

# The Truth about Mobile Phone and Wireless Radiation:

**What we know**

**What we need to know**

**What we can do now**

Dr. Devra Davis

President, Environmental Health Trust

Visiting Professor of Medicine:

Hebrew University Hadassah Medical School

Ondokuz Mayıs University Medical School

Co-sponsored by the Melbourne School of Engineering, the Melbourne Networked Society Institute, the Faculty of Medicine, Dentistry and Health Sciences, and the Faculty of Science.

# 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 overview

- Laws and customs
- Who is at risk?
  - Brains child/adult
  - Pregnancy
- What's the problem?
  - Sperm
  - Breasts
  - Honey bees
- Business opportunities/  
Responsibilities
- Global policy responses

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# Show and tell—hidden safety advice

- For iPhone go to
  - Settings
  - About
  - Legal
  - RF exposure

For all other smartphones go to

[www.showthefineprint.org](http://www.showthefineprint.org)

# Telstra safety message being texted regularly to mobile customers in Australia

A service message from Telstra.  
For information on mobile use,  
Electromagnetic Energy and tips  
to reduce exposure, visit [http://  
telstra.com.au/mobiletips](http://telstra.com.au/mobiletips)

The WHO provides the following information on how to reduce mobile phone exposure

1. Use hands free device to keep mobile phone away from the head & body
2. Limit the number and length of calls
3. Use the phone in areas of good reception



# Standards for cell phones based on outdated assumptions



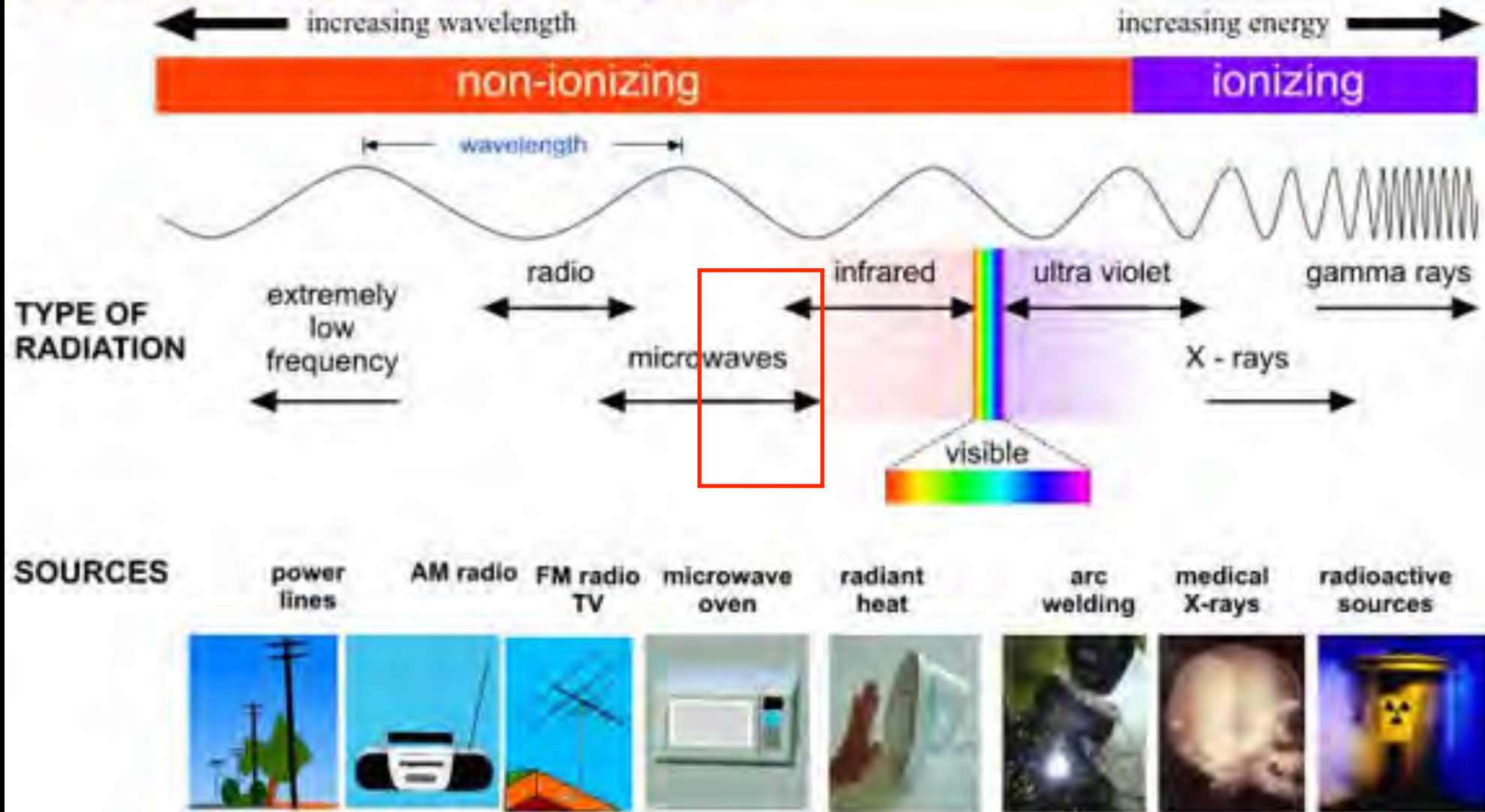
- . 1997 typical user was military, medical, or business
- . Employs the head of a 220 lb male at the top 98% of military recruits in 1989
- . Designed to avoid heating after 6 minute call
- . Does not consider growing evidence of non-thermal impacts from chronic exposures

# Since 1997 secondary insurers do not cover health damages from wireless

- [Lloyds of London](#) denies 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.

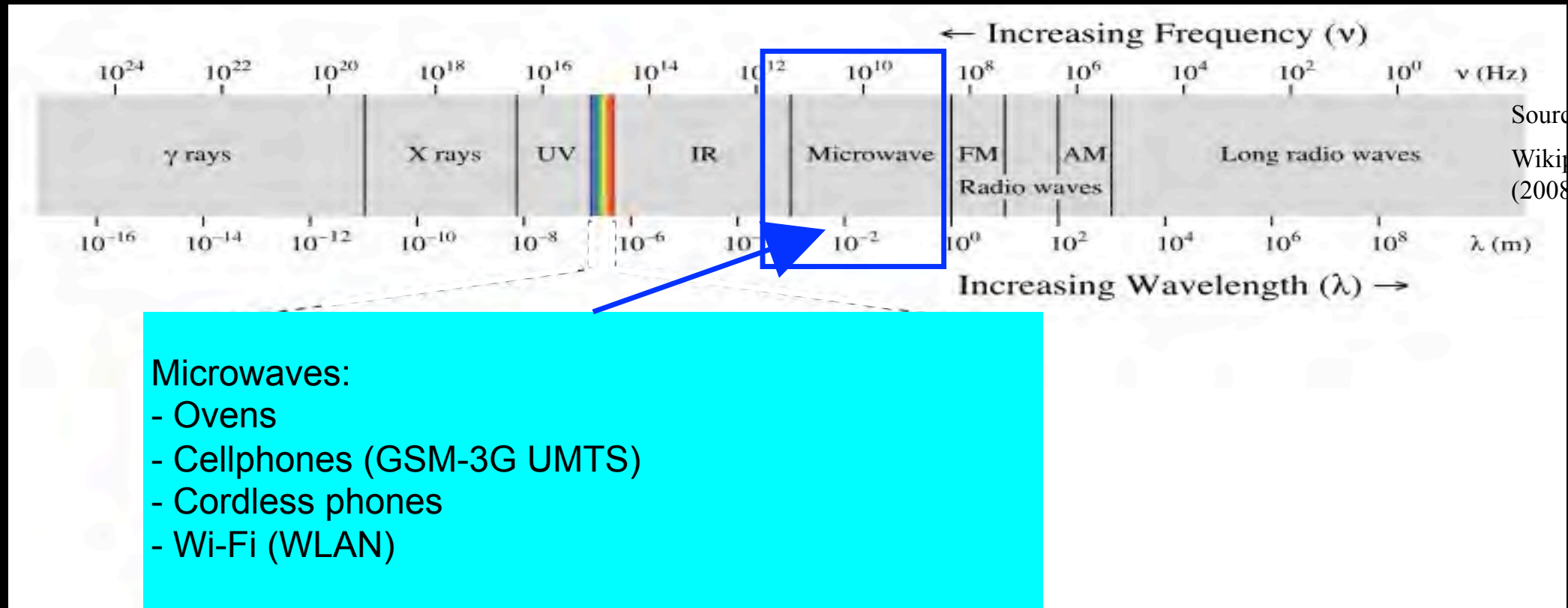
# Electromagnetic Spectrum

## THE ELECTROMAGNETIC SPECTRUM

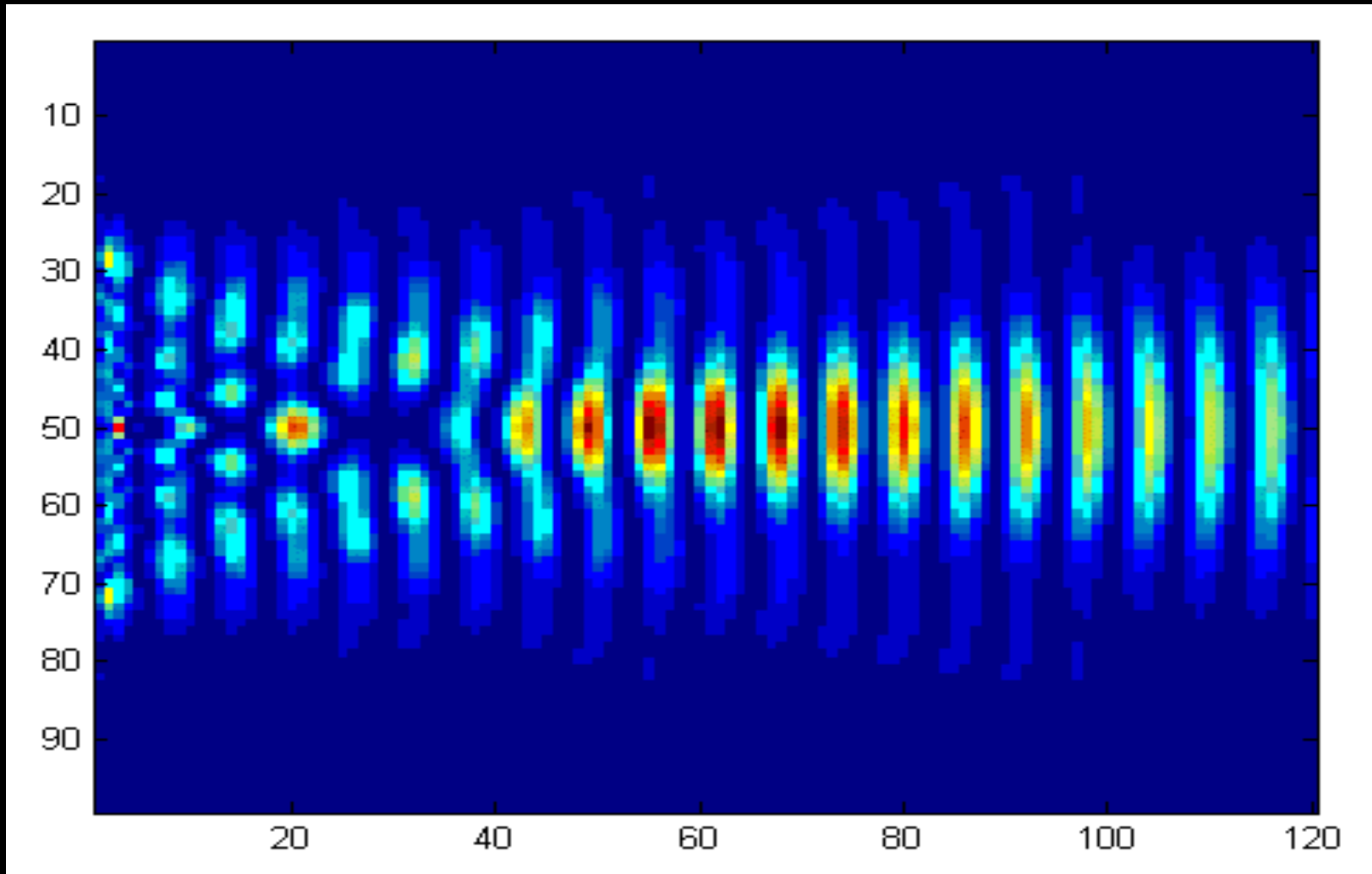




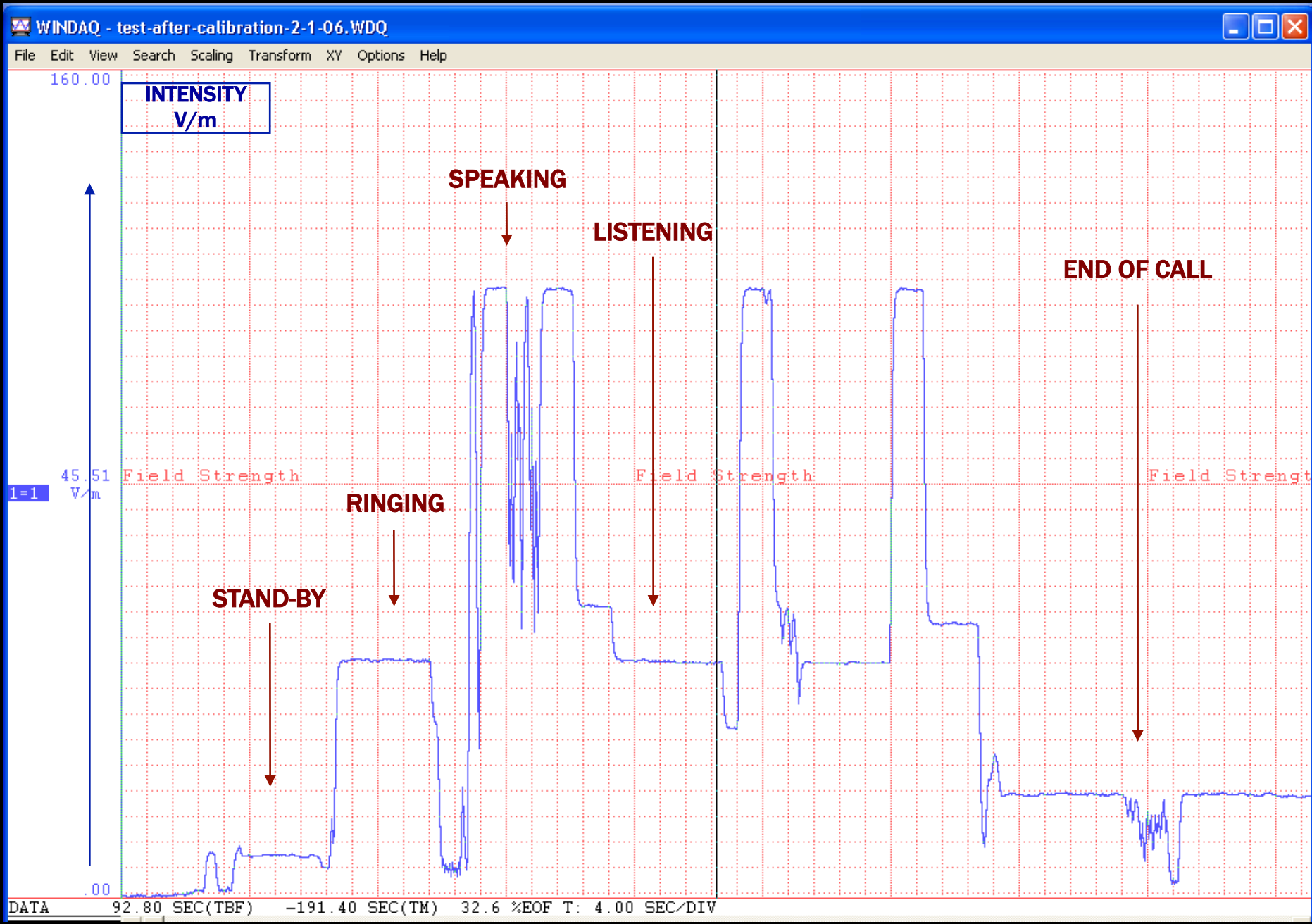
# Electromagnetic Spectrum



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



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



Time 4 sec/division

# Sunlight exposure is distinct from absorbed dose



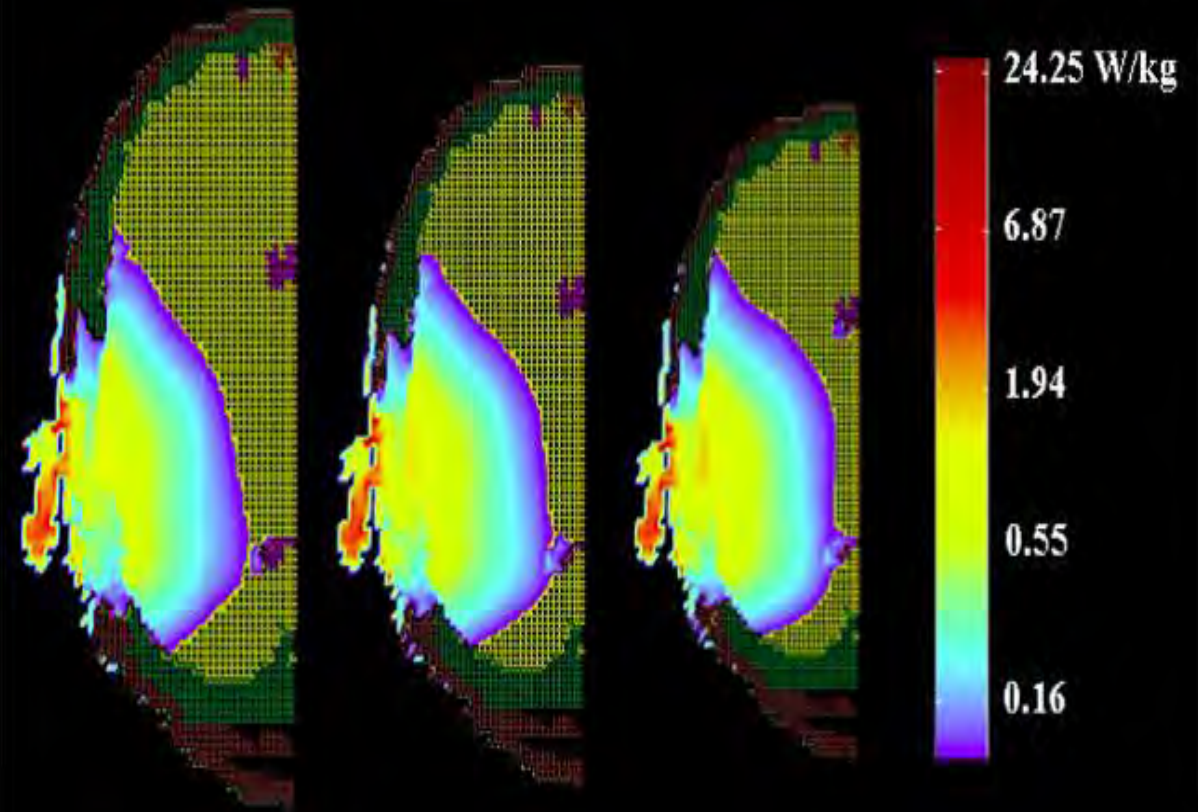
Identical sunlight exposure results in different UV dose to my red-haired blue-eyed granddaughter and my darker daughter



# 2-D modeling showed that children & smaller adults absorb more radiation than larger adults (1996, 2002)

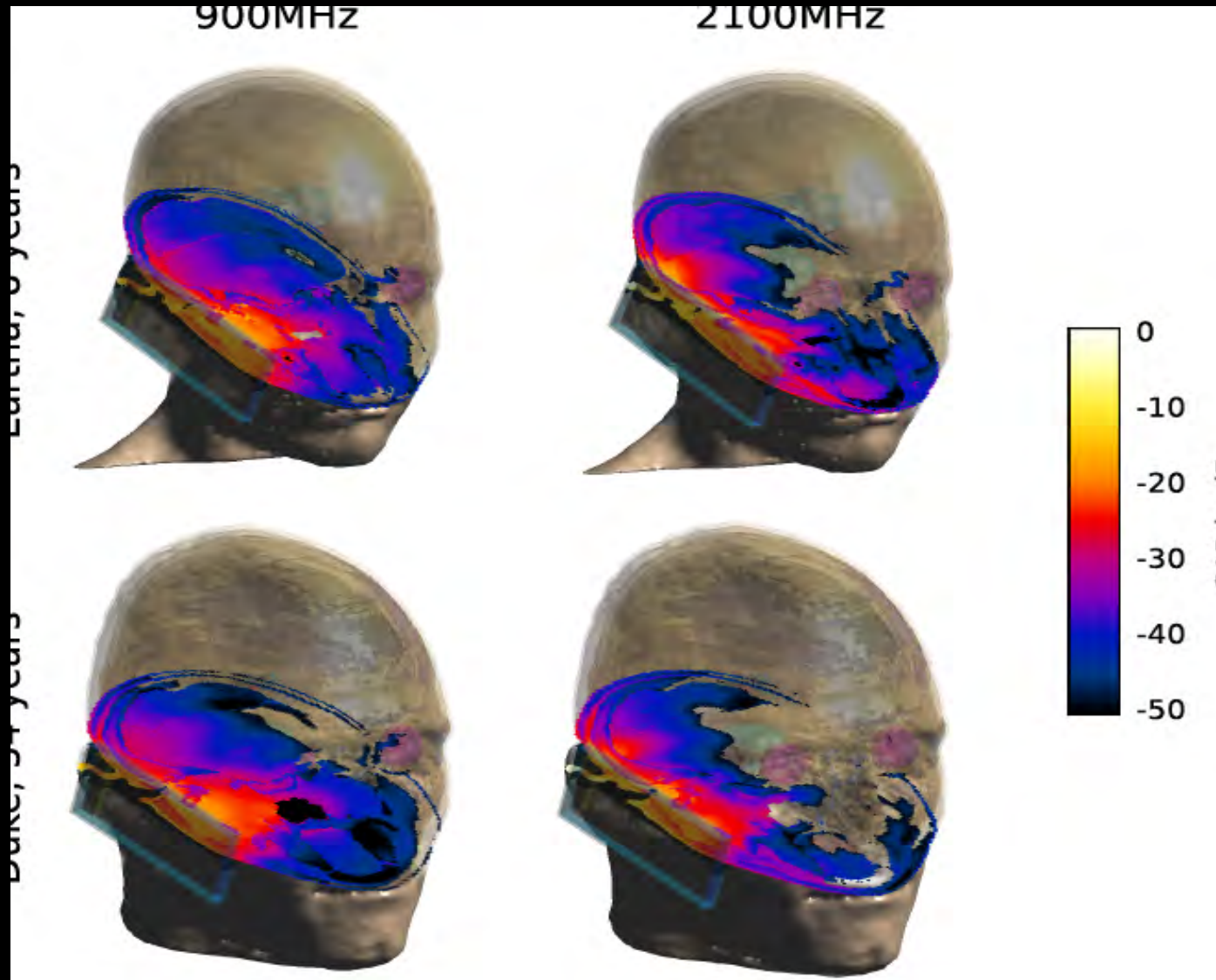


Gandhi 1996 scaled relative absorption in child/adult, questioning whether the adult model adequately predicted child exposure

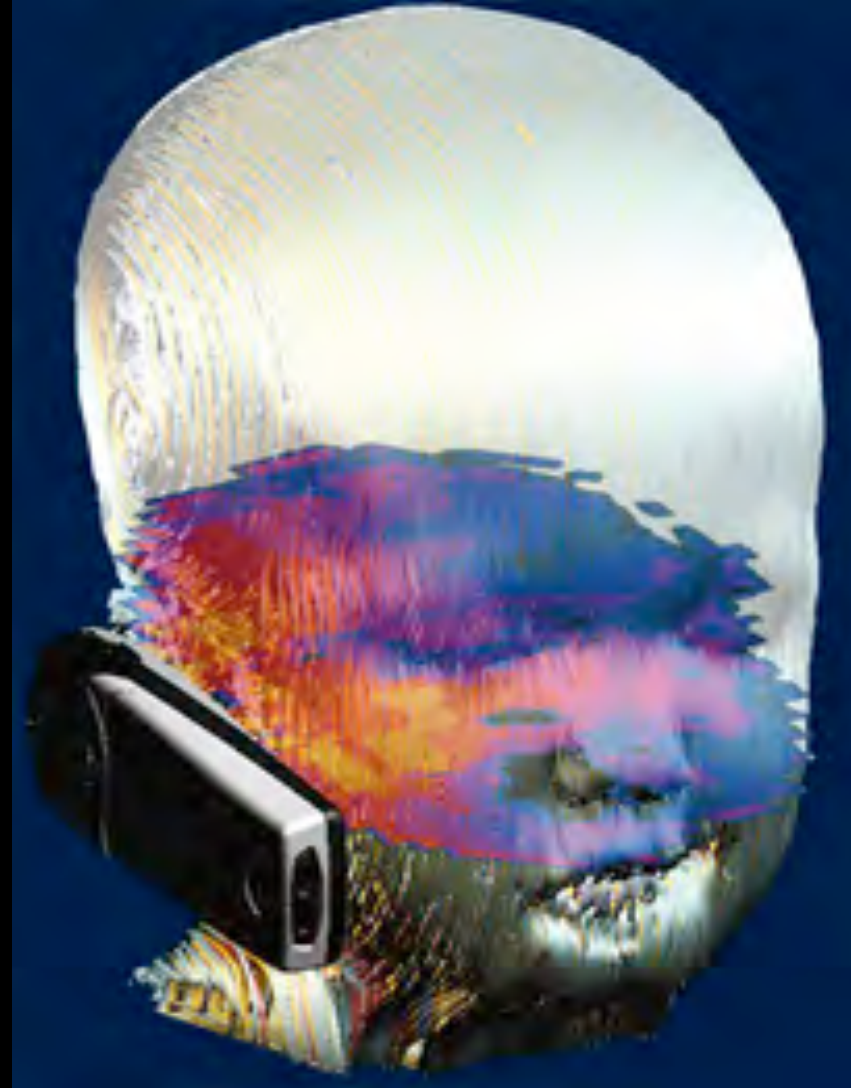


Gandhi and Kang 2002 confirmed proportionally greater absorption in smaller head

# 3-D anatomically based modeling reveal proportional difference in radiation dose in 8 & 34 year old heads

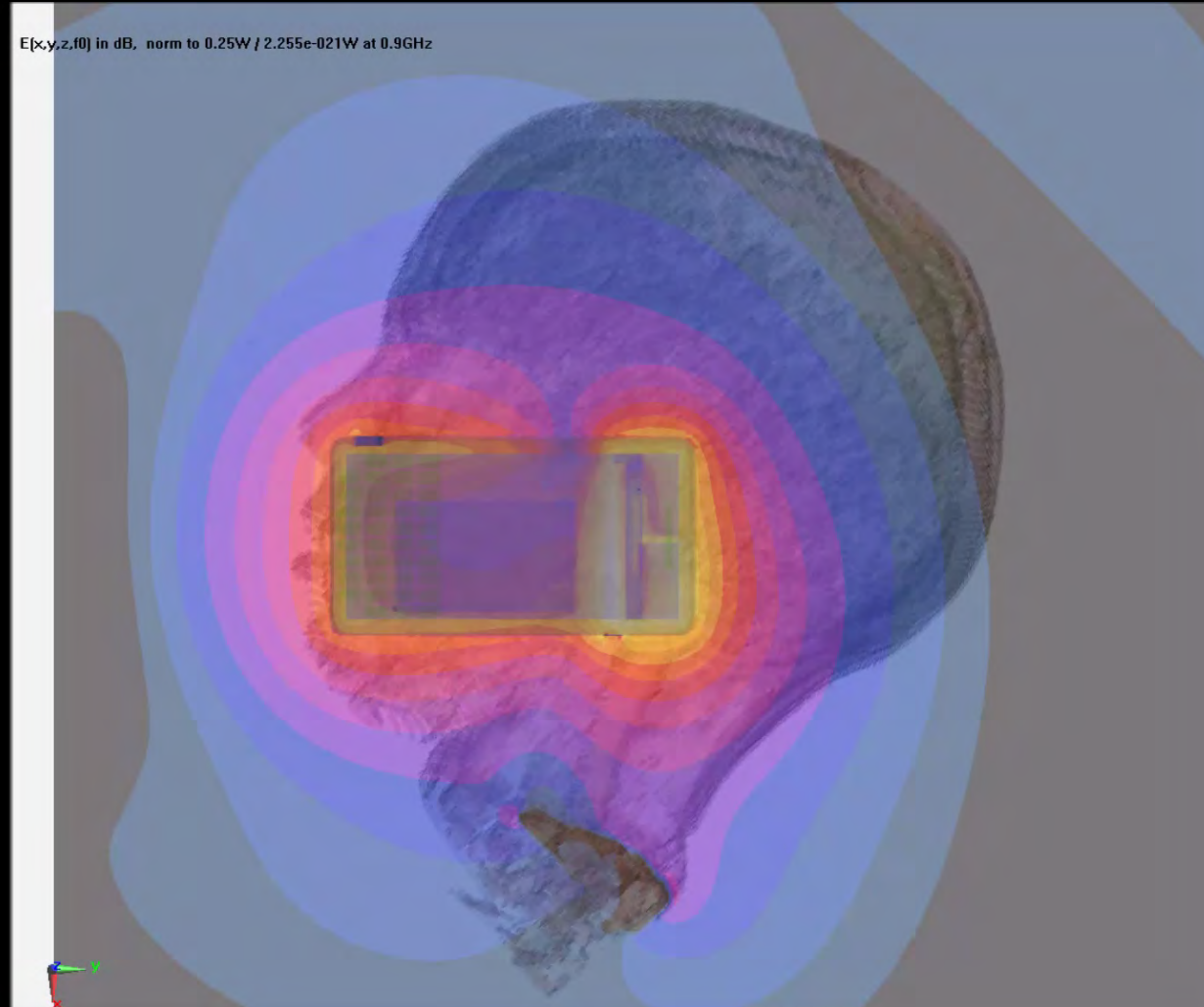


# 3-D modeling of dose at target tissue infant exposure



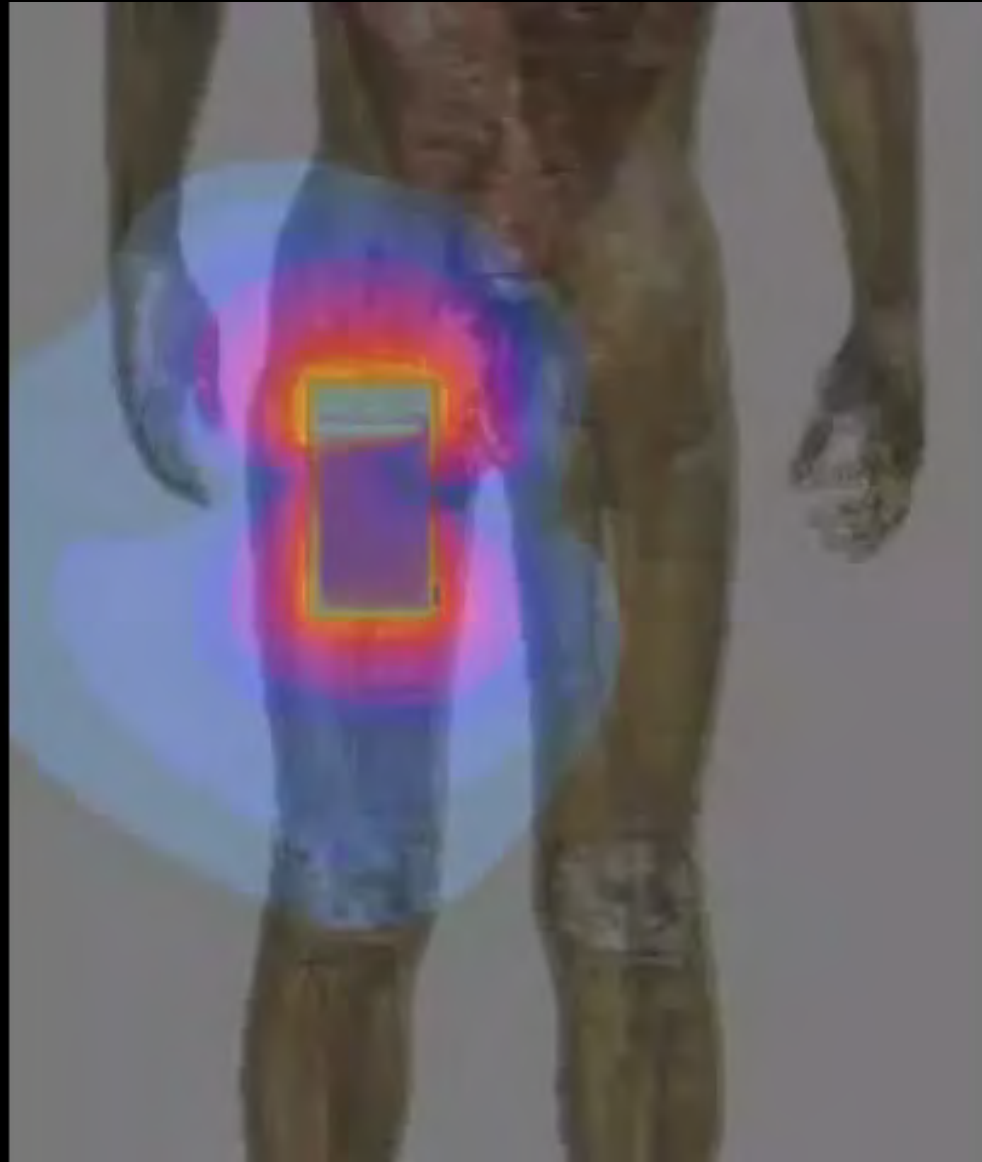


Modeled microwave radiation dose of six-year old showing greater levels to frontal and temporal lobes, eyes and cheek, extending into brainstem



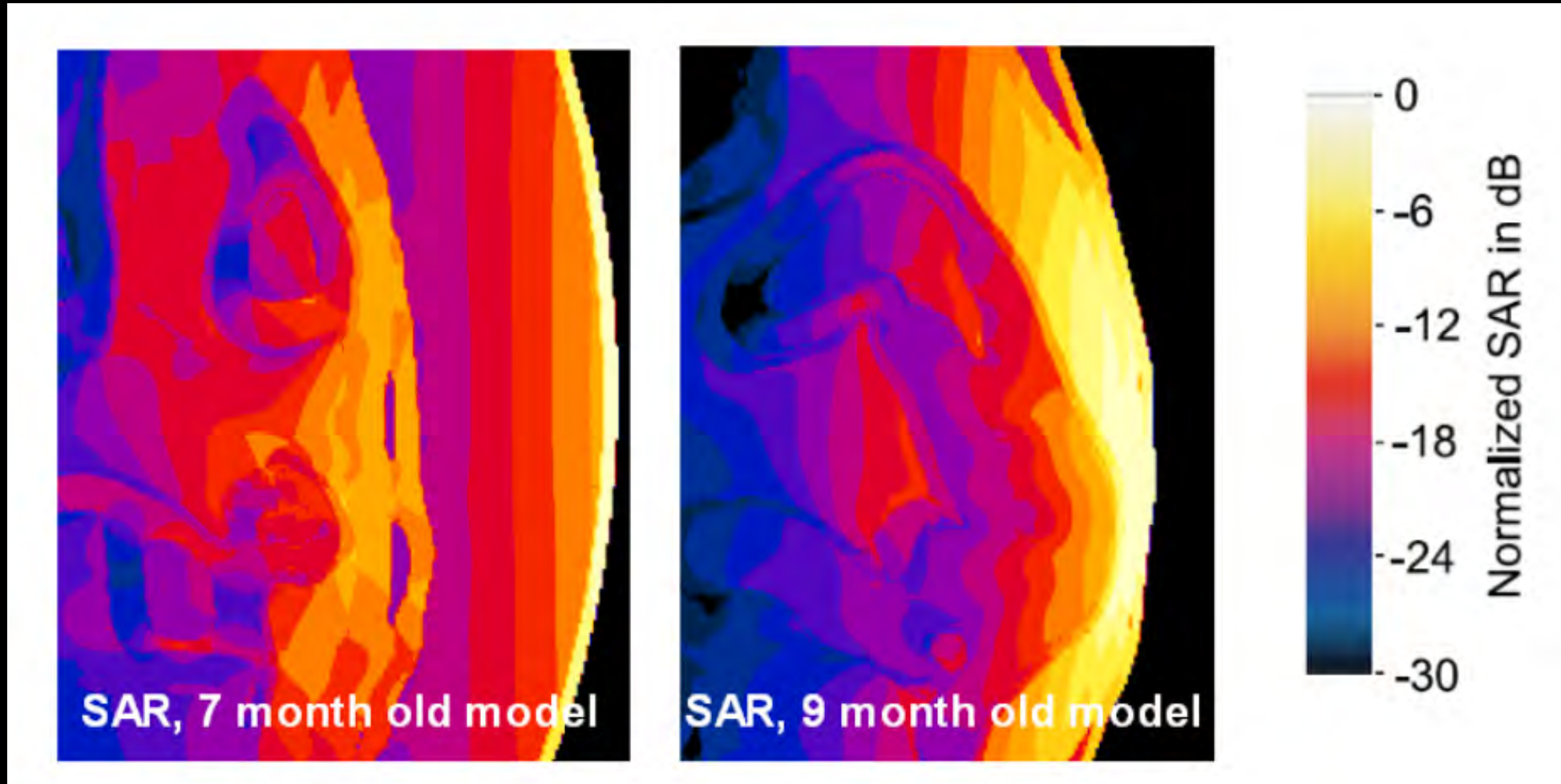


# Mobile Phone in Pocket Exposes Reproductive Organs and Bone Marrow



# Greatest exposure occurs to fetal head/spinal cord

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



*(courtesy Andreas Christ, IT'IS, 2013)*

# Cell phone radiation absorption in adult brain



# Relatively greater absorption into fast growing tissue



 ENVIRONMENTAL  
HEALTH TRUST

Fernandez et al. *IEEE Access* 2015

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



Best Baby Apps  
parents.com calls iPad 'best babysitter'

<https://www.youtube.com/watch?v=U2Rrb9-9NiQ>





GAZI UNIVERSITY



ATHENS UNIVERSITY



# Experimental Studies of Wireless Radiation Exposure Pregnancy in Rats & Rabbits

**Prof. Nesrin Seyhan**  
Chairman, Gazi University  
Faculty of Medicine  
Biophysics Department  
Ankara, Turkey

**EHT Conference**  
Convened In collaboration with Turkish  
Ministry of Health, Istanbul  
May, 2011

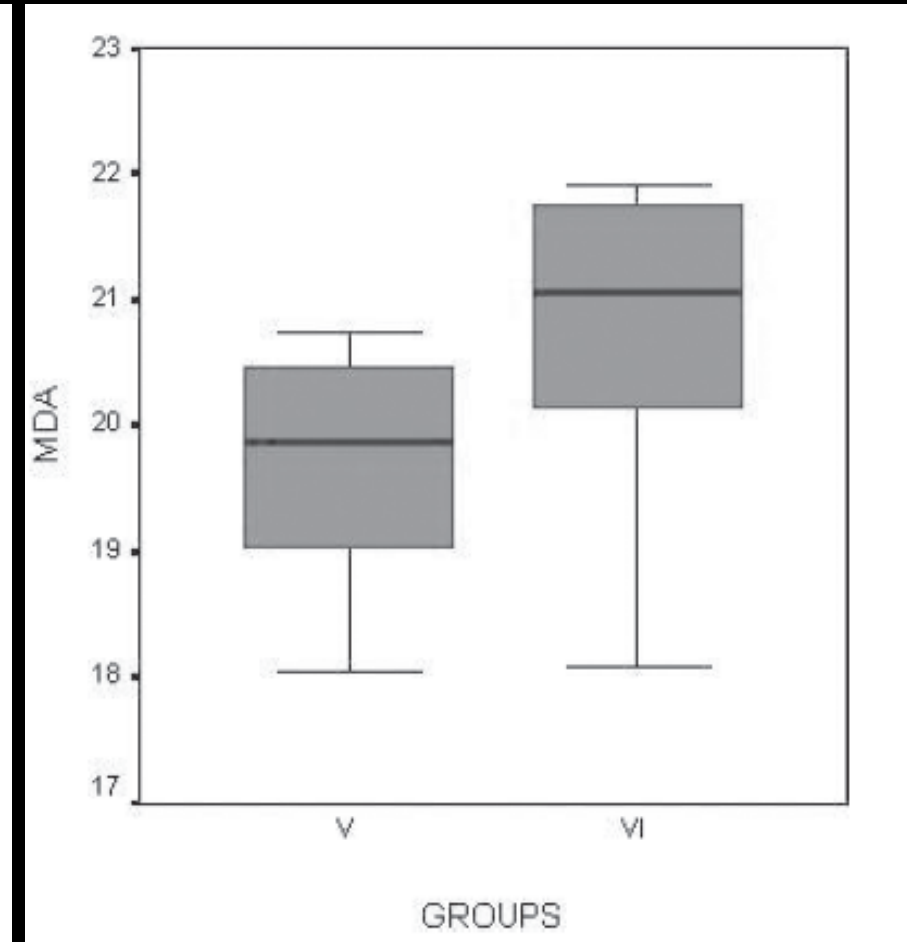
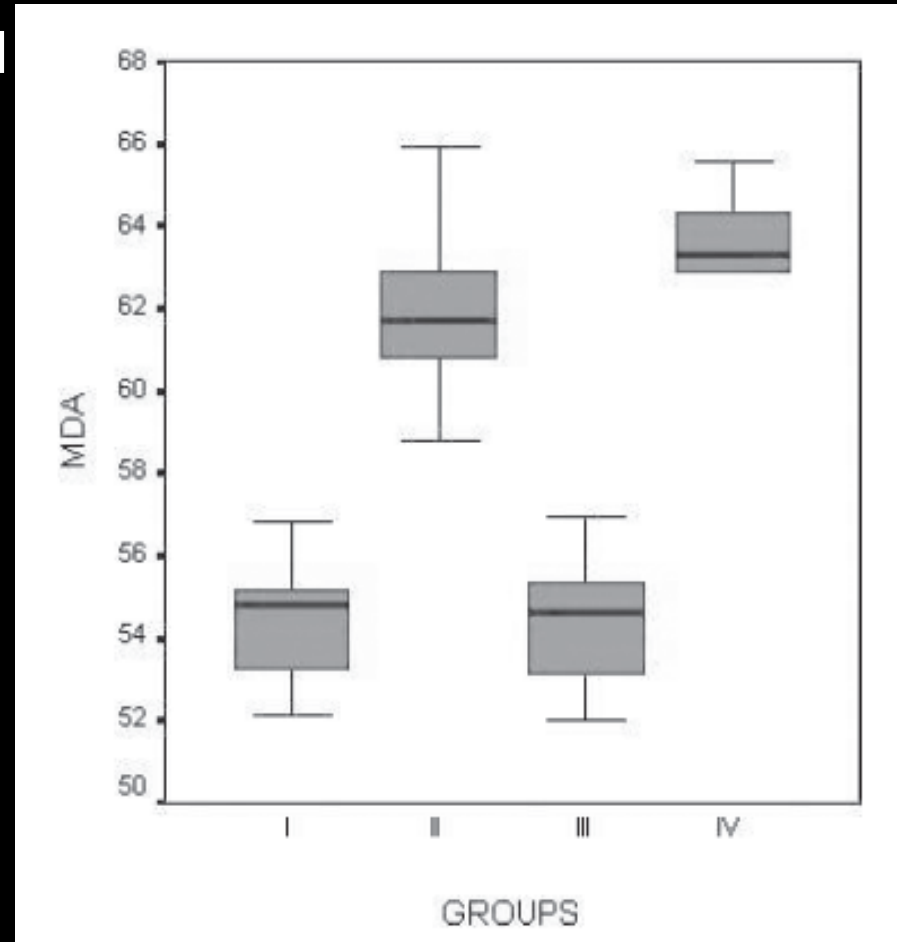
# Biomarker of cellular damage increased in prenatally exposed compared to control groups

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

Control Groups 1, III, and V show significantly less DNA damage than exposed

To wireless transmitting devices

- Changes in the liver Malondialdehyde (MDA, nmol/g tissue) level.
- All values are expressed as median (IQR) values.



# Prenatal exposure to microwave transmitting devices reduces brain & testes growth

Prof. Süleyman KAPLAN  
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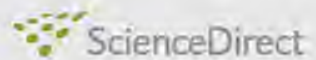


# Prenatal 900 MHz EMF exposure decreased hippocampal granular cell number in the dentate gyrus of newborn rats

BRAIN RESEARCH 1238 (2008) 224–229



available at [www.sciencedirect.com](http://www.sciencedirect.com)



[www.elsevier.com/locate/brainres](http://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<sup>☆</sup>

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<sup>b</sup>Department of Anatomy, Afyon Kocatepe University School of Medicine, Afyonkarahisar, Turkey

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### ARTICLE INFO

#### Article history:

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#### Keywords:

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Dentate gyrus

Granule cell

Stereology

Optical fractionator

Rat

### ABSTRACT

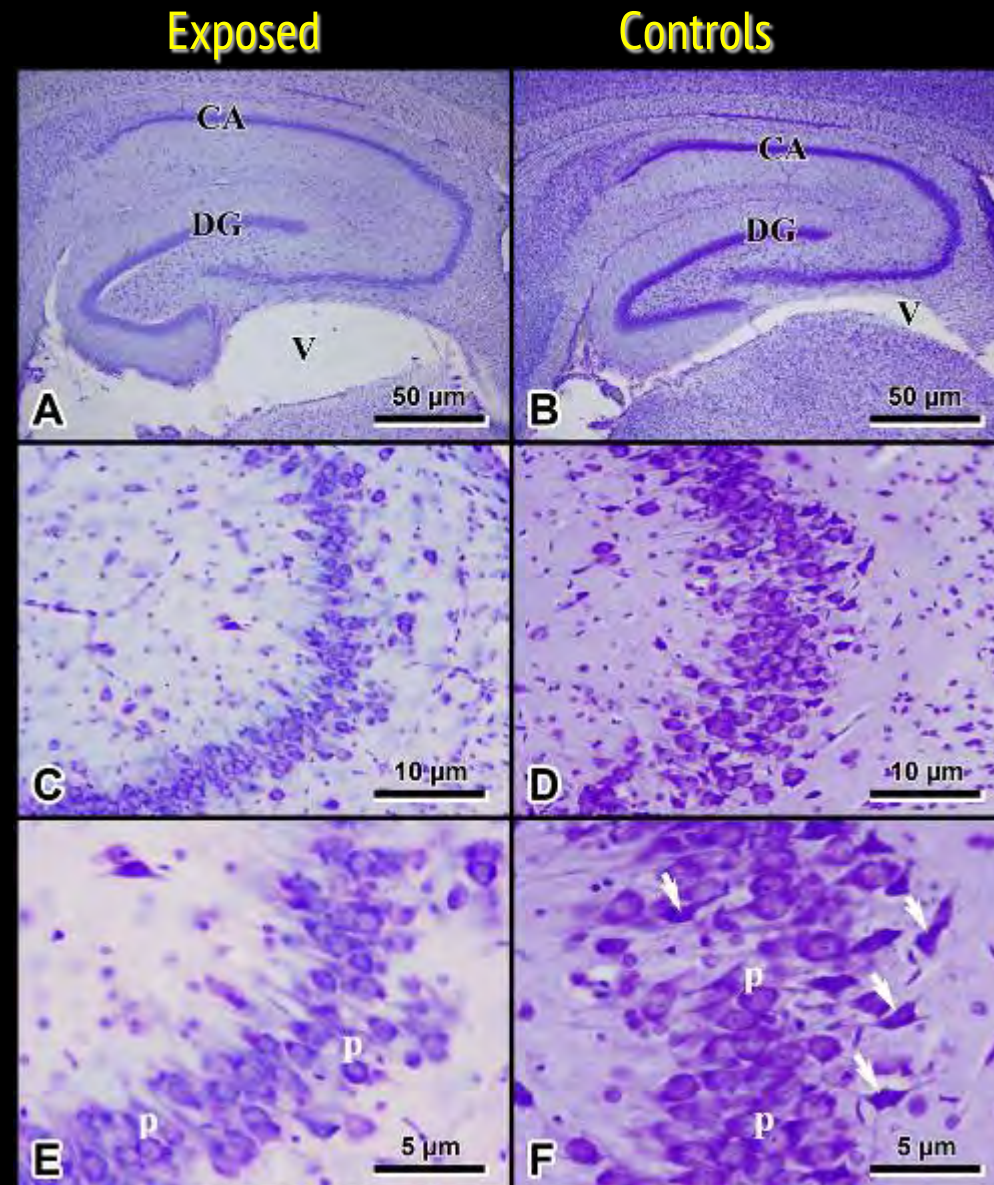
Electromagnetic fields (EMFs) inhibit the formation and differentiation of neural stem cells during embryonic development. In this study, the effects of prenatal exposure to EMF on the number of granule cells in the dentate gyrus of 4-week-old rats were investigated. This experiment used a control (Cont) 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.

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

## RESULTS:

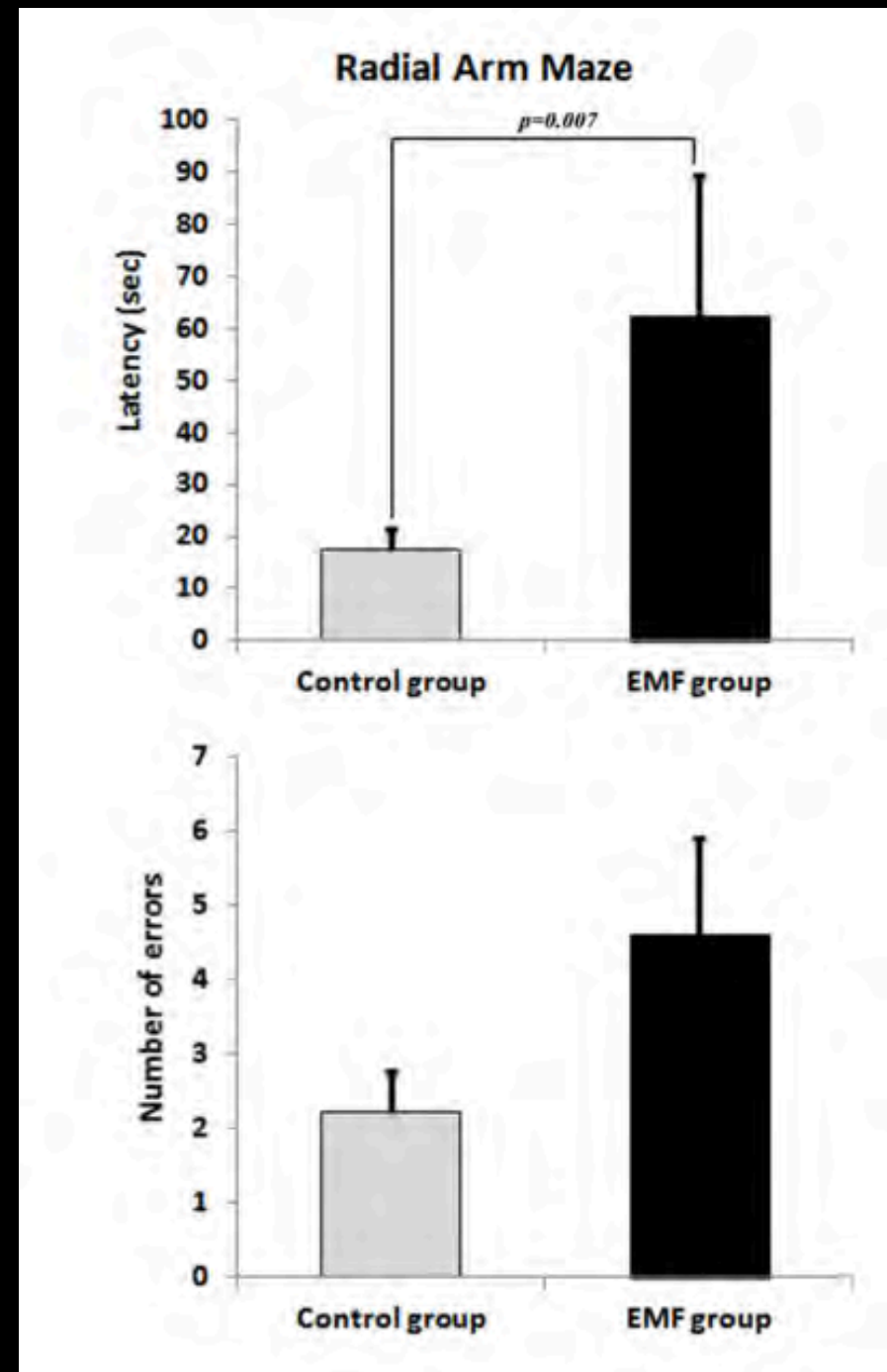
Prenatal exposure to wireless radiation damages cells of rat hippocampus –the thinking and memory Section of the brain (Odaci et al., 2008)



# Prenatally exposed newborns have impaired memory and learning

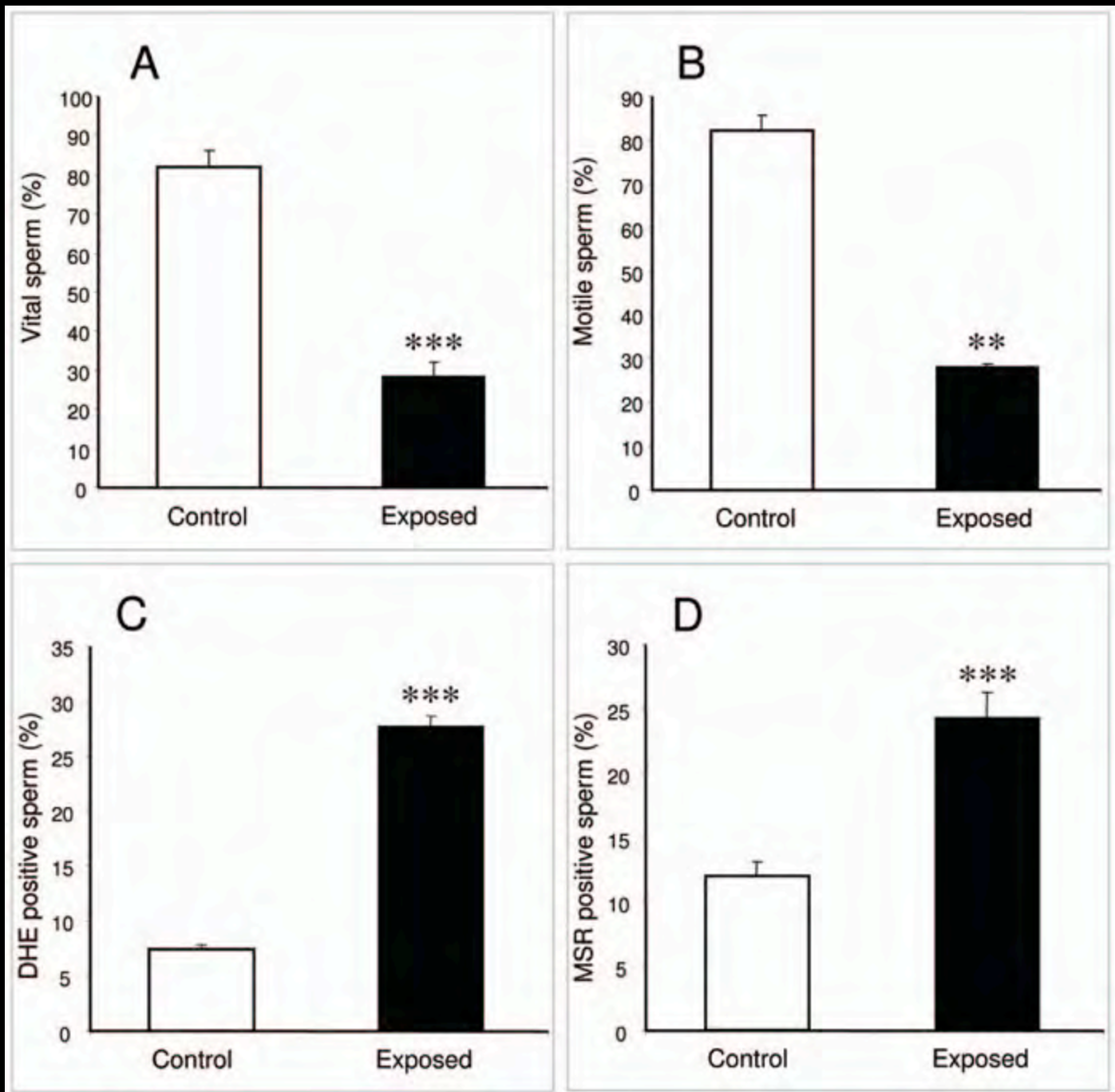
Figure 2. Radial arm maze test results from the newborn control and newborn electromagnetic field (EMF) groups.

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





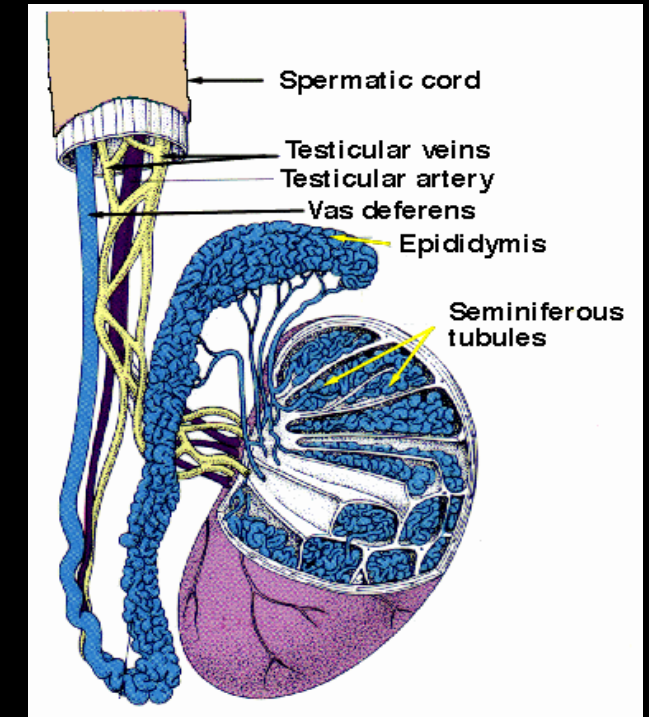
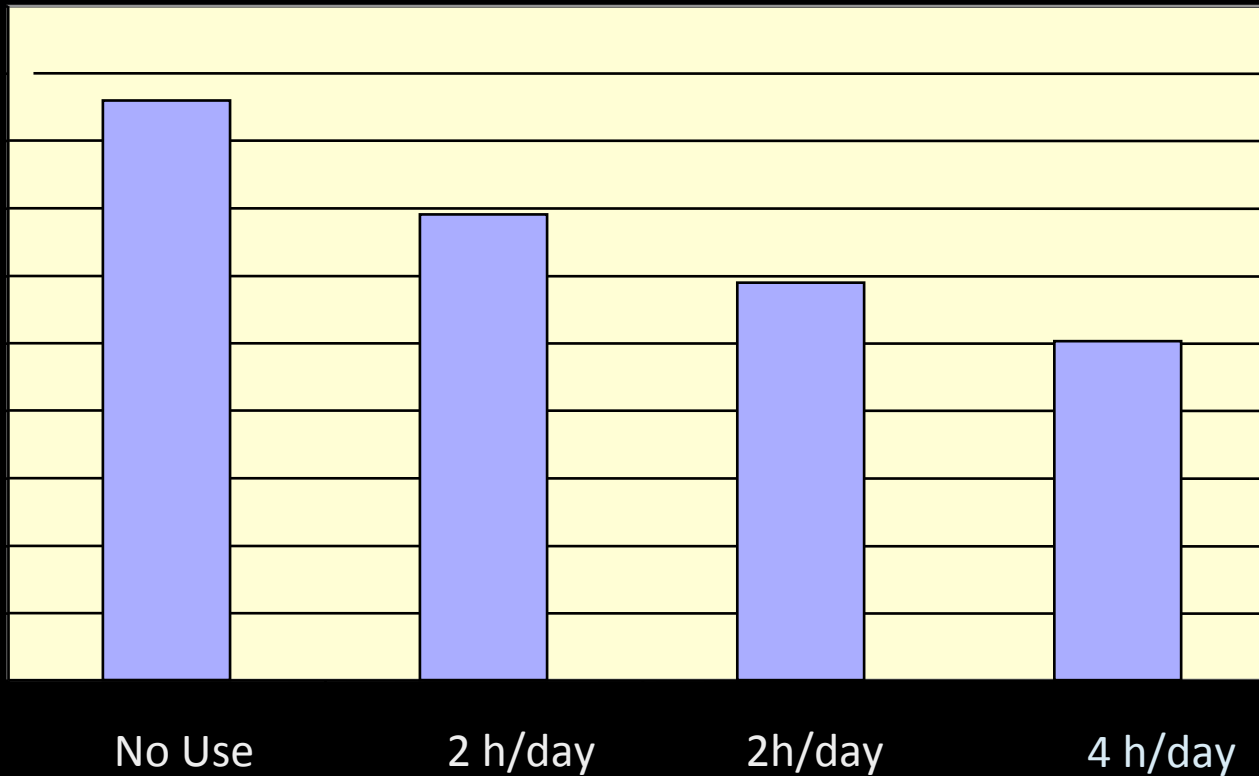
Experimental studies find mobile-phone exposed human sperm more damaged than controls



De Iuliis et al, 2009 with Laureate Professor John Aitken, Newcastle

# Heavier cell phone users have reduced sperm count

Sperm  
count



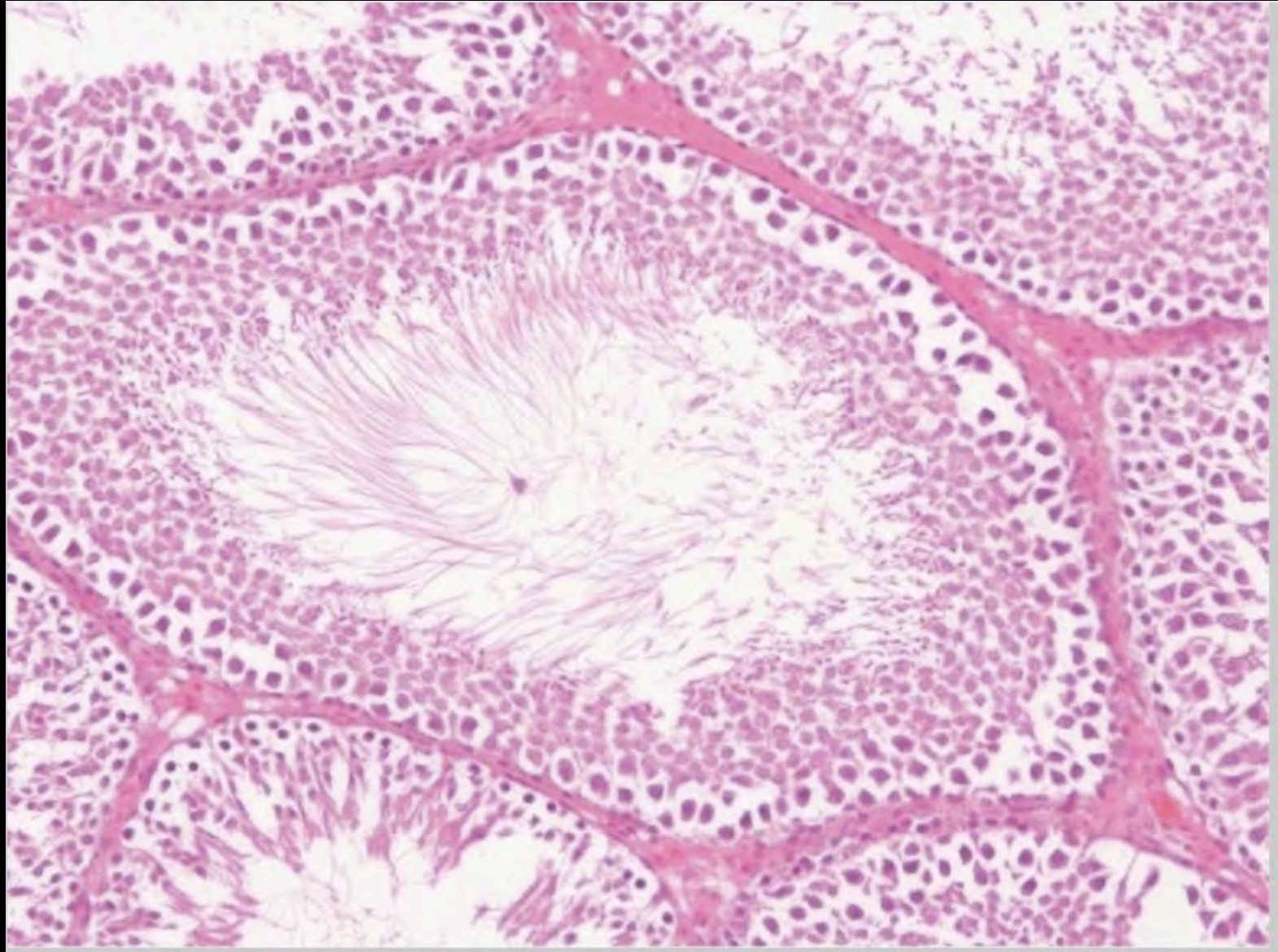
Ashok Agarwal MD PhD, Cleveland Clinic, 2008; and  
seven other studies

# Evidence for mobile phone radiation exposure effects on reproductive pattern of male rats: role of Reactive Oxygen Species

- 70 day old male rats exposed to cellphone radiation (middle-aged) 2 hours a day for 45 days
- Lower testosterone
- Increased enzyme tied with DNA damage (caspase-3)
- Overall lower fertility with offspring showing diminished male reproductive capacity

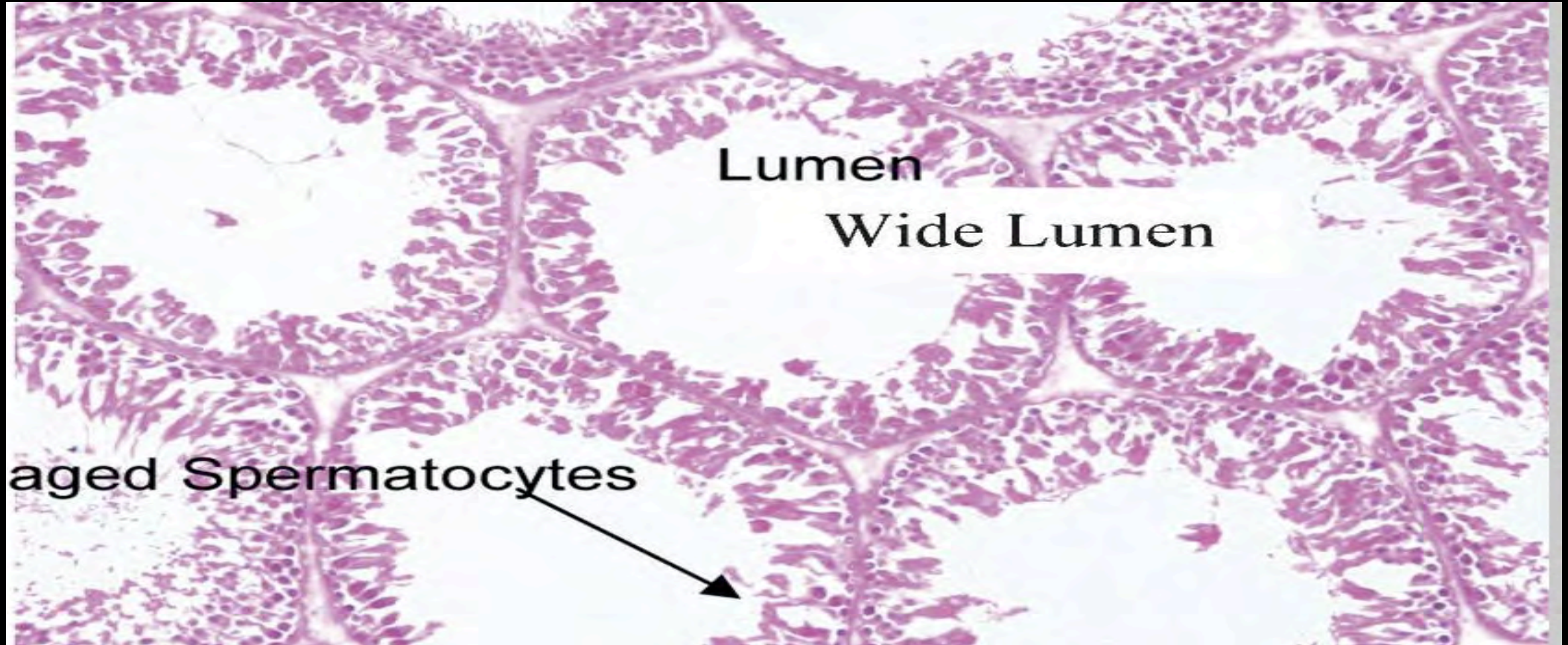
[Kesari KK<sup>1</sup>](#), [Behari J.](#) 2012

# Normal testes





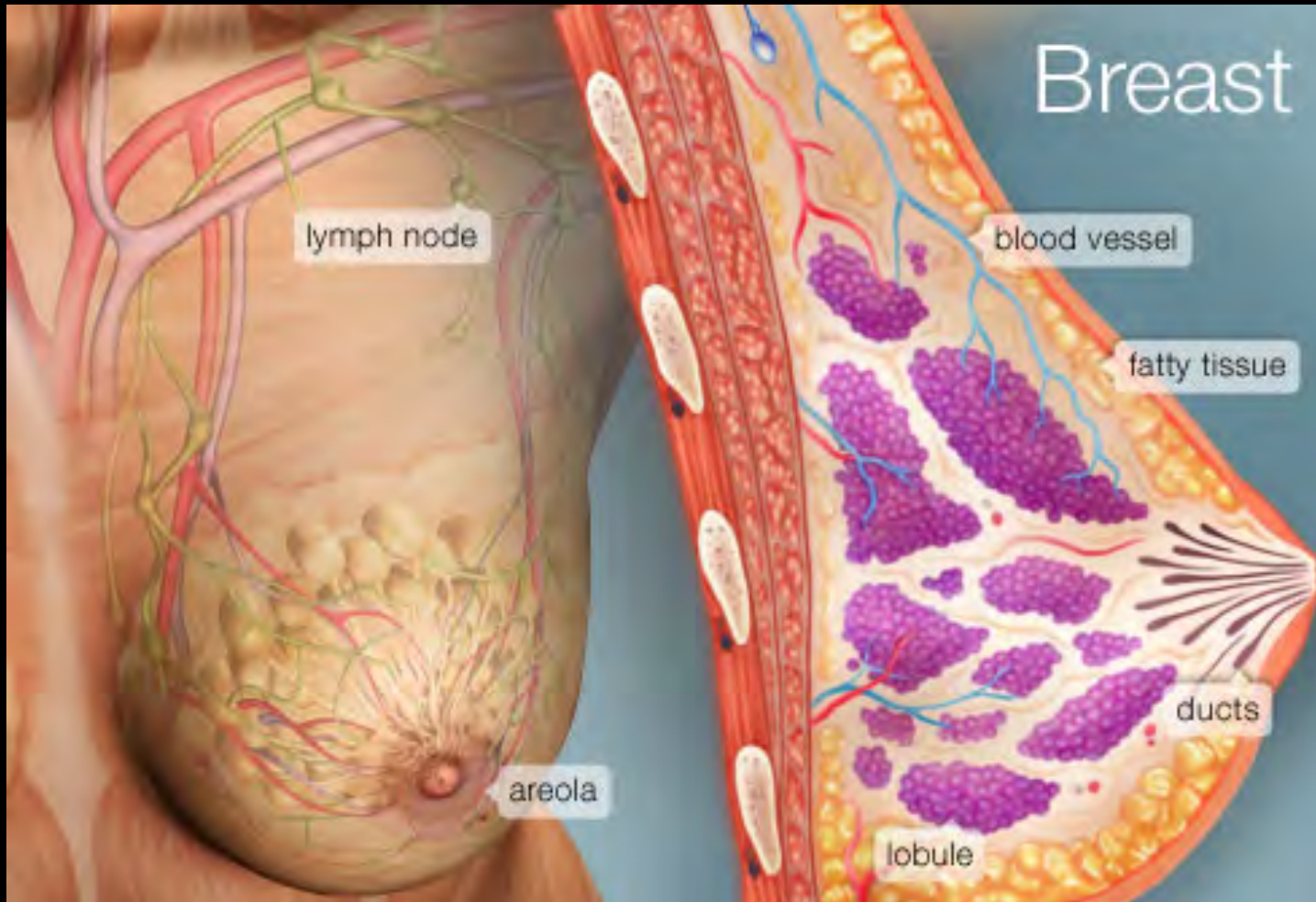
# Damaged testes after cell phone exposure



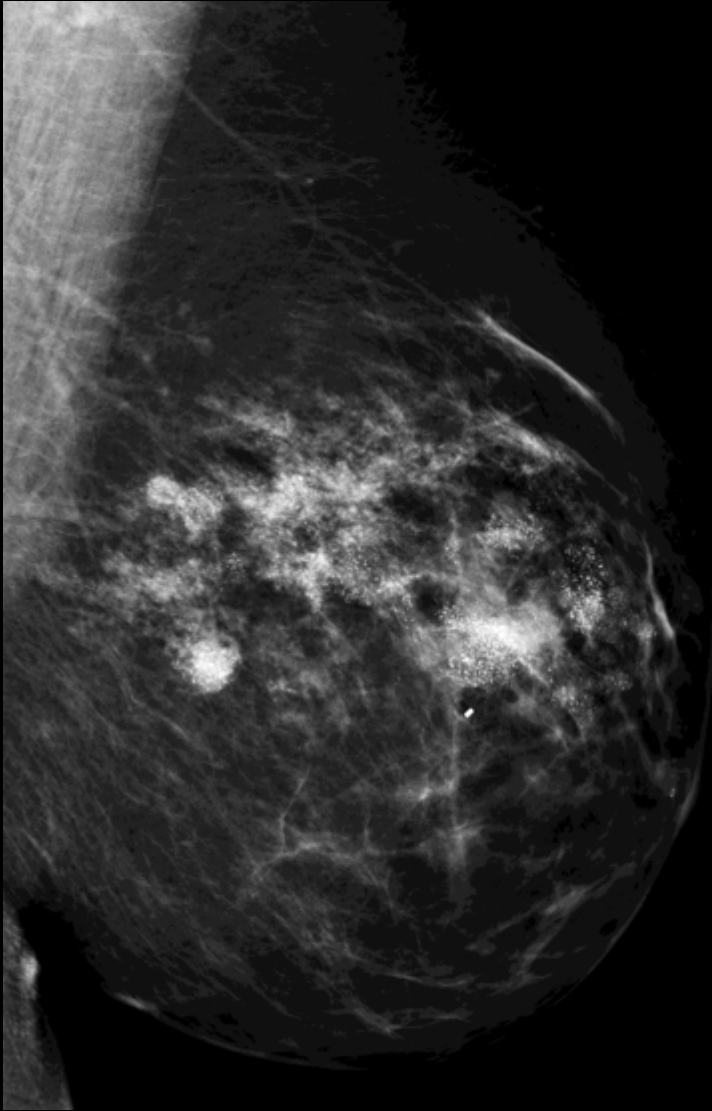


# Fat and fluid cook in microwave oven

## Breast = chiefly adipose and fluid



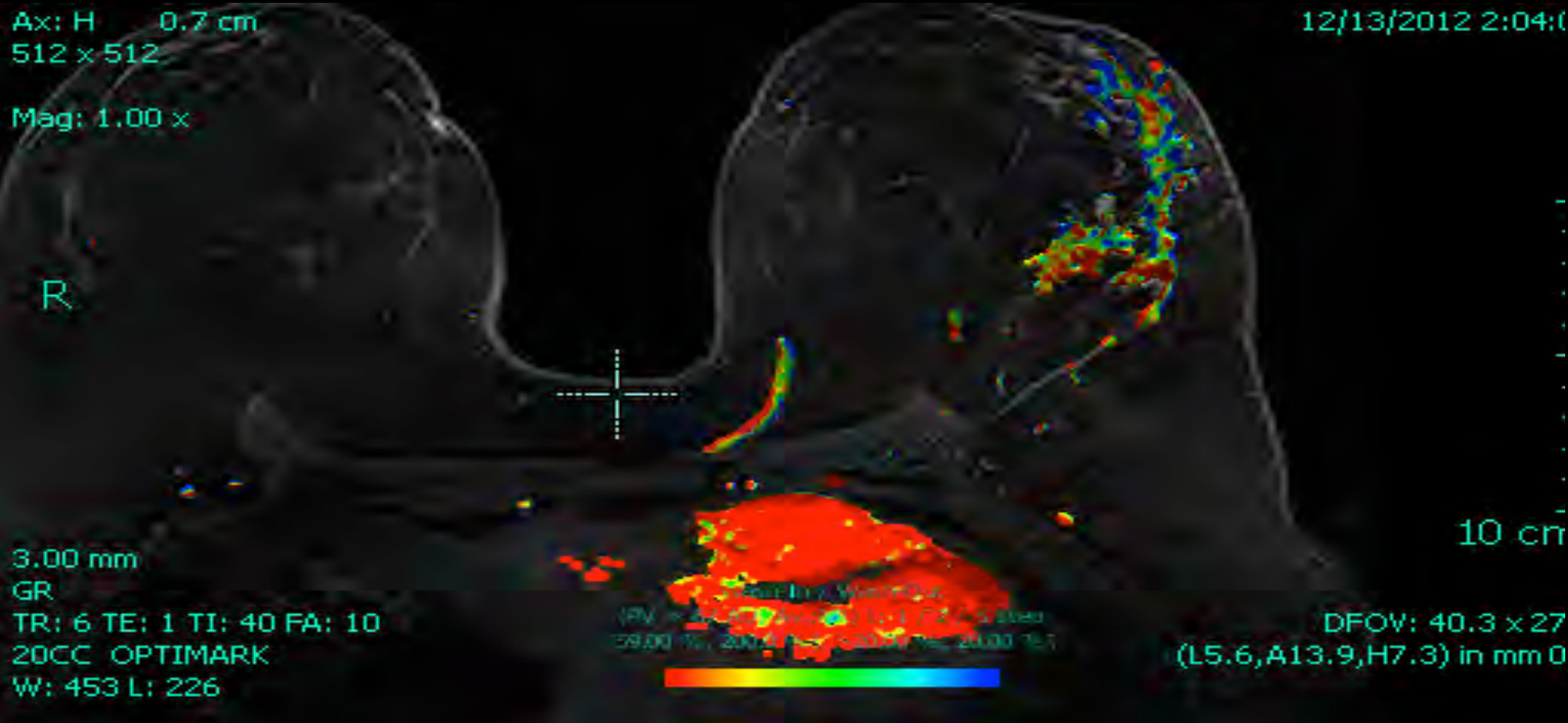
# Caveat - first case report, 2009



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*

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



# Summary of 38+ Cases

- Negative for BRCA1/2—NO known genetic risks
- No family history or other risk factors
- Multi-focal tumors occur directly under phone antennas 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 metastases at young ages

# Yale University studies report prenatally exposed mice do not develop normal brains or behavior

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

Tamir S. Aldad, Geliang Gan ,Xiao-Bing Gao and Hugh S. Taylor  
(slides courtesy of Prof. Taylor)

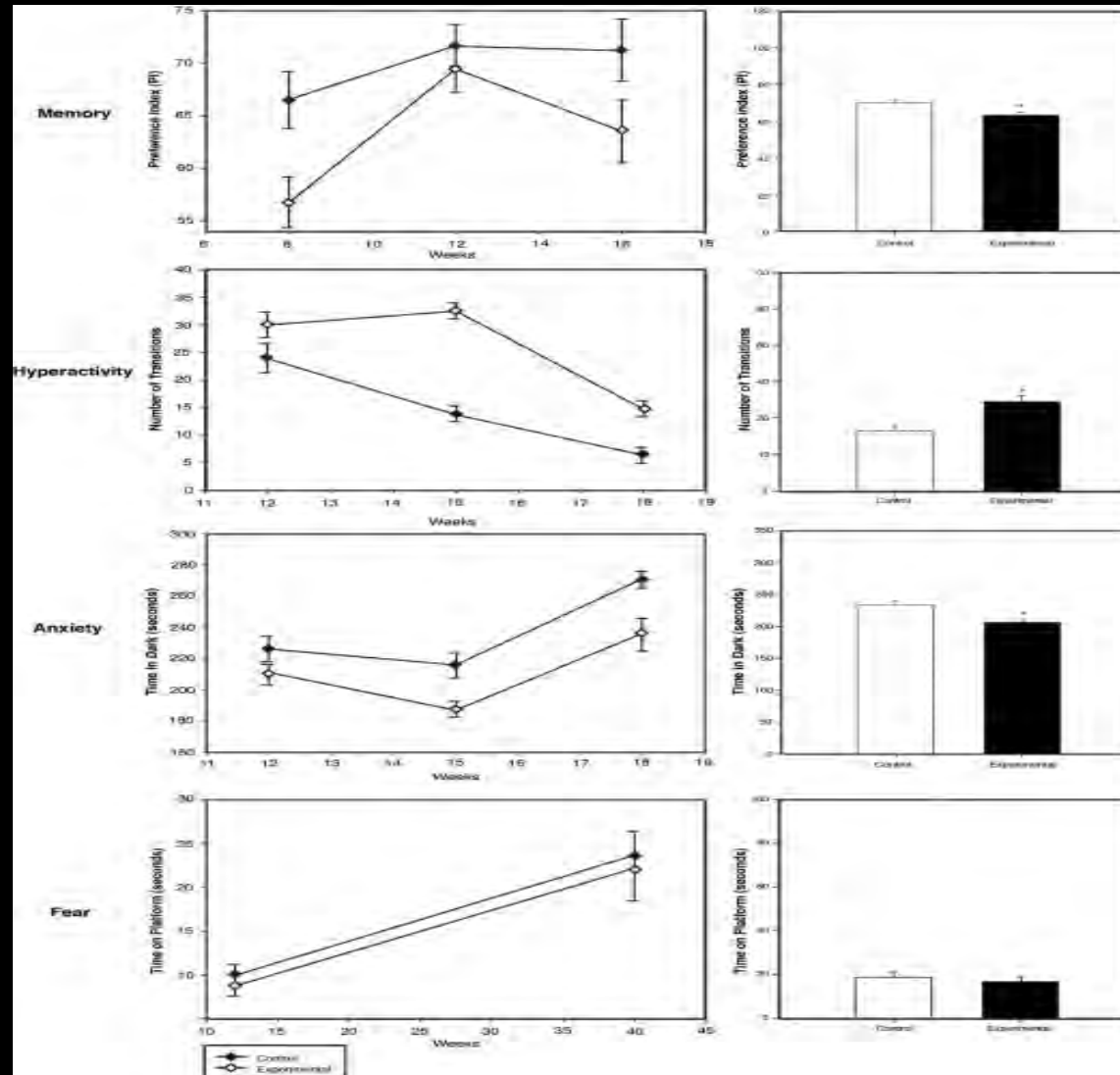
# Prenatal RF-Exposure causes significant behavioral impacts in adults

Memory

Hyperactivity

Anxiety

Fear





# IARC RF working group: Press conference May 30, 2011, Lyon, France

- **Committee Chair Jonathan Samet:** "the evidence, while still accumulating, is strong enough to support a conclusion and the 2B classification. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."
- **IARC Director Christopher Wild:** "it is important that additional research be conducted into the long-term, heavy use of mobile phones. Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting."

# Cell phone radiation a “Human Carcinogen”

International Agency for Research on Cancer of the World Health Organization,  
2011: declared cell phone and other wireless radiation:

***“Possible Human Carcinogen”***

EHT Experts, 2013

***“Probable Human Carcinogen”***

International Journal of Oncology



# Increased Glioma risk 3 found in all case-control studies published since IARC 2011

	Interphone (2010)	Interphone (App. 2) (2010)	Hardell (2013)	CERENAT (2014)
1640+ hours	1.40*	1.82*	1.75*	2.89* (896+ hrs)
10+ yrs	0.98	2.18*	1.79*	1.61
20+			4-8*	3+

\*those beginning to use phones as teens have greatest risks

# Atomic Bombs Japan, 1945



No increase in brain tumors was found in survivors

*until 40 years later*

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



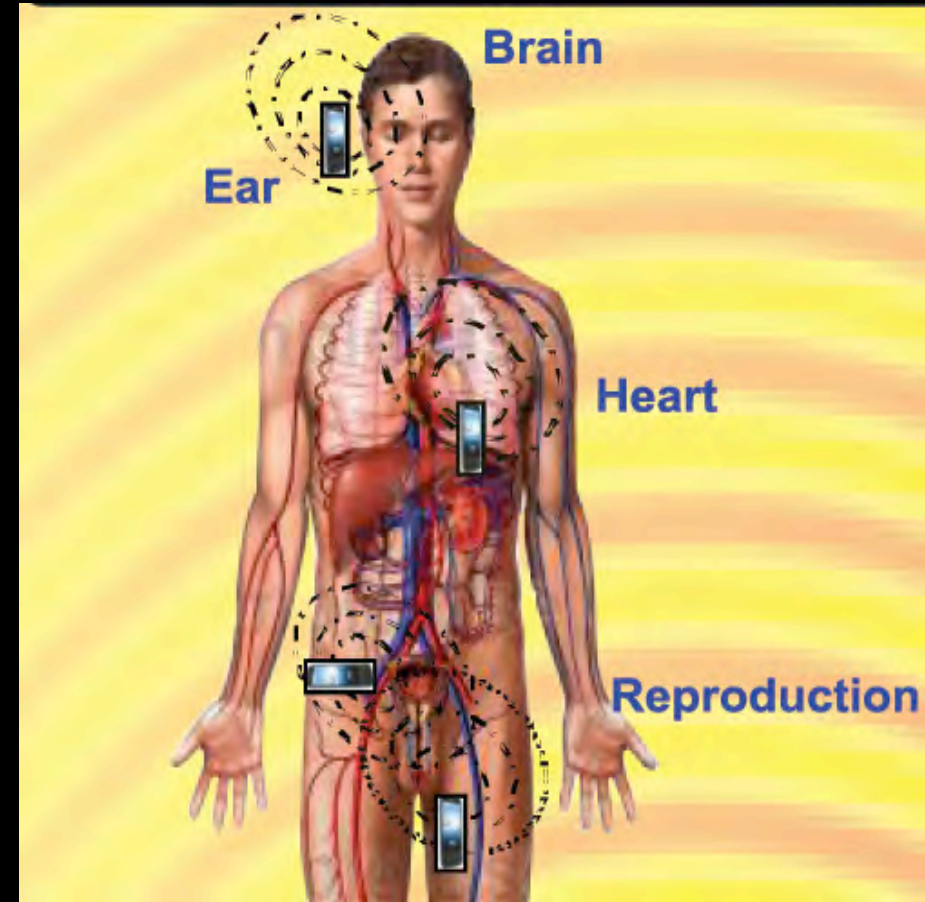
until after at least ten years of heavy use



# Radio Frequency Radiation and Human Health: Technical Studies from India



**Dr. R. S. Sharma**  
**Sr. Deputy Director General & Scientist-G**  
**Division of RCH**  
**Indian Council of Medical Research**  
**New Delhi – 110 029**

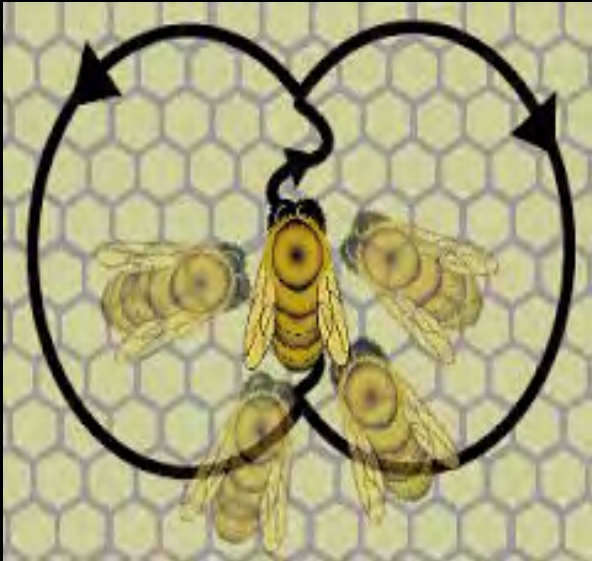


# Decoding the language of the Honey Bees

Nobel Lecture, December 12, 1973

Karl Von Frisch

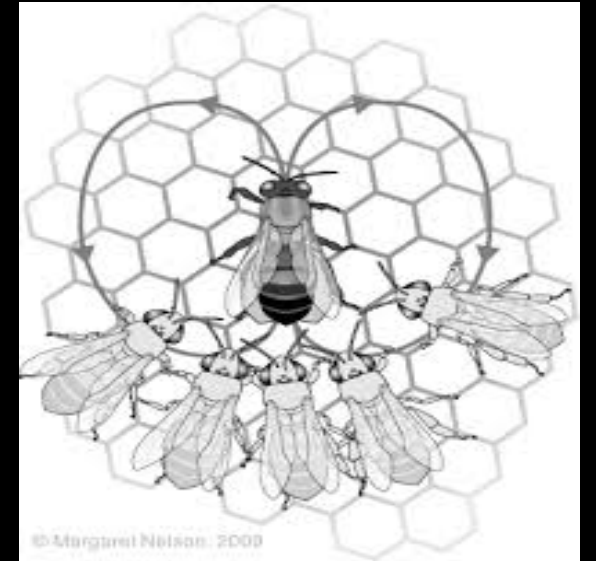
University of Munich, Federal Republic of Germany



**Waggle Dance**

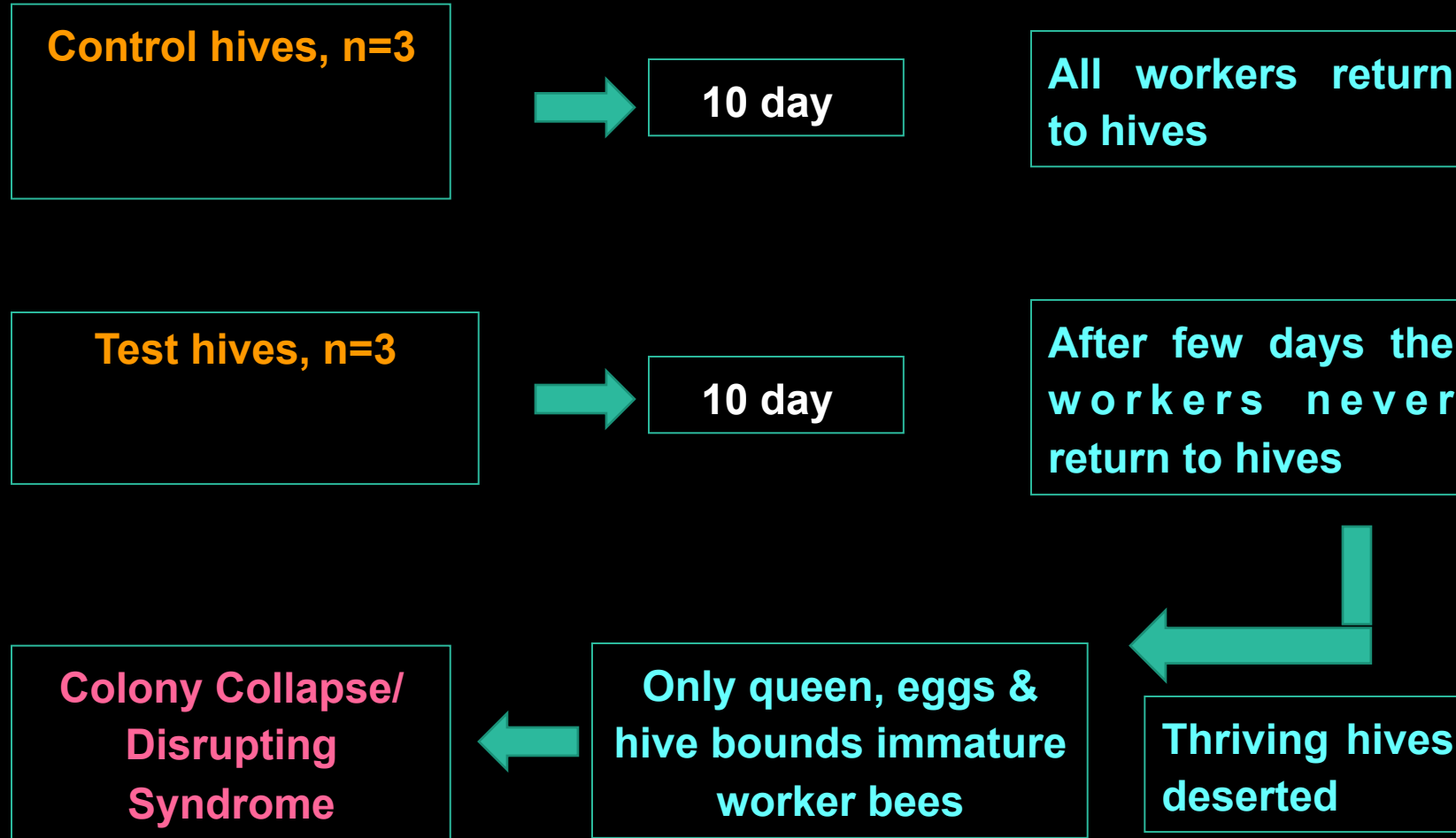


**Shaking Dance**



**Tremble Dance**

# Electromagnetic radiation (EMR) damages Honey Bees (Sainudeen, 2011)



# Wireless Repels Honey Bees

After 10 minutes of cell phone radiation, daily for 10 days worker bees did not return to test colonies.



3 Hives Exposed



3 Hives Controls



# Why so many inconsistent results?

- It is truly complicated
- Different cells studied, i.e., adult lymphocytes compared to neuronal stem cells
- Different exposures used (CW/Digital)
- Sponsored research can induce publication bias, i.e., most industry sponsored research finds no effect and while independent research finds an effect (Lai et al, 2008)
- Secret Industry memo in 1994 to conduct “war-games” to discredit the scientists and the science

# Policy Responses

- Right to Know Laws & Policies
  - Labeling
  - Headsets Provided with all phones
- Changes in Hardware/Antennae
- Changes in Software/OS
- Challenges to Evidentiary Burden of Proof
  - Daubert
  - Frye

# What is to be done?

- Standardized metrics for evaluating personal exposures (OGC)
- Opportunistic cross-sectional surveys
  - Memory
  - Reaction time/accuracy
  - Reproductive health
- Promoting wired school programs with mobile tablet banks
- Public educational programs sharing 'fine print' advisories
  - Parents
  - Teachers
  - Health professionals

# May 2010 French House of Deputies and Senate Chamber passed law

- Bans on advertising to young children
- All cell phones sold with ear pieces
- Labeling of SAR on phone
- Restrictions for childrens' use
- Warnings for all users overall to reduce direct radiofrequency
- Radiation to the brain

FRANCE, DECEMBER 2008



# India

2012 Exposure Limits lowered to 1/10 of ICNIRP SAR labeling mandated on phones.

- Official Guidelines For Cell Phone Use
- Use Headsets or Speakerphones
- Limit cell use and choose landlines
- Increase distance from devices



EMF Webpage of Ministry of Communications and Information Technology educates the public to reduce cell phone radiation exposure in detail.

2013: Indian Supreme Court upheld Rajasthan State Court decision to remove all cell towers from the vicinity of schools, hospitals and playgrounds because of radiation “hazardous to life.”

# Israel has national institute on non-ionizing radiation



- No Wi-Fi in kindergarten
- Prefer wired over wireless in schools
- All phones come with headsets and information about safety
- No advertising with children

# Belgium Law Implemented 2014



- No phones designed or sold for children under age 7
- All handsets sold with headsets
- Safety Information Readily available
- SAR publicly accessible wherever mobile phones are sold as well as on the Internet
- Children's mobile phones may no longer be sold. Besides this, the specific absorption rate (SAR) has to be listed for every mobile phone at the point of sale.
- As of 1 March 2014, the sale of mobile phones that have been specially manufactured for young children (under 7s) will be prohibited.



# Canada

Health Canada's Official "Practical Advice" on reducing exposure to wireless radiation.

1. Limit the length of cell phone calls,
2. Replace cell phone calls with text, use "hands-free" devices and
3. Encourage children under the age of 18 to limit their cell phone usage

2015: National Bill 648: *An Act Respecting the Prevention of Potential Health Risks From Radiofrequency Electromagnetic Radiation*"

2015: Canadian Parliament Report "Radio Frequency EMF and the Health of Canadians" 12 recommendations

- Awareness campaign on cell phones and Wi-Fi
- Policy measures on the marketing to children
- Funding for research.



# Canadian Parliamentary Health Committee urges that test system be updated & public educated about risks

- Based on flawed modeling of total head absorption and inaccurate analyses using homogenous liquid (Morris et al, 2015, IEEE/Access in press)
- Does not take into account
  - Dose at the target tissue of **brain**
  - Developmental immaturity of **young brain**
  - Non-thermal biological impacts
  - Impacts on pregnancy, sperm and nervous system
  - Proliferation of apps for infants and toddlers
  - microwave radiation is now a "serious public health issue" June 18, 2015



# US. District Court ruling 2014

*“If there is even a reasonable possibility that cell phone radiation is carcinogenic, the time for action in the public health and regulatory sectors is upon us. Even though the financial and social cost of restricting such devices would be significant, those costs pale in comparison to the cost in human lives from doing nothing, only to discover thirty or forty years from now that the early signs were pointing in the right direction. If the probability of carcinogenicity is low, but the magnitude of the potential harm is high, good public policy dictates that the risk should not be ignored.”*

# Cell Phone Right To Know Ordinance

Unanimously passed by City of Berkeley California defended by Harvard Law Professor Lawrence Lessig and Yale Law Dean Robert Post

**May 2015: requires cell phone retailers provide a fact sheet**

*"The City of Berkeley requires that you be provided the following notice:  
To assure safety, the Federal Government requires that cell phones meet radio frequency (RF) exposure guidelines. If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation. Refer to the instructions in your phone or user manual for information about how to use your phone safely."*

# showthefineprint.org



**Body-worn SAR testing has been carried out at a separation distance of 1.0 cm. To meet RF exposure guidelines during body-worn operation, the device should be positioned at least this distance away from the body.**

Yes, it actually says this in the Galaxy S5 user manual under SAR Value.

[FIND YOUR PHONE](#)

## SHOW US THE FINE PRINT.

# Baby Safe Project Underway Globally to Promote Precautions During Pregnancy

“As a research scientist and physician...I am deeply concerned about the growing exposure to cell phone and other wireless radiation”

Hugh Taylor, MD PhD  
Chief Yale- New Haven Hospital







# VODAFONE

FORM 20-F

(Annual and Transition Report (foreign private issuer))

Filed 06/10/14 for the Period Ending 03/31/14

**“Principal Risks Factors and Uncertainties # 7: Our business may be impacted by actual or perceived health risks associated with the transmission of radio waves from mobile telephones, transmitters and associated equipment.**

Risk: Concerns have been expressed that electromagnetic signals emitted by mobile telephone handsets and base stations may pose health risks. Authorities including the World Health Organization (‘WHO’) agree there is no evidence that convinces experts that exposure to radio frequency fields from mobile devices and base stations operated within guideline limits has any adverse health effects.

**A change to this view could result in a range of impacts from a change to national legislation, to a major reduction in mobile phone usage or to major litigation.”**



## China Mobile Limited

UNITED STATES  
SECURITIES AND EXCHANGE COMMISSION  
FORM 20-F 2014

***“Actual or perceived health risks associated with the use of mobile devices could materially impair our ability to retain and attract customers, reduce wireless telecommunications usage or result in litigation.”***

**“...we cannot be certain that future studies, irrespective of their relative reliability or trustworthiness, will not impute a link between electromagnetic fields and adverse health effects.”**

“Research into these issues is ongoing by government agencies, international health organizations and other scientific bodies in order to develop a better scientific understanding and public awareness of these issues...”



# AT&T

## 2014 Annual Report

**“Unfavorable litigation or governmental investigation results could require us to pay significant amounts...”**

As we deploy newer technologies, especially in the wireless area, we also face current and potential litigation relating to alleged adverse health effects on customers or employees who use such technologies including, for example, wireless handsets.

We may incur significant expenses defending such suits or government charges and may be required to pay amounts or otherwise change our operations in ways that could materially adversely affect our operations or financial results.”

# Would you give two cents?\*

\*Monthly fee on all devices, users, IP providers to support:

- Cross-disciplinary training programs in bioelectromagnetics for engineers, docs & computer scientists
- Identify data gaps and R & D needs re hardware/software reconfigs & research priorities
- Monitoring of special populations similar to drug surveillance for biological impacts of mobile phones and wireless,
  - hearing, memory, reaction time, insomnia, & other behavioral endpoints
  - Sperm count & other measures of reproductive health

# So how can you minimise exposure?

- Avoid carrying your mobile phone on your body (e.g. in a pocket or bra)
- Avoid holding any mobile phone against your body when in use (i.e. against your head)
- Use your mobile phone on loud speaker or with an “air tube” headset
- Put your mobile phone on ‘airplane mode’ when not in use
- Avoid using your mobile phone in cars, trains or elevators
- Keep mobile phones away from you when you are asleep (out of the bedroom)



# Materials used with permission- thank you!

- Ashok Agarwal MD PhD, *Cleveland Clinic*
- John Aitken, MD, Laureate Prof. and Pro Vice-Chancellor, Newcastle
- Frank Clegg, former President Microsoft Canada
- Alvaro De Salles, Claudio Fernandez, Brazilian Federal Universities, Rio Grande de Sul
- Joel Moskowitz, PhD, *University of California Berkeley*
- Nesrin Seyhan, Suleyman Kaplan, Gazi and Ondokuz Mayıs Universities
- Robert Nagourney MD PhD, *Rational Therapeutics*, John West MD, *Orange County Breast Center*
- Lisa Bailey MD, *former President American Cancer Society/California, breast surgeon*
- Lloyd Morgan, BSEE, Robert Morris, MD, PhD, *Environmental Health Trust*
- R.S. Sharma, MD, PhD India Council of Medical Research
- Hugh Taylor MD PhD, *Yale University*
- *Lukas Margaritis, MD University of Athens*

The world is not dangerous because of those  
who do harm, but because of those who look at  
it without doing anything  
-Albert Einstein

# Questions?

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eh

Mobile Phones & Wi-Fi  
Devices Emit Pulsed Microwave  
Radiation



# Slides for discussion



## Scientific Collaborators

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# Digital Dementia Diagnosed in South Korean Children

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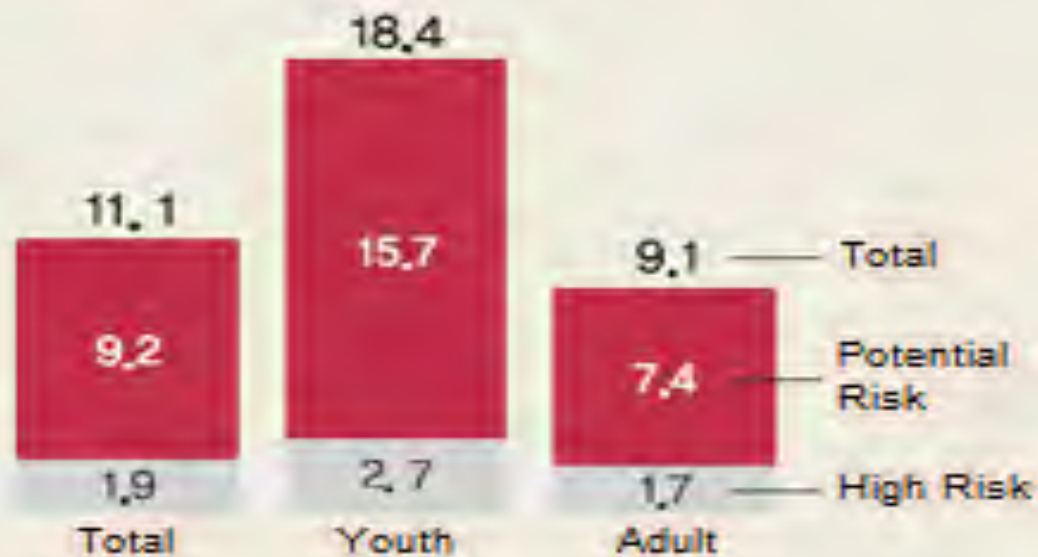


Dr. Byun Gi-Won a cognitive expert from the Balance Brain Center in Seoul, South Korea states, “Young People who are heavy technology users are likely to have a properly developed left hemisphere of the brain while the right hemisphere will be unused and underdeveloped.”

# Korean government studies on digital addiction and dementia

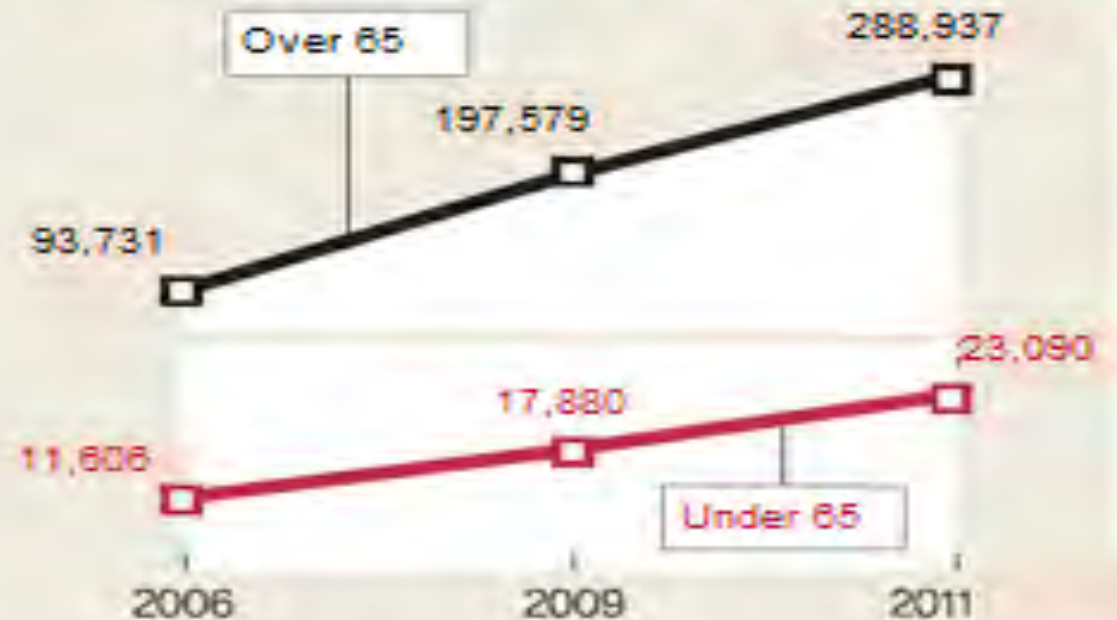
### 2012 Smartphone Addiction Rate

(Unit: %, Age 10~49 surveyed)



Source: Ministry of Science, ICT and Future Planning

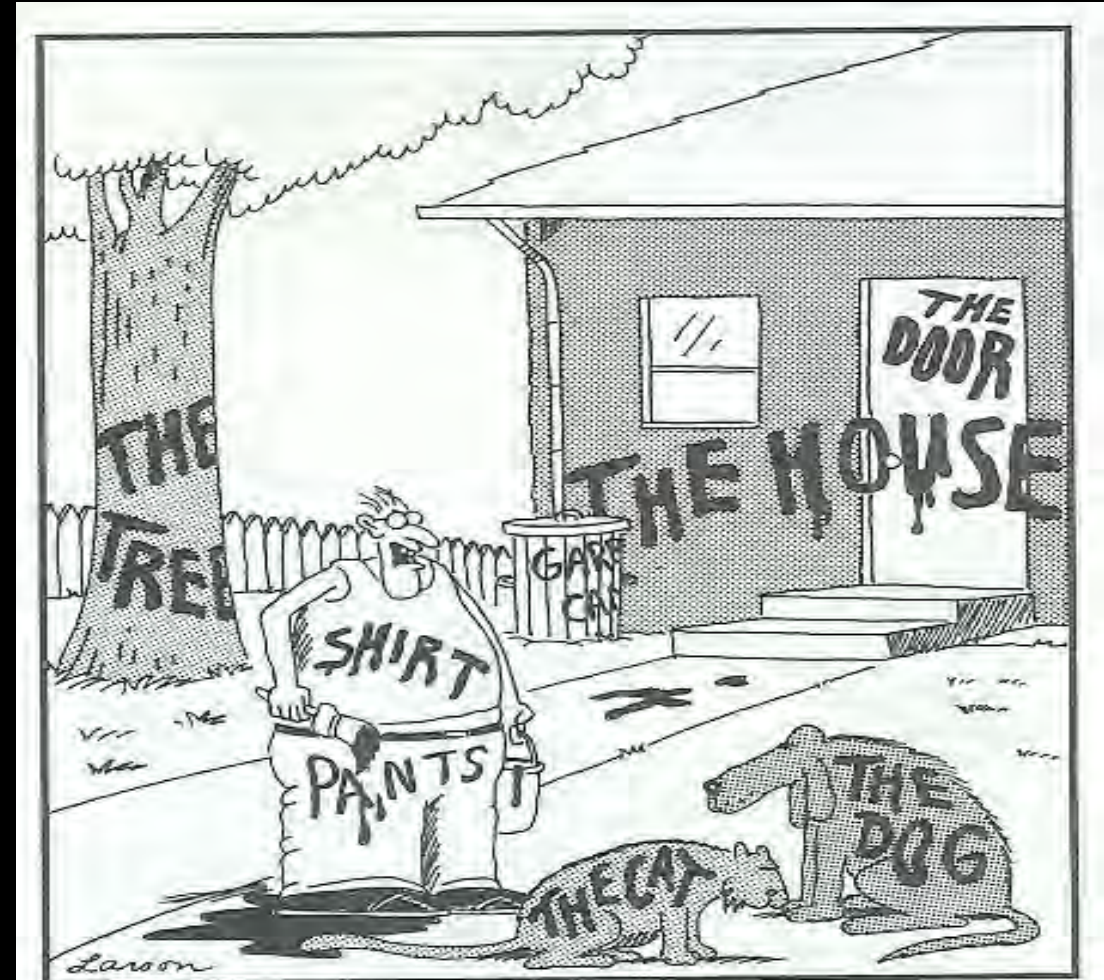
### Change in # of Dementia Patients (Unit: Person)



Source: National Health Insurance Services

# operability now!

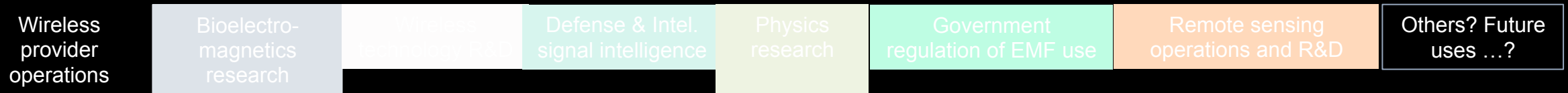
Time to agree on a commonly used and widely *blessed* vocabulary and grammar for EMF!



“Now! ... That should clear up a few things around here!”

# We lack uniform standards for measuring Electromagnetic Fields (EMF)

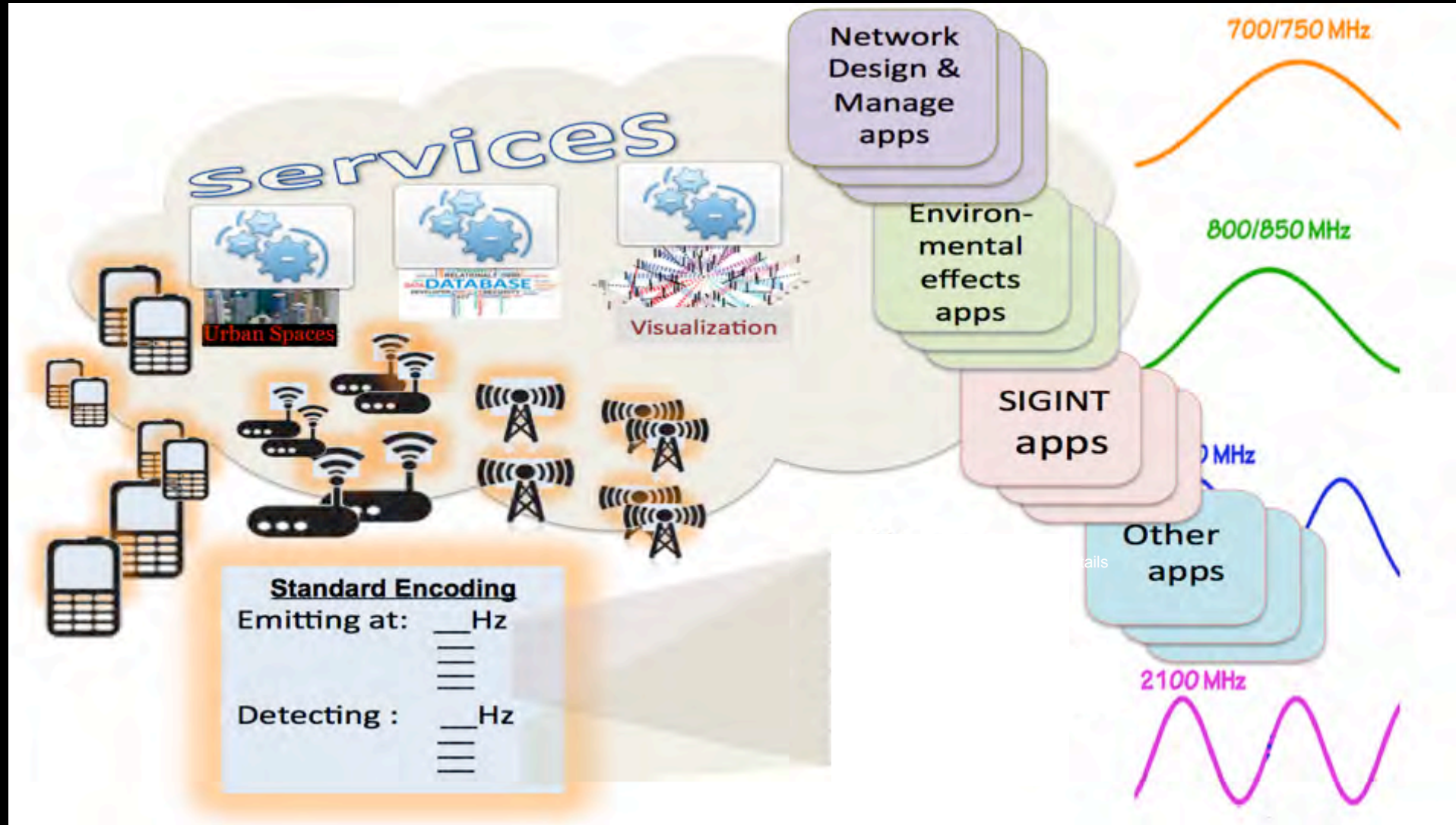
1. Radio frequency spectrum is a limited (though instantly renewable) natural resource essential to modern civilization, yet there is no common language to describe it!
2. Many domains need to record and process data about real world EMF emissions and measurements.



3. Data *communication* requires standards.
  - Open standards maximize opportunities for communication between systems. A standard data model provides a basis for standard interfaces and/or Semantic Web best practices.
  - A standard data model supports efficient publishing, discovery, assessment, access, aggregation and use of data.
4. A standard data model provides a template for rigorous and useful data collection and aggregation. In research, this enables comparison, verification, averaging of results, longitudinal studies, cross-disciplinary studies etc.
5. Open standards create opportunities for innovation and new markets. Convergence of digital and wireless is still new, still ripe for innovation.



# An open standard would open up opportunities for cloud analytics and apps





# Open Geospatial Consortium

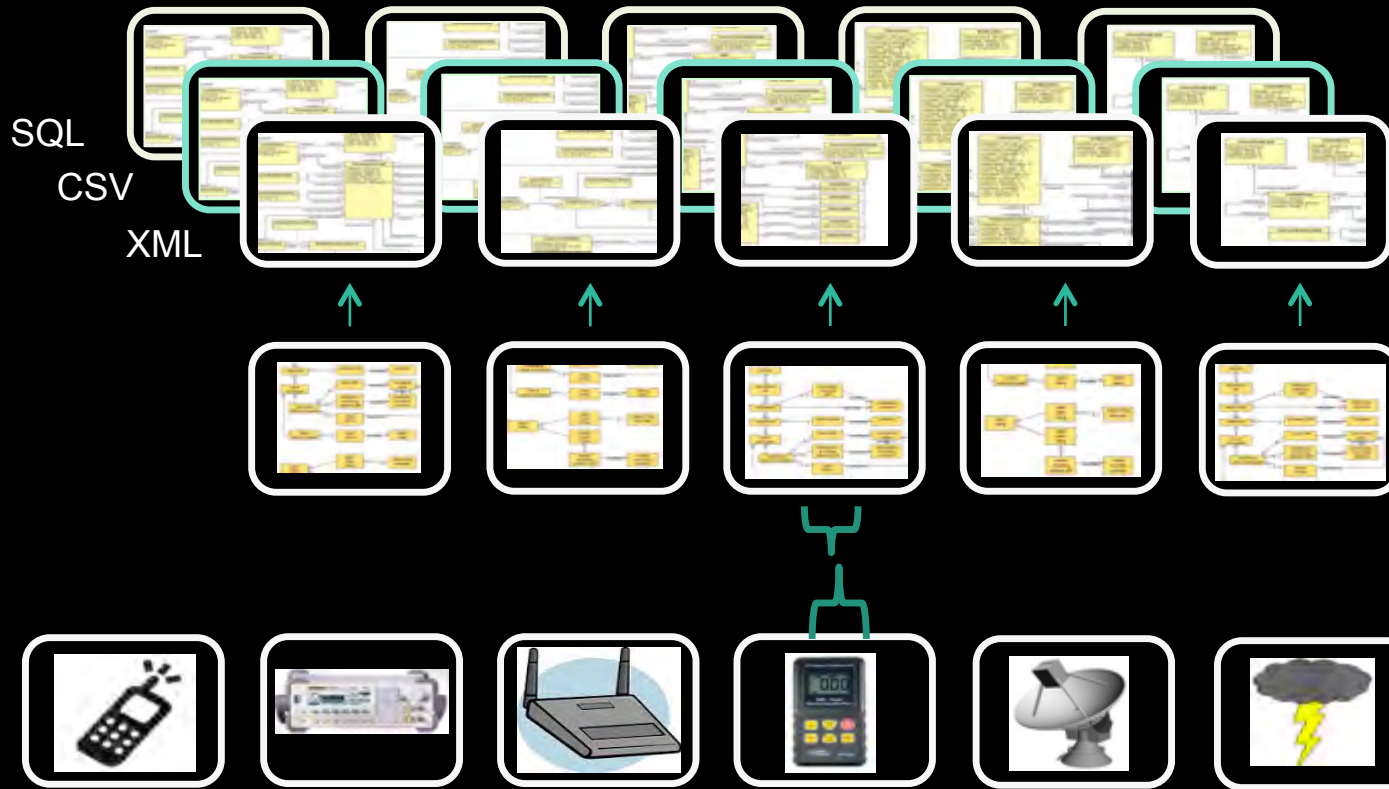


- Not-for-profit, international consortium of 500+ industry, government, and university members, including Google
- Founded in 1994
- Work based on collaboration and consensus
- Members set policies and procedures.
- Many alliance partners: W3C, OASIS, ITU, ISO, Smart Grid Interoperability Panel, buildingSMART International, etc.

## OGC Mission

Deliver geospatial data encodings, interface standards and best practices that are openly and freely available for global use.

# Abstract models and implementation models



Implementation models model how features, phenomena and relationships are to be encoded for a particular software implementation platform.

Abstract and/or conceptual model models what needs to be described/modeled in software (location, orientation, time, signal type, frequency, pulsing characteristics, energy intensity max/min, etc.). Includes relationships and units of measurement.

# Example OGC standard: OGC WaterML 2.0

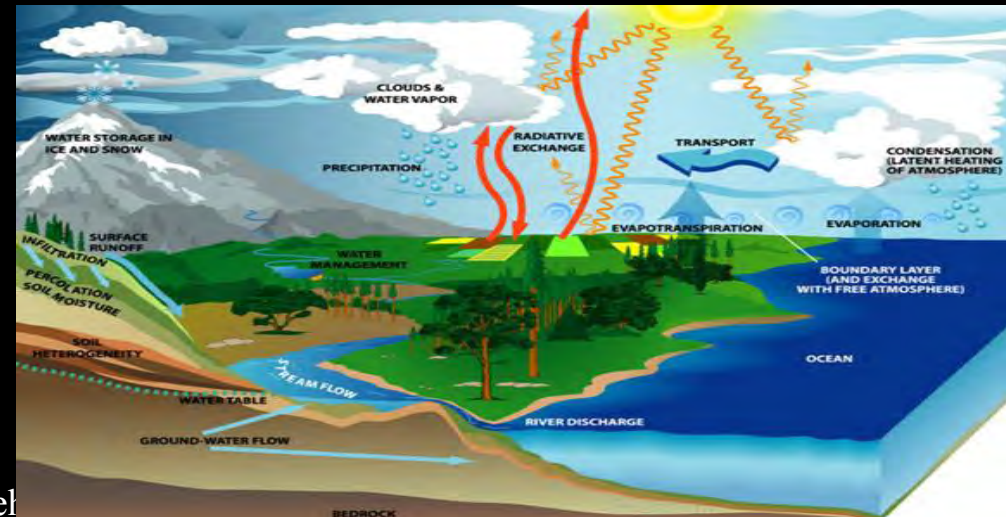
**SITUATION:** Nations seek to provide integrated national and cross-border views of fresh water resources. Also, there is increased need for the exchange of hydrologic data to improve our understanding of complex environmental processes, such as climate change.

**PROBLEM: 2005** Global Climate Observing System (GCOS) report: “There are no established international standards on the acquisition of river data, the set of required metadata, data formats, and transmission modes.”...

**APPROACH** WMO (World Meteorological Organization), an International team of hydrologic organizations came together to form the OGC WaterML 2.0 Standards Working Group. They used OGC’s rapid prototyping process to develop the WaterML 2.0 standard.

**SOLUTION:** WaterML2.0 is a standard information model for the representation of water observations data, with the intent of allowing the exchange of such data sets across information systems. Based on existing OGC standards, it is used to address a range of exchange requirements.

CSIRO (Australia)  
San Diego Supercomputer Center (US)  
Australian Bureau of Meteorology  
Geological Survey of Canada, Nat. Resources  
Canada  
USGS (US)  
KISTERS AG (Private sector – Germany)



# Collaboration is needed to address complexity.

Complexity makes data integration and communication difficult.  
Collaboration make integration and communication possible.

## EMF are complex:

- \_Frequency or frequencies
- \_Modulation type & other pulse details (waveform parameters)
- \_Polarization
- \_Energy intensity max/min.
- \_Energy intensity ave.
- \_Location & orientation
- \_Time
- \_Unique source ID?
- \_Sensor or emitter specs
- \_Etc.

OGC members who are EMF domain experts will bring this expertise to working group meetings.

## Spatial data are complex:

- \_Vector, raster, point clouds and other types data
- \_Diverse Earth coordinate reference systems & Earth shape models (geodesy)
- \_2D, 3D, 4D and nD
- \_Conflating semantically different data
- \_Conflating precise and imprecise data
- \_Harmonizing with other standards for spatial features and phenomena
- \_Navigating IT trends, e.g. database > services > linked data etc.

OGC staff and OGC members who are spatial technology experts will bring this expertise.

# Why the Open Geospatial Consortium (OGC)?

1. EMF instances are inherently spatial. All
  - have a point or region of origin. All EMF instances that we observe have one or more points at which observations are collected.
  - are affected by the media they travel through.
  - are absorbed, reflected, and refracted by the objects and phenomena they impinge upon.
  - have effects on the objects and phenomena they impinge on.
2. The OGC focuses on spatial and temporal encoding and interface standards.
  - Historically, OGC's focus was solely *geospatial*.
  - Recently, OGC members are working with other standards organizations on convergence of geospatial data & technology with data & technologies used to model the built environment.
  - Basic principles of modeling macrospatial and mesospatial features and phenomena can be extended to microspatial and nanospatial (and nanotemporal) features and phenomena.
3. The OGC's standards portfolio includes a comprehensive portfolio of standards for description and management of sensors and sensor data.
4. The OGC's membership includes a broad range of companies and organizations that might participate in developing an EMF standard.



# Martha Herbert MD, PhD, Harvard Medical School Concerned About RF Increasing Autism Risk, 2013

“With dramatic increases reported in autistic spectrum disorders coincident in time with the deployment of wireless technologies, we need aggressive investigation of potential ...EMF/RFR links. The evidence is sufficient to warrant new public exposure standards benchmarked to low-intensity (non-thermal) exposure levels now known to be biologically disruptive, and strong, interim precautionary practices are advocated.”

**HARVARD MEDICAL SCHOOL**

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# Worldwide Cell Phone Advisories



## Belgium 2013:

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



## Australia 2013:

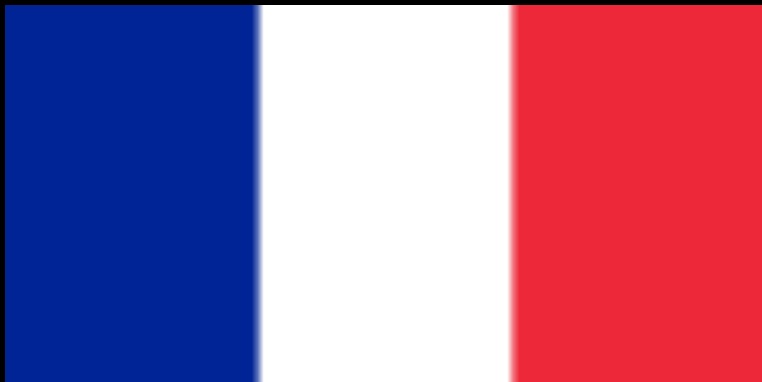
The federal government's Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has created a fact sheet providing citizens ways to reduce exposure from wireless devices. The agency advises that parents limit children's exposure to cell phones.

# Worldwide Cell Phone Advisories



## **Italy 2012:**

On October 12<sup>th</sup>, 2012 the Italian Supreme Court ruled in favor of an Italian business man 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 and in nurseries.

# 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.



# Save the girls

Doctors warn that unusual breast cancers are occurring in women who stored cell phones in their bras.



#SaveTheGirls

ENVIRONMENTAL  
HEALTH TRUST

[www.ehtrust.org](http://www.ehtrust.org)



# 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.

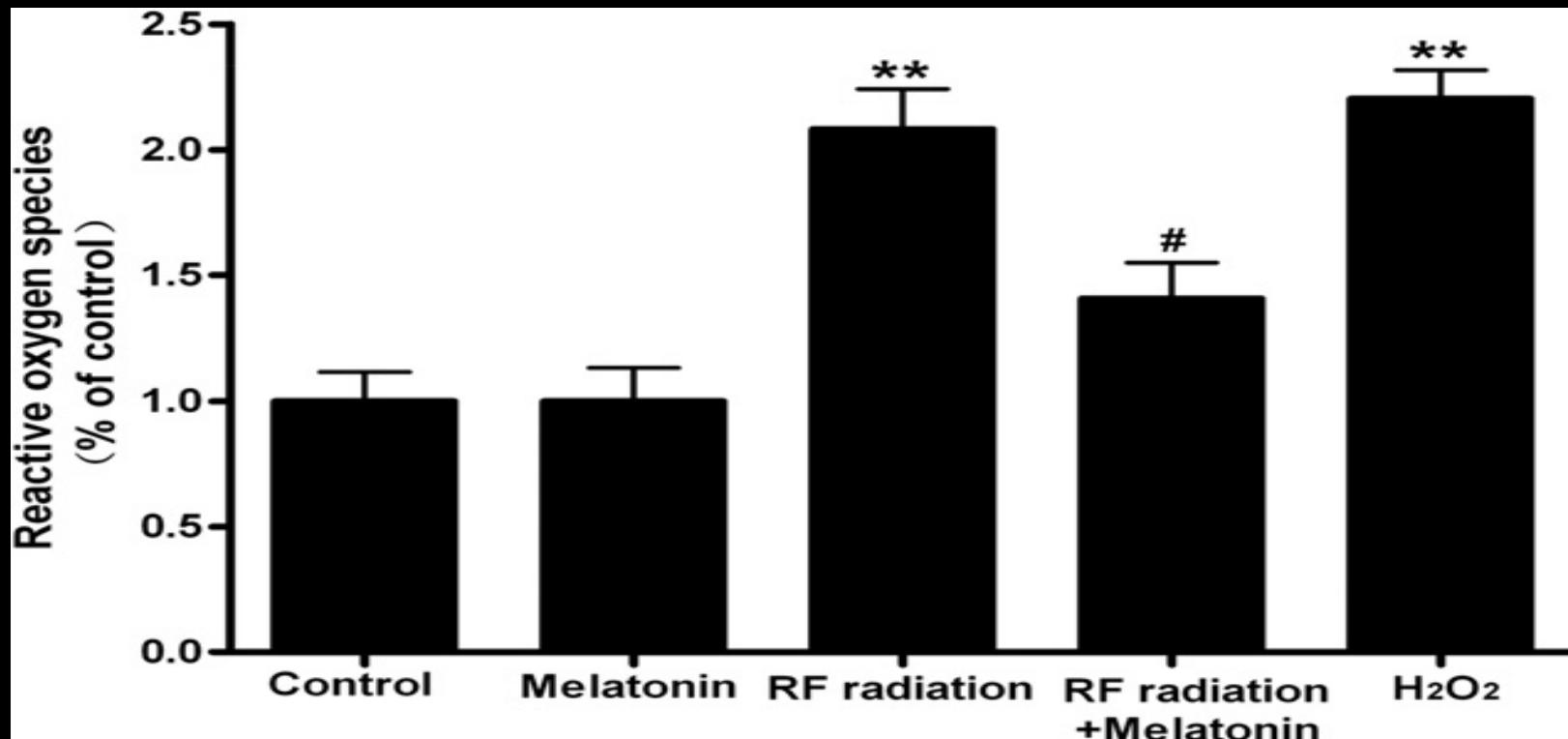


SAVE  
THE  
MALE



# Melatonin Protects Against 1800 MHz RF Radiation Damage

- Xu et al
- Brain Research, 2010



# Precautions Noted by the FCC, FDA, and ACS as of September, 2010

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- Use an earpiece or headset.
- Avoid continually wearing a wireless earpiece
- Keep wireless devices away from your body when they are on
- Use speakerphone
- or purchase a low SAR phone to reduce exposure to the head.
- Consider texting rather than talking, but don't text while you are driving.
- Can limit talk time

# We protect children in car seats

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- Different carseats and distances at different ages
- Am Acad. Pediatrics recommends



# Radiation Risks of CT Scans

Exam Type	Machine Setting	Relevant Organ	Approximate Equivalent Dose to Relevant Organ (mSv)	Equivalency in chest x-rays*
				.15-.01 mSV
Pediatric Head CT Scan	Unadjusted <sup>1</sup>	Brain	60	400-6000
Pediatric Head CT Scan	Adjusted <sup>2</sup>	Brain	30	200-3000
Pediatric Abdominal CT Scan	Unadjusted	Stomach	25	166-2500
Pediatric Abdominal CT Scan	Adjusted	Stomach	6	40-600
Chest X-ray (PA/lateral)	n/a	Lung	0.01/0.15	1



# As Low as Reasonably Achievable in Pediatric CT Scans

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- Children ten times more vulnerable than adults to radiation (*Int'l Com Radiol Prot, 1991*)
- Quality of CT image better with higher radiation
- Many unnecessary tests ordered in children and adults

*Slovis, Pediatric Radiology, April 2002*

# 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 “air tube” 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.

