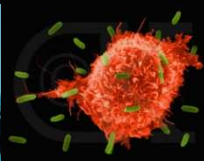
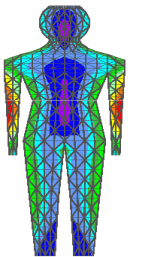


# Biological Effects of Cell Tower Radiation on Human Body

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ISMOT- 2009



# OBJECTIVE



Radiation measurements near the cell towers



EMF exposure Safety norms



Review Biological effects  
(far below current standards)

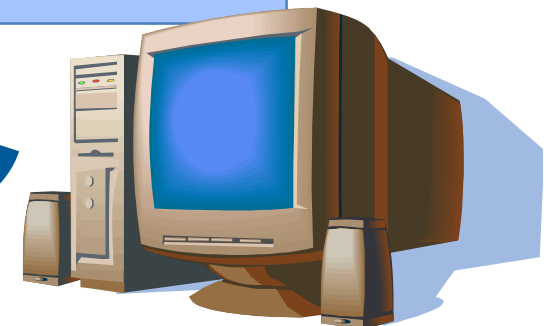


Radiation Shield (reduce Radiation levels)



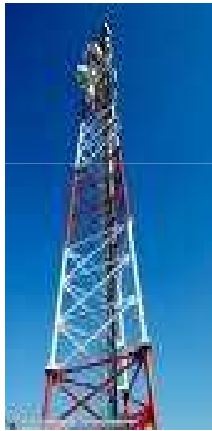
## Electromagnetic Radiations

Radiation emitted from Cell Phones, Cell phone towers, Wi-Fi, TV and FM towers, microwave ovens, etc are called Electromagnetic radiations and are known to cause significant biological effects on the human body and health of animals.



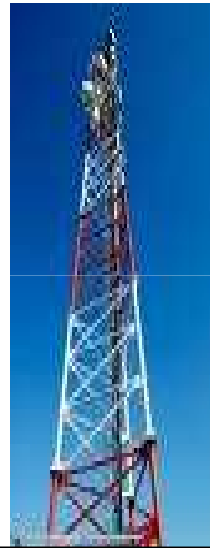
# Cell Tower Statistics in India

**3.75 lakhs**



Current  
(2009)

**4.25 lakhs**



Predicted  
(2010)

Antennas on Cell tower transmit in the frequency range of:

- 869 - 890 MHz (CDMA)
- 935 - 960 MHz (GSM900)
- 1805 – 1880 MHz (GSM1800)
- 2110 – 2170 MHz (3G)\*



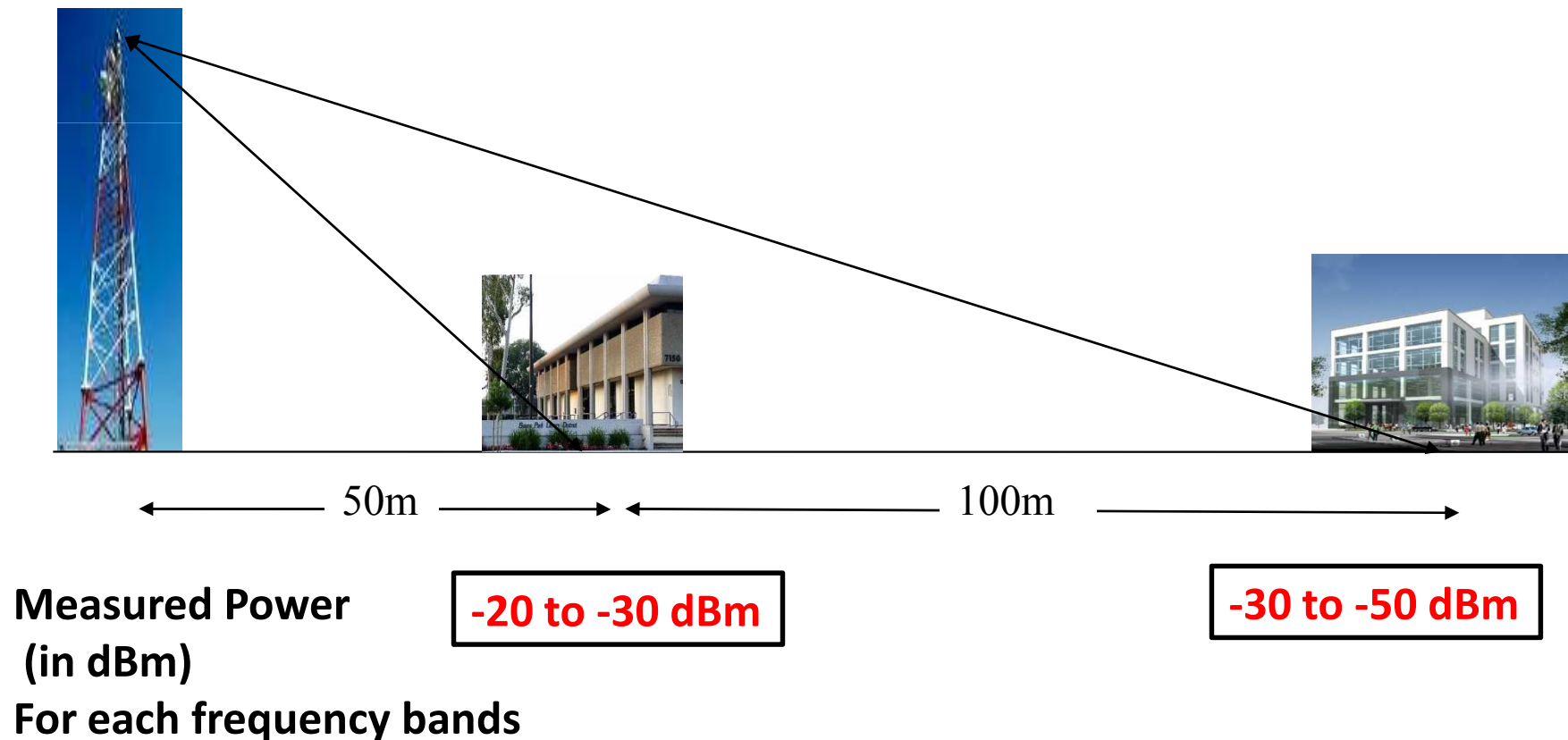
Microwave radiation effects are classified as:

- Thermal
- Non-thermal

The current exposure safety standards are mainly based on the thermal effects, which are inadequate.

# EXPERIMENT: Radiation level measurements near several Cell Tower sites

A broadband monopole antenna of gain = 2 dB was used to measure radiated power by various cell phone towers (CDMA, GSM900 and GSM1800)



## Theoretical calculations

Power Received  $P_r$  by an antenna at a distance  $R$  is given by:

$$P_r = \frac{P_t \times G_t \times Area}{4\pi R^2} = P_t \times G_t \times G_r \times \left( \frac{\lambda}{4\pi R} \right)^2$$

For a transmitter power of  $P_t = 20$  W,  
transmitting antenna gain of  $G_t = 10$  dB,  
receiving monopole antenna of gain  $G_r = 2$  dB,  
the received power at  $R = 50$  m is:

At 887 MHz,  $P_r = -10.2$  dBm

At 945 MHz,  $P_r = -10.8$  dBm

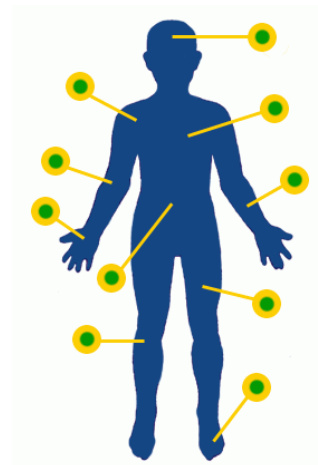
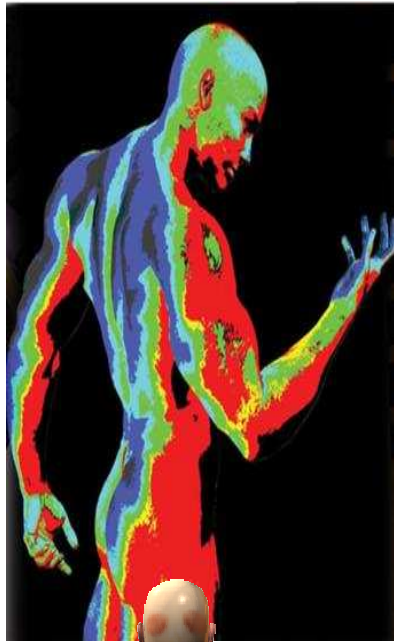
At 1872 MHz,  $P_r = -16.7$  dBm



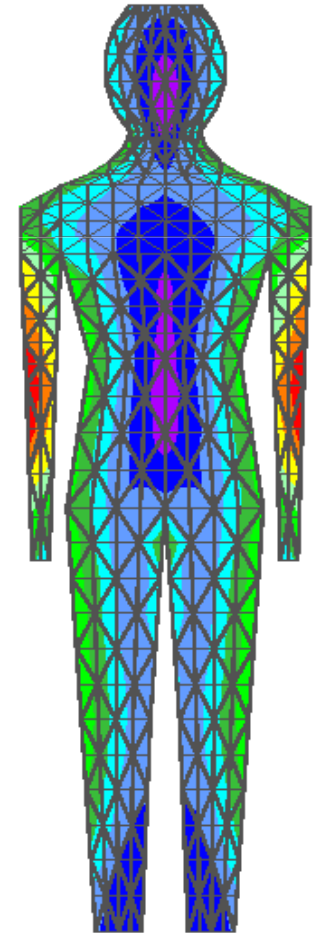
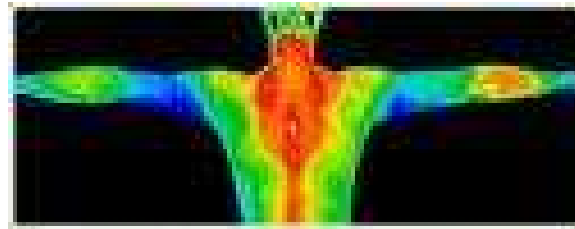
- Measured power is less than theoretically calculated power as the concrete wall provides some attenuation and also these buildings were not directly in the direction of maximum radiation of transmitting antenna.
- A mobile phone requires -80 to -100 dBm power for its proper operation. Thus power level at 50m is 50 to 60 dBm (100,000 to 1,000,000 times) more than required by mobile phone.
- The power density at  $R = 50\text{m}$  is equal to  $6.366 \text{ mW/m}^2 = 6366 \text{ }\mu\text{W/m}^2$ .

## Other standards and guidelines

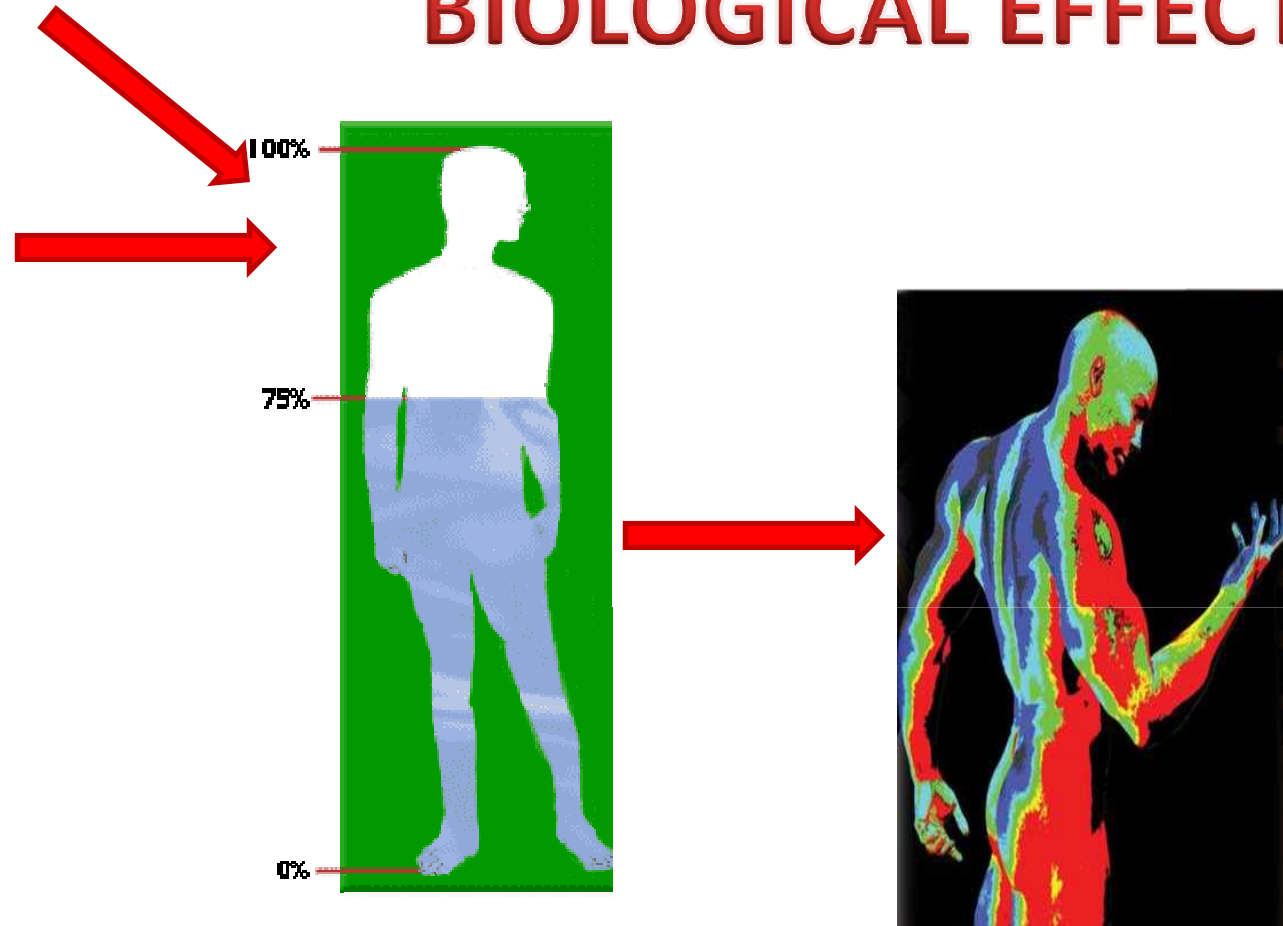
- BioInitiative Report 2007 - **1000  $\mu\text{W}/\text{m}^2$**  for outdoor, cumulative RF exposure
- Building Biology Institute, Germany, provide the following guidelines for exposure:
  - a.  $<0.1 \mu\text{W}/\text{m}^2$  ( $0.00001 \mu\text{W}/\text{cm}^2$ ) - no concern
  - b.  $0.1 - 10 \mu\text{W}/\text{m}^2$  ( $0.00001$  to  $0.001 \mu\text{W}/\text{cm}^2$ ) - slight concern
  - c.  $10 - 1000 \mu\text{W}/\text{m}^2$  ( $0.001$  to  $0.1 \mu\text{W}/\text{cm}^2$ ) - severe concern
  - d.  $> 1000 \mu\text{W}/\text{m}^2$  ( $> 0.1 \mu\text{W}/\text{cm}^2$ ) - extreme concern
- H Thomas et al, Germany; ..power densities should not exceed **100  $\mu\text{W}/\text{m}^2$**
- G J Hyland, International Institute of Biophysics, Germany, 2002: a maximum intensity limit of **100  $\mu\text{W}/\text{m}^2$**  is indicated.
- We recommend up to  $50 \mu\text{W}/\text{m}^2$  , with a upper limit as **100  $\mu\text{W}/\text{m}^2$** .



# BIOLOGICAL EFFECTS

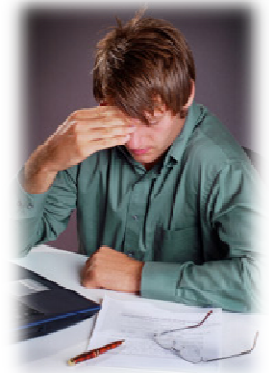


# BIOLOGICAL EFFECTS



Multiple Resonances - localized heating - This results in boils, drying up the fluids around eyes, brain, joints, heart, abdomen, etc - leg/foot pain, muscle and joint pain.

## 1. Most common complaints:



**Cognitive functions** - Concentration, memory, behavior, etc

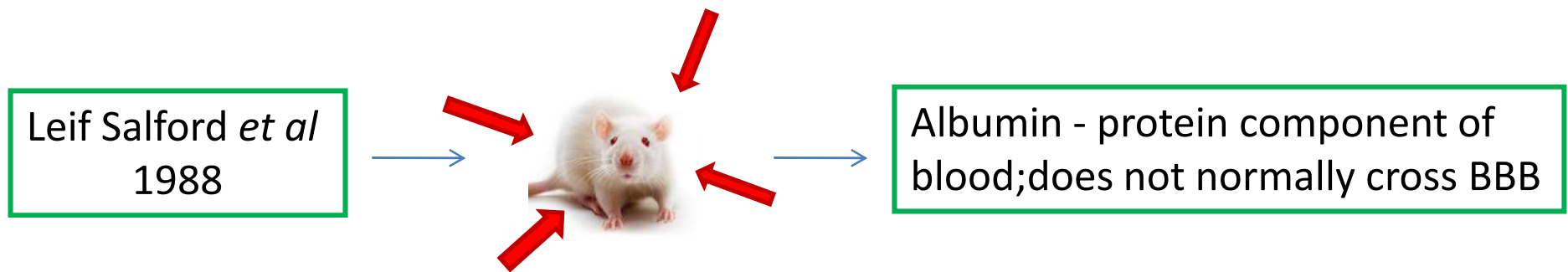
**Epidemiological studies** - Sleep disruption, Headache , Depression, discomfort, irritability, nausea, dizziness, appetite loss, muscle spasms, numbness, tingling, altered reflexes

*Subjects reported buzzing in the head, palpitations of the heart, light-headedness, heat, visual disorders, cardiovascular problems, respiratory problems, nervousness, agitation. More severe reactions include seizures, paralysis, psychosis and stroke.*



**All these are related to changes in the electrical activity of the brain**

**Blood Brain Barrier** -selectively lets nutrients pass through from the blood to the brain, but keeps toxic substances out.



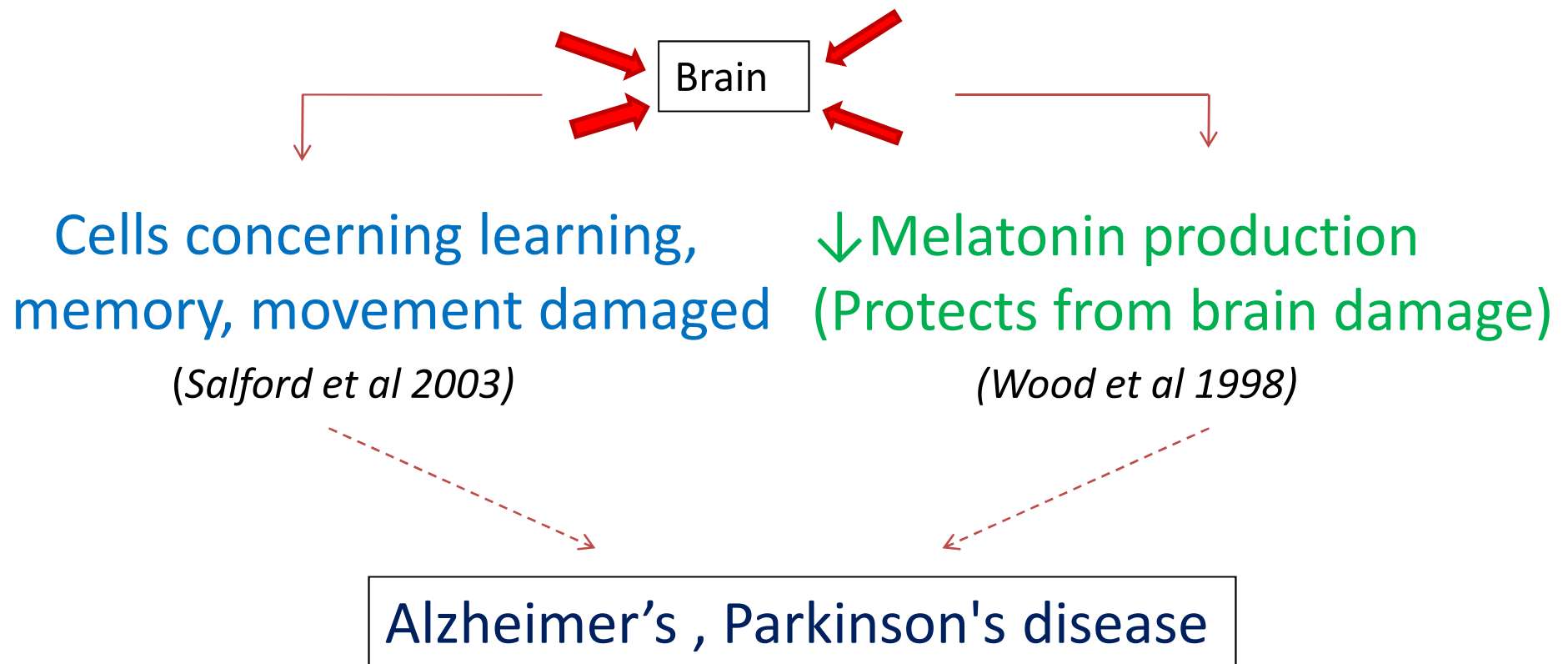
- Albumin in brain tissue - Damaged blood vessels & lost brain protection
- Neuron - Grouped & shrunken with loss of internal cell structures.

*Neuronal damage - not immediate consequences -but may result in reduced brain reserve capacity -unveiled by other later neuronal diseases*

**NOTE:** BBB in is the same in a rat and a human being.

## 2. Alzheimer's , Motor neuron, Parkinson's disease

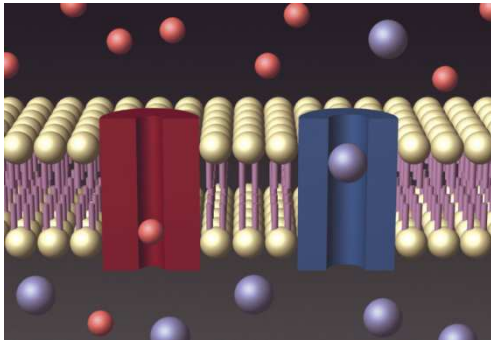
- 4 times incidence of Alzheimer's disease (*Hakansson et al 2003*)
- 3 times amyotrophic lateral sclerosis (ALS) (*Savitz et al 1998*)



### 3. DNA Damage



#### 1. Ca<sup>2+</sup> release:



- ❑ ELF release Ca<sup>2+</sup> bound to membranes
- ❑ Loss of Ca<sup>2+</sup> causes leaks in the membranes of lysosomes releasing DNAase that causes DNA damage.

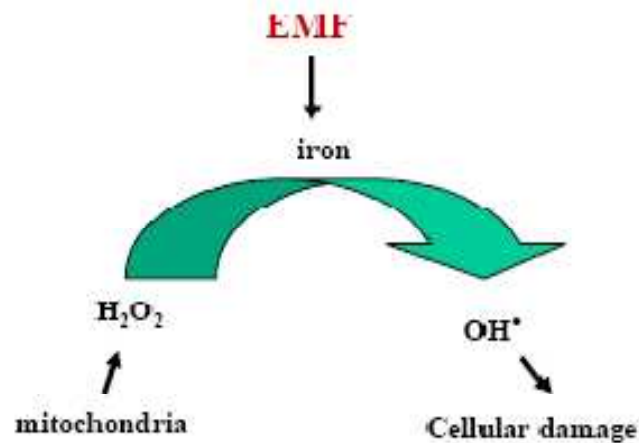
#### 2. Interfere with natural processes:

- ❑ DNA replication & repair -altering molecular conformation
- ❑ This could result in chromosome aberrations, micronuclei formation & increased DNA fragmentation



### 3) Free radical formation inside cells:

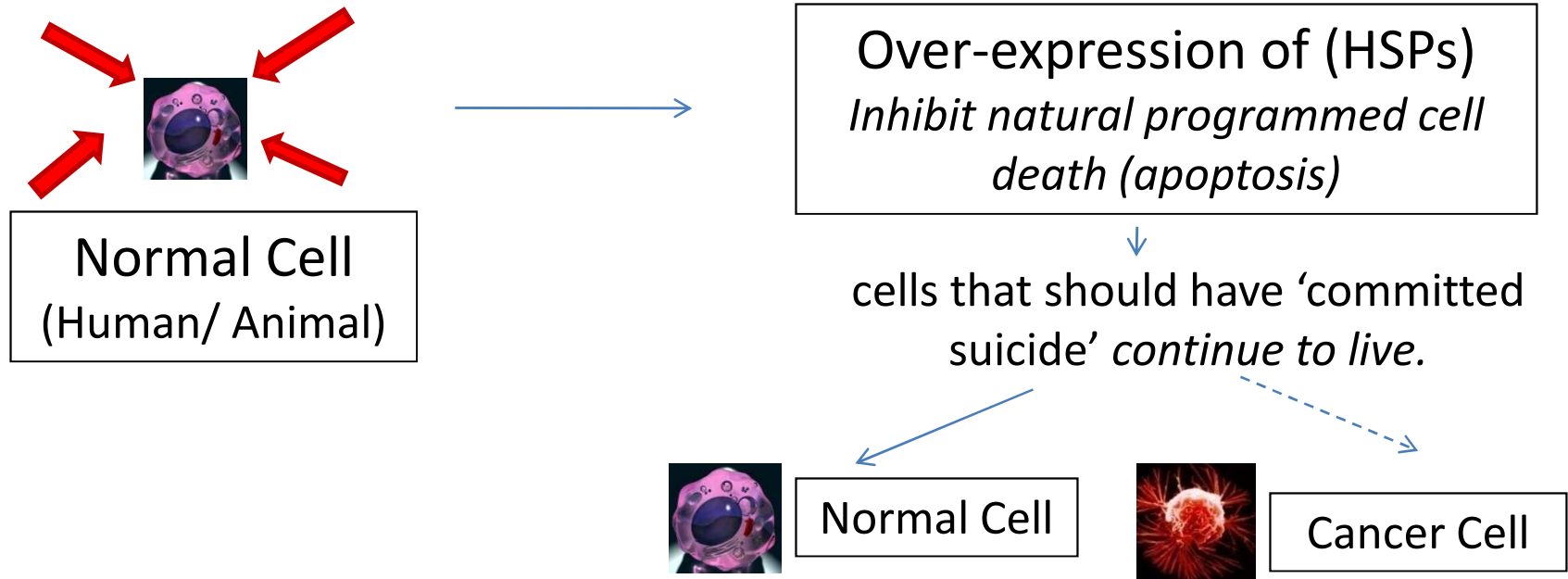
- ❑ ↑ free radical activity in cells from EMF via Fenton rxn.
- ❑ Free radicals kill cells by damaging macromolecules, such as DNA, protein and membrane.



THE FENTON REACTION

When Damage to DNA > Rate of DNA repaired, there is the possibility of retaining mutations and initiating cancer

## 4. Effect on HSP



Consistent with the 2-3-fold ↑ in incidence of a rare forms of cancer

## 5. Irreversible infertility

Continuous exposure



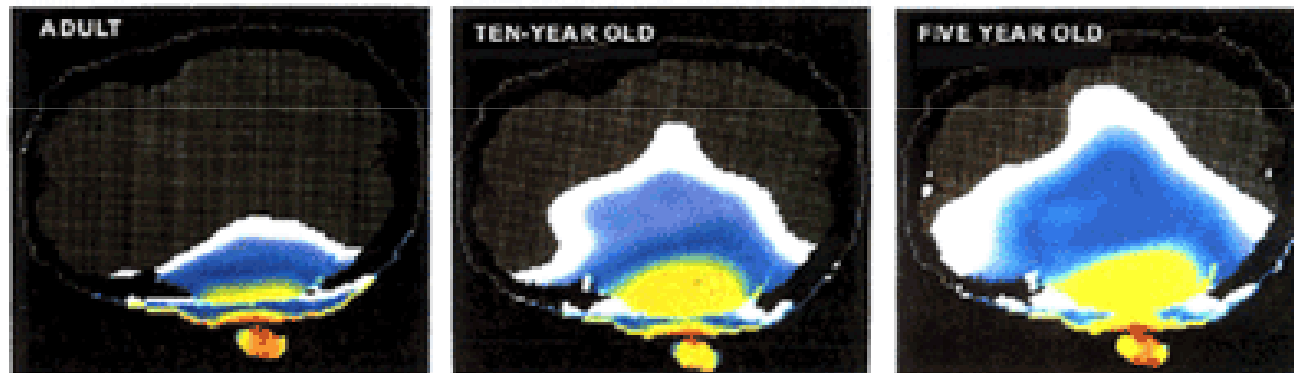
Reduction in Sperm Viability and Mobility by around 25 % in men

## 6. Risk to Children



Children are more vulnerable as:

- Skulls are smaller & thinner - ↑'s radiation absorption
- ↑rate of Cell division - more susceptible to genetic damage
- Myelin sheath not developed - Electrical brain-wave activity

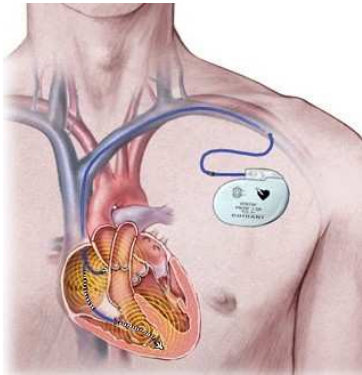


RF penetration in the skull of an adult (25%), 10 year (50%) and a 5 year old (75%).



**Fetus & Mother** -RF can pass placental barrier & continuously react with the developing embryo and increasing cells

## 7. Risk to Patients Carrying Pace Makers, Implantable cardiovascular defibrillators and Impulse Generators



Stop Pace Maker from delivering pulses in a regular way by generating external pulses putting the patient to death.

## 8. Occupational hazard

Workers in the highest 10% category for EMF exposure are:

- Twice as likely to die of prostate cancer
- Elevations in brain cancer, non-Hodgkin's lymphoma etc



## Effect on Environment

- **Effect on farm animals-** According to Dr. W. Löscher of the Institute of Pharmacology, Toxicology and Pharmacy ,Germany, dairy cows that were kept in close proximity to a TV and cell phone tower for two years had a reduction in milk production along with increased health problems and behavioral abnormalities.
- **Vanishing Bees-** A study in England showed that bees refused to return to their beehives where there was a DECT cordless phone station. It is discussed that the extensive use of mobile phones may be one reason why bee colonies are vanishing at a huge scale in Europe and the US.

Similarly, EMR from cell phone towers - diseases in plants & animals and is the reason for the *vanishing butterflies, some insects and birds like sparrows.*





- Until now, man has been absorbing the harmful, unseen EM radiations without even being aware of it, but now, with the rapid advent in technology, this RF Radiation pollution has started having ill effects on human health, health of animals, medical investigatory equipments and even on food products being consumed by everybody.
- Hence, there is an urgent need to take precautionary steps.

➤ Example, when a glass is filled with water, it holds up to a certain level, but once it reaches the rim, it starts spilling. Similarly, our bodies can also absorb radiation up to a certain limit.

## RADIATION SHIELD

- ❑ A “Radiation Shield” consisting of multiple orthogonally polarized broadband monopole antennas (800 to 4000 MHz) has been developed.
- ❑ The antennas are terminated in matched load to absorb the harmful radiation to produce a safe radiation free environment.
- ❑ It also has a LED which lights up (without battery) when a strong radiation source is brought close to it.
- ❑ Absorbs 10% to 50% of radiation depending upon its placement and direction of source of radiation. Multiple units can absorb radiation up to 80% to 90%.

## CONCLUSIONS

- ❑ In addition to continuous radiation from cell towers, there is radiation from cell phones, computers, laptops, TV & FM towers, microwave ovens, etc -additive in nature.
- ❑ Stricter radiation norms must be enforced across globe.
- ❑ This does not mean that we have to stop living near these towers. We all know that automobiles create air pollution... Hence came up with unleaded petrol, CNG driven vehicle, hybrid vehicles, etc. Similarly, the solution to avoid excess radiation is to use radiation shields.
- ❑ Mobile companies should not be in the denial mode and accept that radiation causes serious health problems. Only then people all over the world will carry out research to come out with solutions.



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