

Technical Briefing on Cell Phones and Health

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President

Environmental Health Trust

Presented to American Academy of Pediatrics

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Presentation overview



What is cell phone radiation?

In vitro and in vivo evidence of health impacts:

- sperm damage (Aitken, MD, Agarwal MD)
- prenatal damage (Taylor MD, PhD, Kaplan, PhD)
- Neurological impacts on brain structure/function of children (Redmayne PhD)
- cancer risk and digital dementia in children?

National and local efforts

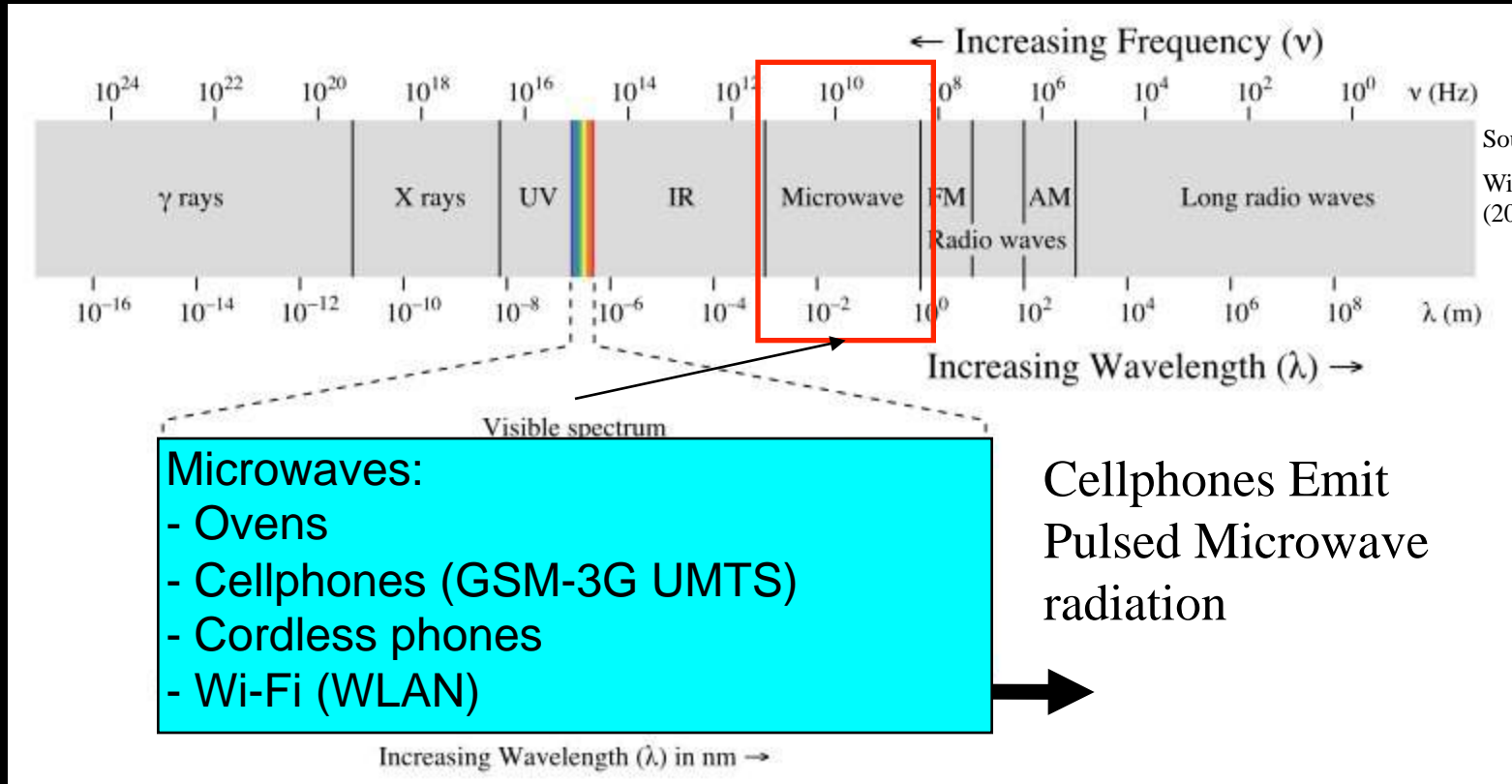
Israel Ministry of Health, Canadian Parliament

New laws in France, Belgium, Taiwan

Berkely City Ordinance

EHT Advice from Expert Groups About How to Protect Yourself and Your Family

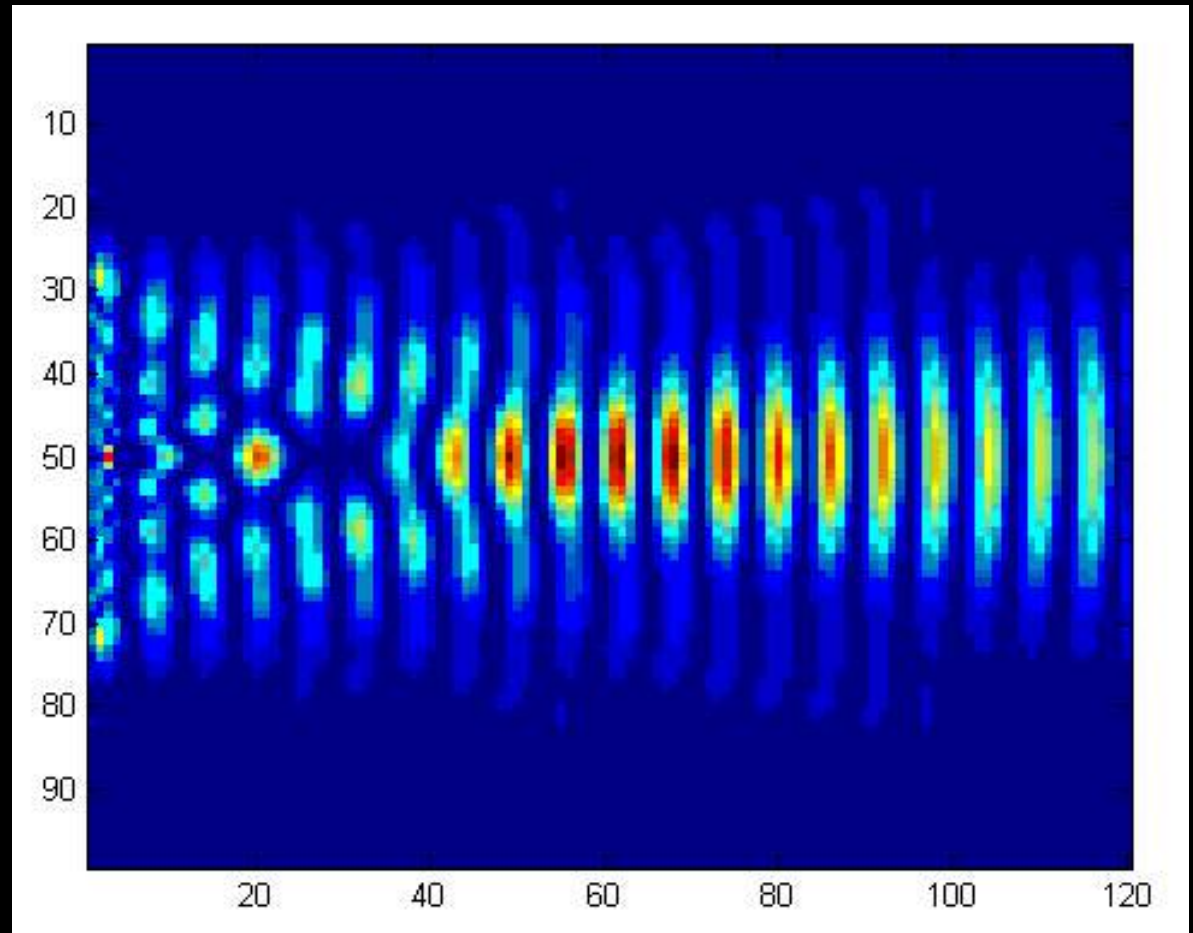
Radiation Electromagnetic Spectrum



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

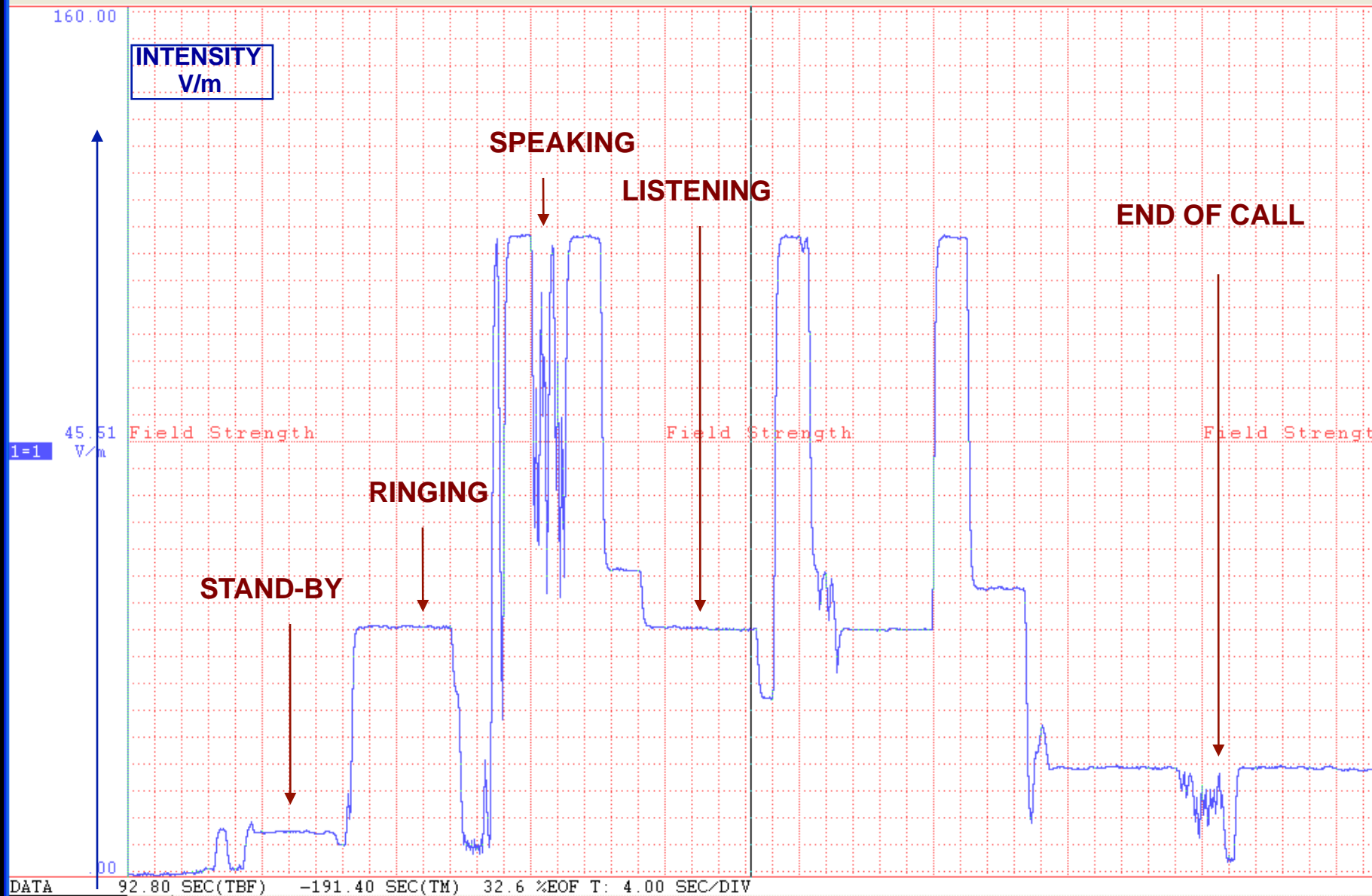
- Frequency
- Amplitude
- Pulse
- Wavelength
- Information

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Do not take without permission

Courtesy of Margaritis et al



Time 4 sec/division



Standards for cell phones unchanged for 18 years

1997 Average user was military,
medical, or business

Average call took less than 6 minutes

Employs the head of a 220 lb male

Designed to avoid heating

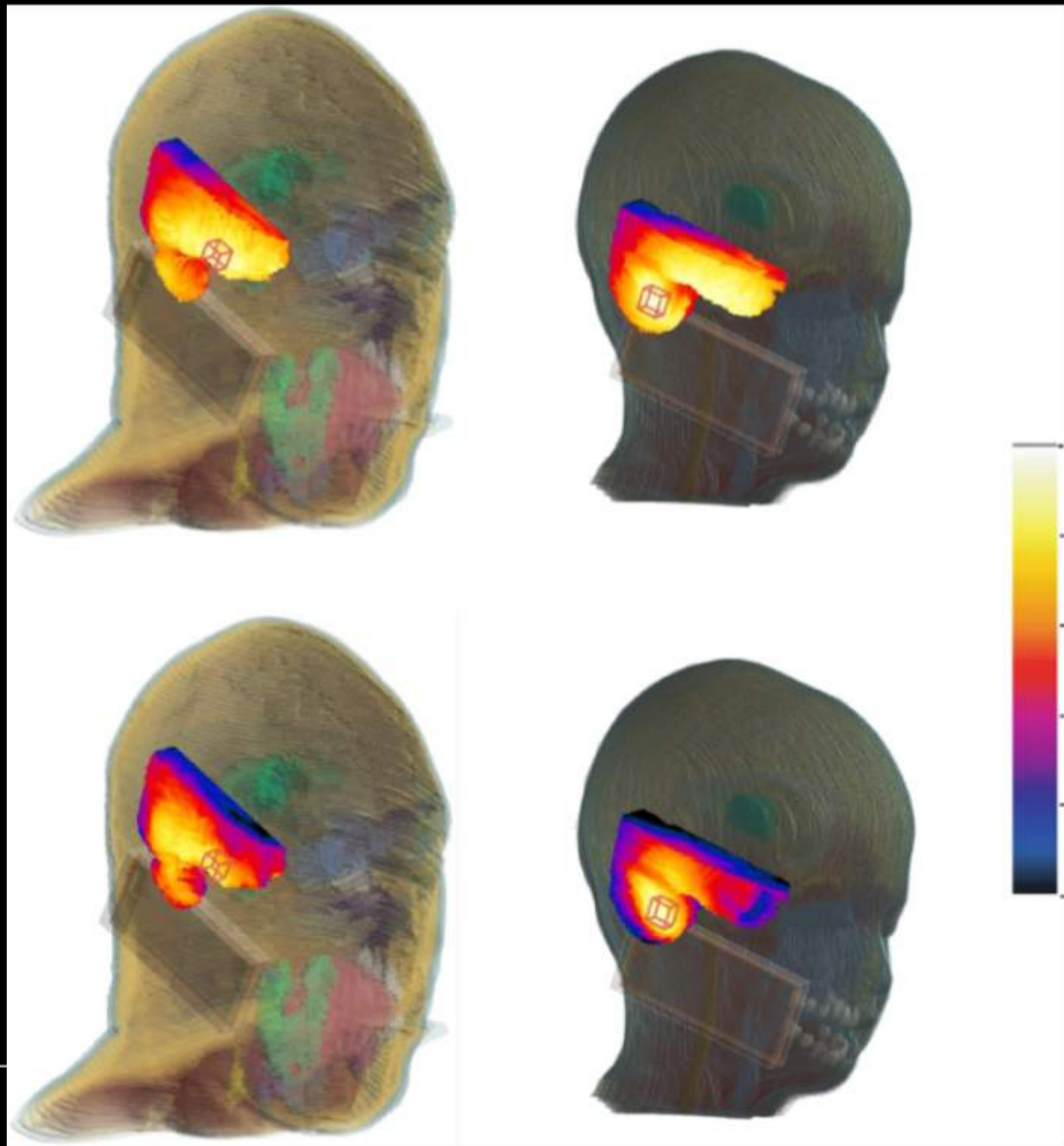
Cell phone standards are developed to avoid heating a heavy-set man, NOT a young child

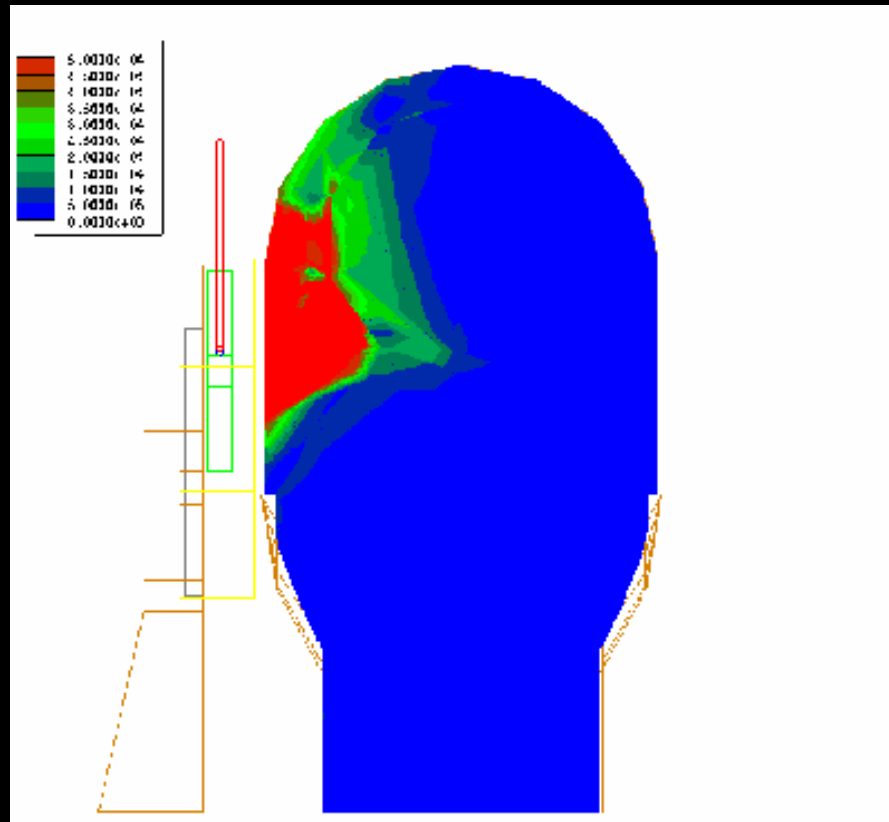
900 MHz the SAR maximum occurs in the center of the case

Children's skull bone absorbs 10x more than adults

Images courtesy of IT'IS, 2010

1800 MHz SAR max occurs at edge of case, Christ et al, 2010

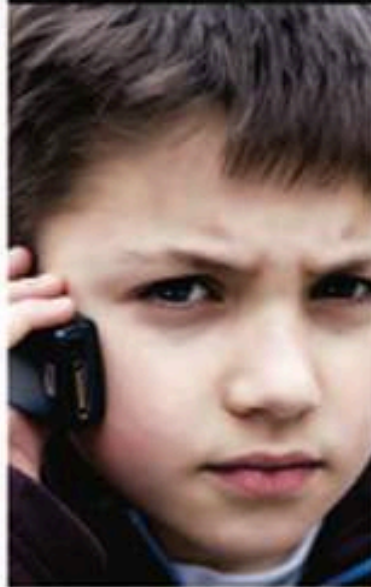




Much energy is absorbed by the brain cells

MARGARITIS LH - ISTANBUL WORKSHOP - MAY 2011

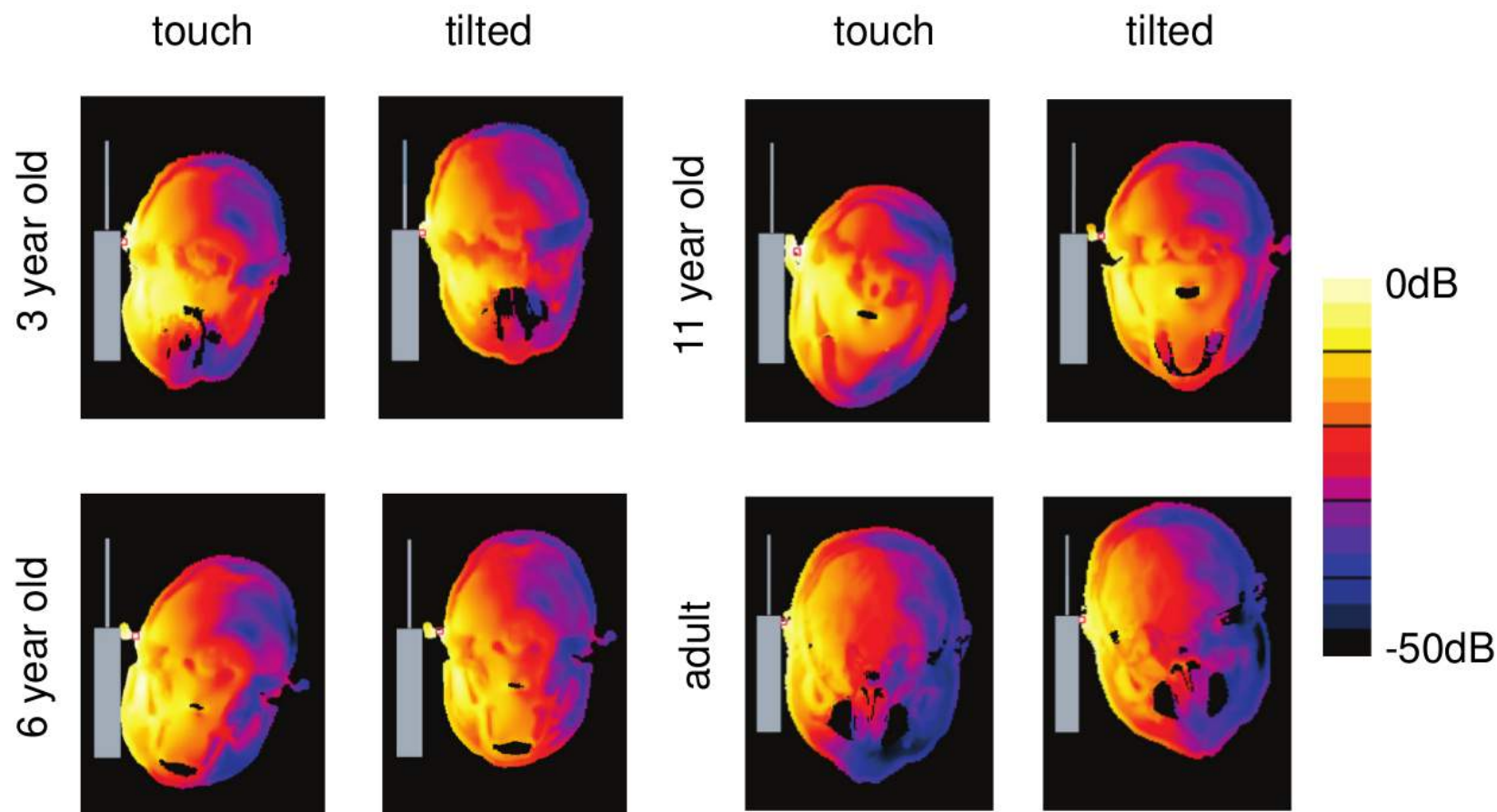
Who's Most At Risk?



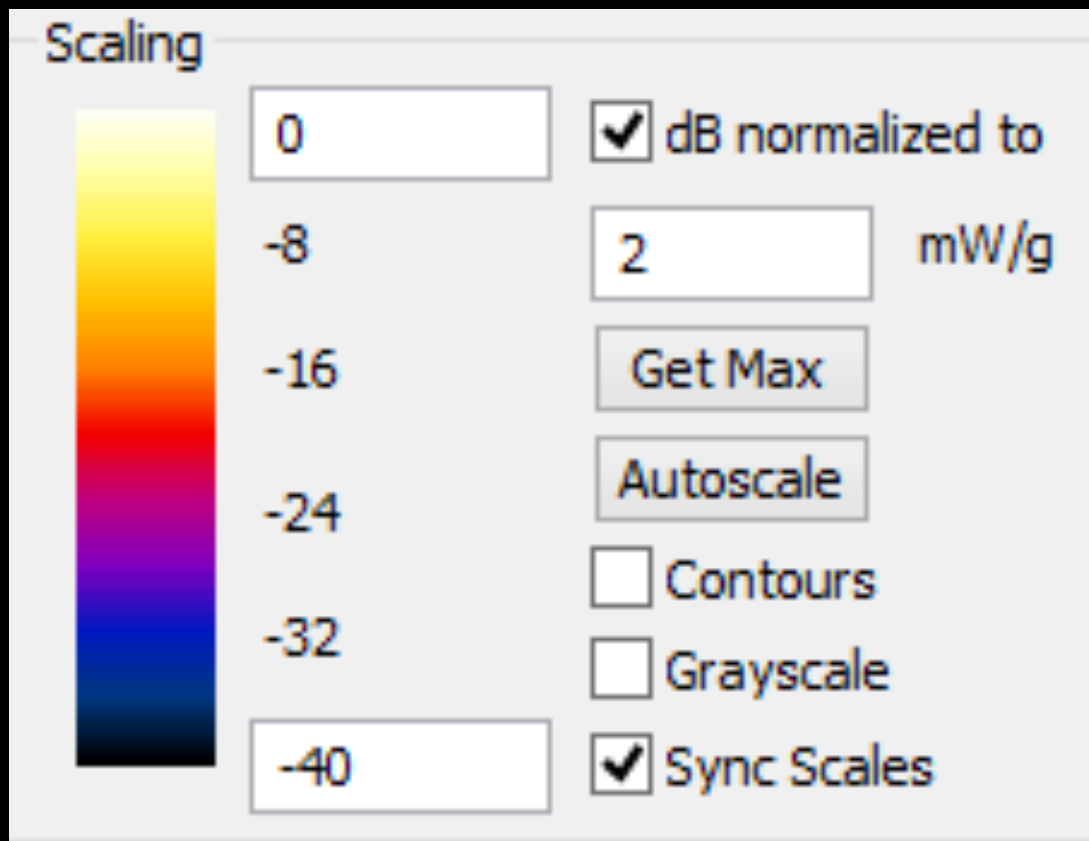
These computer models from the University of Utah show how radio-frequency radiation from cell phones passes further into the brain of a child than that of an adult. Research that Dr. Om P. Gandhi and Dr. Devra Davis are currently working on indicates that children may be exposed to twice as much radio-frequency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

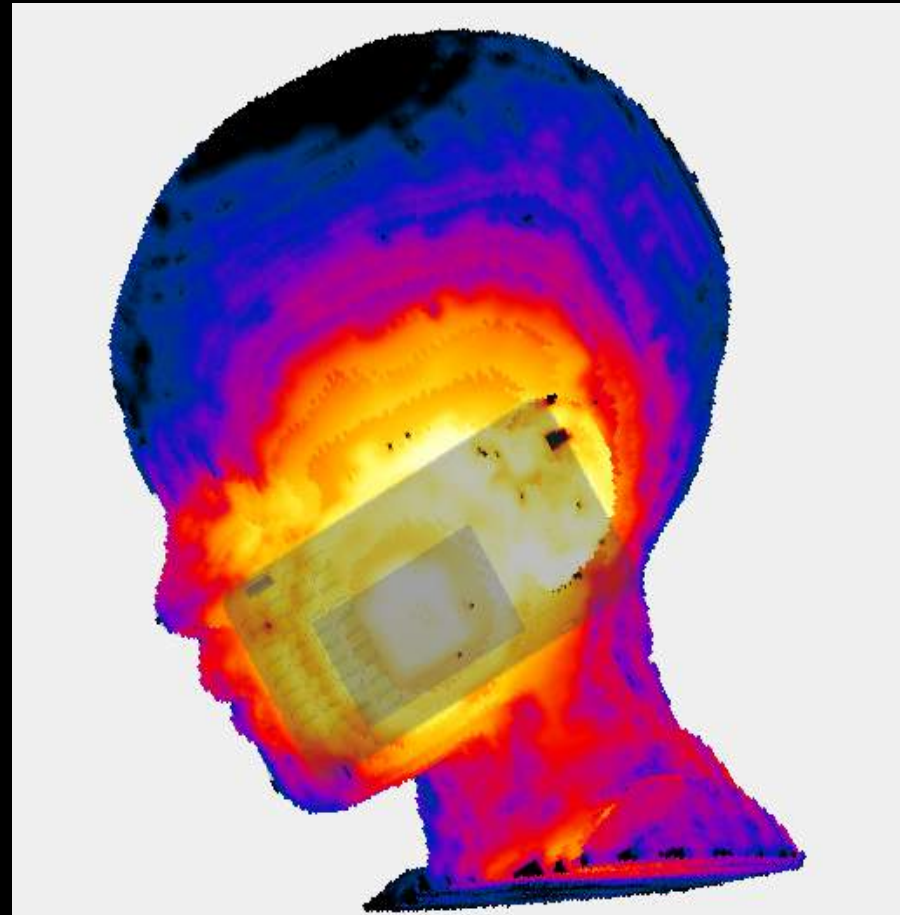


Scaling for University of Porto Alegre/Environmental Health Trust Brain Models



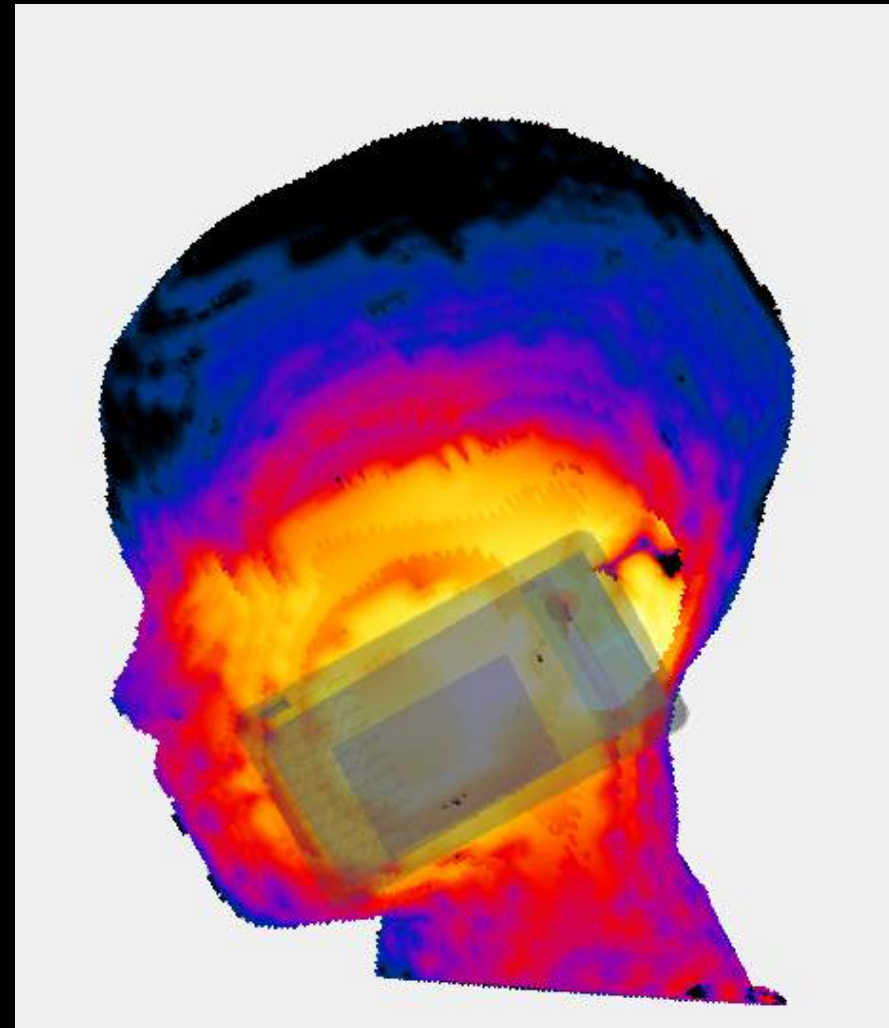
Age-Related Differential Microwave radiation absorption from cell phones (Fernandez et al, 2015)

Six year old
anatomically based
Model of Porto
Allegre
Environmental
Health Trust
(PAEHT)



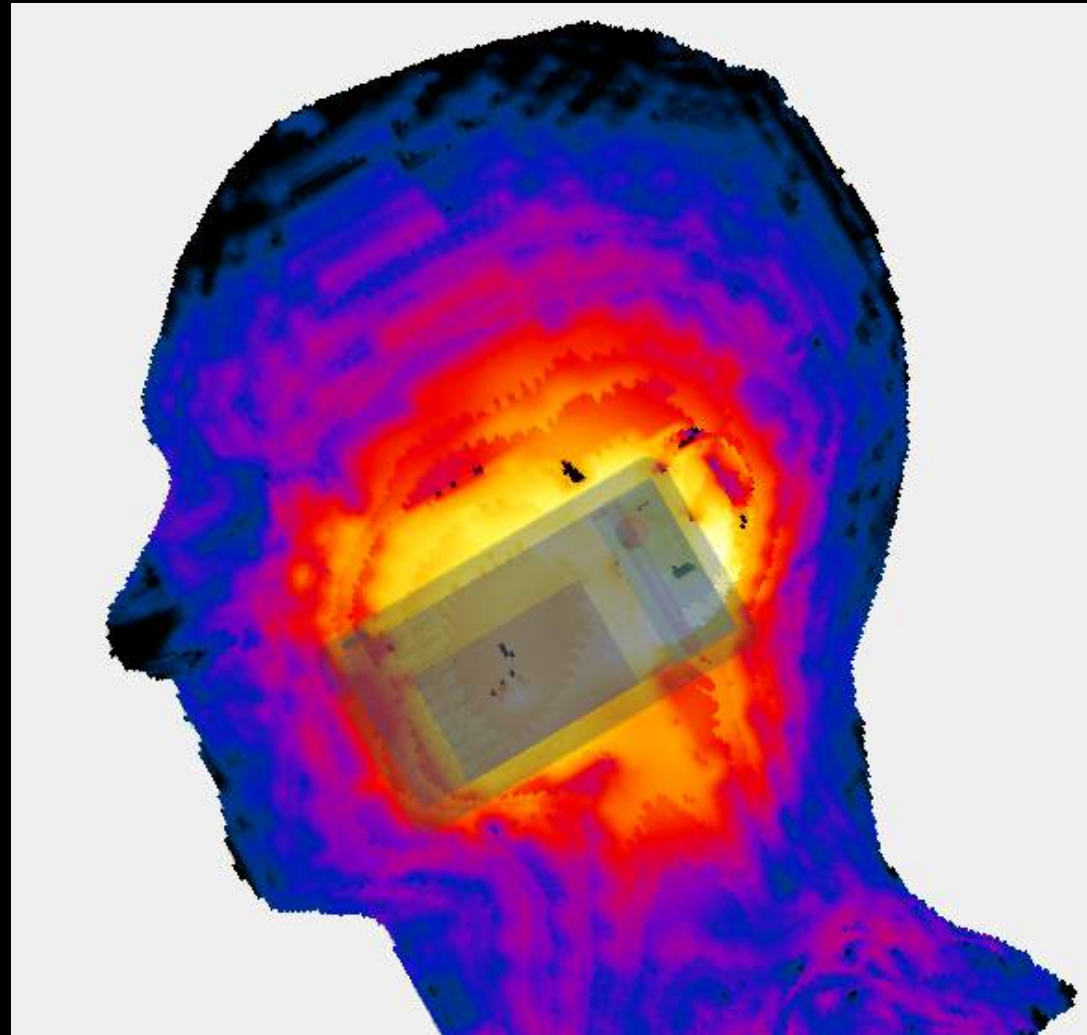
Age-Related Differential Microwave radiation absorption from cell phones (Fernandez et al, 2015)

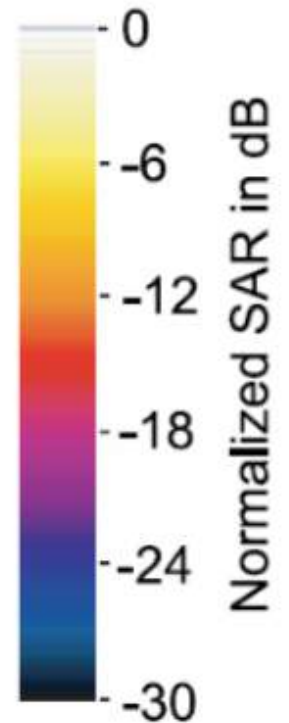
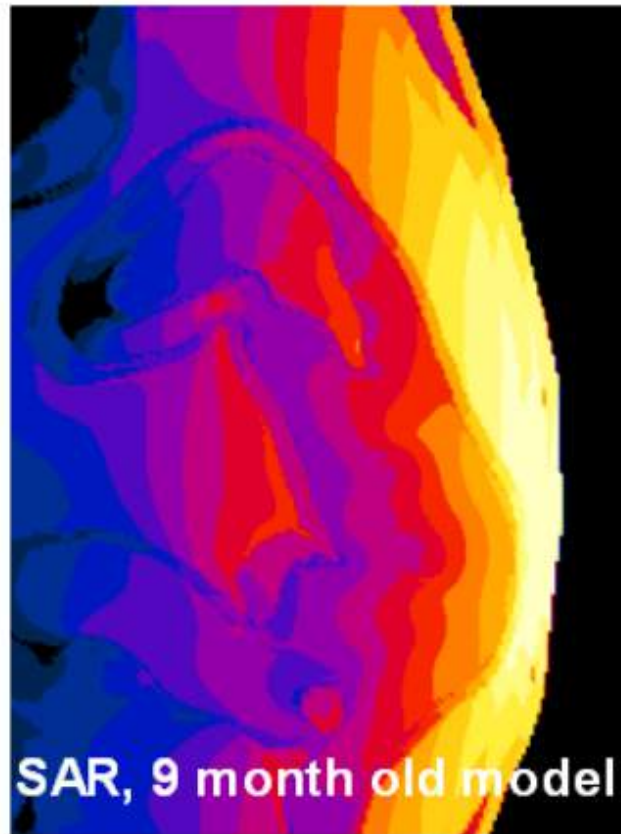
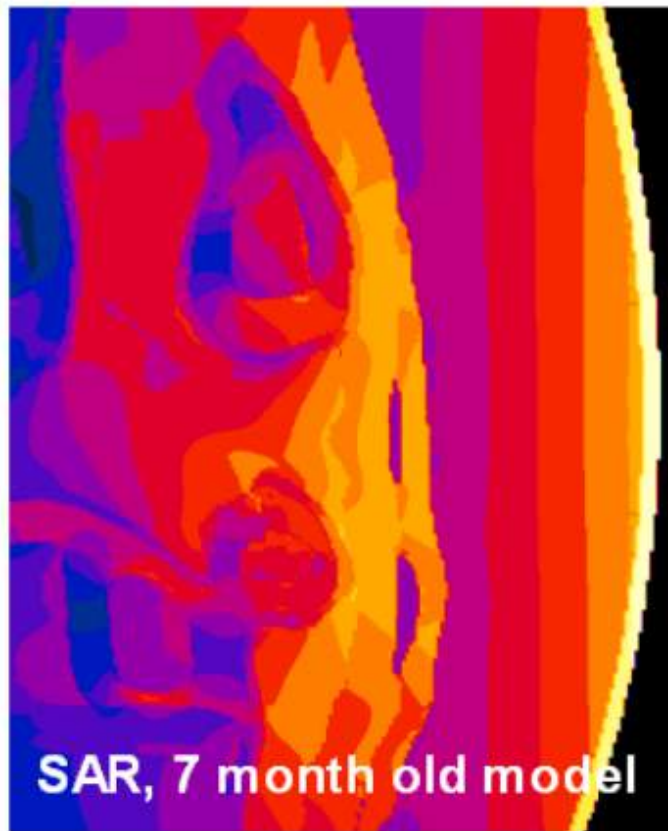
11 year old anatomically
Based Porto Alegre
Environmental Health
Trust Model PAEHT



Age-Related Differential Microwave radiation absorption from cell phones (Fernandez et al, 2015)

34 year old
Adult male
PAEHT

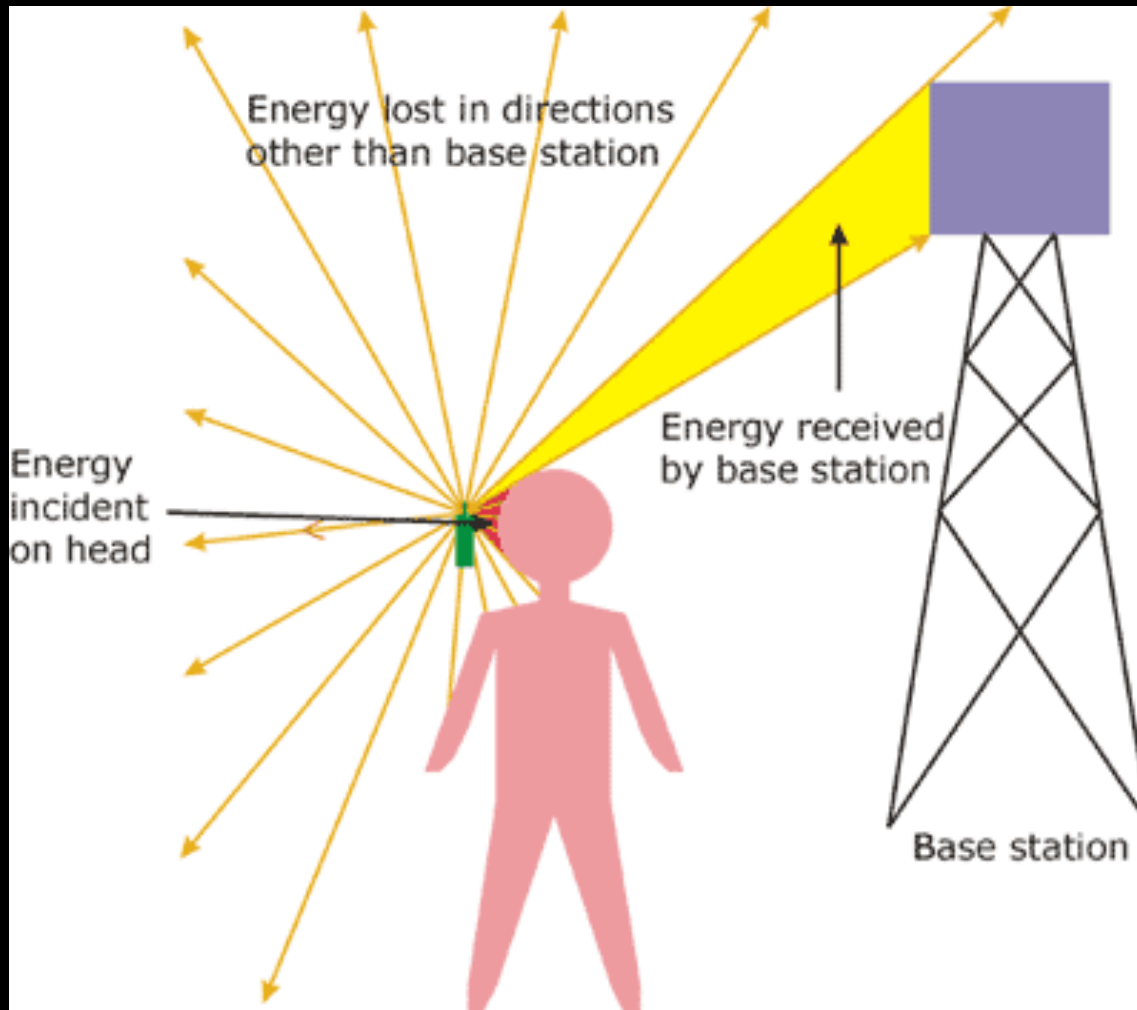




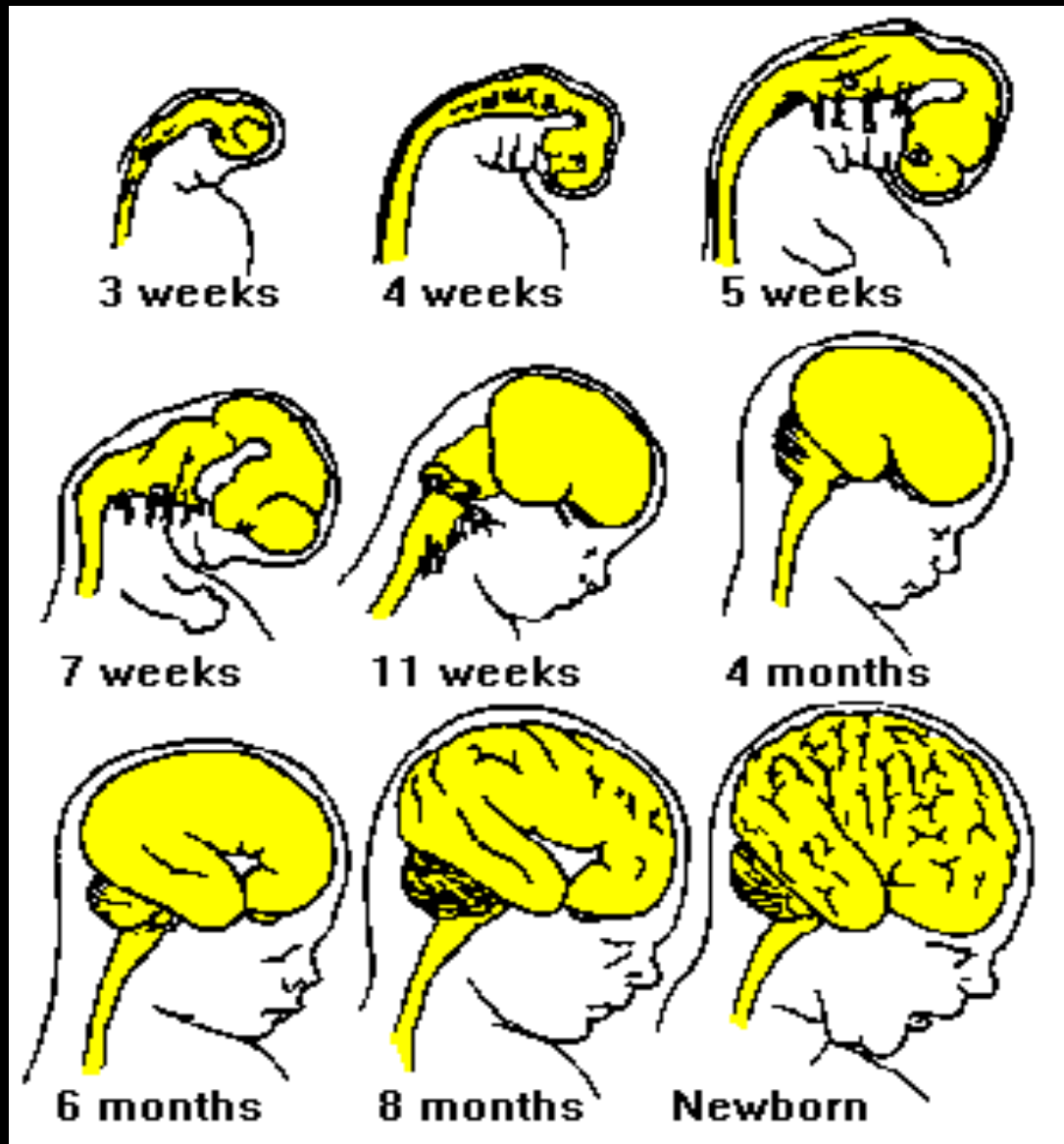
Normalized SAR for the mother and the fetus exposed to a dipole antenna in front of the abdomen (courtesy Andreas Christ, IT'IS, 2013)

Radiation from phone absorbed into head/body

Hugh Taylor, 2013



Brain grows rapidly throughout embryonic & early life



Hugh Taylor, 2013

Vulnerability to Toxic Insult

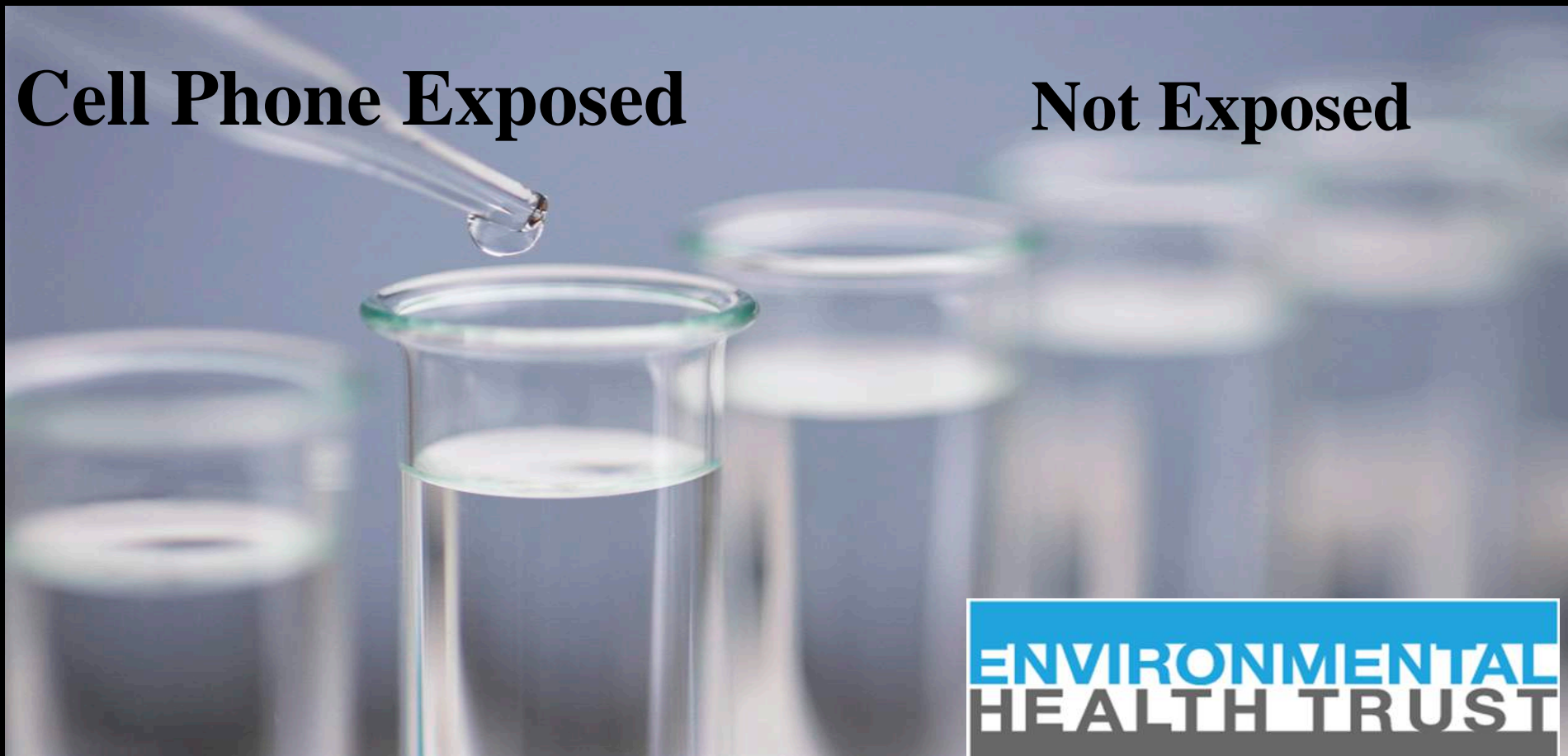
- Depends on the rate of cell proliferation
- Therefore, younger faster growing cells are more vulnerable, i.e., spermatocytes, neuronal stem cells, mouse embryonic (all have thinner Membranes!?)



Experiments with Human Sperm Show Effects not Tied with Heating

Cell Phone Exposed

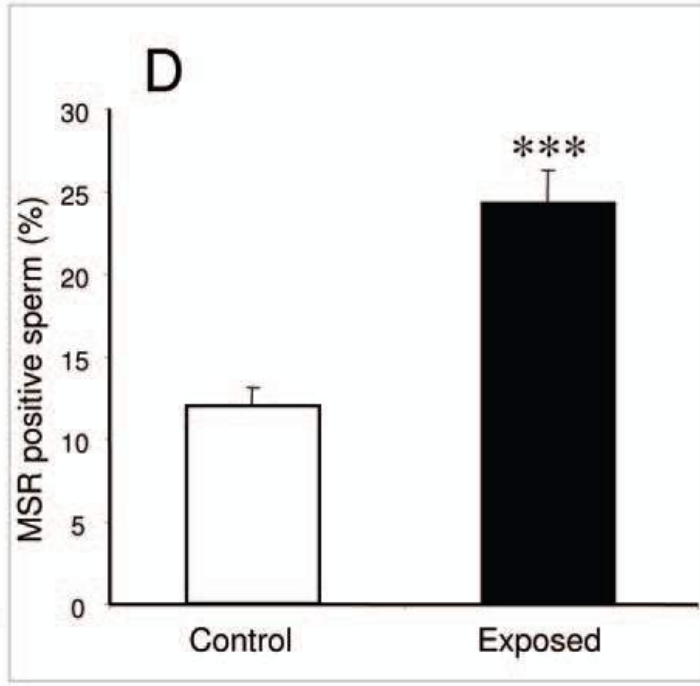
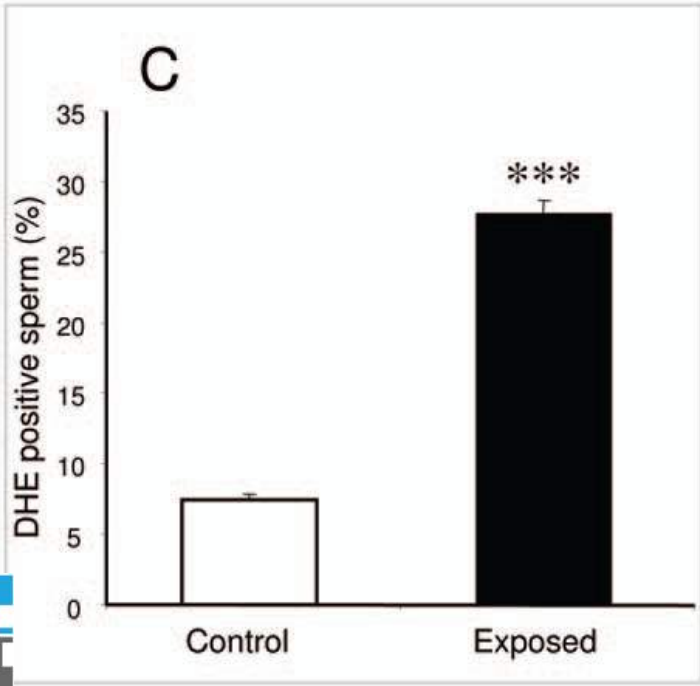
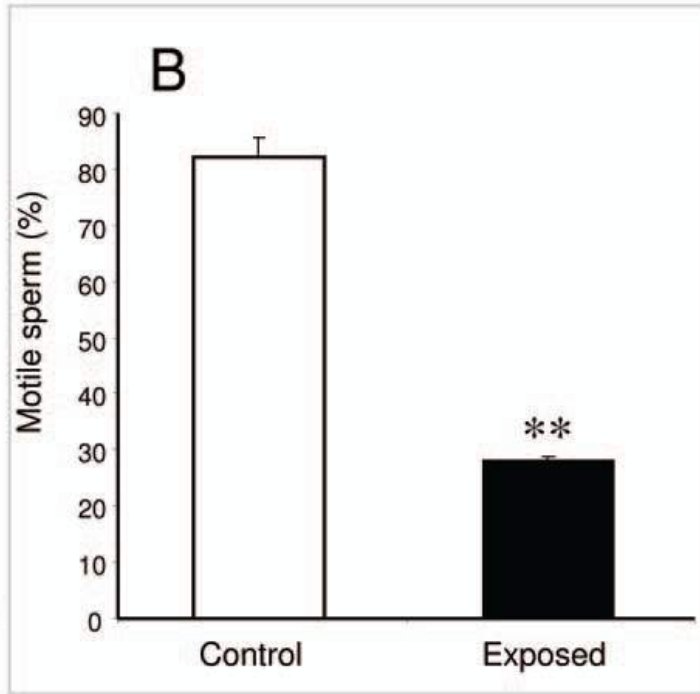
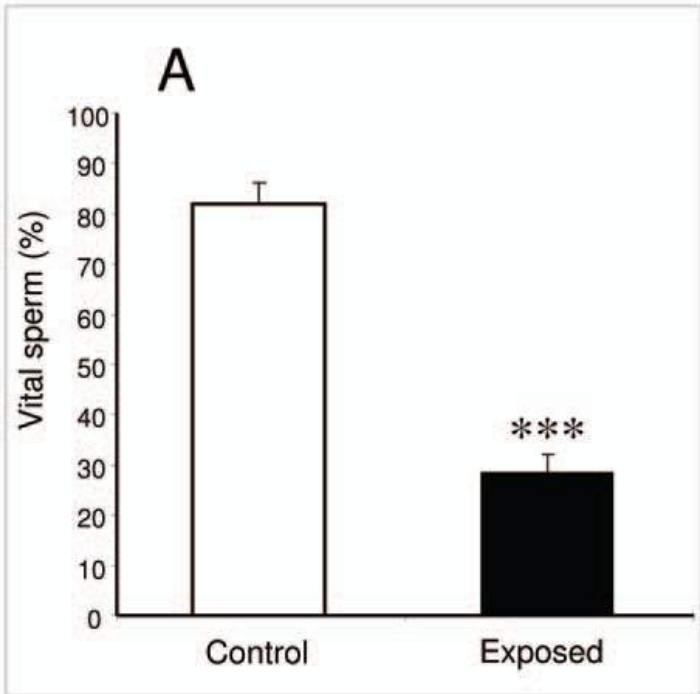
Not Exposed



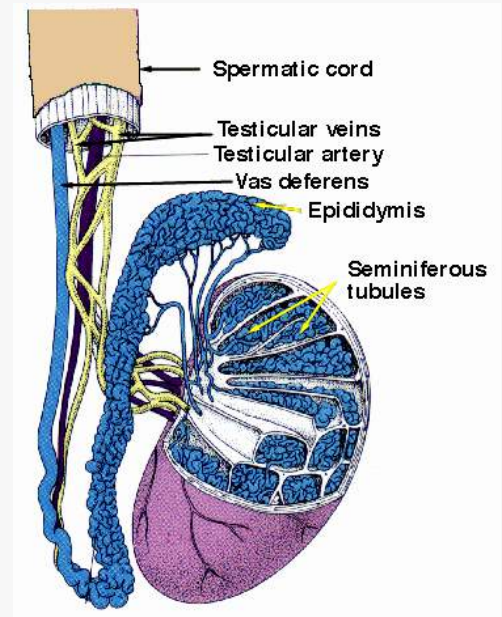
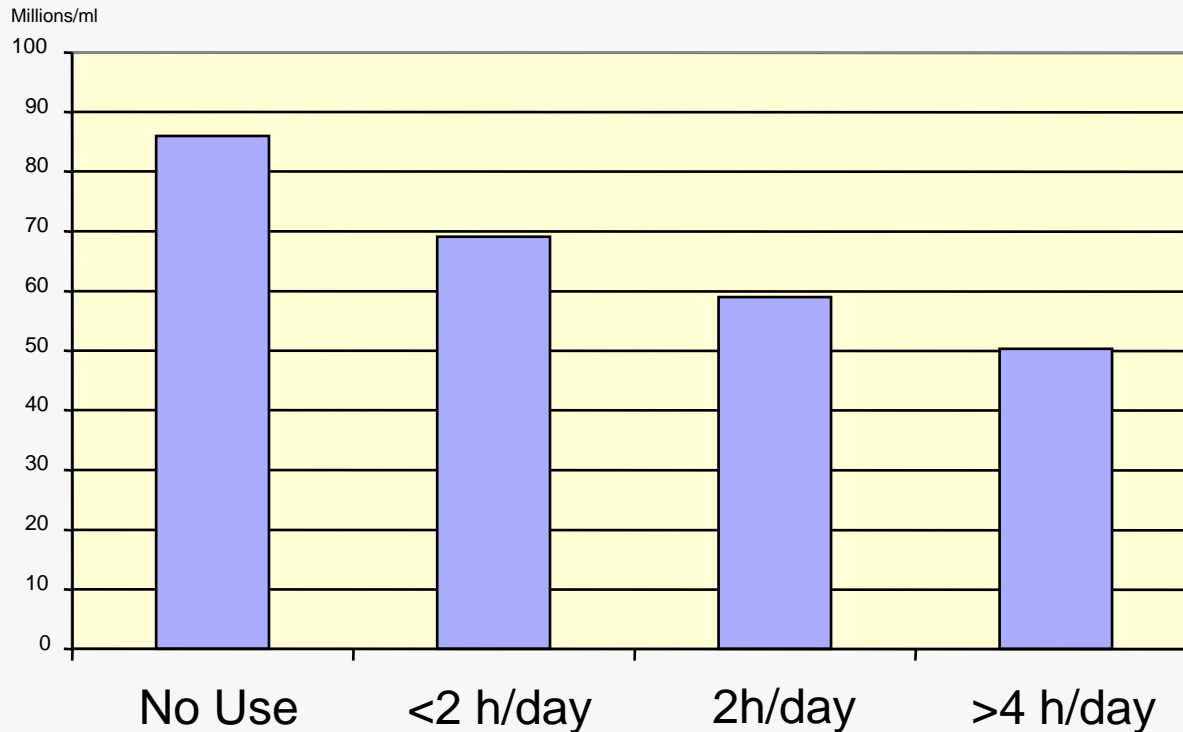
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Laureate
Professor
John Aitken

Cell Phone
Exposed
Sperm
Significantly
Reduced
& Damaged

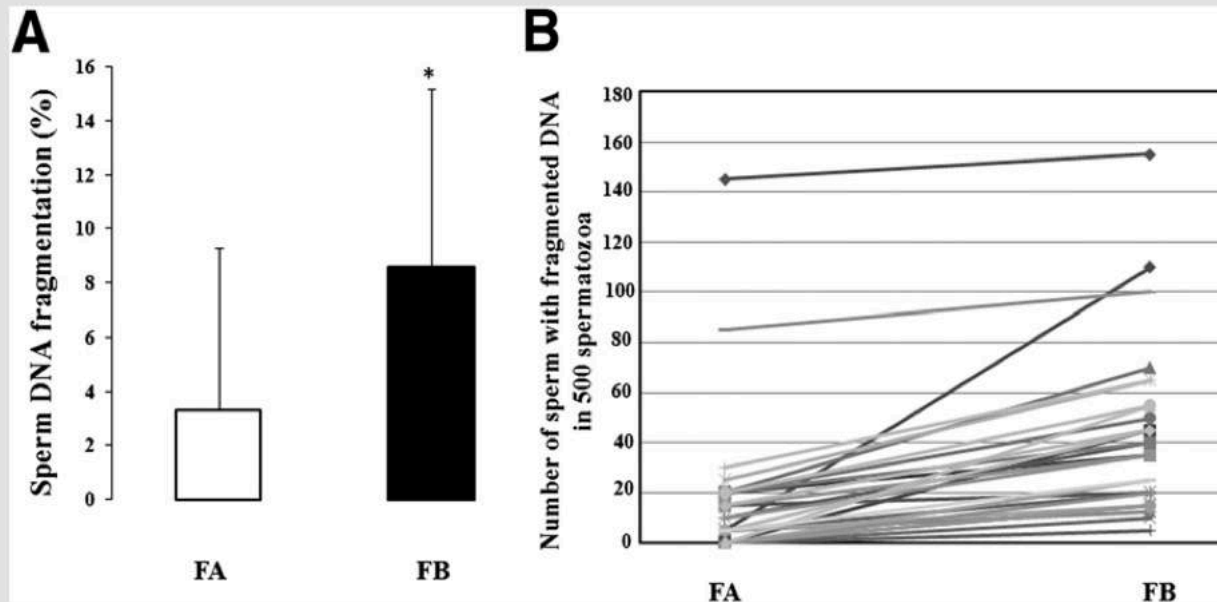


Heavier Cell Phone Users Have Reduced Sperm Count



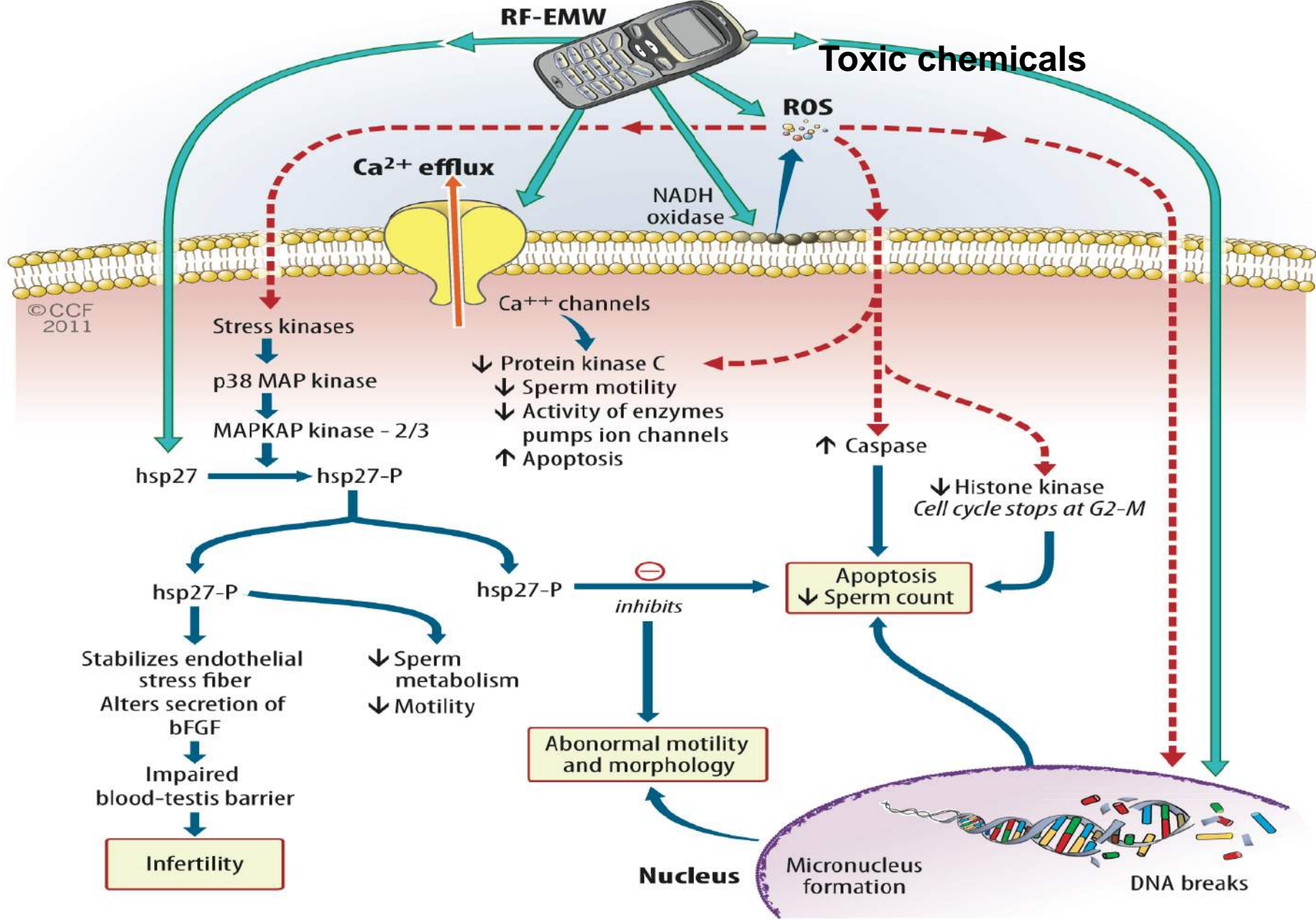
Agarawal, Cleveland Clinic, 2008; and seven other studies

Wifi damages Sperm

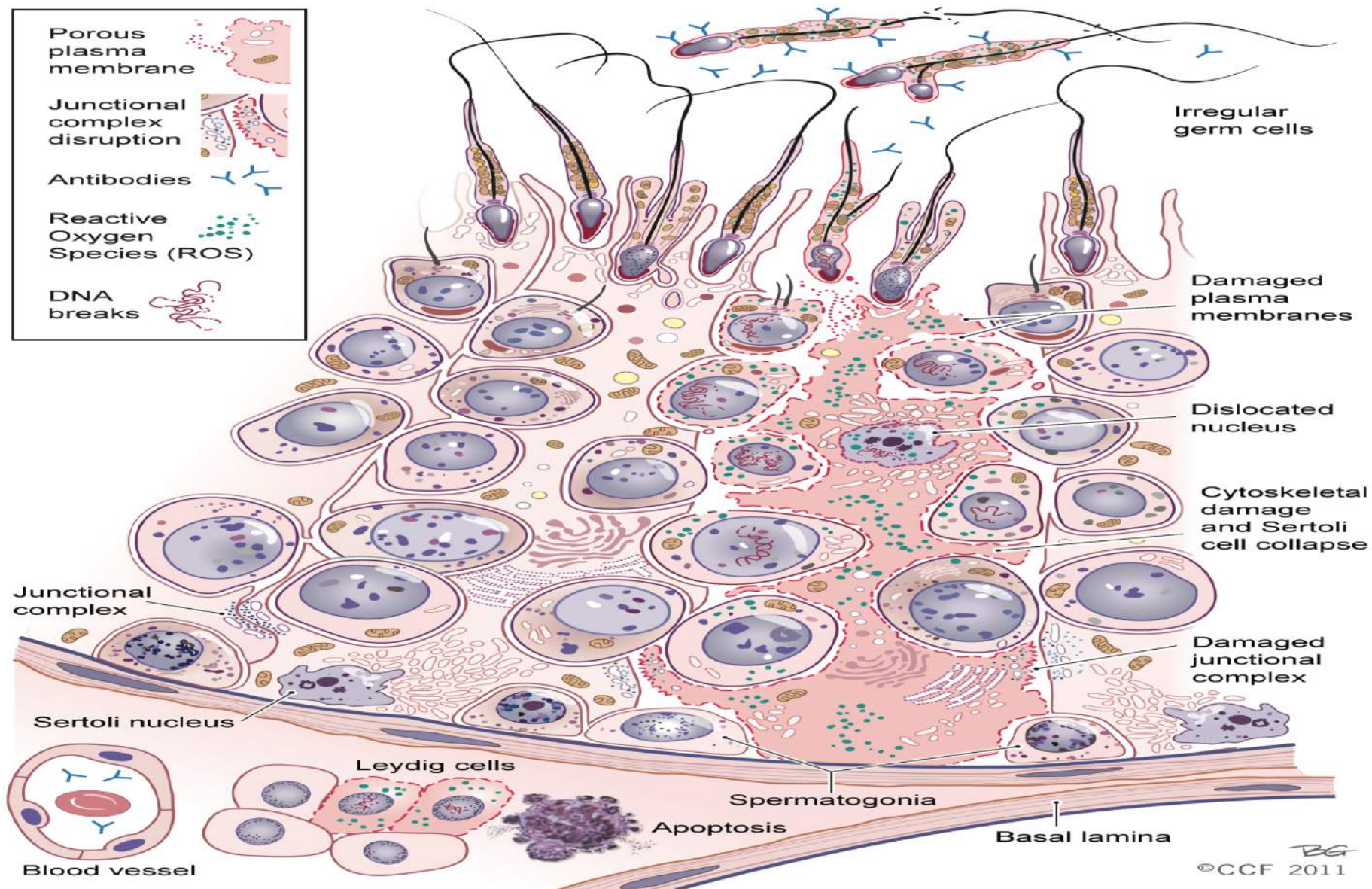


Laptop exposure and human sperm DNA fragmentation. Sperm suspensions were incubated under a laptop computer connected to the internet by Wi-Fi (FB) during 4 hours at 25°C. Aliquots of the same samples were placed outside of the reach of other computers or electronic devices, in a separate room (FA). (A) Sperm DNA fragmentation was increased after 4 hours of laptop exposure. In the test group, $8.6\% \pm 6.6\%$ of the cells were fragmented, whereas only $3.3\% \pm 6.0\%$ 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

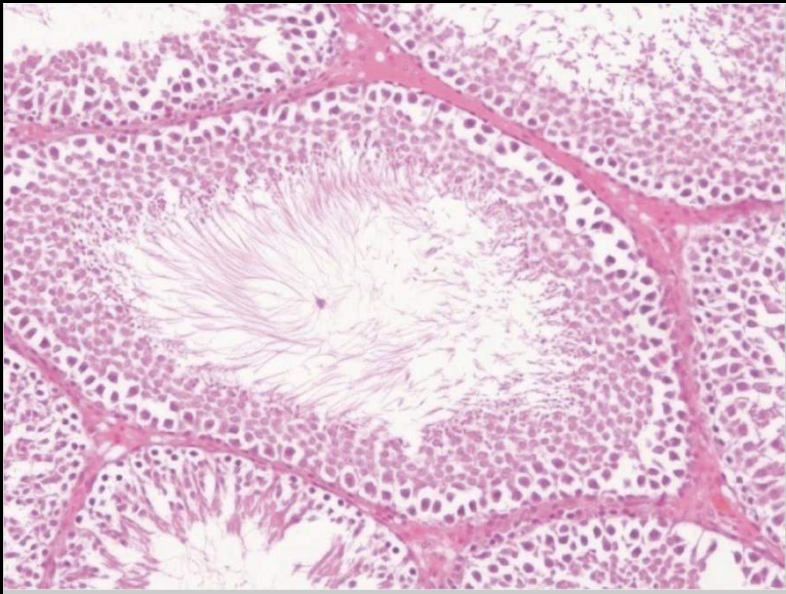


Hamada et al., 2011

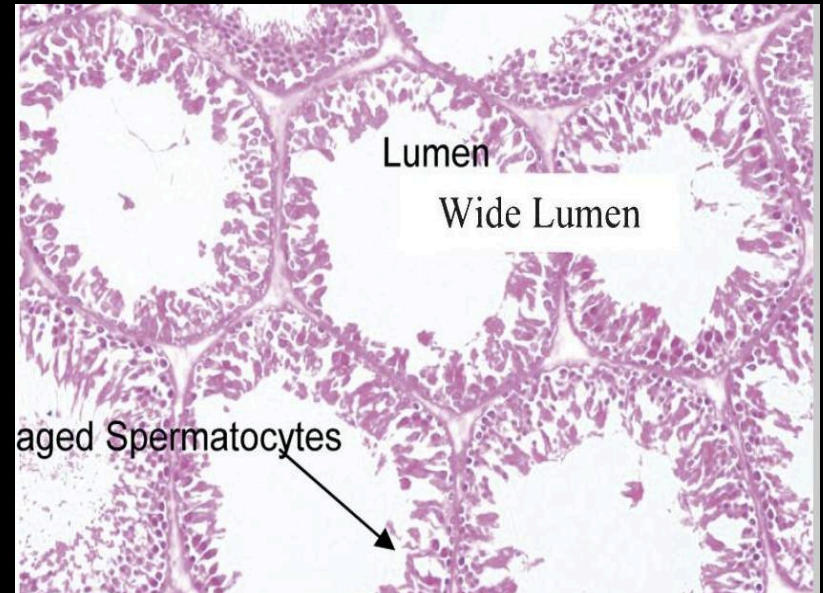


Adult Rat Testes Before and After Cell Phone Exposure

Normal Testes



Damaged Testes

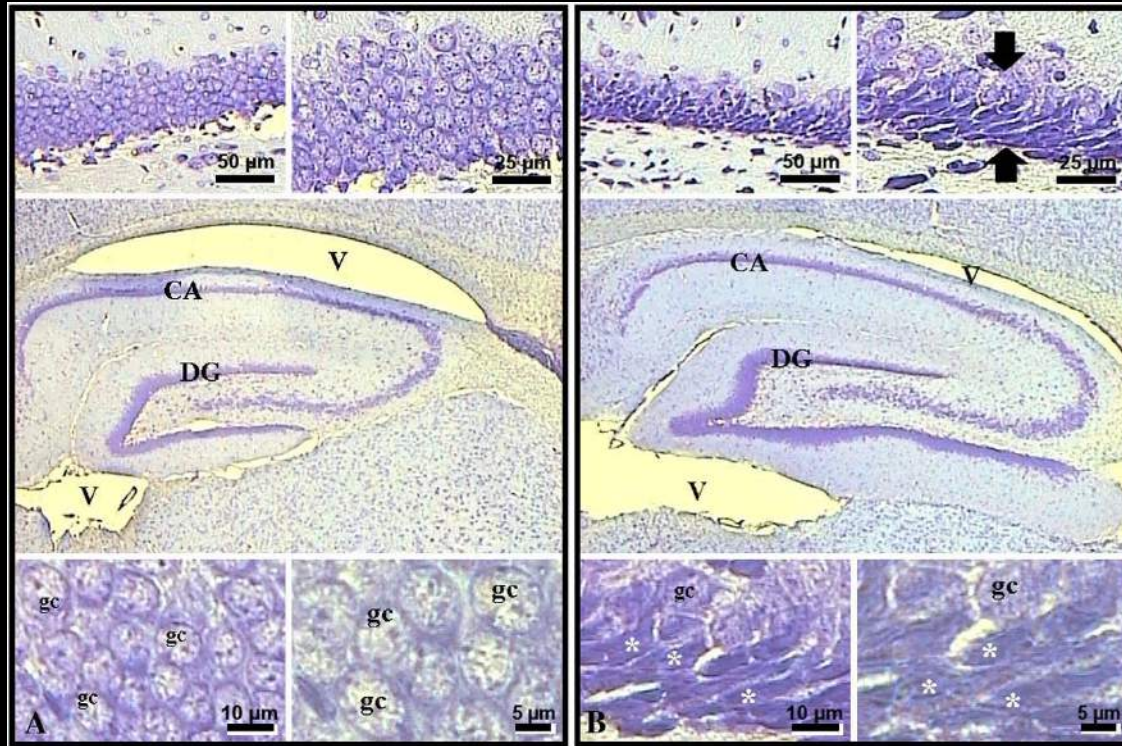


All groups were exposed to the same electromagnetic frequency for 15, 30, and 60 min daily for two weeks

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3400170/>

Prenatal exposure to EMF affects the hippocampus and cerebellum of rats

control



900 Mz
exposed

Arrows point to condensed cells. DG, dentate gyrus; V, ventricle; CA, cornu ammonis; DG, dentate gyrus; gc, granular cell

Prenatal EMF exposure caused lower numbers of granule cells in the dentate gyrus of the rats. (Odaci et al, 2008, *Brain*)

<http://www.ncbi.nlm.nih.gov/pubmed/18761003>

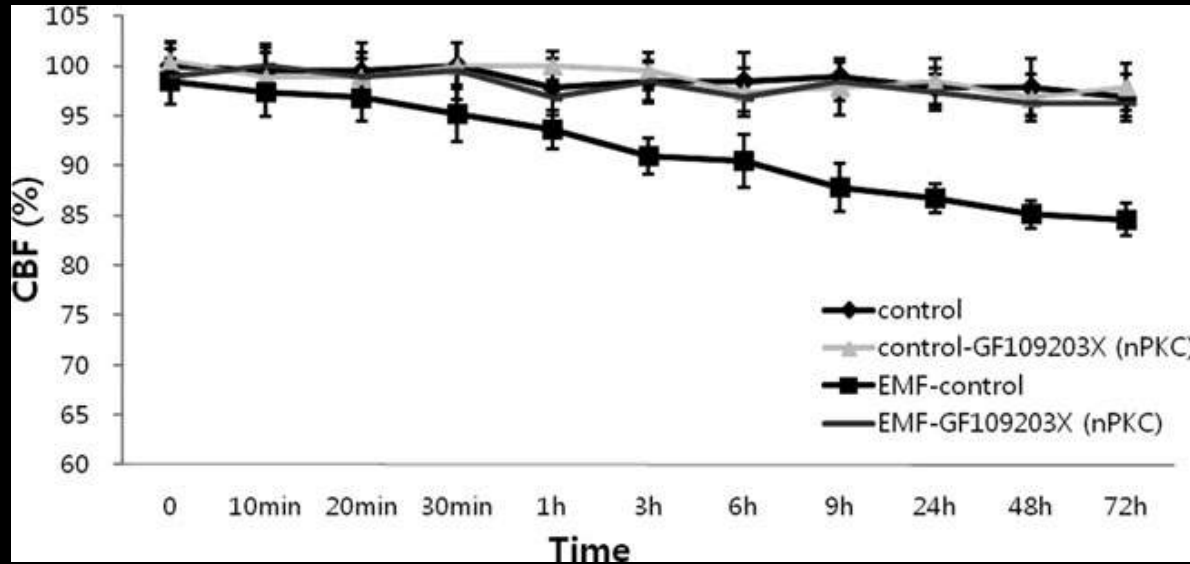
Fetal radiofrequency radiation exposure from cellular telephones affects neurodevelopment and behavior in mice

Hugh S. Taylor, M.D., Chair of Obstetrics, Gynecology and Reproductive Sciences, Yale School of Medicine

- We have shown that behavioral problems in mice that resemble ADHD are caused by cell phone exposure in the womb.
- The rise in behavioral disorders in human children may be in part due to fetal cellular telephone irradiation exposure.

<http://www.ncbi.nlm.nih.gov/pubmed/22428084>

1.8 GHz radiation reduces cilia frequency (mucus clearance capacity)

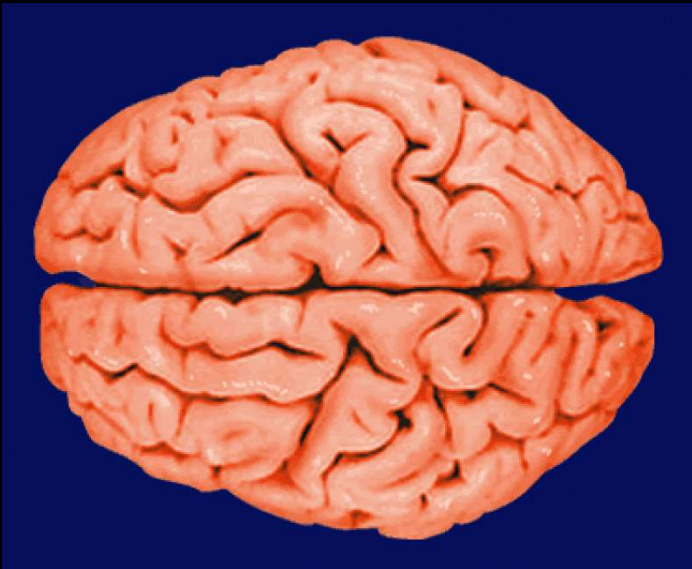


- Human mucosal cells in vitro (In et al, 2012)
- Associated with increased enzyme protein kinase C, that digests protein
- Reduced ciliary beat frequency

<http://www.ncbi.nlm.nih.gov/pubmed/23060235>

Digital Dementia Diagnosed in South Korean Children

- Characterized by: memory loss, attention disorders, lack of eye contact and empathy, difficulty feeling or showing emotions.
- Children are at the greatest risk because their brains are still developing.



- 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.”

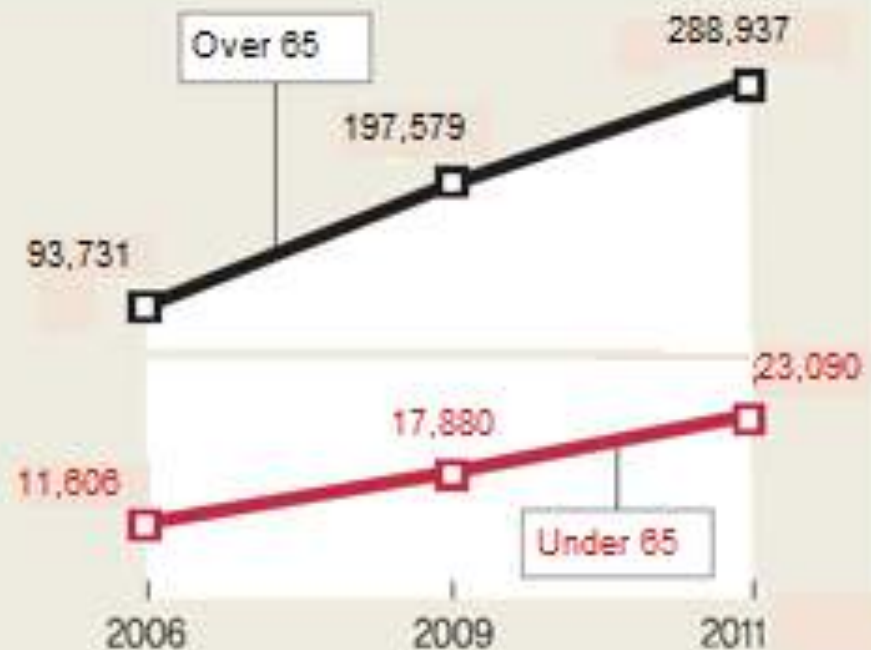
New Korean government reports on smartphone addiction and dementia

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



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, published*
 - March 2012
- 

Fetal Brain Programming

Radiation-exposed 33 pregnant mice

42 pregnant controls

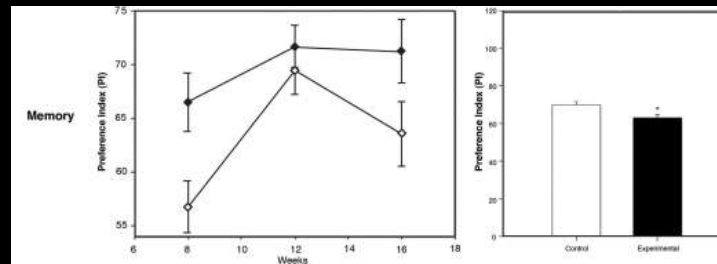


Study Design

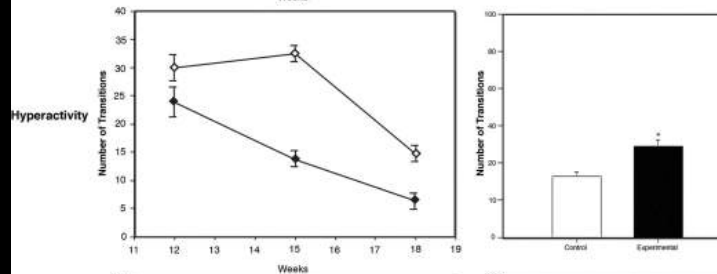
- A muted and silenced 800–1900Mhz cellular phones with a SAR of 1.6W/kg was used.
- The phones were positioned above each cage over the feeding bottle area at a distance of 4.5–22.3 cm from each pregnant mouse.
- Mice exposed as fetuses were tested

Prenatally RF-Exposed Adults Evidence *Significant Behavioral Impacts*

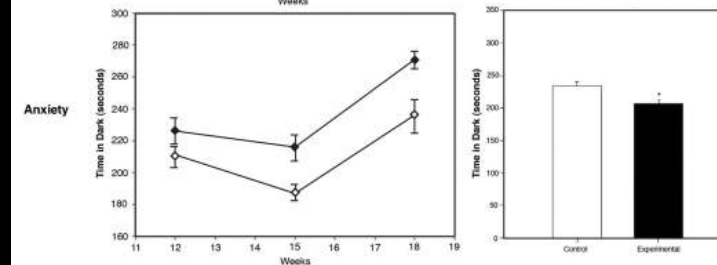
Memory



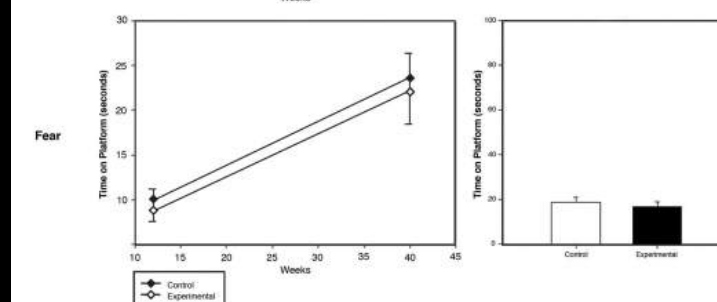
Hyperactivity



Anxiety



Fear



Evidence for mobile phone radiation exposure effects on reproductive pattern of male rats

- 70 day old male rats (middle-aged) exposed to cellphone radiation 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 and Behari, 2012)

<http://www.ncbi.nlm.nih.gov/pubmed/22897402>

Definition

- Attention Deficit Hyperactivity Disorder (ADHD), sometimes called Attention Deficit Disorder (ADD), involves hyperactivity, difficulty paying attention and a tendency to act impulsively.



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.

Does Prenatal Cell Phone Exposure Reduce Number of Cells in Thinking Part of Brain????

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

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

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Rat

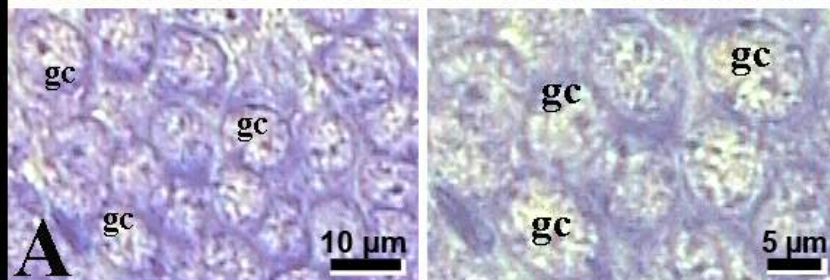
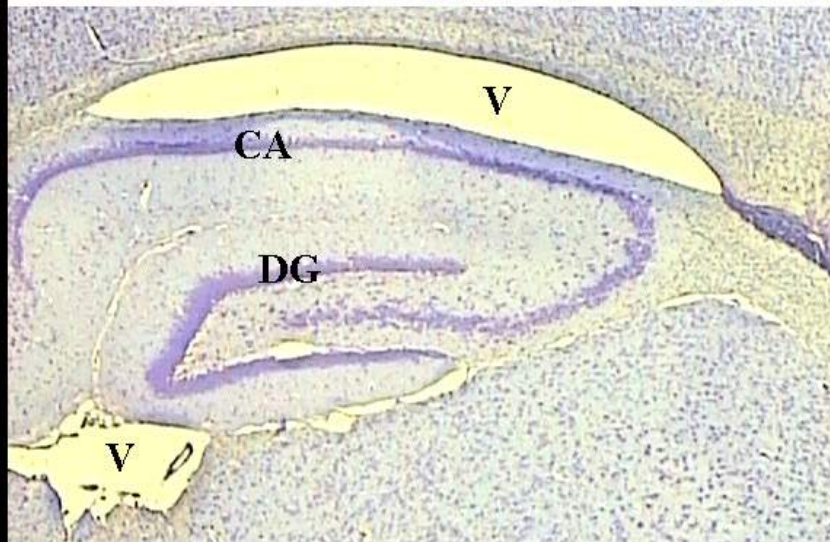
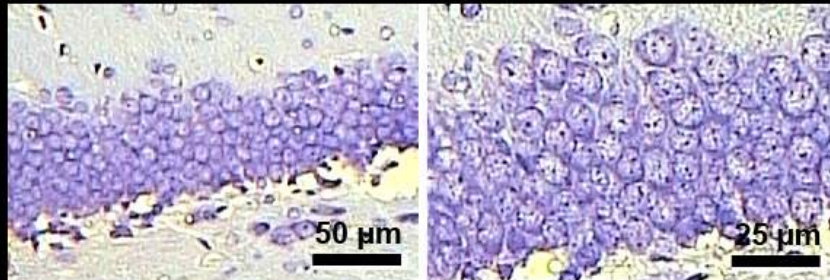
ABSTRACT

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.

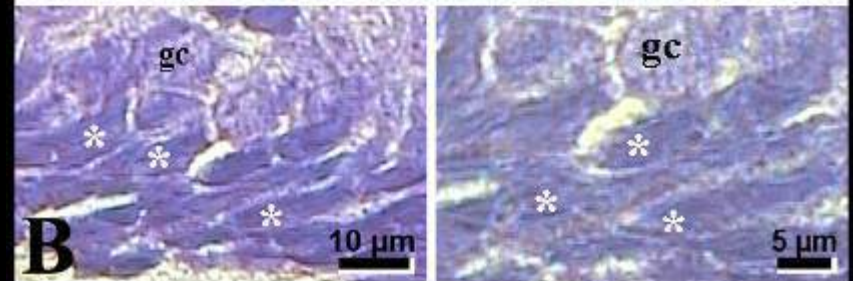
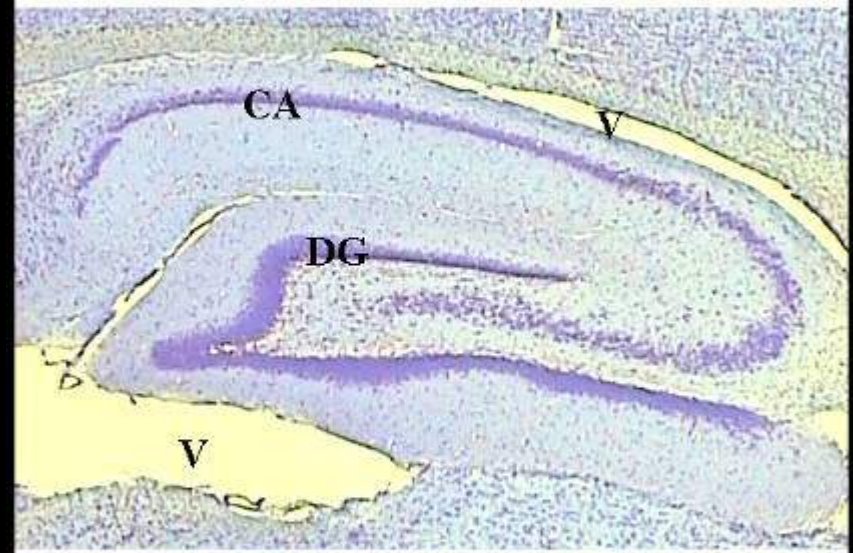
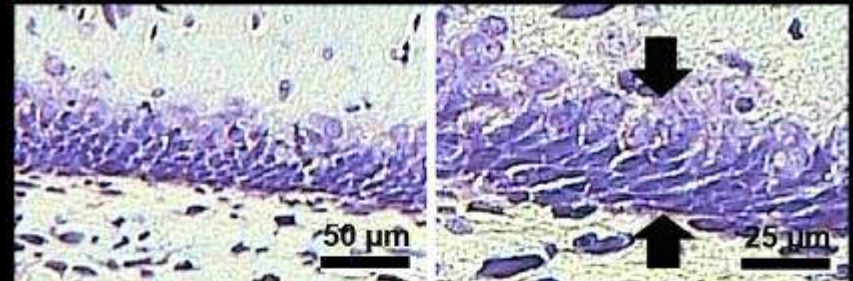
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Prenatal 900 MHz EMF exposure decreased hippocampal granular cell number in the dentate gyrus of newborn rats

Controls

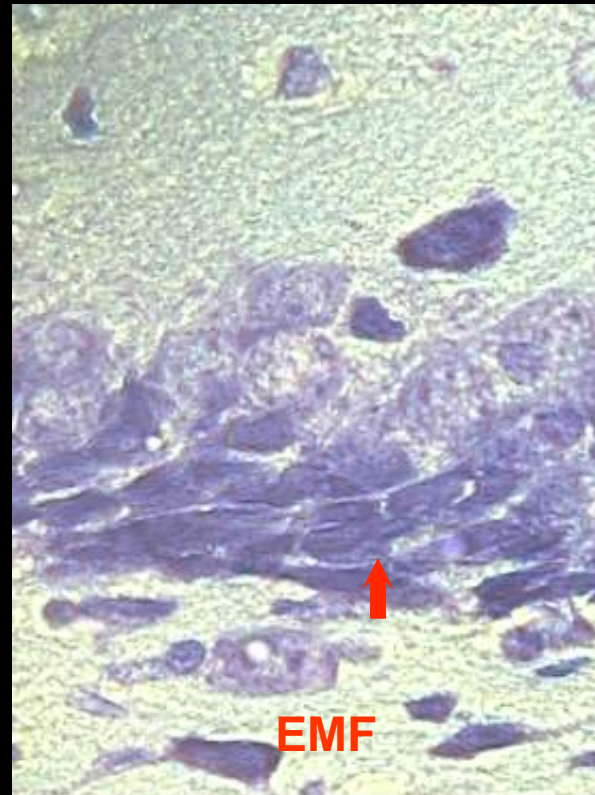
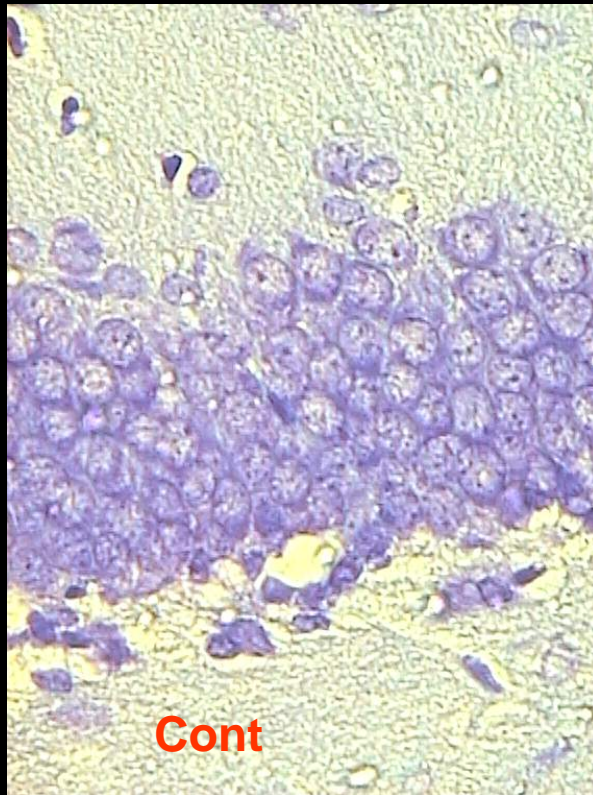


Exposed



YES Prenatal Cell Phone Exposure Does Reduce Number of Cells in Thinking Part of Brain

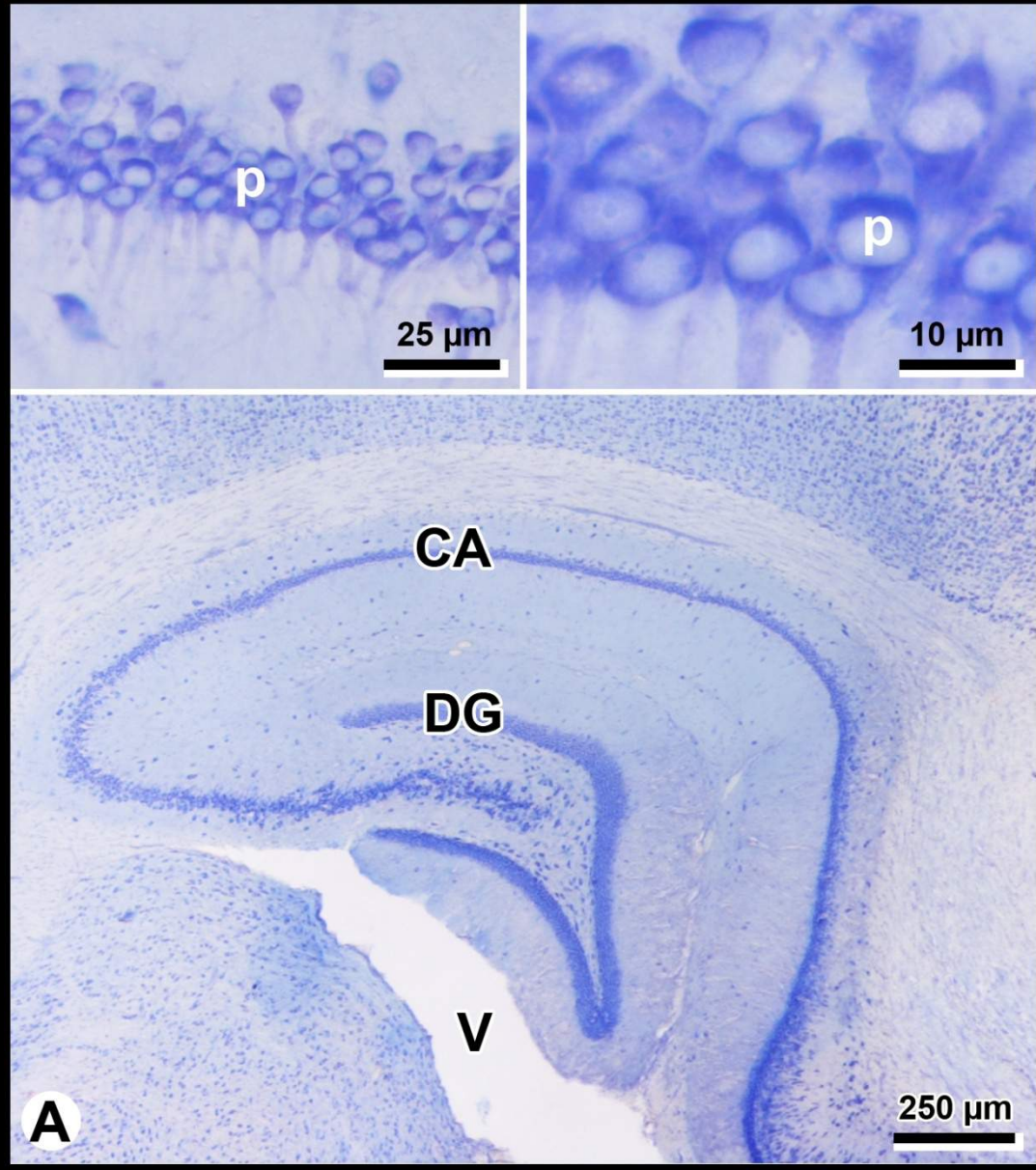
Granular cell loss might be caused by an inhibition of granule cell neurogenesis in the dentate gyrus during prenatal life as well as in the postnatal life.



RESULTS

Panoramic views of the Cont (A), Sham (B) and EMF (C) groups.

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.



Adult Cell phone exposure kills brain cells tied to balance and other integrative functions

