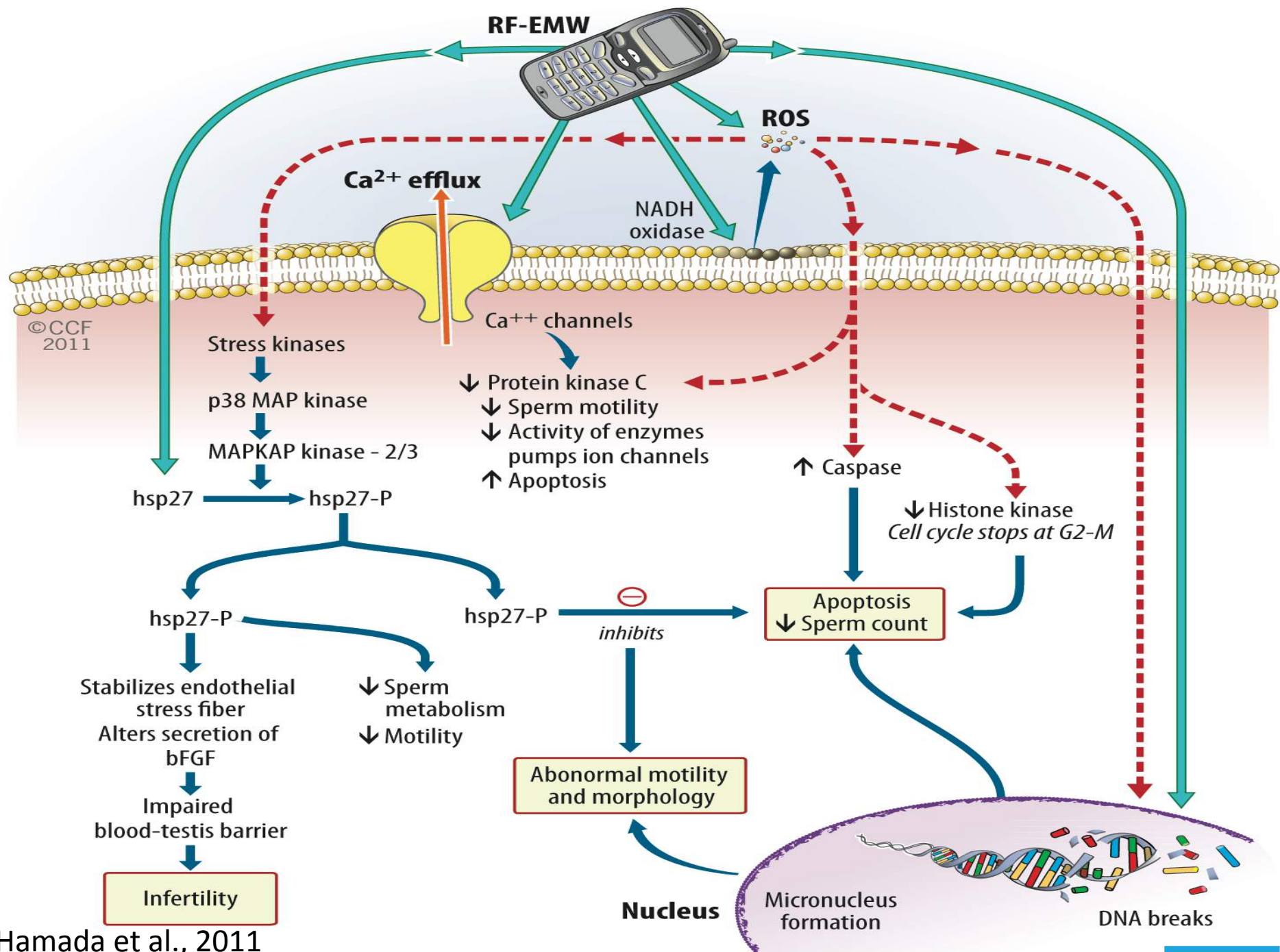
RESULTS:



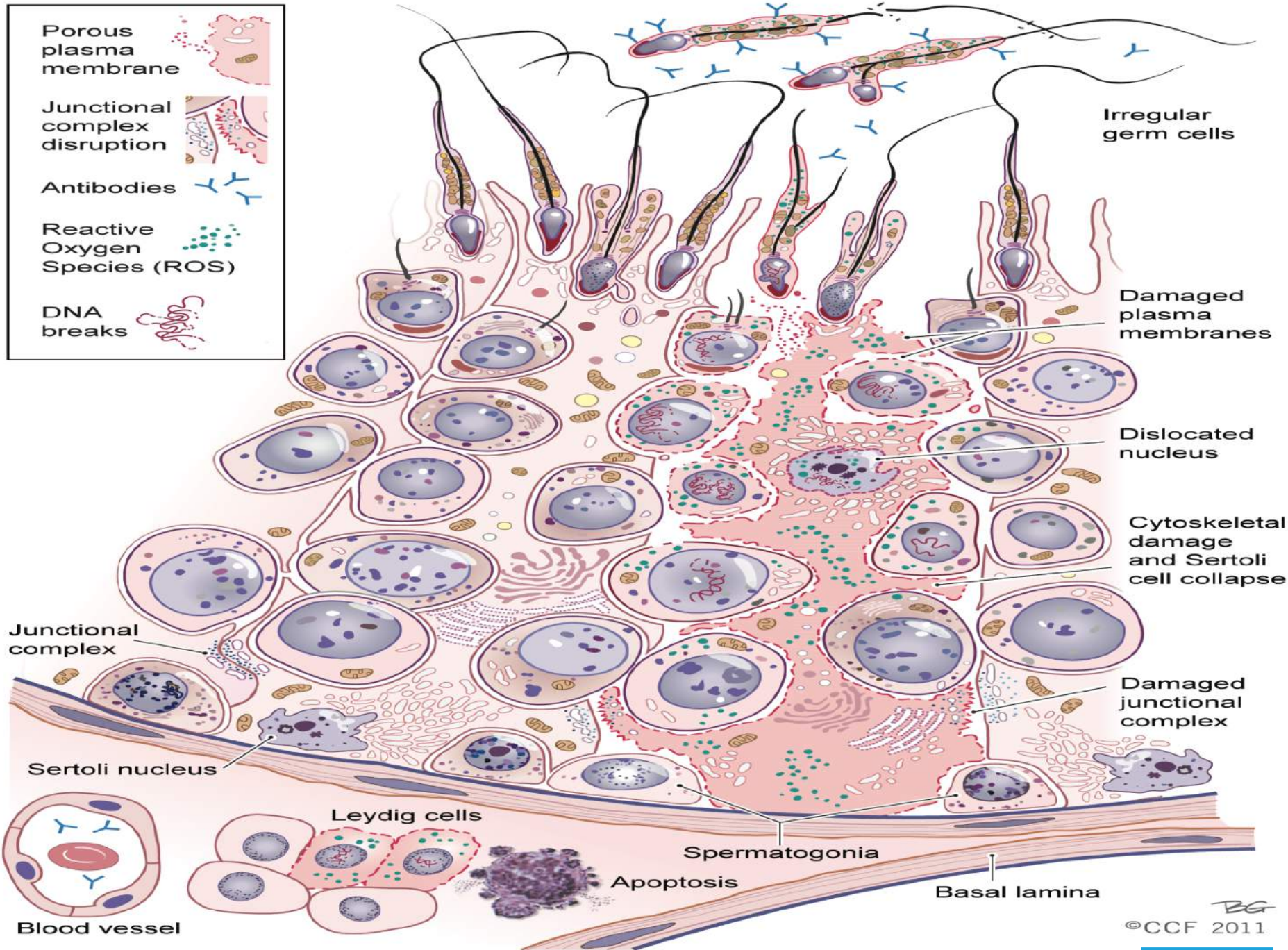
Possible Mechanisms

- Younger faster (less differentiated) growing cells are more vulnerable
- i.e., pre-pubertal breast cells, fibroblasts, spermatocytes, neuronal stem cells mouse embryonic cells

(all have thinner membranes & faster transformation rates, greater vulnerability to shifts in extracellular matrix)

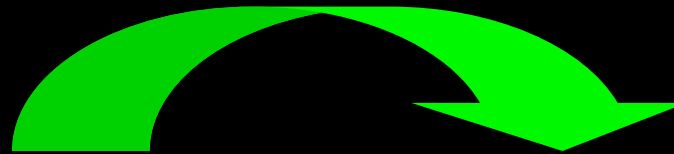
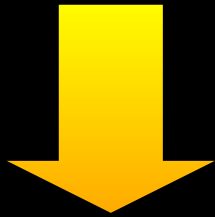


Hamada et al., 2011



EMF are source for Sustained stress

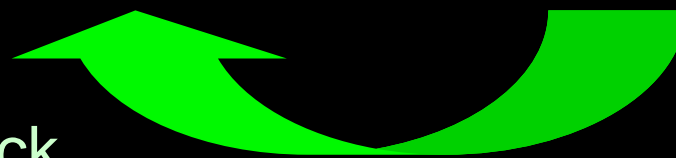
Receptor down-regulation



Glucocorticoid hypersecretion

Loss of hippocampal corticosteroid receptors

Negative-feedback insensitivity



Perlmutter, 2013

Interventions proposed: Melatonin Protects Against Breast Cancer

- Blind women have half the risk of breast cancer possibly due to higher melatonin
- IARC declared work at night a “probable human carcinogen,” possibly due to lowered melatonin levels
- Melatonin currently in clinical trials with metastatic breast cancer @ NCI
- Pre-exposure with melatonin reduces apoptosis induced by RF in vitro

Sanchez-Barcelo et al, 2002

Protective Effects of Melatonin + in rat testis

- Four groups devices have become part of everyday life and mostly located near reproductive organs while they
 1. cage control
 - 2. sham control
 - 3. 2.45-GHz EMR exposed 1 hour daily x 30 days
 - 4. 2.45-GHz exposed to EMR+melatonin (C)
- Vitamin A and E concentrations decreased and lipid peroxidation increased in exposed group, but not in melatonin exposed group.
- Wireless(2.45 GHz) EMR caused oxidative damage in testis by increasing the levels of lipid peroxidation and decreasing in vitamin A and E levels. Melatonin supplementation prevented oxidative damage induced by EMR and also supported the antioxidant redox system in the testis.

Melatonin Protects Against Mitochondrial DNA damage

ROS production in primary cultured cortical neurons exposed to RF radiation.

Neurons incubated with DCFH-DA at 37 °C for 20 min.

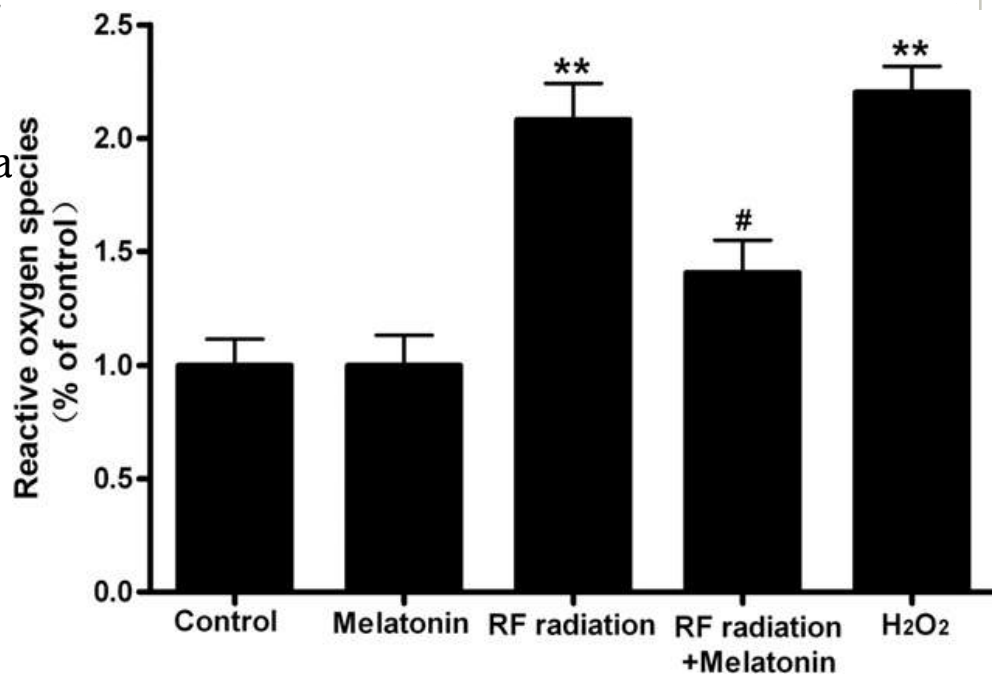
Fluorescence images were acquired with a Leica fluorescence

microscope at 485nm for excitation and 530nm for emission.

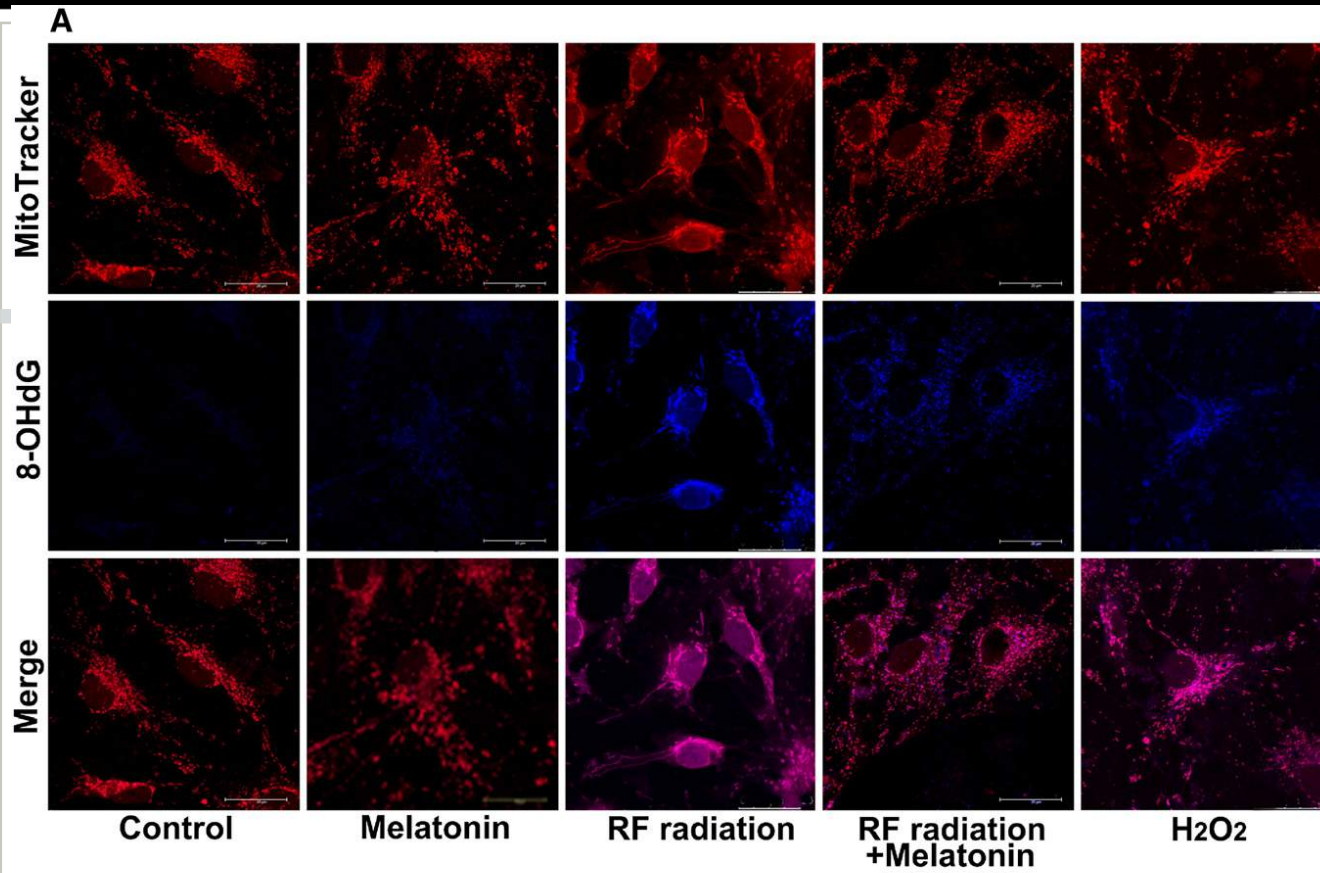
Cellular fluorescence intensity

expressed as the multiple of the level in control groups.

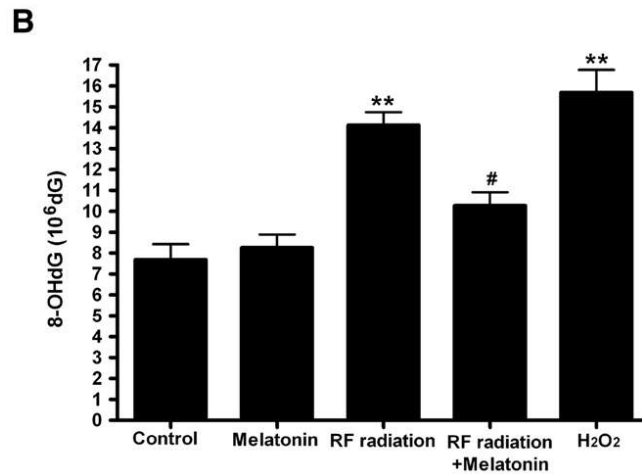
**p<0.01 versus sham-exposed control group and melatonin



*Exposure to 1800 MHz radiofrequency radiation induces oxidative damage to mitochondrial DNA in primary cultured neurons, Brain Research, 2009
Shangcheng Xu et al*

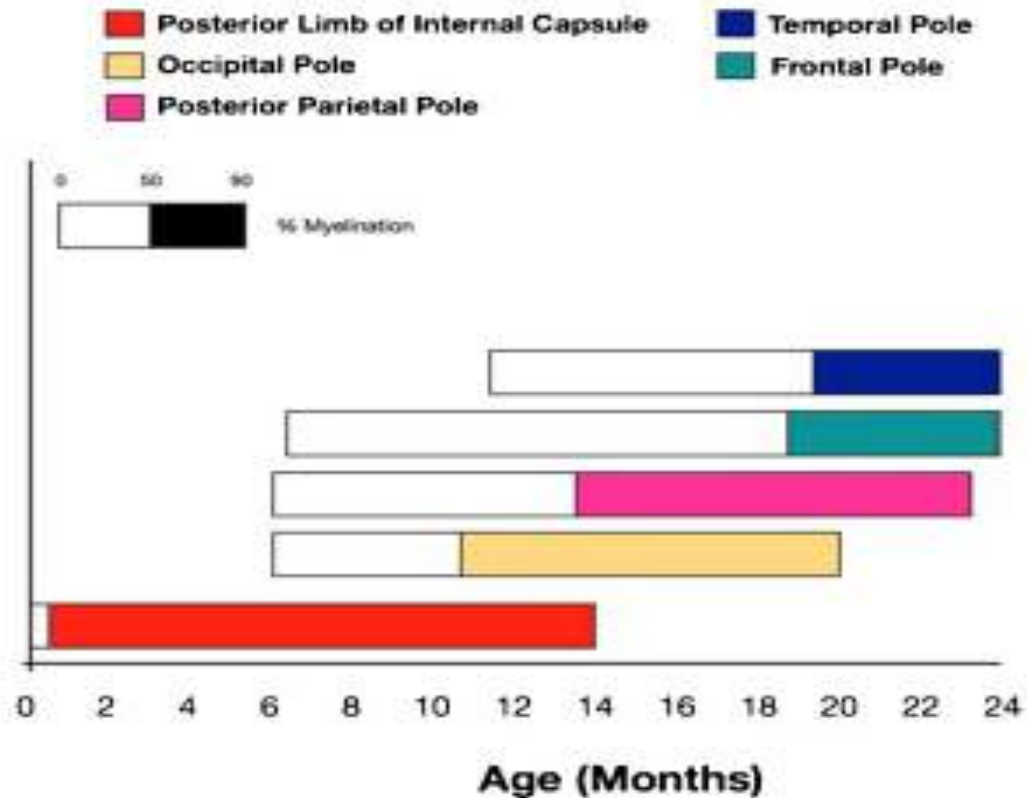


- Increase of 8-OHdG in mitochondria after RF



Myelination occurs in a specific order

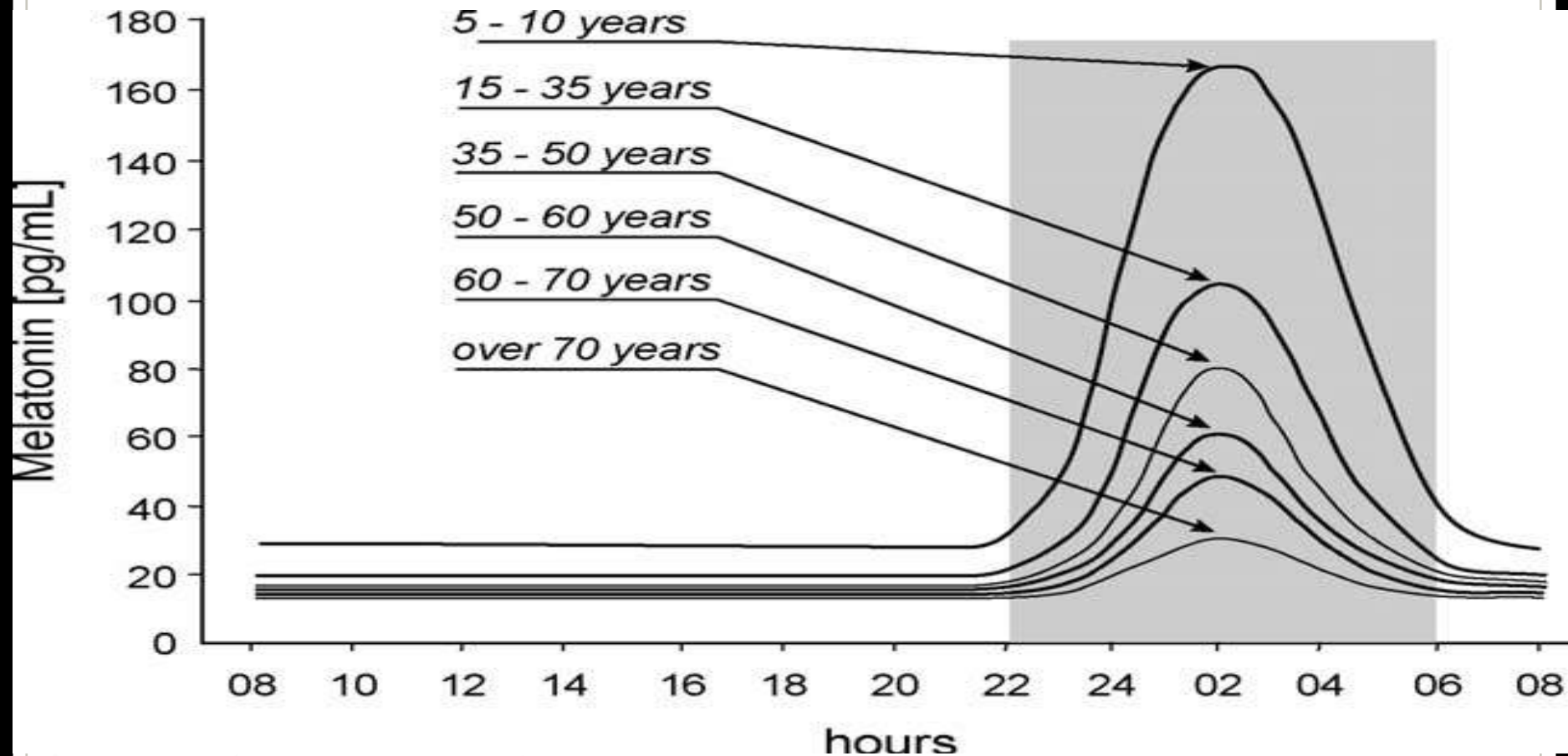
Different areas most exposed at different ages



(Rosenzweig et al. 2012)

Oxidative Stress & Melatonin

Melatonin is a powerful weapon against oxidative damage

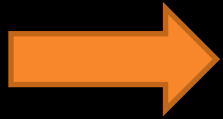


Digital Dementia, 2013

- Characterized by: memory loss, attention disorders, and not feeling or showing emotions.
 - Children are at the greatest risk because their brains are still developing.
- Dr. Gi-Won a cognitive expert from the Balance Brain Center in Seoul, South Korea states, "Young People who are heavy technology users are likely to have a properly developed left hemisphere of the brain while the right hemisphere will be unused and underdeveloped."

It's the membranes that are key

EMW exposure alters calcium homeostasis



weakening membranes

Negatively charged phospholipid bilayer of the cell membranes binds to divalent cations, between phospholipid molecules and prevents them from repelling each other.

Consequently, calcium helps to stabilize and strengthen cell membranes. Induced alternating voltage across the cell membrane displaces sub membrane calcium ions on and off the cell membrane.

Paradigm shift

FDA approves EMF/RF radiating devices for treating liver & brain cancer

"Treated with very low levels of an electromagnetic field emitting from a spoon-like device placed in the patients' mouths. ... After six months, the tumors in 14 patients had stabilized after each received three one-hour treatments per day each day; the therapy created no significant side effects."

Clinical trials / 3 publications in the British Journal of Cancer :
Zimmerman *et al.* (2012)
Costa *et al.* (2011)
Barbault *et al.* (2009). <http://www.ncbi.nlm.nih.gov/pubmed/22134506>



Operating at
27.12 MHz,
Pulses between
100 Hz–21 kHz

PEMF (Pulsed ElectroMagnetic Fields) treatment approved by the FDA www.novocure.com

- Treating glioblastoma, melanoma and lung cancer. Effect on post-mitotic spindle formation, i.e., dividing cells, only.
 - Using kHz-pulses: melanoma 100 kHz
 - glioma cells at 200 kHz
- Device is called: *NovoTTF-100A*

Clinical trials I, II, III and their reports:
Kirson *et al.*, (2007)
Kirson *et al.*, (2009)
Stupp *et al.* (2010)

<http://tinyurl.com/novocure>

Thank You

Nora Volkow, National Institute on Drug Abuse
Suleyman Kaplan, Ondokuz Mayıs Medical Univ
Robert Nagourney, Rational Therapeutics
Lisa Bailey, Alta Bates
Ashok Agarwal, Cleveland Clinic
Wilhelm Mosgoeller MD, Medical University of Vienna
Lukas Margaritis MD, Adamantia Fragoupoulou, University of Athens
Igor Belyaev, Alexandra Markova, Bratislava
Rony Seger, Weizmann Institute
Alvaro de Salles Fed. U of Porto Alegre
Claudio Fernandez
Andreas Christ and Niels Kuster, IT'IS, Switzerland
Nesrin Seyhan, Meriç Arda Eşmekaya, Gazi University, Turkey
John West, Nimmi Kapoor, Shu-Yuan Liao, June W. Chen, Breast Link
Lloyd Morgan, Toni Stein and Rachael Levitz, Environmental Health Trust

Additional Slides for Discussion

Worldwide Cell Phone Advisories



Belgium 2013:


The Public Health Minister bans cell phone sale both in shops and online to children under 7 years old. Cell phone advertisements are also banned during children's TV programs.



Australia 2013:

The federal government's Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has created a fact sheet providing citizens ways to reduce exposure from wireless devices. The agency advises that parents limit children's exposure to cell phones.

Worldwide Cell Phone Advisories



Italy 2012:

On October 12th, 2012 the Italian Supreme Court ruled in favor of an Italian businessman who claimed that his brain tumor developed from using cell phone 5-6 Hours a day



France 2013:

The French National Assembly bans Wi-Fi in schools until it is proven to be safe for human consumption.

Worldwide Cell Phone Advisories



Turkey 2013:

Governor Aksoy Huseyin, of the Samsun province is launching a cell phone campaign using EHT's pamphlets and health/ science materials.

Formula for calculating exposure

- The FDTD method provides a full wave solution of Maxwell's equations,

$$\nabla \times \vec{H} = \varepsilon \cdot \frac{\partial \vec{E}}{\partial t} + \sigma \cdot E,$$
$$\nabla \times \vec{E} = \mu \cdot \frac{\partial \vec{H}}{\partial t} + \rho^* \cdot \vec{H},$$

- Where σ is the conductivity, ε is the permittivity (dielectric constant), μ is the permeability and ρ^* is an equivalent magnetic resistivity.

Atomic Bombs in Japan, 1945



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

Do not take without permission

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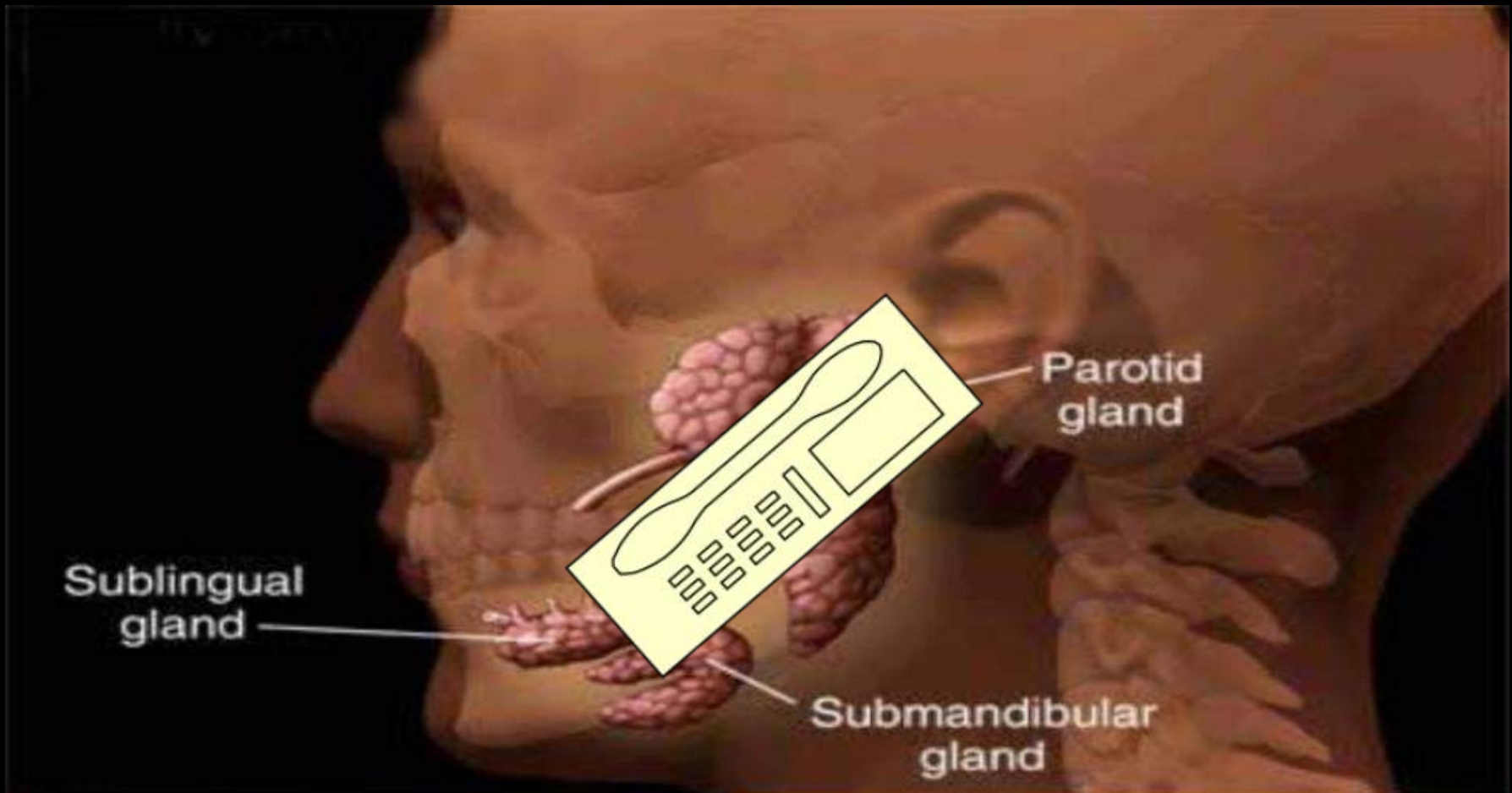


In most epidemiological studies, cell phones
do not increase brain cancer

Until after at least ten years of
heavy use

Do not take without permission

Parotid or Salivary Gland Tumors Tripled in Israel: 1 in 5 under age 20



Israeli Dental Association Warning

- 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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2007 Israeli case control finding: Association Between Tumors and Cell Phone Use

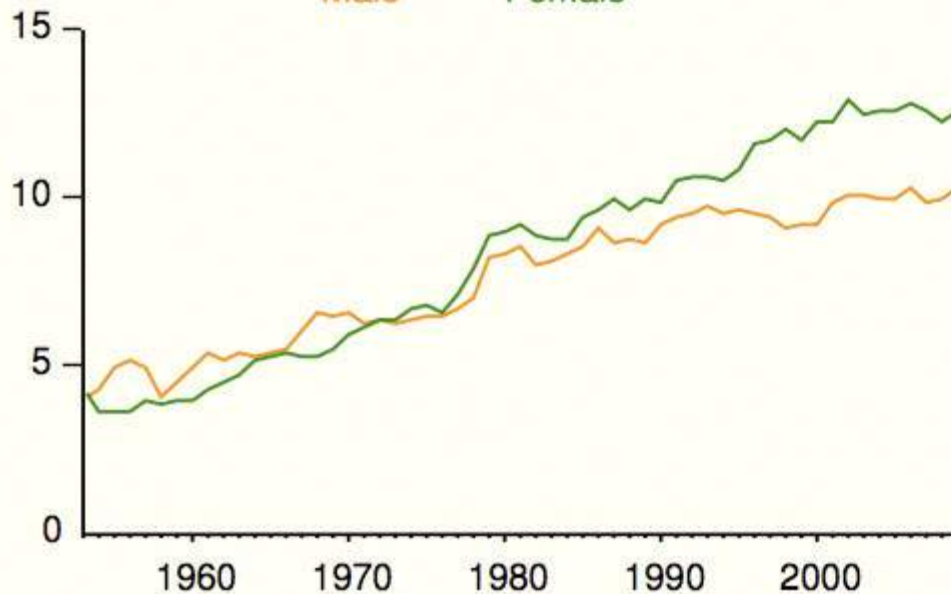
- “Based on the largest number of benign [parotid gland tumors] patients reported to date, our results suggest an association between cellular phone use and PGTs.”
 - Recommend continued research and implementation of precautionary measures by governments until further evidence becomes available.

Increasing brain tumor incidence in countries with longer term use of cellphones

Increasing Brain Cancer Incidences in Finland 2005-2009 (NORDCAN)

Age-standardized rates (W) over time
Incidence

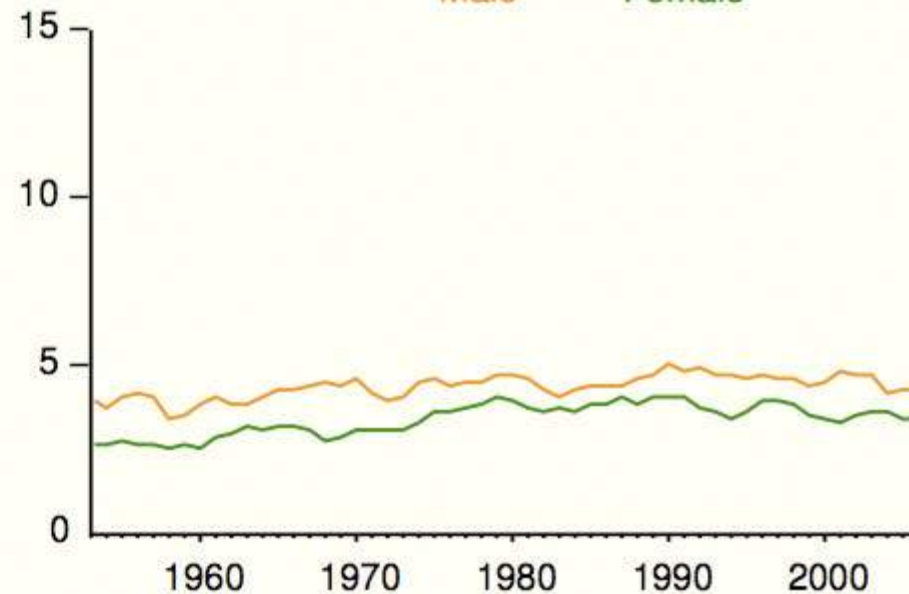
Male Female



NORDCAN

Age-standardized rates (W) over time
Mortality

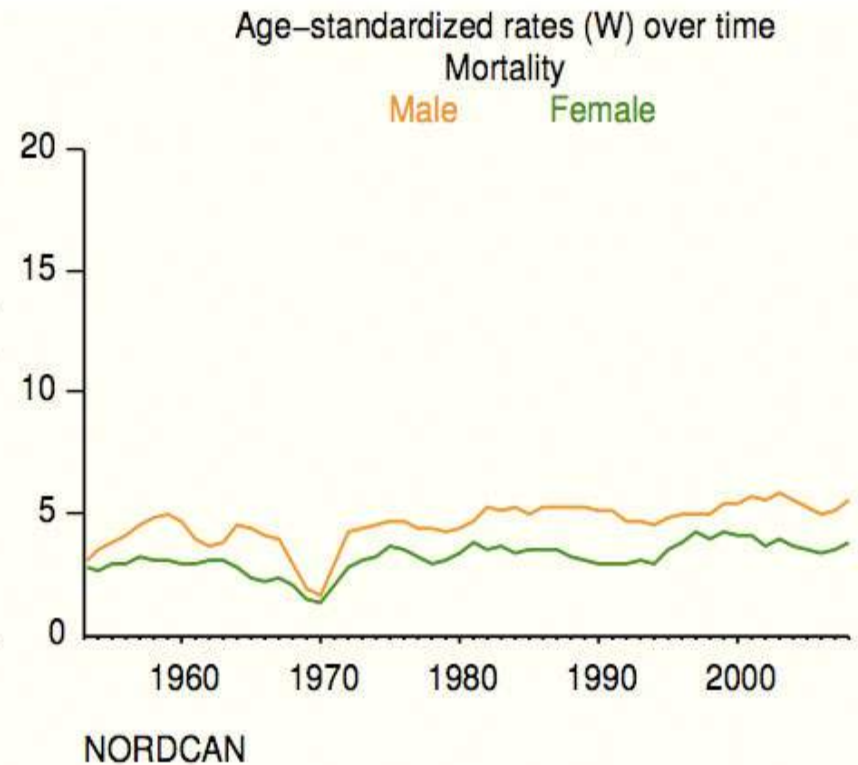
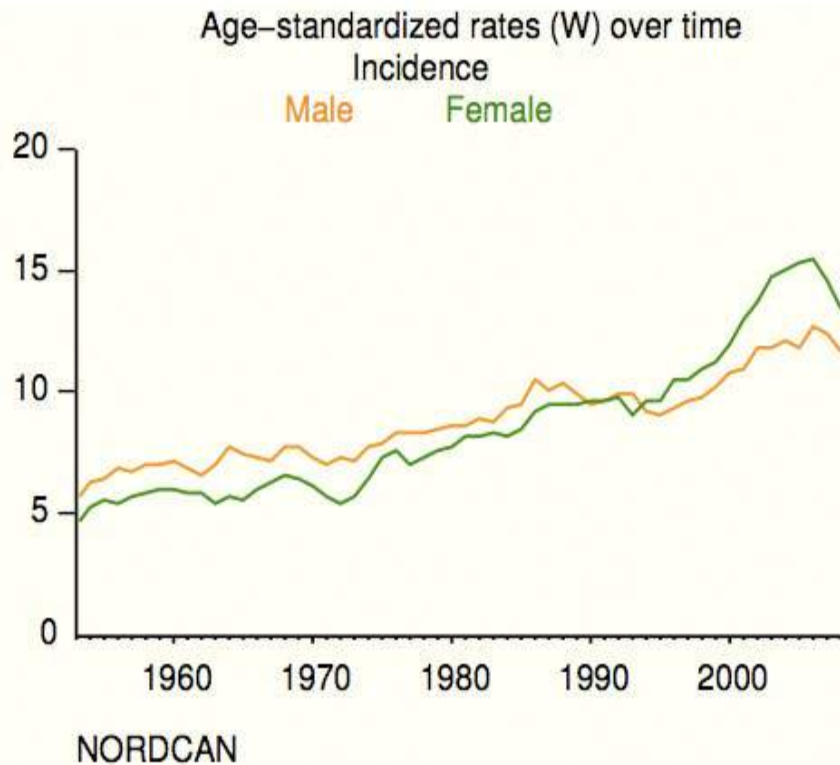
Male Female



NORDCAN

Increasing brain tumor incidence in countries with longer term use of cellphones

Increasing Brain Cancer Incidences in Norway 2005-2009 (NORDCAN)



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, Claudio Fernandez, University of Porto Allegre
- Suleyman Kaplan, Ondokuz Mayıs Medical Univ.
- Lukas Margaritis and Adamantia Fragopoulou, University of Athens, Greece
- Lloyd Morgan and Ron Herberman, EHT
- Nesrin Seyhan, Gazi University, Ankara
- Hugh Taylor, Yale University
- David Gultekin, Memorial Sloan Kettering Cancer Center
- Rony Seger, Weizmann Institute of Science

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



Don Wright, Miami News