



Dr Mary Redmayne

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Victoria University of Wellington

Wellington

Saturday, August 10, 2019

(Room 10)

8:30 - 9:25 WS #67: Screen use is affecting health. What can we do about it?
9:35 - 10:30 WS #77: Screen use is affecting health. What can we do about it?
(Repeated)

Mary Redmayne

PhD, Dip Teach, Dip BBE, Dip Env Stud, BA



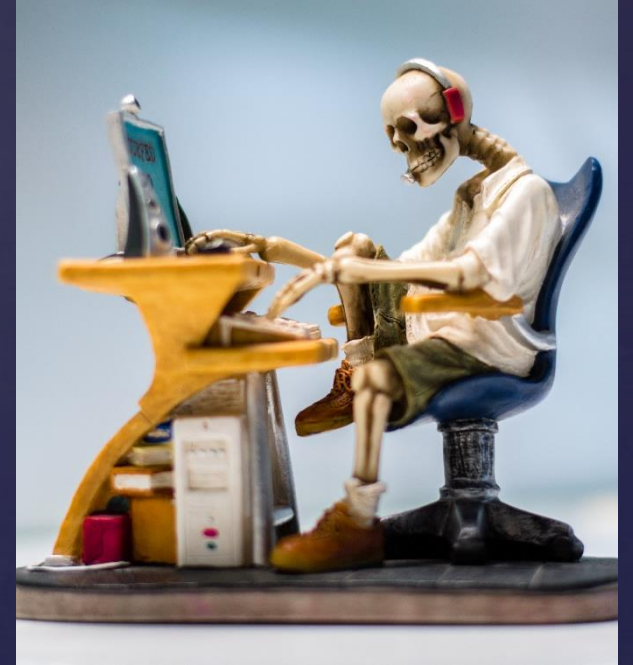
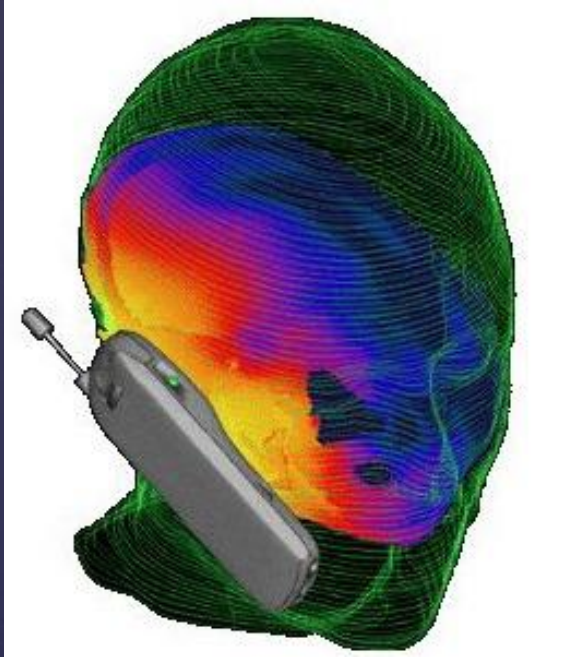
ASNZ 2772.2 (2016)

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Screen use is affecting health.

What can we do about it?



Mary Redmayne, PhD

Adjunct Research Fellow

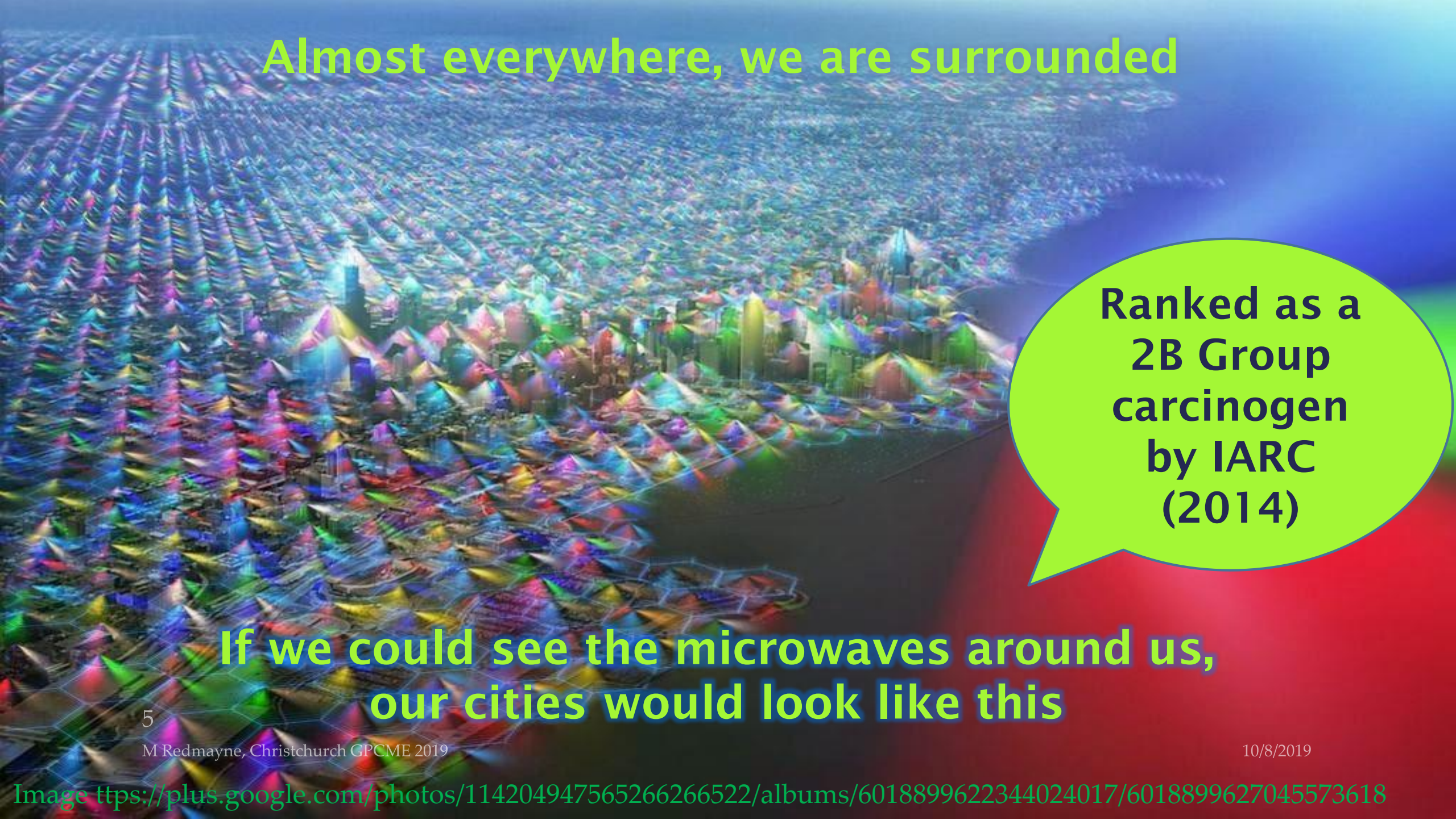
Victoria University of Wellington and Monash University

Centre for Population Health Research on Electromagnetic Energy (PRESEE)

Christchurch GPCME July 2019

Workshop outline

- Introduction to 'electrosmog', what the controversy is about, and mechanisms
- Identifying microwave sources
- What the exposure standard does /doesn't
- Common bio-effects and health concerns (with bullet-point response actions)
- Extended screen use – mental health and wellbeing concerns
- Prevention, diagnosis and treatment



Almost everywhere, we are surrounded

**Ranked as a
2B Group
carcinogen
by IARC
(2014)**

**If we could see the microwaves around us,
our cities would look like this**

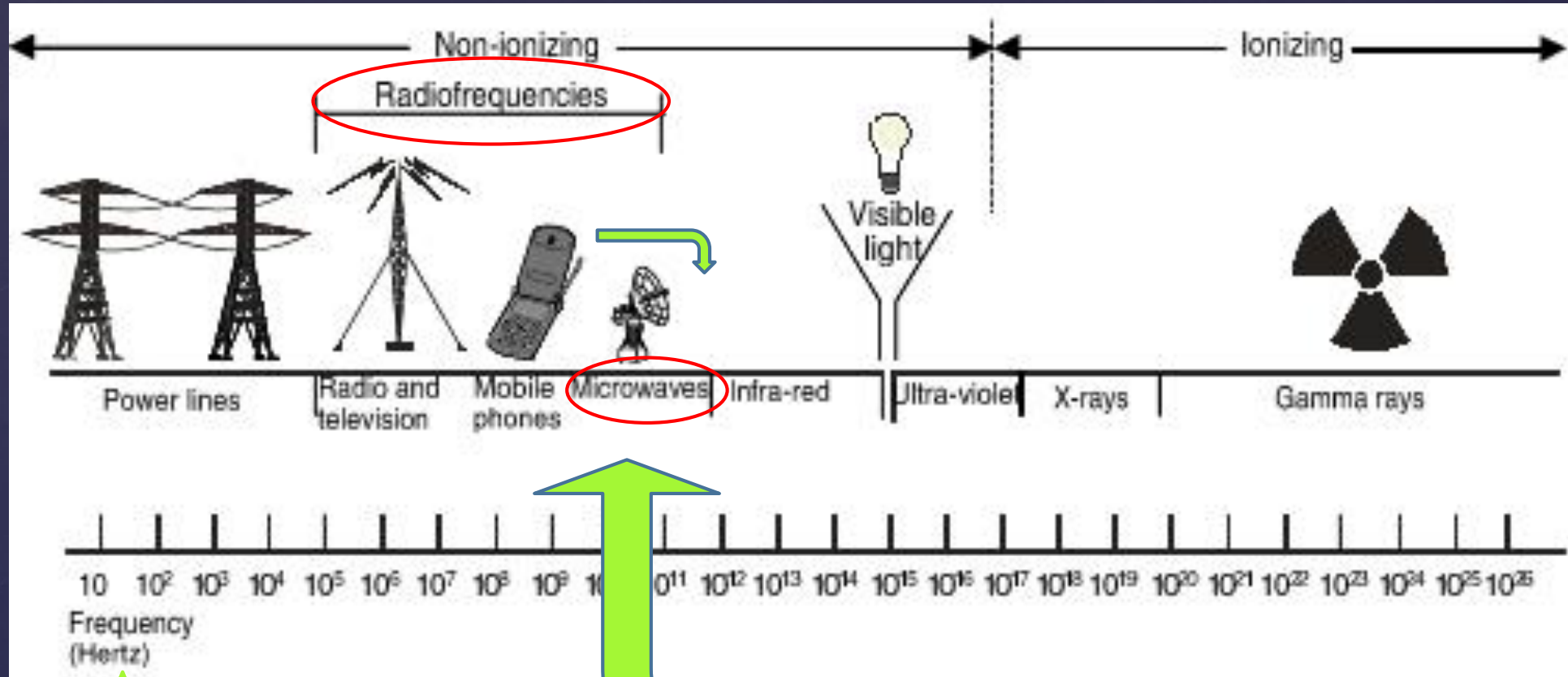
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Image <https://plus.google.com/photos/114204947565266266522/albums/6018899622344024017/6018899627045573618>

The Electromagnetic Spectrum



Extremely low frequencies

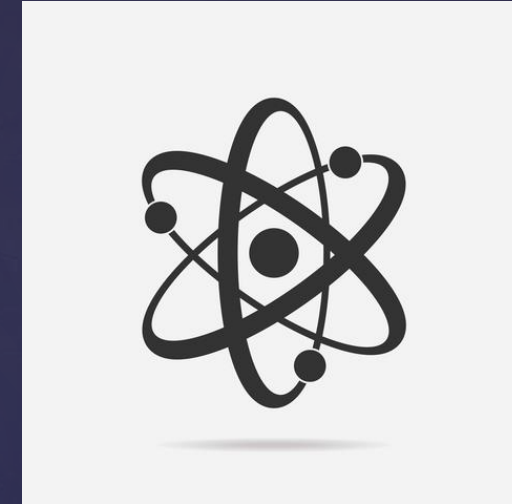
Microwaves (MW)

Mechanism: The Root of Contention



Physics

VS



- Research observation &
- Experience





3D Model From
Ted-Kyte.com



Listen to phone emissions

Some everyday exposure sources

Mobile phone; Wireless phone headset; **WiFi router;** Photocopiers; **Bluetooth headset;** MRI scanner; Phone tucked in clothing (eg in bra while running); **Two-way pagers;** FitBit; Smart watch; Remote control toys; Wireless virtual or alternative reality goggles;; **Wireless laptop/keyboard/mouse;** Drones Cordless phone; E-reader; **Router on WiFi setting;** Microwave oven; **Baby monitors** (one of the highest outputs in small devices); Mobile phone base stations; **Tablet;** Radio and TV transmitters; Smart meters; **Free WiFi** (eg in cities/public places such as shopping malls); Driverless cars; **Household appliances** etc

Doesn't the NZ Exposure Standard protect us?

NZS 2772-1 1999 is intended to prevent heat damage, shock, burns etc. from the RF/MW transmissions

It specifically excludes acute and chronic 'non-thermal' biological effects

Some Commonly Demonstrated Bio-effects (ORSAA database)

- Altered Enzyme Activity/Protein Damage/Protein up- or down- regulation
- ROS/ Oxidative Stress/ Free Radicals
- Damaged sperm
- Neurobehavioural effects
- Cell Irregularities/Damage
- DNA Breaks/ Mutagenic/Genotoxic

In vivo and in vitro studies



Eg. Anxiety, attention, accuracy, hyperactivity, stress



Eg. Seminiferous tubules diameter reduced pre-birth



Some Health Concerns from Radiofrequency Exposure

- A. **Oxidative stress**
- B. **Brain tumours**
- C. **Electrohypersensitivity – EHS**
- D. **Fertility**

Oxidative Stress

- RF exposure stimulates increased production of ROS

Of 537 studies with 'Oxidative stress' endpoint

93% Yes; 6% No; 1% Uncertain

- Some people more vulnerable to oxidative stress
- Ongoing exposure poses increased risk

Brain Tumours (Research status)

Risk factors for glioma associated with mobile phone use: use to formulate advice to patients

- **Years of use**
- **Extent of use for calls by the head**
- **Tumour on same side of head as phone is used (adults) – opposite side may be higher risk for younger people**
- **Starting use before age 18 years**
- **Living rurally**
- **Total cumulative energy at tumour location**

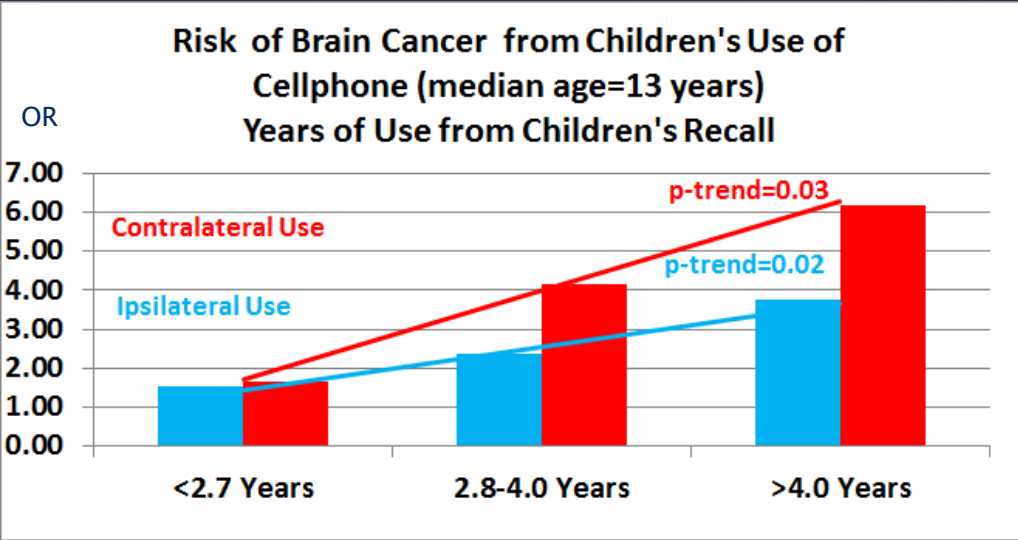
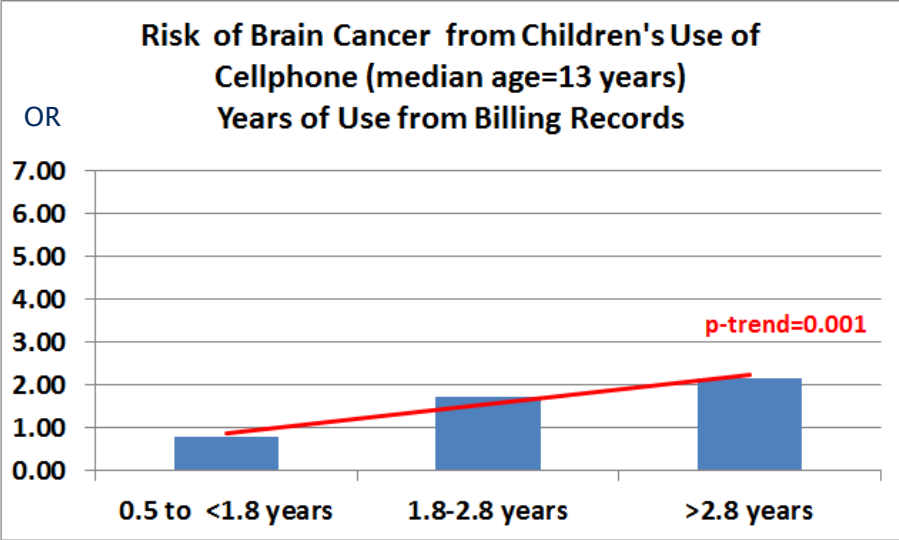
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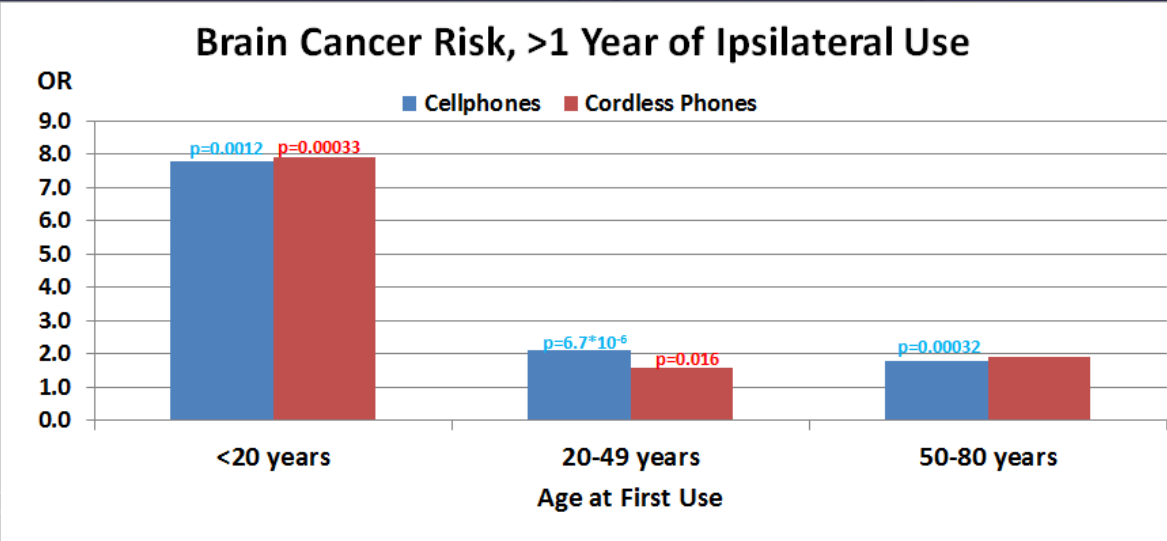


10/8/2019

Tumour-related Cellphone Risk for Children and Teens



CEFALO [Aydin et al 2011)



Graphs courtesy
of L Morgan,
2018

Malignant glioma and schwannoma

Two Studies of Rats (2018):

U.S. National Toxicology Program NTP; Italy's Ramazzini Institute

**Same/related tumours in rats and humans
(malignant glioma, schwannoma)**

Expert peer review of NTP (3 day meeting) concluded:

“Some evidence” cellphone radiation caused brain tumours in male rats

“Clear evidence” that cellphone radiation caused malignant schwannomas in male rats

They used a 4 step system similar to that of IARC

ElectroHyperSensitivity (EHS)

ElectroHyperSensitivity “manifests itself as a variety of severe dermatological, neurasthenic and/or vegetative symptoms which the person attributes to electromagnetic field exposure

... Whatever its cause, EHS is a real and sometimes a disabling problem for the affected persons.”

(WHO, 2005)

SUBJECTIVE SYMPTOMS

Nervous system: Fatigue, headache, tremor, stress, sleep problems



Skin and eyes: Itch, dryness, smarting, tingling, rash (similar to sunburn – see fit-bit ‘burn’ on right)



Motor: Trunk, limbs, joint pain or aches; numbness, weakness, dizziness

Cognitive: Memory impairment, lack of concentration, anxiety, depression



Other: Heart palpitations, irregularities; digestive problems

Belpomme Conclusions:

EHS appears to involve:

- Inflammation-related hyper-histaminemia
- Oxidative stress
- Autoimmune response
- Temporal lobe capsulothalamic hypo-perfusion
- Blood Brain Barrier opening
- A deficit in melatonin metabolic availability

521 (71.6%) diagnosed with EHS

SEE SPARE SLIDE FOR EXTRA INFORMATION

Belpomme et al 2015

EHS proposed objective results

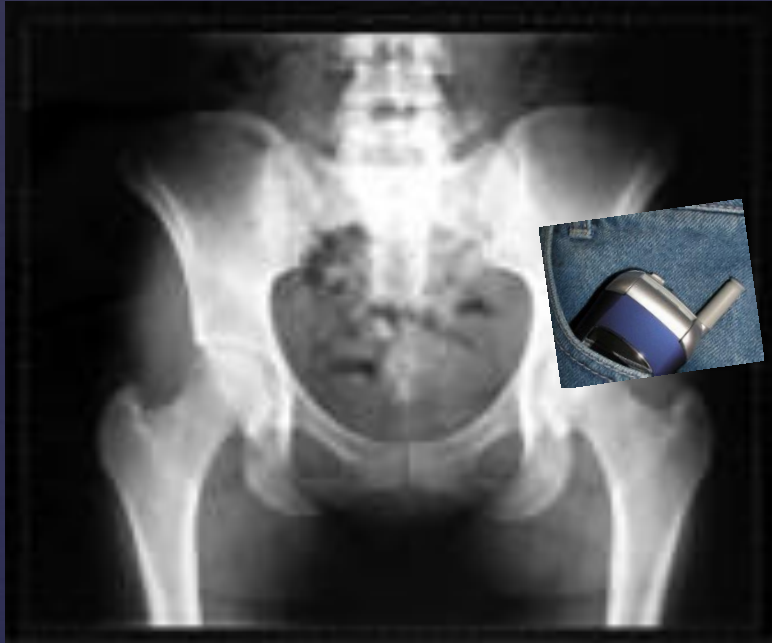
De Luca et al., 2014 found:

- Metabolic pro-oxidant/pro-inflammatory alterations with distinctively increased plasma coenzyme-Q 10 oxidation ratio
- 9.7-fold increased risk of developing EHS for the haplotype (null)GSTT1 + (null)GSTM1 variants.
- [GSTS = glutathione S-transferase]

Tuengler & von Klitzing, 2013, found:

- Lower heart-rate variability in harmonic frequencies
- Diminished micro-circulatory flow
- Reduced amplitude of skin electric potential

Sperm damage



Fertility at risk?

EMF increases ROS production (Yahyazadeh et al 2018)

An analysis of 10 studies of cellphone effects on human sperm found:

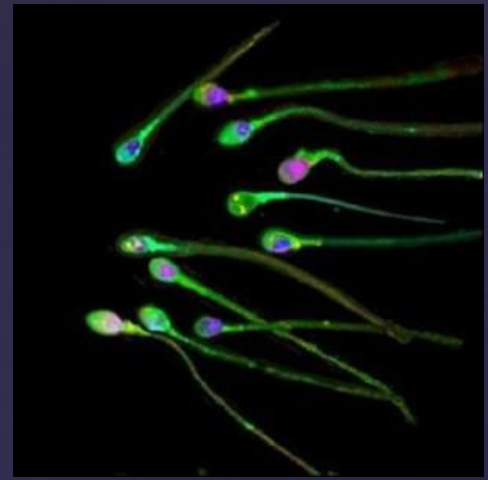
- Reduced sperm motility
- Reduced sperm viability
- Increased sperm DNA fragmentation

Effects were related to:

- Duration of ownership & Extent of cellphone use
- Carrying the phone in a side-pocket / belt carrier

(Adams et al., 2014)

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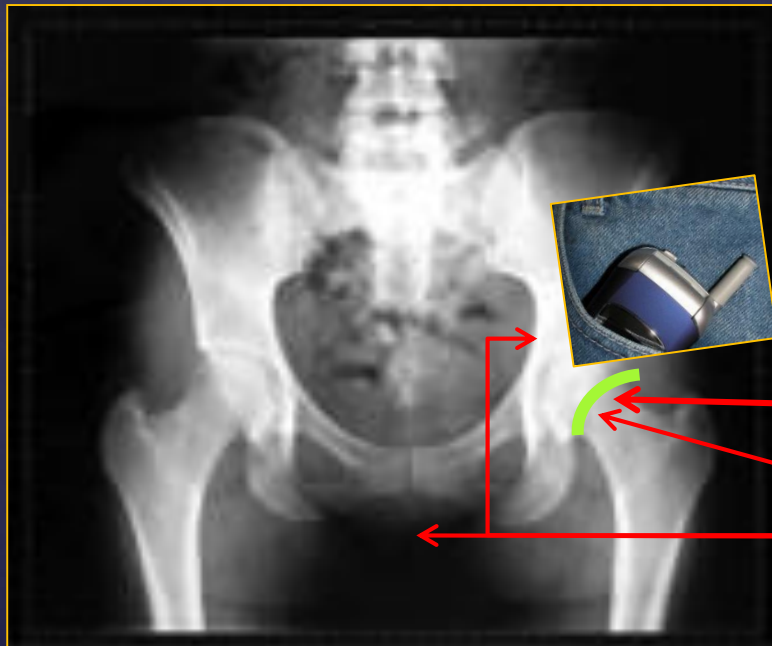
**RF exposure
occurs using a
laptop or tablet
with WiFi
connection on the
lap, or with phone
or iPod in pocket**

Stem cell damage

1. MW radiation causes double strand DNA breaks
 2. MW exposed stem cells less able to repair DNA breaks
 3. Stem cells did not adapt to chronic exposure
 4. Stem cells are more sensitive to some frequencies e.g. 915 MHz
- (used for diathermy, microwave ovens, and by some mobile companies)

ACTION:

- Don't store or use transmitting devices near or against areas with active stem cells (and rapidly dividing cells)



Growth plate of femur
(upper leg bone)

Active stem cells

ICD-10-CM Code W90.0

W90.0 “Exposure to radiofrequency”

ICD is increasingly used in clinical care and research to define diseases and study disease patterns, as well as manage health care, monitor outcomes and allocate resources. (WHO 2019)

<https://www.who.int/classifications/icd/factsheet/en/>

Tips for Reducing Microwave Exposure

1. Increase distance from the transmitting source
2. Remove or minimise transmitting devices at home
3. Turn WiFi and phones off at night
4. Use an alternative (eg meeting friends in person, wired landline, wired internet)

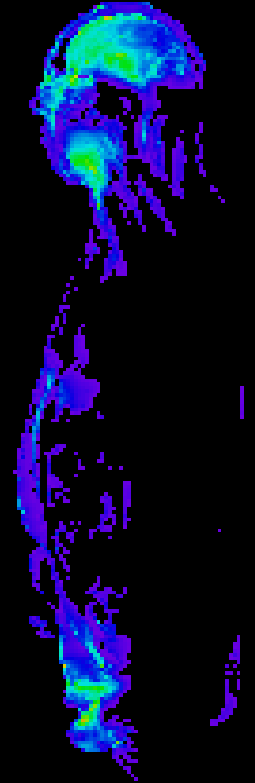


© [Kornilovdream](#) photo

Minimising exposure: Know what your phone is doing

Transmitting devices increase the amount of microwave energy they're emitting when:

1. Transmitting (rather than receiving)
 2. Moving quickly
 3. Having trouble picking up signal (low bars) eg in a lift
- Smartphones transmit frequently (updating apps and 'talking to' the router or base-station)
 - MW energy level reduces rapidly as the distance from the device increases
(double the distance = $\frac{1}{4}$ the exposure)



Side view of person exposed to cell phone type radiation – the light bits show the most heating

Slide courtesy Dr V. Anderson
Swinburne University Brain Sciences Institute,
Melbourne

Emerging developmental and wellbeing effects related to screen use by children

- A. **Myopia & Spinal**
- B. **Postural problems**
- C. **Language development**
- D. **Obesity (screen and snacking/ insufficient exercise)**
- E. **Low Vitamin D**

Other screen-related physical/mental problems cont'd

- A. Anxiety, Loneliness, Depression**
- B. Increased suicide ideation/action**
- C. Screen addiction (behaviour probs/brain changes)**
- D. INATTENTION FROM PARENT**
- E. LACK OF HEALTHY BALANCED LIFESTYLE**

Gaming Disorder listed in ICD-11

Definition: a pattern of gaming behavior characterized by:

- impaired control over gaming
- gaming takes precedence over other interests and daily activities
- continuation or escalation of gaming despite negative consequences
- The behaviour pattern is of sufficient severity to result in significant impairment in personal, family, social, educational, occupational or other important areas of functioning

Online Addiction and Mental Health issues

“Teens who spend more time online are more likely to be lonely, unhappy, depressed and have more risk factors for suicide”

(Twenge 2017)



“All of our minds can be hihacked. Our choices are not as free as we think they are.” Tristan Harris 2018, former Google employee

Dopamine thrills [from social networking and gaming] are leading to addiction, depression, anxiety (Lustig 2017)

Risk-factors for suicide increase from 2 hour/day up
Twenge, 2018

Mobile Phone Addiction/Dependence

Vulnerability to gaming addiction



Increased impulsivity, changed grey matter volume, reduced white matter integrity in heavy mobile users Wang et al 2016

Changes in brain blood flow

Grey Matter Changes

- Grey matter changes in gaming
- Many brain areas grey matter decreases
- Hippocampus either way: there are two types of strategies in video games: spatial or response.

<https://www.equinoxrtc.com/blog/video-game-addiction-negative-brain>

Response strategy (counting, memorizing, and patterning a series of actions to remember certain arrays) **MORE AT RISK: GREY MATTER REDUCTION**

Spatial strategy (learning the relationship between specific landmarks and target goals) **SOME BENEFIT**

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PREVENTION screen/phone addiction and mental health issues

- **Refer parents to the American Psychological Assn. Digital Guidelines: Promoting Healthy Technology Use for Children**
- **Discuss with parents importance of helping children build self-regulation skills (eg delayed gratification, avoiding impulsiveness)**
- **Urge parent to be present to infants/children/teens and model tech behaviour they want**

DIAGNOSIS AND TREATMENT of Screen/Phone Addiction

- Be aware of online activity as a possible cause of depression, anxiety and stress in young people (approx. 11 – 30+ years)
- Assess the patient with MPPUS-10 Mobile Phone Problem Use Scale (Foerster et al 2015) (SG2)
- Assess for poor self-regulation (see refs for link)
- Cognitive Behavioural Therapy shown to help internet addiction in adults (Young 2007)

Take back control <http://humanetech.com/>

Centre for Humane Technology suggestions:

- Turn off all notifications except from *people*
- Use grey scale for the screen
- Use home screen for tools only
- Charge your device [at night] out of the bedroom
- Go Cold Turkey: remove social media from your phone
- Download apps that help avoid distraction

Other suggestions:

- Keep the phone out of sight and reach

Finally

Stress the importance of :

1. Children having a balanced lifestyle
2. Parents being present when with their children and setting screen boundaries
3. Plenty of 1-to-1 time for infants/children to learn communication skills

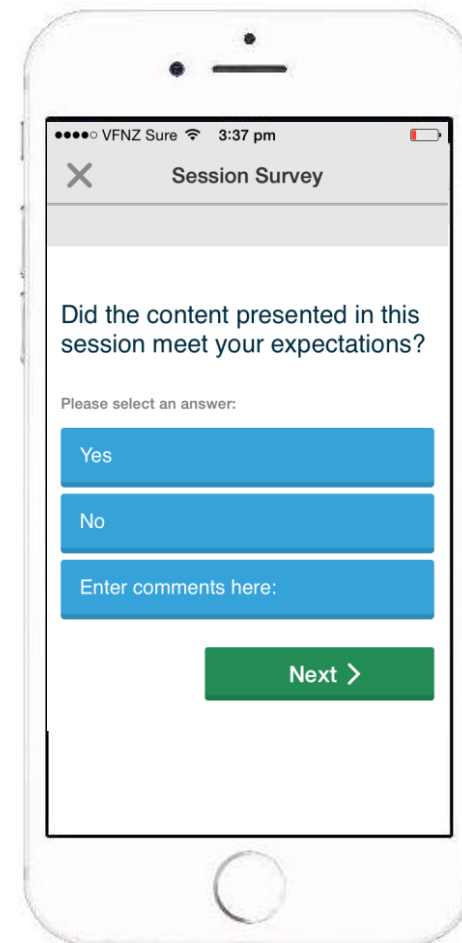
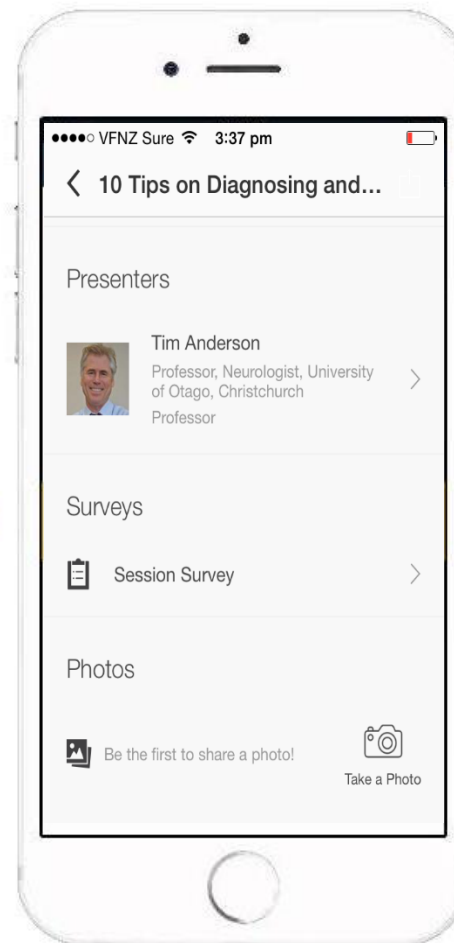
Acknowledgements

My thanks to:

- The organisers of GPCME for inviting me to run this workshop
- You, for your interest and participation
- Victoria University of Wellington, NZ, and Monash University, Melbourne for use of their library facilities

Full references for my talk are in the following slides and/or on the earlier slides

**Don't forget
to take the
session survey!**



Thanks for coming along
You can contact me on
mary.redmayne@monash.edu

Questions?

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ICD-11 Gaming disorder <https://icd.who.int/browse11/l-m/en#/http://id.who.int/icd/entity/1448597234>

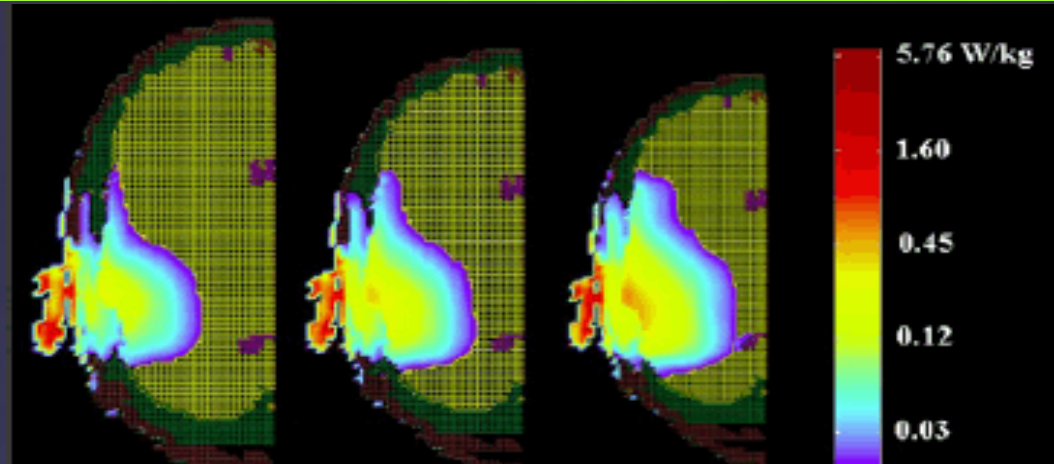
Assessing self-regulation: A guide for out-of-schooltime-program practitioners
<https://www.childtrends.org/publications/assessing-self-regulation-a-guide-for-out-of-school-time-program-practitioners>

Slide 3 image retrieved from Image from
<https://plus.google.com/photos/114204947565266266522/albums/6018899622344024017/6018899627045573618>

The hacking of the American Mind by Dr Robert Lustig 2017
<https://www.youtube.com/watch?v=EKkUtrL6B18>

SPARE SLIDES

1. Greater absorption in children



Bird's eye view of
phone to left ear
Ghandi & Kang
2009

Adult 10 year old 5 year old

IMPACT ON CHILDREN:

1. Increased conductivity, especially in bone marrow (10x), deeper energy penetration
2. Greater RF absorption rate than adults

ACTION: No phone against a baby or child's head

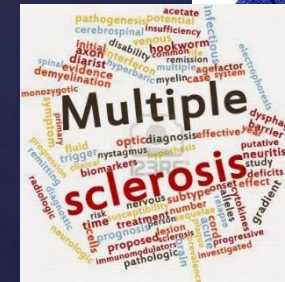
2. Increased vulnerability of the developing nervous system

RESEARCH with animals found **myelin degeneration** around neurons after RF exposure

Branski 1977, Switzer & Mitchell 1977

Lowest MYELIN protection of the central nervous system in:

- **Foetus, babies**
- **Young children**
- **Elderly**
- **Some illnesses**



ACTION to protect the nervous system

- Zero use of phone/devices against body, especially in the most vulnerable, especially pregnant women, babies, toddlers and children under 18
- Zero storage of phone against body unless switched off

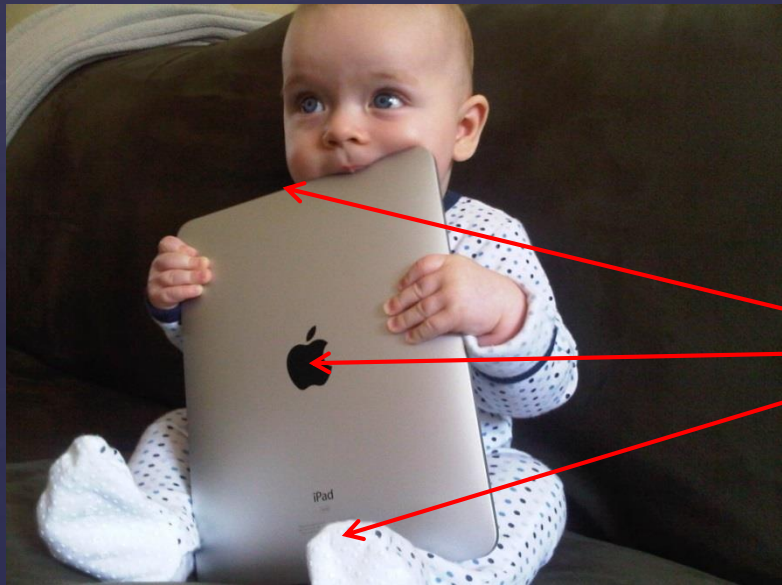


ACTION to protect the nervous system

Babies and transmitting devices

Parents are reminded not to give a mobile to children until old enough to follow recommendations to limit exposure, such as using hands-free kit

National Health Board, Denmark, 2008



**Locations
of
transmitting
antennas**



**WiFi & GPS
antennas at top
GSM at bottom**

Rapid cell division during growth

Stem cells are more active in children

Williams et al 2006



young children's stem cells are very sensitive to microwave exposure Markova et al, 2010

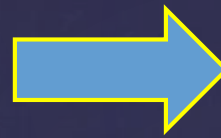
ACTION:

- **Don't store or use transmitting devices near or against areas with active stem cells (and rapidly dividing cells)**

_4. Microwaves cause changes in brain electrical activity

RESEARCH

- **Increased alpha activity** (Croft et al, 2010, Leung et al, 2011)
- **Frontal inter-hemispheric coherence reduced in adolescents** (Vecchio et al. 2010)



IMPLICATION

- 1. Errors are more likely when alpha activity increases during tasks** (Mazaheri, 2009)
- 2. Same response shown in children with ADHD** (Barry et al. 2011)

NOTE: This does not prove an association. Read research

**ACTION: None -
Unavoidable with any exposure**

5. Headaches are related to microwave/device exposure/use

MANY STUDIES e.g.

>2000 adolescents 11-15 years

Chiu et al 2014

Mobile phones users significantly more likely to have headaches as non-users



ACTION:

- **Use wired landline instead**
- **Reduce time spent on cordless and mobile phones**
- **Use speaker phone**

Headaches: NZ study Redmayne et al. 2013

Woken by text or call strongly related to:

- Chronic headaches: Odds nearly 6 times higher than when not woken
- Daily tiredness at school:
- Odds increased 3½ times



WHAT TO DO

- No devices in bedrooms at night
- Stop screen use an hour before bed
- Dim screens
- Install F-lux

6. Poorer speech development

Russian 4 year child study (N=196, ages 7-12)

Reported trends for cellphone users compared to control group:

- More phonemic perception disorders
- Slower reactions
- Reduced voluntary attention
- Poorer semantic memory
- Increased fatigue
- Reduced pace of learning progress over the 4 years (Khorseva et al 2011)

ACTION:
Don't allow
pre-schoolers
to use a
mobile or
cordless
phone

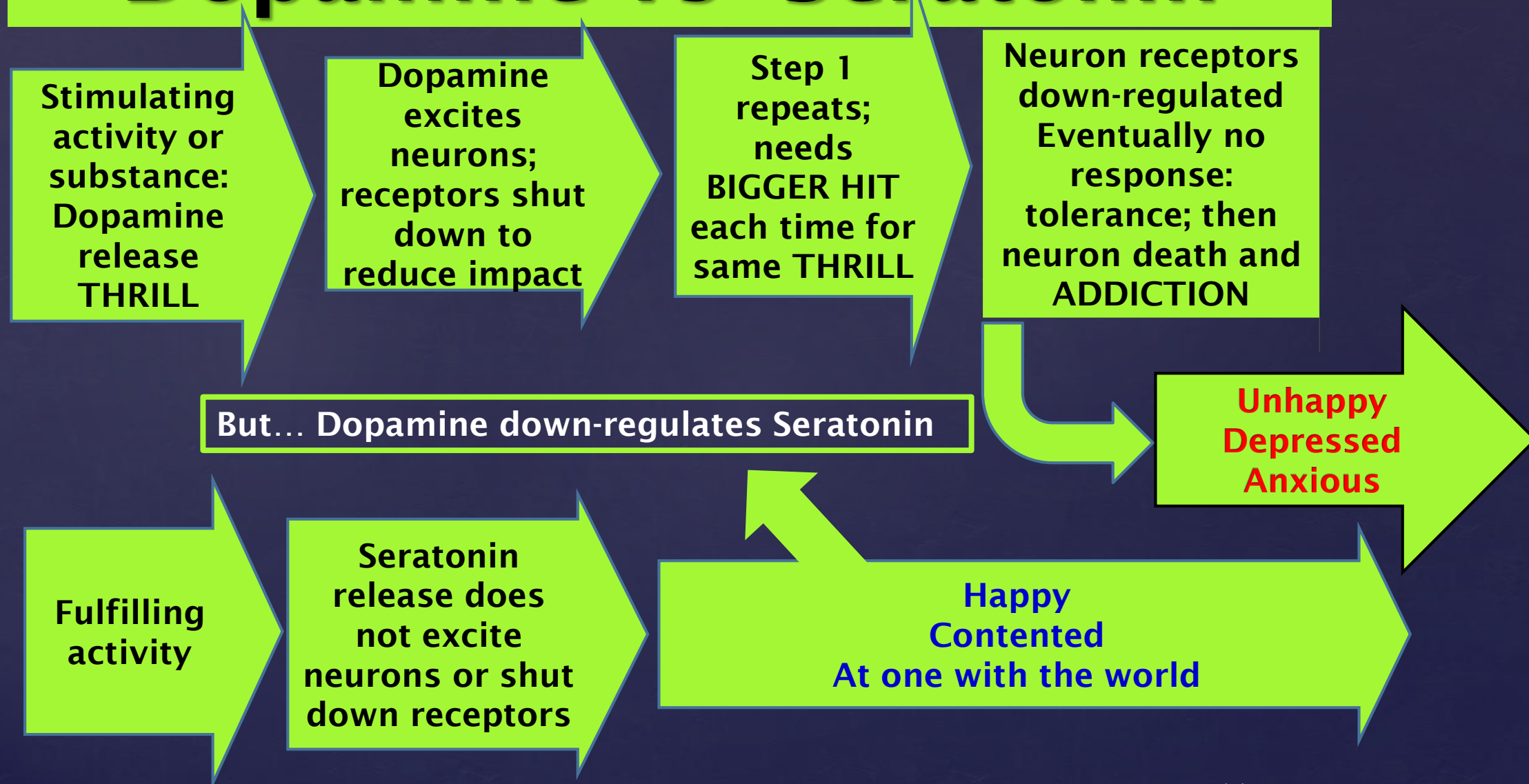
Toasted skin syndrome (toasted scrotum too)



Heat
damage
from using
a laptop on
the lap

ACTION:
Don't use a
“laptop” device
on the lap

Dopamine vs Serotonin



Electrosensitivity symptoms vs demyelination symptoms

Symptoms of Electrohypersensitivity

- Physical
- Eyes – **difficulty in seeing**, smarting, pain
- Aches, **pain, numbness, prickling sensations in joints, bones and muscles in shoulders, arms, legs, feet, wrists, ankles, elbows and pelvis and cramp in arms and legs.**
- **Sleep problems**
- Tiredness –inc. **weakness, tremor**, faintness and **dizziness**.
- Headaches – sometimes extremely severe.
- Tinnitus and Earache.
- **Skin –... Irritation, tingling, crawling sensations.**
- Chest pains, heart arrhythmia.
- Warmth or burning on face.
- Pain in teeth and jaws.
- Cognitive
- **Memory – short and long term impairment**
- **Lack of concentration**
- **Difficulty in learning new things**
- Emotional
- Behavioral – Depression, **mood changes**, including anger and crying
- **Irritability**
- **Stress and anxiety attacks, feeling out of control**

Some symptoms of demyelination

Vision	Blurred vision
Motor	Trunk/limb weakness; balance problems
Sensory	Numbness; paresthesias (unusual and unpleasant sense of touch)
Cerebellar	Tremor, ataxia (reduced muscle control); incoordination
Neuro-psychiatric	Memory and concentration impairment; irritability; anxiety

<http://www.nationalmssociety.org/ms-clinical-care-network/clinical-resources-and-tools/core-curriculum/diagnosing-multiple-sclerosis/signs-symptoms-consistent-with-demyelinating-disease/index.aspx>

NOTE: this does not prove a connection. See research.

Diagnostic Criteria - EHS Reliable Disease Biomarkers - (Belpomme)

Test /Measure	EHS Biomarker	EHS indication
Ultrasound computed tomosphygmography / Brain Blood Flow in temporal lobes	Hypo perfusion in capsule thalamic area	Limbic/Thalamus inflammation
Histamine in the blood	Increase	Chronic inflammatory response
Nitrotyrosine level	Increase	Peroxynitrite production and BBB opening
Protein S100B	Increase	BBB opening
Auto-antibodies against O-myelin	Circulating	Possible auto-immune response
HSP 27 / HSP 70	In peripheral blood	
24 h urine 6-hydroxymelatonin sulfate (6-OHMS)/creatinin ratio	Decreased (<0.8 ng/L)	Chronic insomnia / fatigue, decreased antioxidant defences
Vitamin D2/ D3	Reduced	Outcome of inflammation. Supplement needed

Identifying microwave (MW) transmitting sources

**If you can communicate with others, or upload
files, or use the internet
using a device that's not wired –
then it can transmit (probably microwaves)**

Listen:

[http://www.emfields-
solutions.com/rf/](http://www.emfields-solutions.com/rf/)

Diagnosis: Research-led, proposed objective, measurable biomarkers and medical tests

Group 3: Italy, Russia, Malaysia

Large study

Objective metabolic and genetic screening

- 153 electrophysensitivity, 147 multiple chemical sensitivity, 132 Control participants

Diagnosis involves metabolic pro-oxidant / pro-inflammatory tests for alterations in blood, and selected genetic tests

RESULTS

- Distinctively increased **plasma coenzyme-Q 10 oxidation ratio**
- Significantly altered distribution-versus-control of the **CYP2C19*1/*2SNP variants**
- Combined presence of genotype **Genotype (null)GSTT1 + (null)GSTM1 variants** confers **9.7 times higher risk of EHS** than other GSTM1 GSTT1 combinations

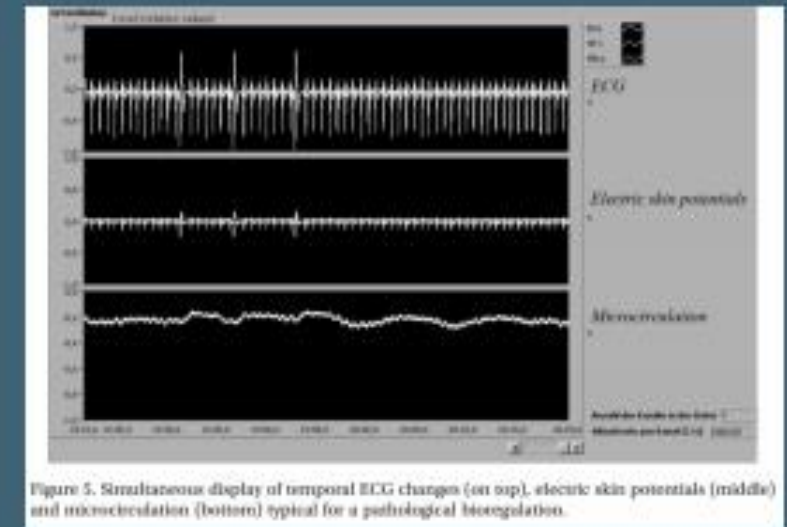
de Luca et al, 2014

Group 2: Germany **EHS trialled diagnostic hypothesis** **Objective simultaneous bio-marker tests**

- Parameters to measure EHS "must be beyond voluntary control and they must be measurable"
- Proposed method - Take simultaneous measurements of:
 - Heart rate variability and bandwidth**
 - Microcirculation measurement of peripheral blood flow**
 - Active electrical skin potentials**

Results consistent with presence of EHS:

- lower heart rate variability in the harmonic frequencies
- diminished microcirculatory flow
- reduced amplitude of skin electric potential difference in "genuine" electromagnetic hypersensitive individuals



Tuengler and von Klitzing 2013 (and Figure 5 from this paper)

Proposed/observed mechanisms

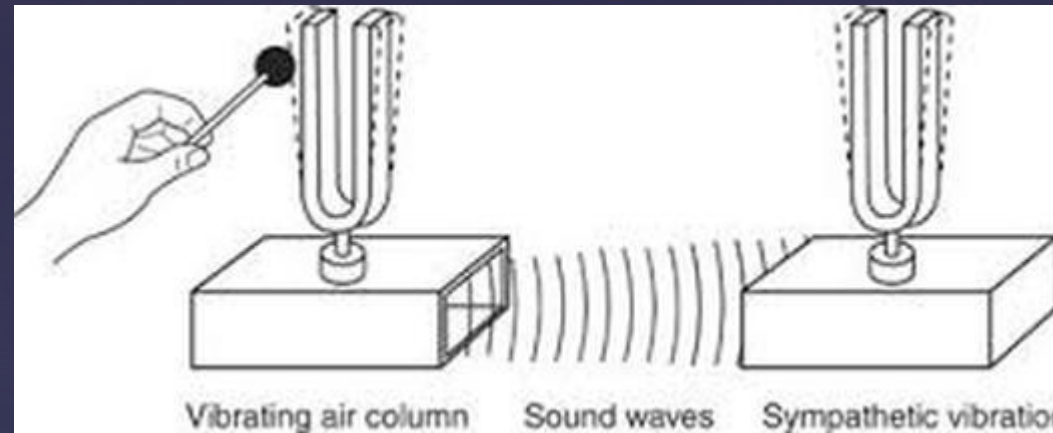
Resonance

Blackman et al 1995



Forced vibration

Panagopoulos et al 2002



Chain reaction

Yakymenko et al.
2016



Voltage-gated calcium channel activation

Pall 2016

