Radiofrequency radiation is a human carcinogen – can we trust that we are protected?

The Danish Parliament's Committee for Health and Senior Citizens April 12, 2018

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The Environment and Cancer Research Foundation wants to promote scientific research on the association between the environment and cancer and other chronic diseases.

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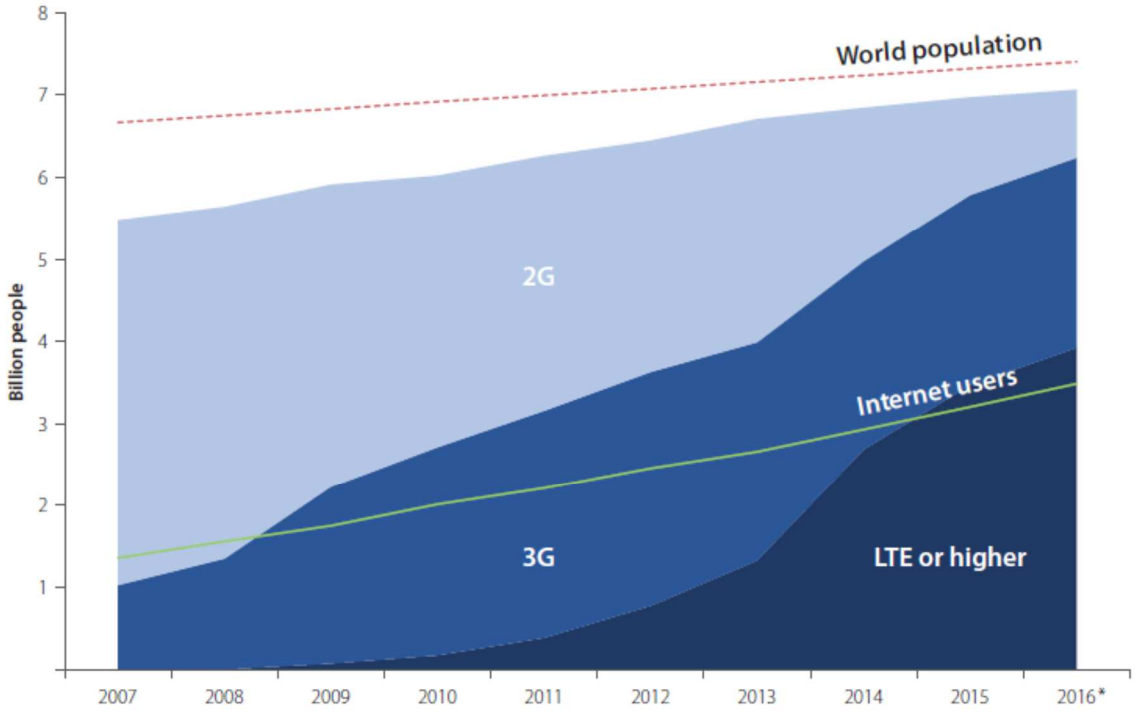
Access to mobile phone



Seven billion people (95% of the global population) live in an area that is covered by a mobile-cellular network.

Mobile-broadband networks (3G or above) reach 84% of the global population but only 67% of the rural population.

LTE networks have spread quickly over the last three years and reach almost 4 billion people today (53% of the global population), enhancing the quality of Internet use.

Source: International Telecommunication Union; ICT Fact and Figures 2016

(1) Strength

Glioma

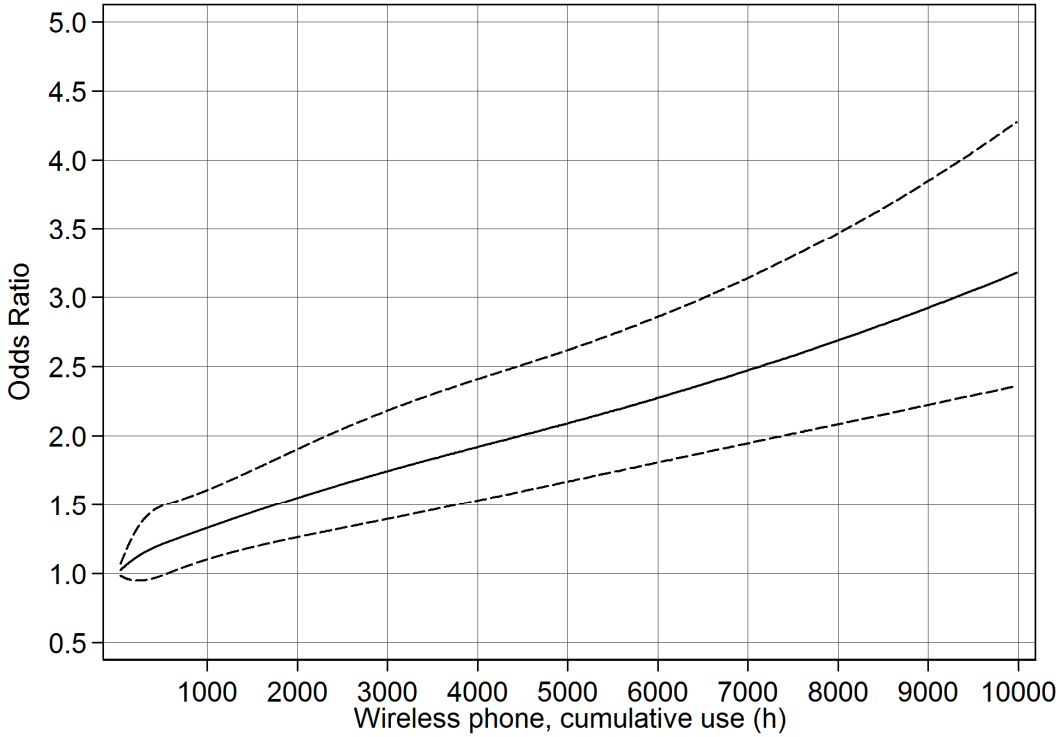
	Ca/Co	OR	95 % CI
Interphone 2010			
Cumulative use ≥1,640 h	210/154	1.40	1.03 – 1.89
Coureau et al 2014			
Cumulative use ≥896 h	24/22	2.89	1.41 – 5.93
Hardell, Carlberg 2015			
Cumulative use ≥1,640 h	211/301	2.13	1.61 – 2.82
Turner et al 2016 (Interphone)			
Cumulative use ≥1,640 h	59/46	2.82	1.09 – 7.32
Meta-analysis*			
Cumulative use ≥1,640 h**	445/477	1.90	1.31 – 2.76

**Based on Interphone, Coureau et al, Hardell, Carlberg.*

***≥896 h used for Coureau et al.*

Random-effects model used for all meta-analyses, based on test for heterogeneity in the overall group ("All mobile").

(5) Biological gradient



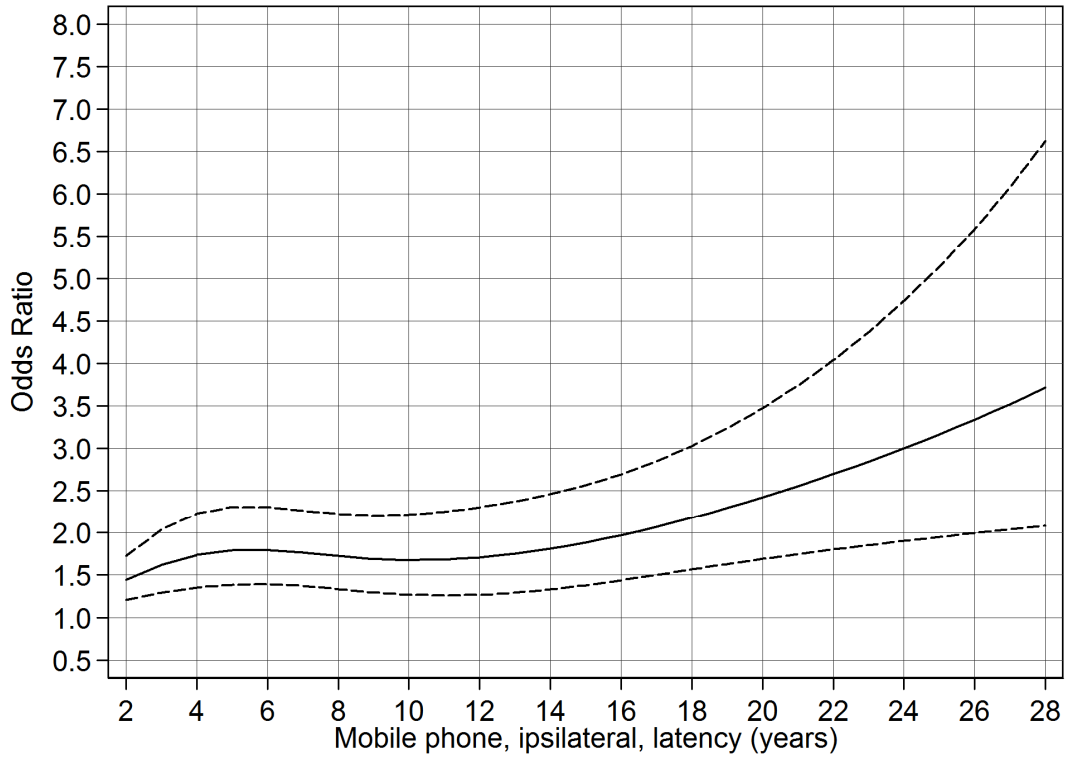
Cumulative number of hours for use of wireless phone and glioma risk. The solid line indicates the OR estimate and the broken lines represent the 95 % CI. Adjustment was made for age at diagnosis, gender, socio-economic index (SEI) and year for diagnosis. Population based controls were used. Hardell, Carlberg (2015)

(3) Specificity

Regions of brain that absorb the highest wireless phone radiation (e.g., temporal lobe) have the highest risk.

	Interphone 2010		**Coureau et al 2014**		**Hardell, Carlberg 2015**	
All	1,666/1,894	0.81 (0.70 – 0.94)	142/270	1.24 (0.86 – 1.77)	945/2,148	1.31 (1.09 – 1.58)
-Temporal lobe, ≥1,640 h	78/47	1.87 (1.09 – 3.22)	7/5*	3.94 (0.81 – 19.08)	59/301	2.05 (1.36 – 3.10)

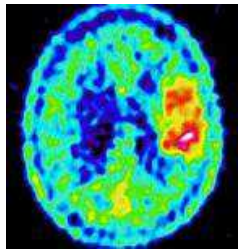
**≥896 h*



Restricted cubic spline plot of the relationship between latency of ipsilateral mobile phone use and glioma. The solid line indicates the OR estimate and the broken lines represent the 95 % CI. Adjustment was made for age at diagnosis, gender, socio-economic index (SEI) and year for diagnosis. Population based controls were used. Hardell, Carlberg (2015)

Increased risk for shorter survival (Carlberg, Hardell 2014)

	Mobile phone			Cordless phone			Wireless phone		
	n, exp	HR	95 % CI	n, exp	HR	95 % CI	n, exp	HR	95 % CI
Glioblastoma multiforme (n=926)									
Age, first use									
< 20 years old	10	2.24	1.04 – 4.85	6	1.78	0.68– 4.67	11	2.27	1.10 – 4.71
20-49 years old	296	1.24	0.98 – 1.58	177	1.31	1.001 – 1.72	328	1.23	0.99 – 1.53
≥ 50 years old	226	1.11	0.91 – 1.36	232	1.09	0.88 – 1.34	279	1.14	0.95 – 1.37



Proliferative Lesions (neoplasms and hyperplasias) in the Brain of Male Rats

Male Rats	Sham	GSM (SAR mW/g)			CDMA (SAR mW/g)		
	0	1.5	3.0	6.0	1.5	3.0	6.0
Lesion	Incidence, %						
Glioma[a]	0	3.3	3.3	2.2	0	0	3.3
Glial cell hyperplasia	0	2.2	3.3[b]	1.1[b]	2.2	0	2.2[b]
Total proliferative	0	5.5*	6.6*	3.3	2.2	0	5.5*

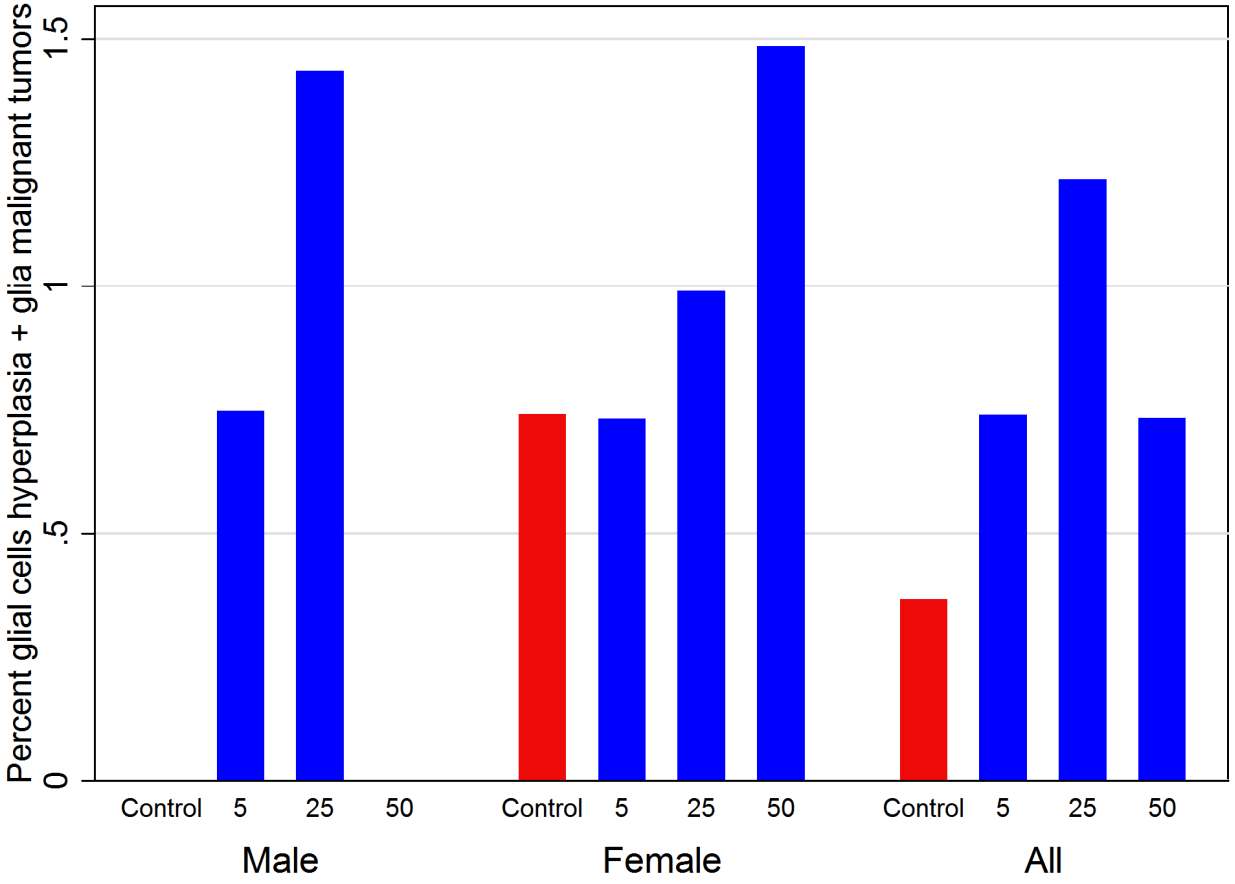
* $p<0.05$

[a] Historical control rate (all routes) = 2/190 (1.1%, range 0-4%)

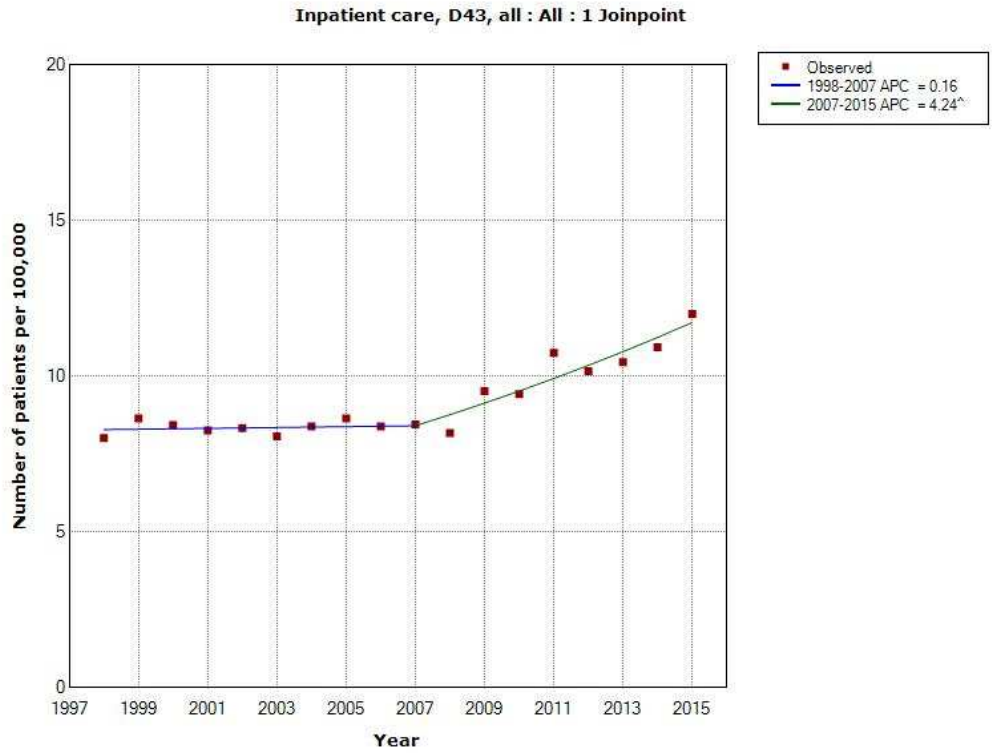
[b] Marked severity of glial cell hyperplasia for one rat in these dose groups; "the hyperplastic lesions are within a continuum leading to malignant glioma"

Ramazzini Institute Rat Study

Glial cells hyperplasia + glia malignant tumor V/m



Joinpoint regression analysis of number of patients per 100,000 inhabitants according to the Swedish National Inpatient Register for both genders combined, all ages during 1998-2013 diagnosed with D43 = tumour of unknown type in the brain or CNS



	Change/year (%)	95 % CI
1998-2015*	+2.06	+1.27, +2.86
-1998-2007**	+0.16	-0.94, +1.28
-2007-2015**	+4.24	+2.87, +5.63

**AAPC (Average Annual Percent Change); **APC (Annual Percent Change)*

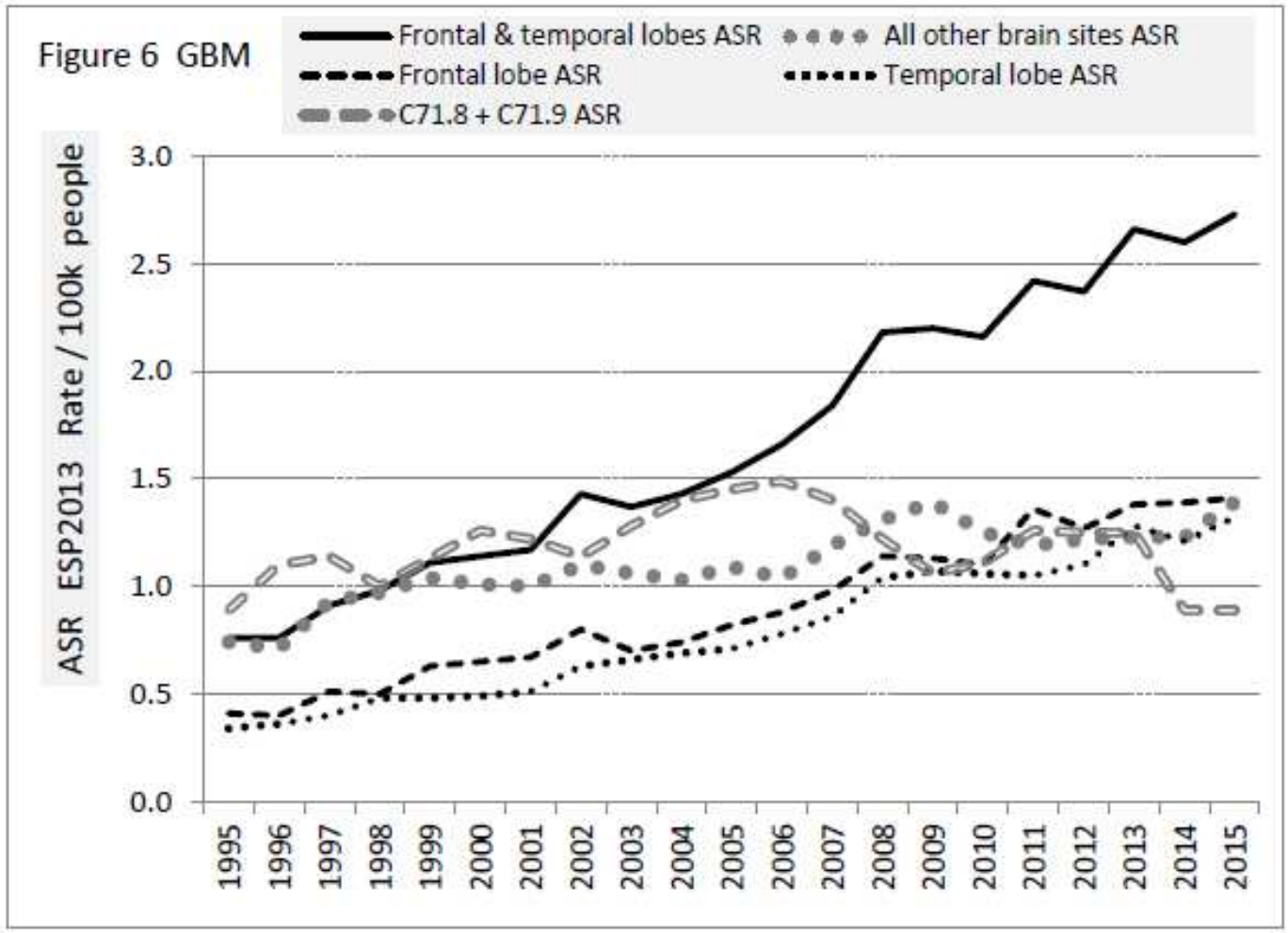
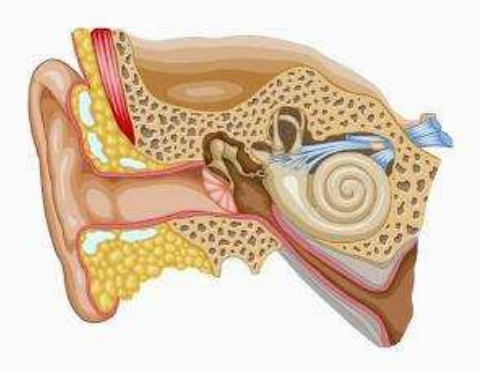


Figure 6 – Frontal and temporal lobe GBM age–standardised incidence rates by tumour site and year (data table in the SI)

Use of mobile phones and acoustic neuroma risk, meta-analysis of Hardell et al (1997-2009) and Interphone (2000-2004).

	Hardell et al 1997-2009		Interphone 2000-2004		Meta-analysis	
	Ca/Co	OR, CI	Ca/Co	OR, CI	Ca/Co	OR, CI
Cumulative use ≥ 1640 h						
-all	27/301	2.40 (1.39-4.16)	77/107	1.32 (0.88-1.97)	104/408	1.63 (1.18-2.25)
-ipsilateral	19/133	3.18 (1.65-6.12)	47/46	2.33 (1.23-4.40)	66/179	2.71 (1.72-4.28)
-contralateral	8/105	1.54 (0.63-3.76)	16/26	0.72 (0.34-1.53)	24/131	0.99 (0.56-1.75)

Random-effects model used for all meta-analyses of latency ≥ 10 years and fixed-effects model used for all meta-analyses of cumulative use ≥ 1640 h, based on test for heterogeneity in the overall (≥10 years and ≥1640 hours) groups.



Pathology findings – Schwannomas

Schwannomas Observed in Male Rats

	Control	GSM Modulation			CDMA Modulation		
	0 W/kg	1.5 W/kg	3.0 W/kg	6.0 W/kg	1.5 W/kg	3.0 W/kg	6.0 W/kg
Number examined	90	90	90	90	90	90	90
Heart‡	0*	2 (2.2%)	1 (1.1%)	5 (5.5%)	2 (2.2%)	3 (3.3%)	6** (6.6%)
Other sites	3 (3.3%)	1 (1.1%)	4 (4.4%)	2 (2.2%)	2 (2.2%)	1 (1.1%)	2 (2.2%)
All sites (total)	3 (3.3%)	3 (3.3%)	5 (5.5%)	7 (7.7%)	4 (4.4%)	4 (4.4%)	7 (7.7%)

‡ Historical control incidence in NTP studies: 9/699 (1.3%), range 0-6%

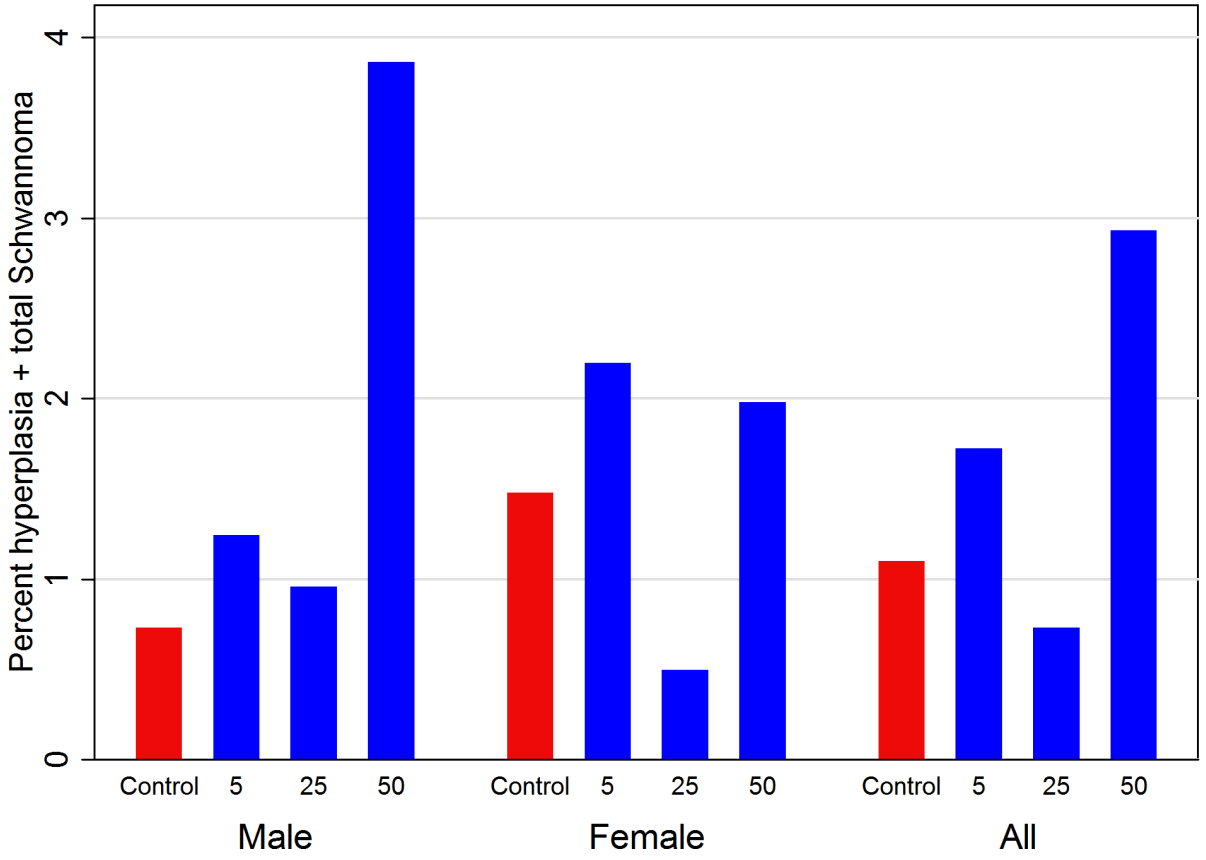
* Significant SAR-dependent trend for GSM and CDMA exposures by poly-3 ($p < 0.05$)

** Significant different than controls poly-3 ($p < 0.05$)

Ramazzini Institute Rat Study

Hyperplasia Schwan cells + total Schwannoma

V/m



Jämförelse: Far field - Basstation exponering, 1.8 GHz

ICNIRP Reference level 'guideline' - in use in Nordic countries	Russia, Switzerland, Italy -	Ramazzini Institute study, Falcioni *et al.* (2018) Schwann cell tumors	Stockholm T-Centralen (Hardell *et al.* 2016)	Pacemakers tested till (EMI/EMC) (IEC 61000-4-3)	
58 V/m	6 V/m	0/5/20/**50** V/m	> 6 V/m (dosimeter limit)	3 V/m	

Falcioni, L., Bua, L., Tibaldi, E., Lauriola, M., De Angelis, L., Gnudi, F., … Belpoggi, F. (2018). Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. *Environmental Research*. https://doi.org/10.1016/j.envres.2018.01.037

Note: In the Ramazzini-study there was only one antenna, while normally close to base station humans are exposed to several antennas. Effects can not be directly extrapolated from animals to humans.

Base station Field Strengths

Riskfulla installationer -- > Höga RF-nivåer nära skolor och dagis

(3 V/m <> 23872 µW/m^2 , bilder från Åbo, Hagström & Ekman)

Meter: Narda **NBM 550**

Near Field –exposure - Mobile phone related SAR
Higher exposures allowed in Europe than in U.S -> 1 g versus 10 g

Region / Country	-- Reference to -- SAR measuremant protocol	Reference to SAR limit	Limit
Europe	European Specification ES 59005 (1998)	ICNIRP Guidelines 1998 (ICNIRP 1998)	**2.0 W/Kg in 10g of tissue**
US	Federal Communications Commission (FCC) Guidelines (FCC 1997)	American Standard ANSI C95.1 (ANSI 1992)	**1.6 W/Kg in 1g of tissue**

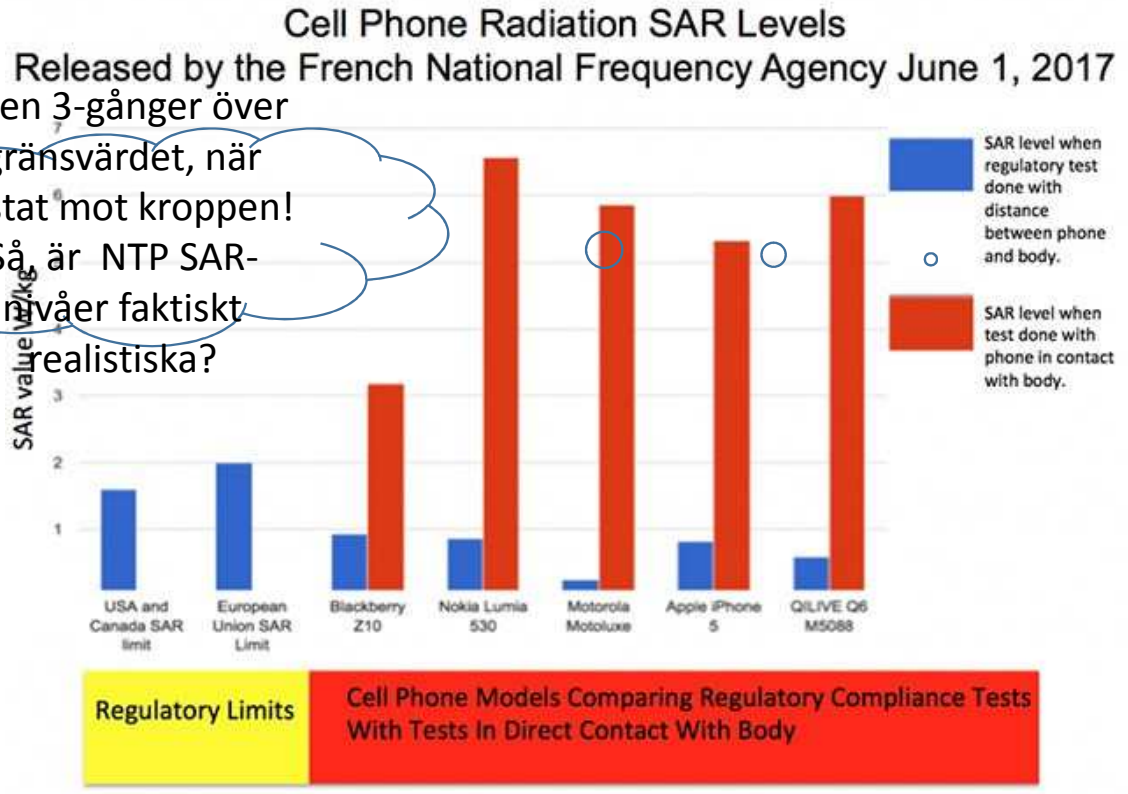
Compare this to National Toxicology Program (NTP) Exposure levels & outcome:

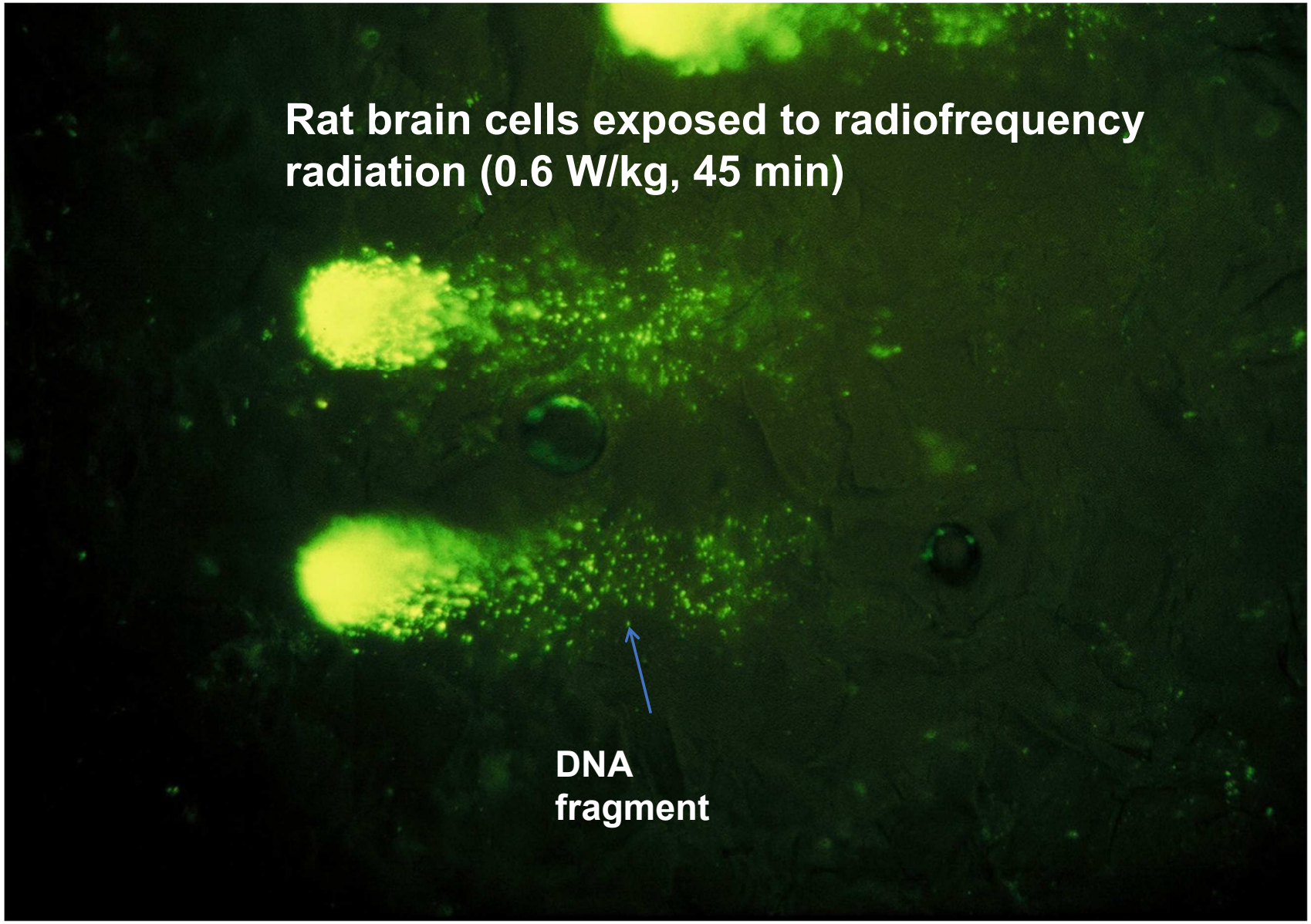
Exposure classes:	Outcomes:		
0			
2 W/kg	Heart: Schwannoma --> Clear evidence Brain: Glioma some --> Some evidence Adrenal Medulla --> Some evidence		
4 W/kg			
6 W/kg			

Notes: A) Non-linear effects were considered in the NTP review.
B) AC & DC magnetic field exposure of a mobile phone missing from NTP-study, can not be directly compared to human mobile phone use.

Läkare Marc Arazi, #Phonegate, http://arazi.fr/wp2/

Även 3-gånger över gränsvärdet, när testat mot kroppen! Så, är NTP SAR-nivåer faktiskt realistiska?




Rat brain cells exposed to radiofrequency radiation (0.6 W/kg, 45 min)
DNA fragment

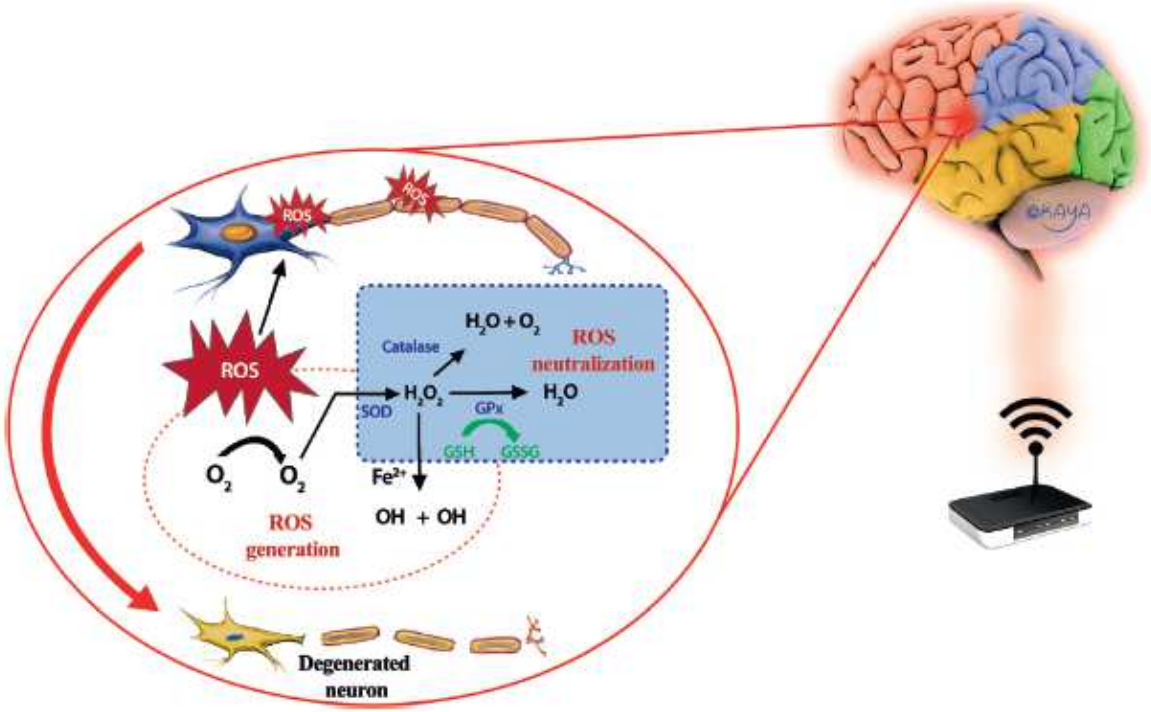
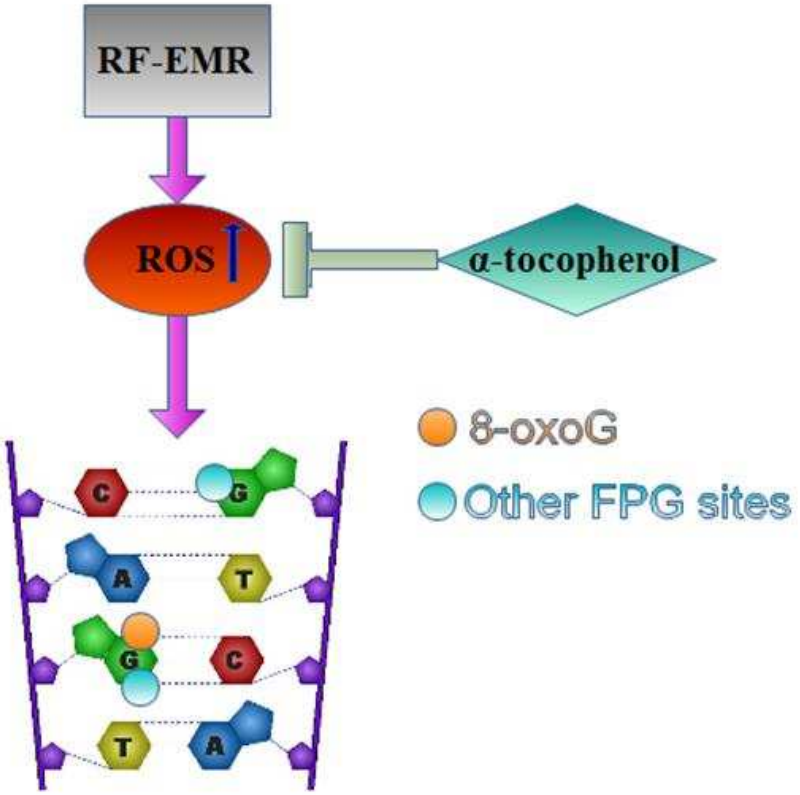


Fig. 2. The role of EMF emitted from several devices, depicting an increase in the generation of ROS and consequent oxidative stress in the central nervous system resulting from the inability of the antioxidant defense system to cope with this increase in ROS [81].

Experiment
Prevention



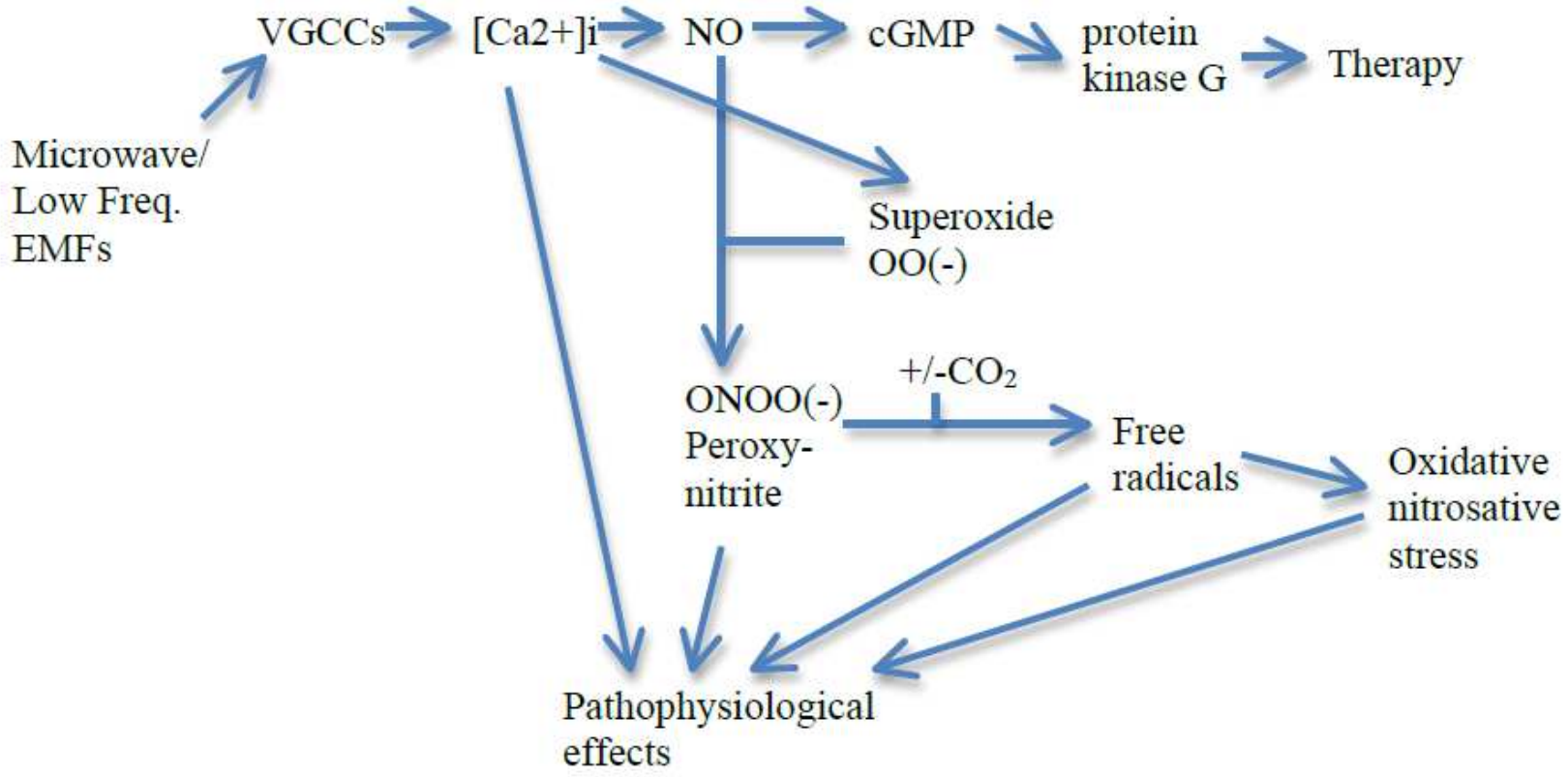


Figure 1. EMFs Act via Downstream Effects of VGCC Activation to Produce Pathophysiological and Therapeutic Effects. Modified from Pall 2015b with permission.

Conclusion

Increased risk for glioma (”brain cancer”) and acoustic neuroma

Higher risk for tumour on the same side of the brain as the wireless phone has been used (ipsilateral) and in the temporal lobe

Highest risk (odds ratio) in persons with first use of the wireless phone before the age of 20 years

Shorter survival in persons with glioblastoma multiforme and use of wireless phones

Glioma and acoustic neuroma are caused by RF-EMF emissions from wireless phones

IARC Preamble:

Group 1: The agent is *carcinogenic to humans*.
This category is used when there is *sufficient evidence of carcinogenicity* in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than *sufficient* but there is *sufficient evidence of carcinogenicity* in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

Table 1. Clinical symptom occurrence in EHS patients.

	EHS
Headache	88 %
Dysesthesia	82 %
Myalgia	48 %
Arthralgia	30 %
Ear heat/otalgia	70 %
Tinnitus	60 %
Hyperacousis	40 %
Dizziness	70 %
Balance disorder	42 %
Concentration/Attention deficiency	76 %
Loss of immediate memory	70 %
Confusion	4 %

Table 1. Clinical symptom occurrence in EHS patients.

	EHS
Fatigue	88 %
Insomnia	74 %
Depression tendency	60 %
Suicidal ideation	20 %
Transitory cardiovascular abnormalities	50 %
Occular deficiency	48 %
Anxiety/Panic	38 %
Emotivity	20 %
Irritability	24 %
Skin lesions	16 %
Global body dysthermia	14 %

Environmental exposure

Figure 12. Stockholm Old Town measurement location with a relatively high radiofrequency radiation level, due to a mobile telephony base station antenna positioned at a low height and targeted towards the square.

Exposure to radiofrequency radiation (Hardell et al 2017)

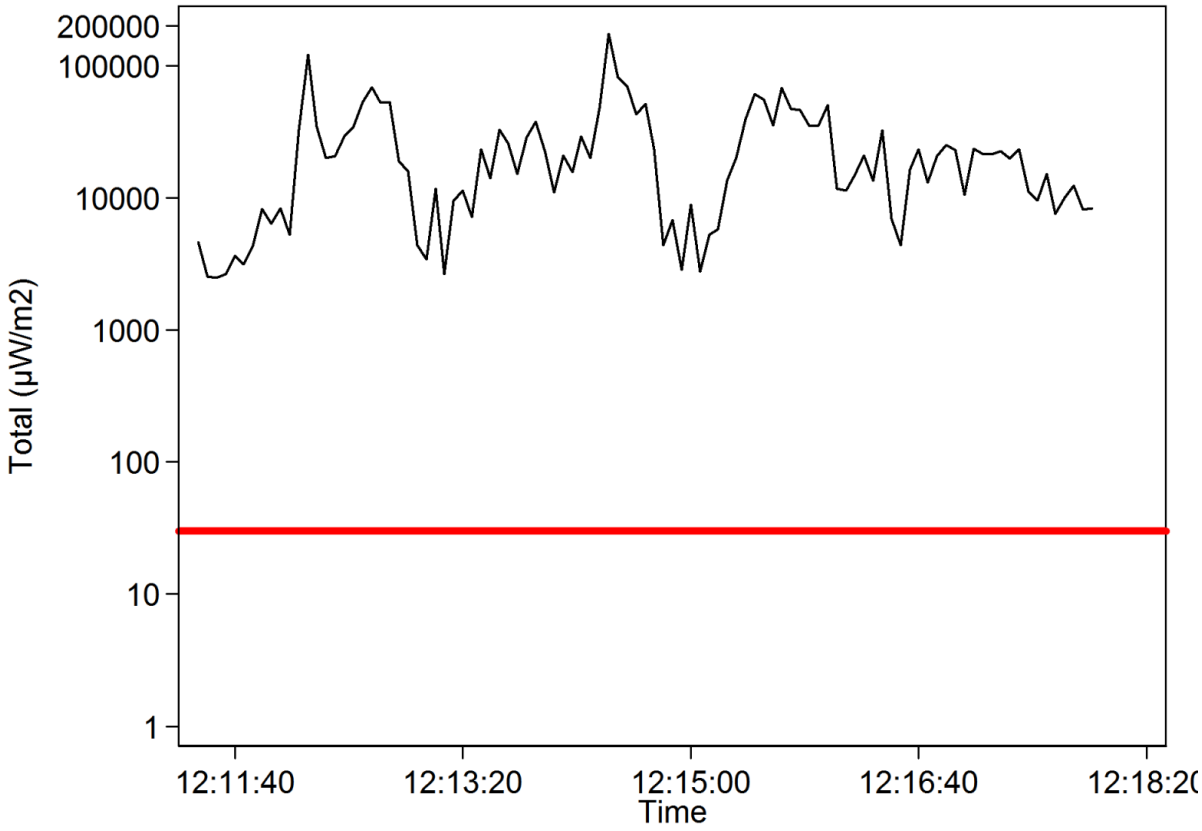
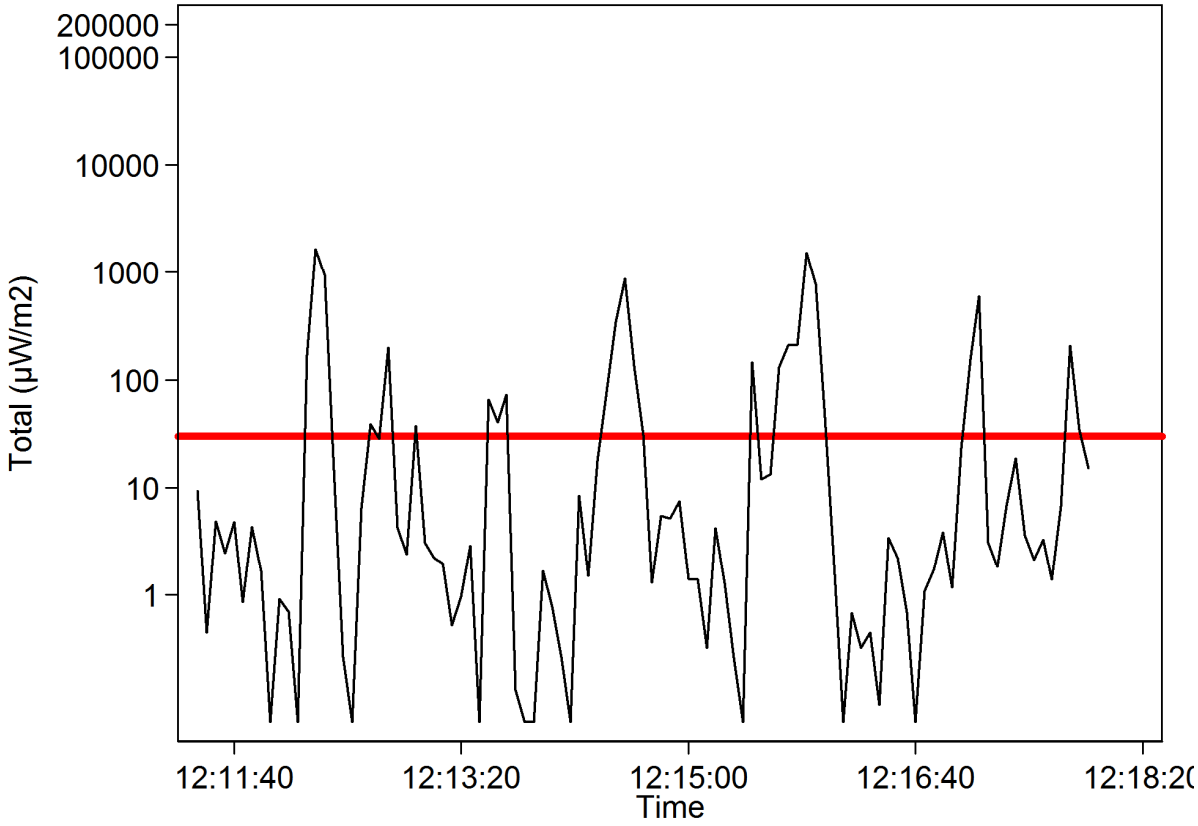


Figure 9. Stockholm Old Town, Järntorget. Total radiofrequency field exposure (mean exposure, 24,766.2 $\mu W/m^2$, logarithmic scale) over time of one typical exposure round (22 April, 2016; time, 12:11:24-12:17:56).

Exposure to radiofrequency radiation excluding base stations

(Hardell et al 2017)



Stockholm Old Town, Järntorget. Total radiofrequency field exposure excluding downloads from base stations over time of one typical exposure round (22 April, 2016; time, 12:11:24-12:17:56).

Figure 4. Group of base stations located 6 m from balcony outside tower. Photo taken from the balcony.

Exposure to radiofrequency radiation (Hardell et al 2018)

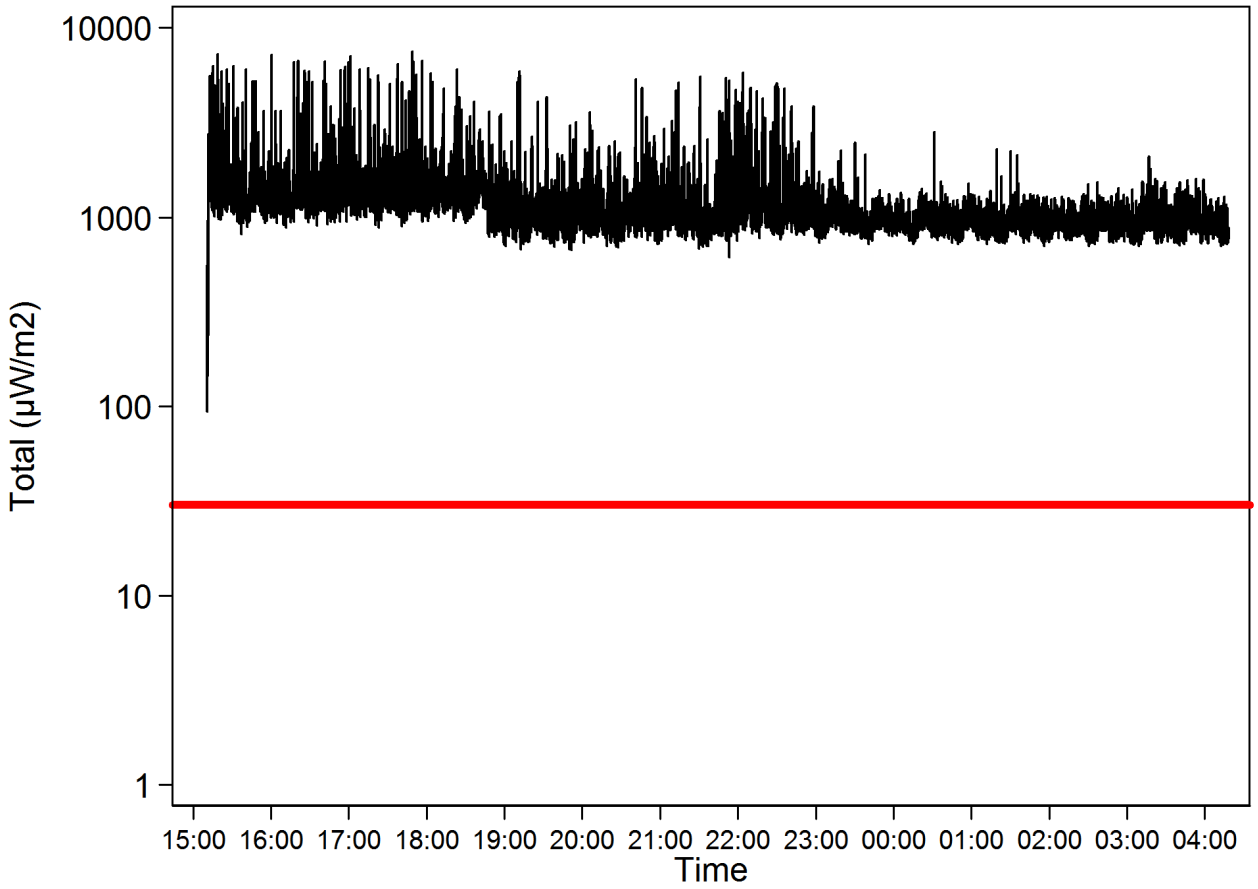
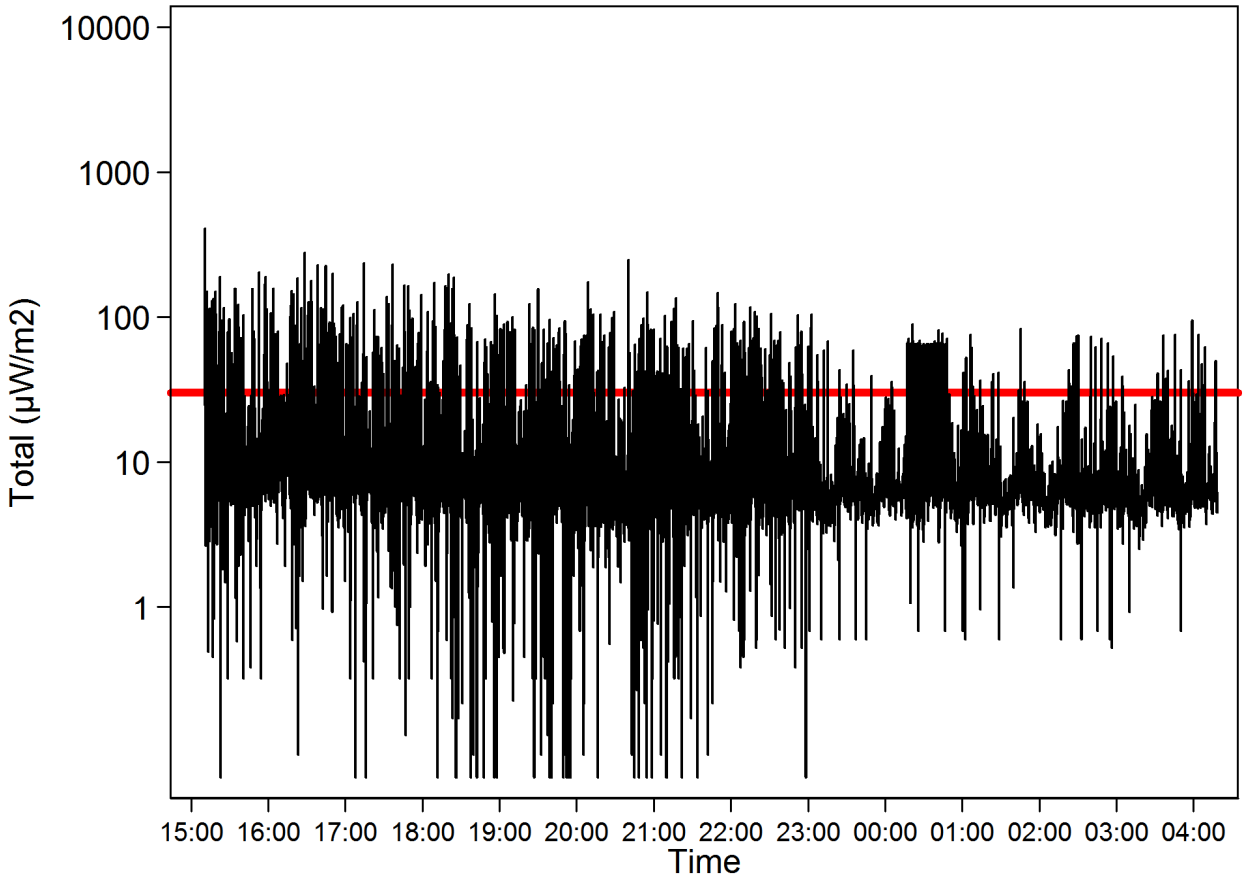


Figure 3. Time variation of measurements in boy's bedroom (apartment at Östermalm, Stockholm) from the afternoon until early next morning, µW/m^2, logarithmic scale. The spikes represent different measurements performed each 4th second.

Exposure to radiofrequency radiation excluding base stations

(Hardell et al 2018)



Time variation of measurements in boy's bedroom (apartment at Östermalm, Stockholm) from the afternoon until early next morning excluding downloads from base stations.

WHO Radio Frequency fields: Environmental Health Criteria Monograph

Expected to be published 2012
Draft 2014
Final document still not published (2018)

Members of WHO Monograph core group and their involvement in different other groups.

Name	WHO	ICNIRP	UK/AGNIR	SSM	SCENIHR
Simon Mann	X	X	X		
Maria Feychting	X	X	X	X*	
Gunnhild Oftedal	X	X			
Eric van Rongen	X	X		X	
Maria Rosaria Scarfi	X	X*		X	X
Denis Zmirou	X				

**former*
WHO: World Health Organization
ICNIRP: International Commission on Non-Ionizing Radiation Protection
AGNIR: Advisory Group on Non-Ionising Radiation
SSM: Strålsäkerhetsmyndigheten (Swedish Radiation Safety Authority)
SCENIHR: Scientific Committee on Emerging and Newly Identified Health Risks

World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review)

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Abstract. In May 2011 the International Agency for Research on Cancer (IARC) evaluated cancer risks from radiofrequency (RF) radiation. Human epidemiological studies gave evidence of increased risk for glioma and acoustic neuroma. RF radiation was classified as Group 2B, a possible human carcinogen. Further epidemiological, animal and mechanistic studies have strengthened the association. In spite of this, in most countries little or nothing has been done to reduce exposure and educate people on health hazards from RF radiation. On the contrary ambient levels have increased. In 2014 the WHO launched a draft of a Monograph on RF fields and health for public comments. It turned out that five of the six members of the Core Group in charge of the draft are affiliated with International Commission on Non-Ionizing Radiation Protection (ICNIRP), an industry loyal NGO, and thus have a serious conflict of interest. Just as by ICNIRP, evaluation of non-thermal biological effects from RF radiation are dismissed as scientific evidence of adverse health effects in the Monograph. This has provoked many comments sent to the WHO. However, at a meeting on March 3, 2017 at the WHO Geneva office it was stated that the WHO has no intention to change the Core Group.

Contents

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Key words: electromagnetic fields, EMF, radiofrequency radiation, public exposure, cancer, WHO, monograph, conflict of interest, ICNIRP, non-thermal effects, health risks

1. Introduction

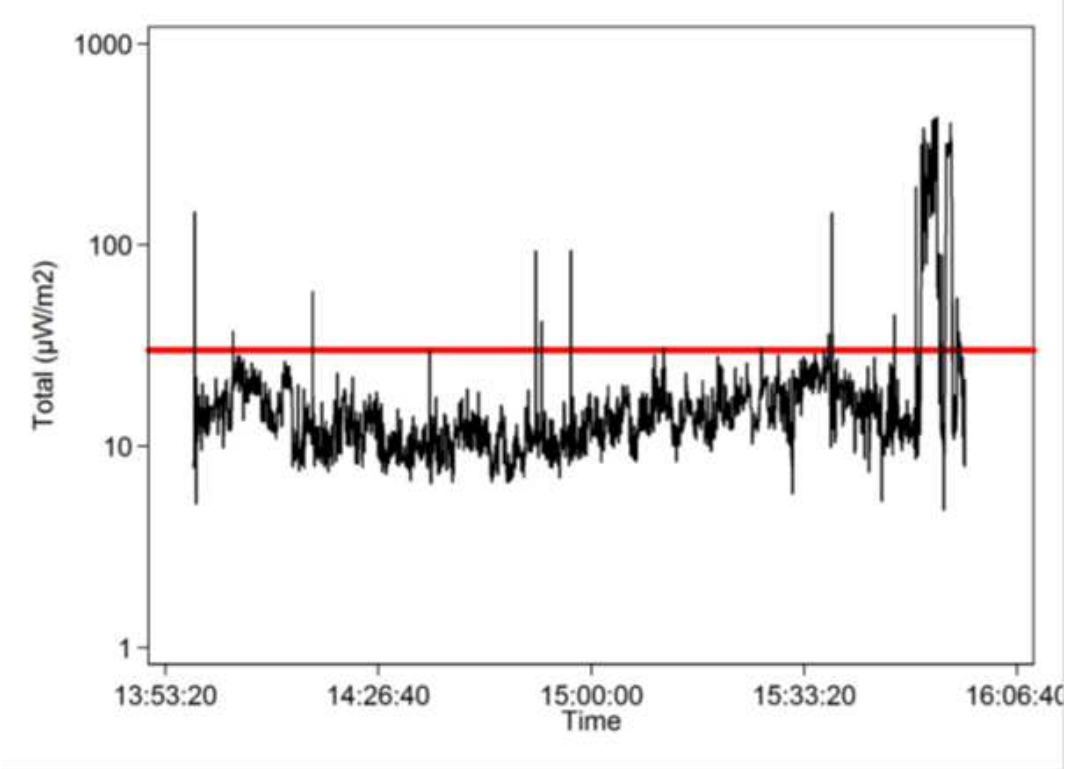
The use of wireless digital technology has grown rapidly during the last couple of decades (http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf). During use, mobile phones and cordless phones emit radiofrequency (RF) radiation. The brain is the main target organ for RF emissions from the handheld wireless phone (1,2). An evaluation of the scientific evidence on the brain tumour risk was made in May 2011 by the International Agency for Research on Cancer (IARC) at the World Health Organization (WHO). IARC is independently financed and has its own governing and scientific councils, which WHO staff only attend as observers (http://www.who.int/ionizing_radiation/research/iarcies/).

Epidemiological studies provided supportive evidence of increased risk for head and brain tumours, i.e., acoustic neuroma and glioma. The working group reached the conclusion that RF radiation from devices that emit non-ionizing RF radiation in the frequency range 30 kHz-300 GHz, is a Group 2B, i.e. a 'possible', human carcinogen (3,4). Later studies have corroborated these findings and have thus strengthened the evidence (5-8).

Several laboratory studies have indicated mechanisms of action for RF radiation carcinogenesis such as on DNA repair, oxidative stress, down regulation of mRNA and DNA damage with single strand breaks (9-13). A report was released from The National Toxicology Program (NTP) under the National Institutes of Health (NIH) in USA on the largest ever animal study on cell phone RF radiation and cancer (14). An increased incidence of glioma in the brain and malignant schwannoma in the heart was found in rats. Acoustic neuroma or vestibular schwannoma is a similar type of tumour as the one found in the heart, although benign. Thus, this animal study supported human epidemiological findings on RF radiation and brain tumour risk (8).

The IARC cancer classification includes all sources of RF radiation. The exposure from mobile phone base stations, Wi-Fi access points, smart phones, laptops and tablets can be long-term, sometimes around the clock, both at home and at

Exposure to RF radiation within the WHO building in Geneva



World Health Organization, 20 Avenue Appia, CH-1211 Geneva 27, Switzerland. Total RF field exposure ($\mu W/m^2$, mean exposure = 21.5 $\mu W/m^2$, logarithmic scale) over time of one exposure round, March 3, 2017 time 13:57:53 – 15:58:31. The horizontal red line represents the LOEL exposure limit of 30 $\mu W/m^2$ suggested by the Bioinitiative Report.

5G Appeal

Scientist Appeal for 5G Moratorium

Scientists and doctors warn of potential serious health effects of 5G

September 13, 2017

We the undersigned, more than 180 scientists and doctors from 36 countries, recommend a moratorium on the roll-out of the fifth generation, 5G, for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry. 5G will substantially increase exposure to radiofrequency electromagnetic fields (RF-EMF) on top of the 2G, 3G, 4G, Wi-Fi, etc. for telecommunications already in place. RF-EMF has been proven to be harmful for hu-mans and the environment.

http://www.environmentandcancer.com

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Profitability Versus Public Health

CORPORATE TIES THAT BIND

An Examination of Corporate Manipulation and Vested Interest in Public Health

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Who is winning the battle over public health?

The fight between corporate profit and public health has resulted in unnecessary disease and even death. ***Corporate Ties That Bind*** (Skyhorse hardcover, 3/28/17, $35.00) clearly shows how conflicts of interest, lies, distortion of facts, and the corruption of scientists affect our exposure to toxins and radiation—and the quality of our lives.

From a wide range of writers, here are groundbreaking pieces on:

- The basis of bad science
- Industrial influences on cancer epidemiology
- Secret ties in asbestos
- Hiding environmental issues
- Downplaying radiation risk
- And much more

Whether you're concerned about how corporations have distorted the health impacts of their products or how their financial interests affect our well-being, ***Corporate Ties That Bind*** is a must-read for anyone concerned about the future of public health.

—Over—

Conclusion

-We are not protected

-The environment is not protected

-No longer a scientific issue

-Time for politicians and decision makers to act