RADIO FREQUENCY (RF) BIO-EFFECTS

DO WE HAVE A PROBLEM?

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AGENDA

- Early radiofrequency electromagnetic radiation (RF-EMR) bio-effect findings – 1970's and earlier
- RF-EMR bio-effect findings – 2000 to 2012 (TR-164 vs ORSAA DB)
- Health issues that plague modern society – The potential role of RF-EMR
- ORSAA *in vivo/in vitro* comparison with TR-164 findings
- How funding source and country of origin appears to distort outcomes
- Lack of precaution and failure to adequately communicate and manage risk

RESEARCH SUMMARY FINDINGS US NAVAL MEDICAL RESEARCH INSTITUTE (NMRI) 1971

PHYSIOLOGICAL EFFECTS

- Changes in physiologic function
  - Changes in the oxidative processes in tissues and organs
  - Altered sensitivity to drug stimuli
  - Decreased spermatogenesis (decreased fertility, to sterility)
  - Altered foetal development
  - Altered renal function
  - Changes in conditioned reflexes
  - Altered blood flow rate
  - Alterations (EEG) of the cerebral cortex
  - Electrocardiographic (EKG) changes
  - Alterations In sensitivity to light, sound, and olfactory stimuli

Red text = Symptoms typically found in electromagnetic hypersensitive (EHS) suffers

NERVOUS SYSTEM EFFECTS

- Central nervous system effects
  - Headaches
  - Insomnia
  - Restlessness (awake and during sleep)
  - Electroencephalographic (EEG) changes
- Autonomic nervous system effects
  - Neuro-vegetative disorders (e.g., alteration of heart rhythm)
  - Fatigue
  - Structural alterations of the synapses
  - Stimulation of parasympathetic nervous system (bradycardia)
- Peripheral nervous system effects
  - Effects on locomotor nerves

PSYCHOPHYSIOLOGICAL/BEHAVIOURAL EFFECTS

- Psychophysiologic (and psychosomatic) responses
  - Neurasthenia (general "bad" feeling)
  - Depression
  - Anxiety
  - Lack of concentration
  - Dizziness
  - Sleepiness
  - Insomnia
  - Increased irritability
  - Loss of memory
  - Scalp sensations
  - Increased fatigability
  - Chest pain
  - Tremor of the hands
- Behavioural changes

BLOOD/VASCULAR DISORDERS

- Blood Disorders

  Changes in:

  - Blood and bone marrow
  - Phagocytic (polymorphs) and bactericidal functions
  - Number of erythrocytes (decrease)
  - Blood glucose concentration (increase) (type 2 diabetes)
  - Blood histamine content (allergies)
  - Cholesterol and lipids (cardiovascular disease)
  - Albumin/globulin ratio (decrease)
  - Gamma (also α and β) globulin, and total protein concentration
  - Leukopenia (increase in number of white cells), and leukocytosis
- Vascular disorders (stroke)

Blue text = Suggested to have a potential role in a number of diseases found in today's society

OTHER SIGNIFICANT EFFECTS

- Genetic and chromosomal changes
  - Chromosome aberrations
  - Mutations
  - Somatic alterations (changes in cell not involving nucleus or chromosomes, cellular transformation)
  - Neoplastic diseases (e.g., tumours)
- Endocrine gland changes
  - Altered pituitary function
  - Decreased corticosteroids in blood
  - Decreased glucocorticoidal activity
  - Hypogonadism (usually decreased testosterone production)
- Histological changes
  - Changes in tubular epithelium of testicle
- Changes in circadian rhythms

DEFENCE INTELLIGENCE AGENCY (DIA) REPORT 1976

US DEFENCE INTELLIGENCE AGENCY (DIA) REPORT 1976

- "***If the more advanced nations of the West are strict in the enforcement of stringent exposure standards*** (safety regulations)***, there could be unfavourable effects on industrial output and military functions***." (page vii)
- *"Animal experiments reported in open literature have demonstrated the use of low level microwave signals to produce death by heart seizure or by neurological pathologies resulting from breaching of the blood-brain barrier".* (page viii)
- "*Personnel* (military) *exposed to microwave radiation below thermal levels experience more neurological, cardiovascular, and haemodynamic disturbances than do their unexposed counterparts.*" (page 6)
- "*Some of the cardiac and circulatory effects attributed to exposure include bradycardia, hypotension, and changes in EKG indices."* = High and low blood pressure (page 6)

US DEFENCE INTELLIGENCE AGENCY (DIA) REPORT 1976

- *"Subjects (*military personnel*) exposed to microwave exhibited a variety of neurasthenic disorders against a background of angiodystonia (*abnormal changes in the tonicity of the blood vessels*). The most common subjective complaints were* ***headache, fatigue, perspiring, dizziness, menstrual disorders, irritability, agitation, tension, drowsiness, sleeplessness, depression, anxiety, forgetfulness and lack of concentration****."* (page 8)
- *"Long term non-thermal microwave irradiation of male mice evoked diffuse changes in the testes. Subsequent mating of the animals resulted in reduction in the size of the litters"* (page 13)
- *"****Recognition of the .01mW/cm2 standard (stringent safety regulations) could also limit the application of new electronic technology by making the commercial exploitation of some products unattractive because of increased costs imposed by the need for additional safeguards****."* (page 24)
- *"Another possibility is alteration of the permeability of the blood-brain barrier. This could allow neurotoxins in the blood to cross. As a result, an individual could develop severe neuropathological symptoms, either die, or become* ***seriously impaired neurologically****."* (page 26)

INFLUENCE OF MICROWAVE RADIATION ON MAN AND ANIMALS (1970) - NASA TRANSLATION

BIO EFFECT RESEARCH – 1970 CONCLUSIONS*

- RF (Microwaves) may have both pathogenic effects and, under certain conditions, a therapeutic action on the human organism
- Many aspects of this pressing problem remain almost totally neglected; in particular, our information on the mechanism by which microwaves affect the human organism is inadequate
- Microwave radiation on the organism can be dealt with successfully (and the literature material critically generalized) in its present state only by a team of scientists representing various specialties
- It was established from study of the nonthermal (specific) action of radio waves that the changes that appear in the organism cannot be explained solely in terms of the amount of heat formed in it

*Source: Influence of Microwave Radiation on Man and Animals (1970) - NASA Translation

RF BIO EFFECT FINDINGS 2000 – PRESENT DAY & POTENTIAL HEALTH IMPLICATIONS

CHRONIC DISEASES THAT PLAGUE MODERN SOCIETY – DOES EMR HAVE A ROLE TO PLAY?

- Cancer is now the leading cause of death surpassing cardiovascular disease as the nation's top killer (Jan 2017)
  - WHO in 2014 reported that a cancer tidal wave is approaching
- Neurodegenerative diseases are becoming more prevalent with a 40% increase from 2006 to 2016.
  - Dementia is one of Australia's top three leading causes of death with an increasing mortality rate
- Mental health problems are plaguing society
  - This is evident as anxiety based disorders and behavioural problems are become more prevalent, severe, and in many cases disabling
  - Mental illnesses are the third leading cause of disability burden in Australia
  - Neurobehavioral disorders are the major health burden in children
- A significant proportion of the population is suffering from one or more allergies in developed countries and "*allergic diseases are among the fastest growing chronic condition in developed countries, Australia is no exception*"
- About half of all Australians have a chronic disease, around 20% have at least two and 40% of Australians aged 45 and over have two or more of the eight chronic diseases identified:
  - Arthritis, asthma, back problems, cancer, chronic obstructive pulmonary disease, cardiovascular disease, diabetes and mental health conditions

BIOEFFECTS OCCURRING AT LEVELS WELL BELOW RPS3 RF BASIC RESTRICTIONS

- Exposure to microwaves produce distinct changes in the functions of various biological systems
- Changes are not only occurring at a level below where there are no pronounced thermal changes assumed to be occurring, but also at lower levels
- The nature of these changes depend strongly on the duration and number of repeated exposures
- Many studies that are finding effects at very low levels are well conducted research (methodology is sound)

RECOGNISED EFFECTS OF EVEN MINUTE LEVELS OF MICROWAVE RADIATION EXPOSURE HAVE BEEN SHOWN TO:

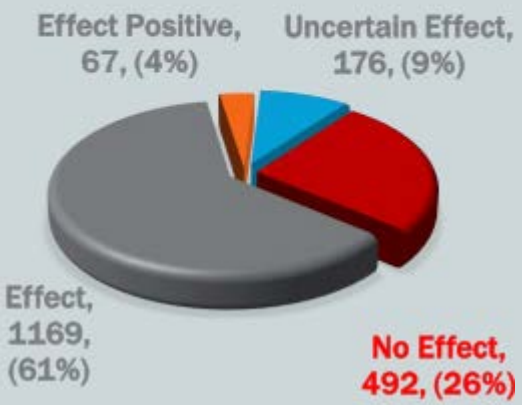
- Increase permeability of blood brain barrier and gut
- Open the blood-brain barrier to viruses and toxins
- Heat head and ear
- **Induce ringing in the ears**, impair sense of smell
- Increase excitability at neuronal synapses
- Damage nerves within the scalp
- **Cause diverse neuropsychiatric changes, including depression**
- Disrupt brain activity, alter brain waves (EEG readings), alter brain chemistry and alter the brain's electrical activity during sleep
- Lower levels of night time melatonin; **sleep disruption and insomnia**
- **Cause memory loss and mental confusion**
- Behavioural changes; Poor exploration of the local environment, motivation inhibiting
- **Cause headaches and induces extreme fatigue**
- Reverse cell membrane polarity (RBC's form Rouleaux formation)
- Altered chronobiology leading to stress response
- **Create joint pain, muscle spasms and tremors**
- Precipitate cataracts, retina damage and eye cancer
- Immune disruption leading to over active, under active, and autoimmune conditions.
- **Create burning sensation and/or rash on the skin**
- Reduce the number and efficiency of white blood cells
- Stimulate asthma by producing & releasing histamine in mast cells
- **Cause digestive problems**
- Stresses the endocrine system, especially pancreas, thyroid, ovaries and testes
- Cause single strand and double strand breaks in cellular DNA (via oxidative stress pathways) – can lead to cancer and neurodegeneration
- Increase in tumour genesis due to fragility and altered expression of RNA and DNA
- Altered hormone and sex steroid levels
- Implicated in both male and female infertility
- **Leads to changes to the electrical control of the heart resulting in tachycardia (rapid heartbeat), arrhythmia** and can result in sudden cardiac arrest
- **Peripheral neurological effects leading to noxious and abnormal sensations or dysesthesia**

Find Search Summary Totals

Peer Reviewed Studies Showing Biological Effects — Number of records used : 1423 of 2399

Auditory Dysfunction / Hearing loss / Tinnitus	37	Apoptosis (Programmed Cell Death)	90	Brain Tumours	49
Blood Brain Barrier Permeability Changes	14	Breast Cancer	13	Cellular Stress	60
Brain Development / Neuro Degeneration	35	Biochemical Changes	326	EEG changes / Brain Waves	84
Neuro Behavioural Effect / Cognitive Effects	187	Cell Irregularities/ Damage/ Morphological Changes	181	Effects on Mitochondria	27
Calcium Influx / Efflux	20	Fatigue	44	Altered Enzyme Activity / Protein Levels / Protein Damage	323
Circadian Rhythm Disruption	10	Altered Gene Expression	144	Headaches/Migraines	64
DNA Damage / Mutagenic / Genotoxic	122	Altered Glucose Level / Glucose Metabolism	20	Inflammation	23
Endocrine / Hormone Effects	68	Cardiovascular Effects	63	Hepatic Effects (Liver)	27
Miscarriage / Spontaneous Abortion / Foetus Resorption	7	Immune System Effects	71	Impaired / Reduced Healing/ Bone Density Changes	4
Memory Impairment	64	Oxidative Stress / ROS/ Free Radicals	186	Speech Impairment	4
Sperm /Testicular Effects	84	Sleep Effects	61	Haematological Effects	53
Tumour Promotion	38	Neurotransmitter Effects	28	Synergistic/Combinative Effects	46
Thyroid Effects	15	Visual Disturbances/ Ocular Effects	42	Autism	10
Leukemia	14	Parotid Gland Malignancy	4	Neoplasis/ Hyperplasia (Abnormal Tissue Growth)	2
Depression	25	Induced Adaptive Response	48	Dizziness / Vertigo / Vestibular Effects	25

EMR RESEARCH EFFECT BREAKDOWN



Source: ORSAA Database as of 24/05/2017: Date Range 1/1/2000 to present day

RF-EMR BIOEFFECTS IN MORE DETAIL

CENTRAL NERVOUS SYSTEM (CNS)

- The CNS is highly sensitive to microwave irradiation and leads to functional changes
  - Some changes may be adaptive in nature
  - Can have a regulatory influence on endocrine glands
  - Changes in cortical excitability
- Some CNS effects can be temporary in nature
  - EEG changes
  - Short term cognitive/behavioural effects
- Or long term and depends on the nature of the exposure and duration
  - Neurodegeneration
  - ADHD – exposure during pregnancy and when child's brain is developing

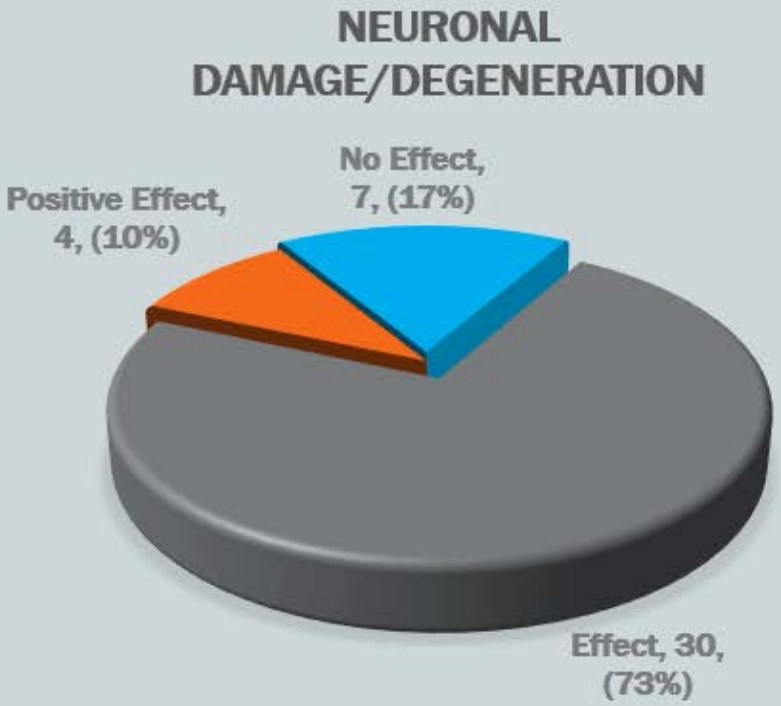
RF EXPOSURE AFFECTS BRAIN

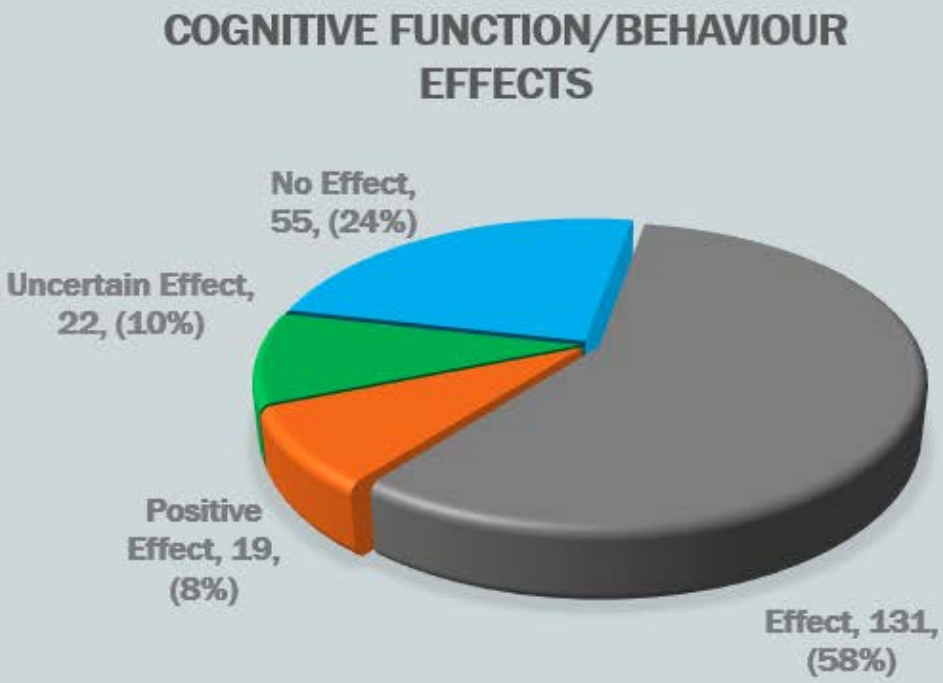
- Studies link RF exposure to:
  - Structural and functional changes of the brain
  - Neurodegeneration
    - Histopathological changes and neuronal damage
    - Pyramidal cell loss (hippocampus) - memory
    - Decreased number of Purkinje cells in cerebellum – motor control
    - Morphological changes, shrunken cytoplasm
    - Expression rates of microRNAs and gene expression in cells
    - Increased oxidative stress
    - Increased apoptosis (cell death)
  - EEG changes – provides the most convincing evidence of a direct impact on brain by RF exposure – mechanism remains to be studied
  - Mitochondrial dysfunction
  - DNA damage, fragmentation, micronuclei induction
  - Altered neurotransmitter (NT) levels and NT receptor expression
  - Blood brain barrier (BBB) breaches and albumin leakage
  - Cognitive function, behavioural and spatial memory deficiencies

NEURODEGENERATION AND ALTERED BEHAVIOUR

- Some studies suggest RF exposures are linked to:
  - Degenerative diseases like Alzheimer's, dementia, Parkinson's Disease, Huntington's Disease etc. (Bas, 2009, Dasdag 2012, Zao 2015, Barnes & Greenebaum 2016)
  - Neurodevelopment and behavioural problems
    - Autism, ADHD etc. (Sage and Herbert 2009, Aldad et al 2012).
  - Other mental illnesses that are linked to metabolic/chemical imbalances in the brain
    - Depression, anxiety
    - Bipolar disorder/schizophrenia
    - Addictive/compulsive behaviour
    - Intolerance and increased aggression (may have a role in the increase in domestic violence and public acts of violence?)
- All of the above are on the rise and parallels the deployment of wireless transmitters in our society

ORSAA DATABASE – NEURONAL DAMAGE AND BEHAVIOUR EFFECTS





Source: ORSAA database as of 23/05/2017

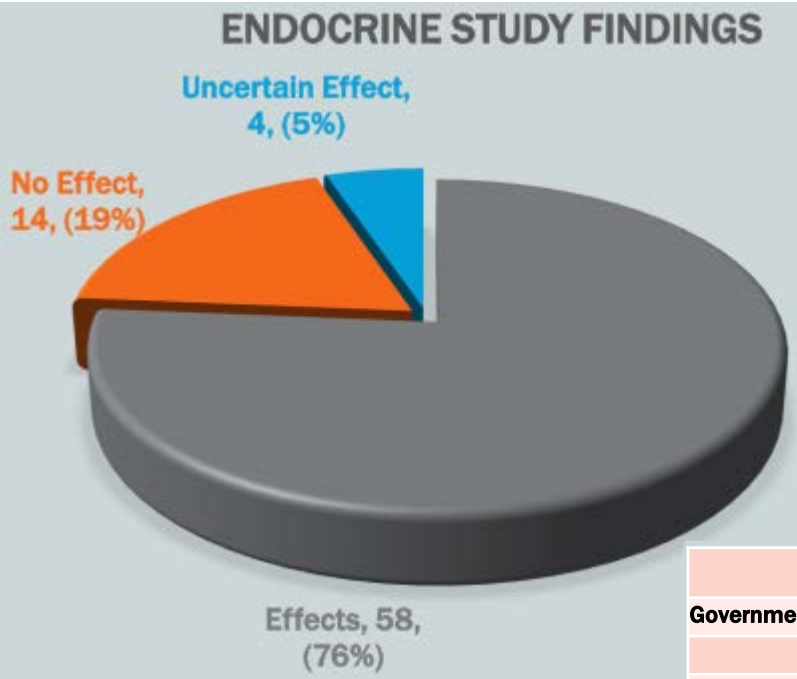
CHRONOBIOLOGICAL EFFECTS

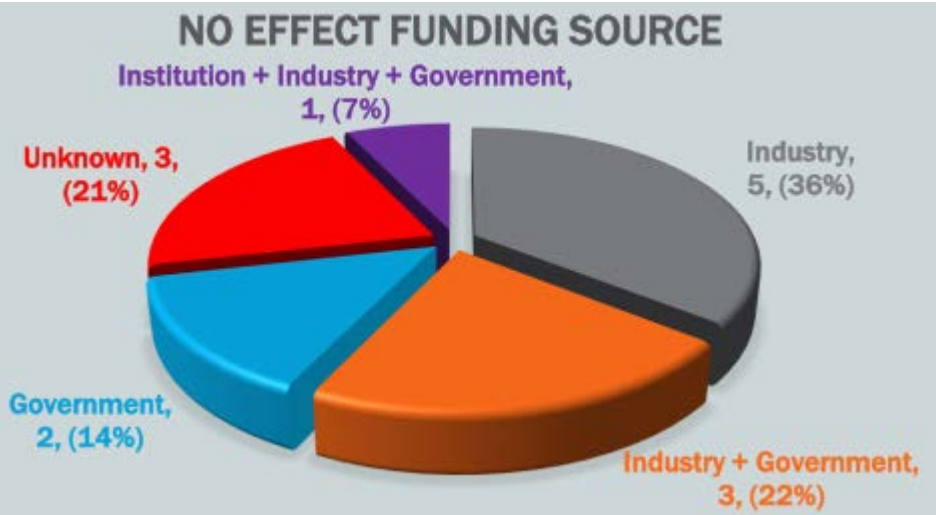
- Circadian rhythm disruption (normal 24-hour cycle of biological processes in animals and plants) (Wever 1970, Vangelova 2002, Chaturvedi 2011, Qin 2013, Cao 2015)
- Ultradian rhythm effects (a recurrent period or cycle repeated throughout a 24-hour circadian day) (Mohammed 2012)
- Time of exposure influences the magnitude of disruption (Qin 2013)
- Downstream effects include hormone release dysregulation, inflammatory and haematological disorders, sleep disorders etc.
- The majority of research papers investigating this endpoint show RF exposures effect circadian rhythm and endocrine function
- Health implications if persistent and long term:
  - Increased risk of diabetes
  - Increased risk of cancer
  - Increased risk of cardiovascular disease
  - Increased risk of obesity
  - Increased risk of stroke

ENDOCRINE EFFECTS

- Biochemical actions induced by EMR exposures lead to adverse changes in hormones essential in male and female reproduction
- Testosterone level decreases
- Luteinising hormone (LSH) levels increased
- Follicle-stimulating hormone (FSH) level increased
- Estrogen level changes
- Progesterone level changes
- Prolactin levels decreased
- Corticosterone level increases
  - Corticosterone is a main glucocorticoid, involved in regulation of energy, immune reactions, and stress responses.
- Adrenaline and Noradrenaline levels (catecholamine) change and is more dramatic with length of exposure
- Thyroid hormone levels change (TSH, T3, T4)
- Adrenocorticotropic hormone (ACTH) levels decreased
- Melatonin level decreases

ORSAA DATABASE – ENDOCRINE PAPERS





No Effects Funding	
Government Funders	Department of Defence
	Korea Communications Commission
	UK MTHR programme
	Ministry of Internal Affairs and Communications, Japan
	Hungarian Ministry of Welfare (Joint Funding with Hungarian Telecommunication Co)
Industry	Deutsche Telekom/T-Systems, Germany
	Mobile Manufacturers Forum (MMF)
	Supported by T-NOVA Deutsche Telekom Innovations-gesellschaft mbH
	UK MTHR programme
	Motorola Corporation
	Forschungsgemeinschaft Funk e.V. (FGF) (Research Association for Radio Applications),
	Hungarian Telecommunication Co. (Joint funding with Hungarian Ministry of Welfare)

Source: ORSAA database as of 23/05/2017

NEUROTRANSMITTER EFFECTS

- Hippocampus injured by long-term exposure to microwaves leads to impairment of cognitive function due to neurotransmitter disruption (Zhao 2012)
- Microwaves influences monoamine neurotransmitter levels and their key regulating enzymes (Megha 2015)
- Many studies looking at learning and spatial memory deficiencies also find neurotransmitter profiles changed (Shtemberg 2000, Zhao 2012, Maaroufi 2014, Qin 2014, Wang 2015 etc.)
- Impacts brain, heart and digestive system
- GABA, dopamine, serotonin, norepinephrine (noradrenaline), epinephrine (adrenaline), glutamate, acetylcholine levels are all impacted by RF

NEUROTRANSMITTER FUNCTION

- **Serotonin**
  - Serotonin is produced both in the Central Nervous System (CNS) and in the Peripheral Nervous System (PNS).
  - Serotonin produced in the CNS is associated with anger regulation, body temperature, mood, sleep, pain modulation and appetite
- **Dopamine**
  - A natural amphetamine and controls energy, excitement about new ideas and motivation
- **GABA**
  - An inhibitory neurotransmitter of the nervous system and is linked with relaxation, anti-anxiety and anti-convulsive effects
- **Acetylcholine**
  - Promotes excitatory actions for cognition, memory and arousal

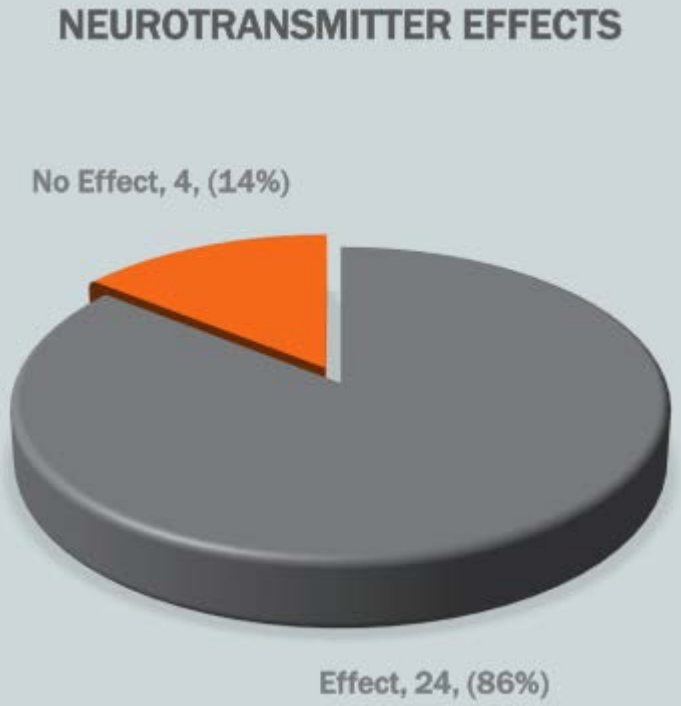
NEUROTRANSMITTER IMBALANCE SYMPTOMS

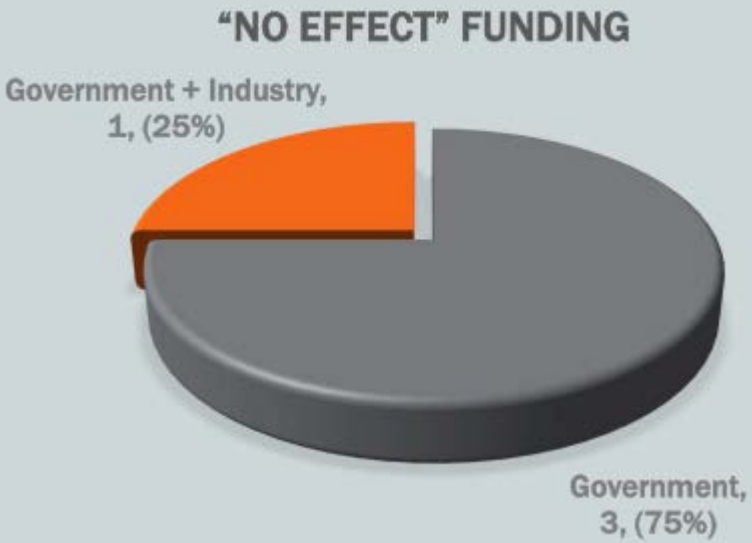
- GABA imbalances
  - Anxiety
  - Difficulty turning the mind off
  - Restless mind
  - Inner tension and excitability
  - Tinnitus
  - Blurred vision
  - Chest discomfort
  - Irritability, oversensitivity
- Dopamine imbalances
  - Depression
  - Fatigue
  - Learning disorders
  - Attention Deficit Disorder (ADD)
  - Irritability and outbursts
  - Distracted easily
- Serotonin imbalances
  - Migraines/headache
  - Rapid heart rate/irregular heart beat
  - Tremor
  - Strong sugar cravings
  - Insomnia
  - Fatigue
  - Depression
  - Reduced emotional control
- Acetylcholine imbalances
  - Learning disabilities
  - Memory lapses
  - Diminished comprehension
  - Slowed mental responsiveness
  - Attention Deficit Disorder (ADD)

A REAL LIFE EXPOSURE CONDITION (BUCHNER ET AL. 2011)

- A long-term study conducted in Germany to investigate the influence of base station RF emissions on neurotransmitters under true-to-life conditions;
- 24 out of 60 participants were exposed to a power density of < 60 µW/m², 20 participants to 60 - 100 µW/m², and 16 participants to more than 100 µW/m² ;
- The levels of stress hormones adrenaline and noradrenaline grew significantly during the first 6 months after starting the GSM base station;
- The levels of the precursor substance dopamine substantially decreased in this time period;
- The initial condition was not restored even after 1.5 years;
- The effects showed a dose-effect relationship and are situated well under public exposure limit values.

ORSAA DATABASE – NEUROTRANSMITTER PAPERS



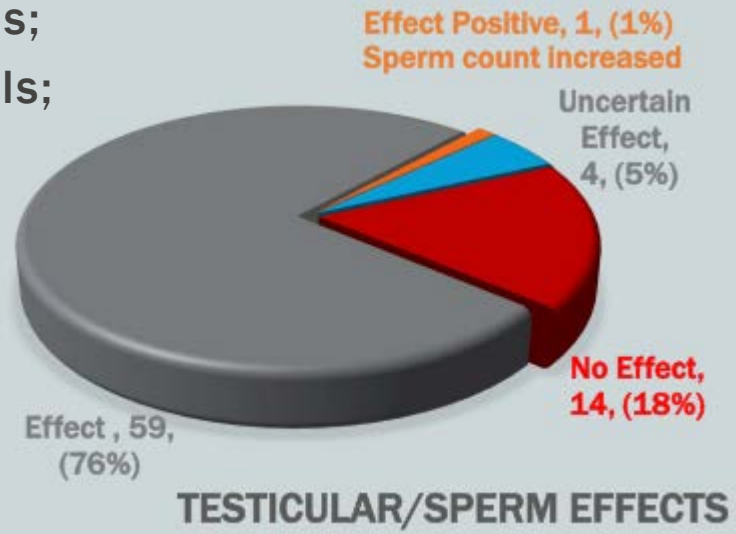


No Effect Funders	
Government	Department of Defence
	Ministry of Internal Affairs and Communications, Japan
	UK MTHR programme
Industry	UK MTHR programme

Source: ORSAA database as of 23/05/2017

SPERM AND TESTICULAR EFFECTS – FERTILITY IMPLICATIONS

- Chronic exposure to radiofrequency electromagnetic radiation of cell phone leads to:
  - Defective and degenerative testicular function;
  - Increased oxidative stress;
  - Atrophy of the seminiferous tubules;
  - Degenerative changes in the epithelium of the testes;
  - Reduction of serum testosterone levels;
  - Reduction in the number of sertoli cells;
  - Malformed sperm;
  - Reduced sperm count and quality;
  - Reduced sperm viability;
  - Reduced sperm motility;
  - Increased sperm DNA damage.



Source: ORSAA database as of 23/05/2017

IMMUNOLOGICAL REACTIVITY CHANGES

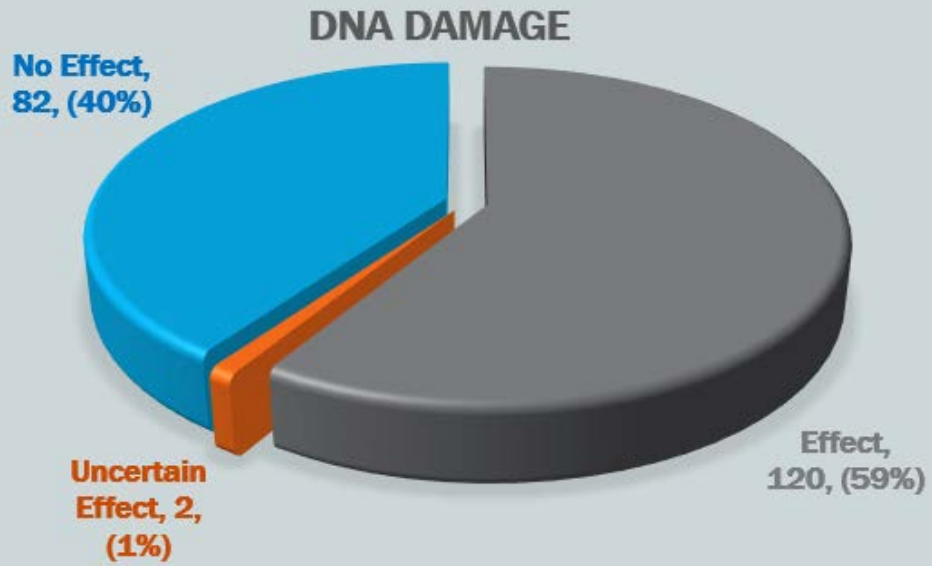
- Inflammation
  - Interleukin 1 beta (IL-1β) levels increased (Eser 2012, Megha 2012)
  - Tumour necrosis factor alpha (TNF-α) levels increased (Megha 2012)
  - Neuroinflammation (Bouji 2012)
  - Changes in Cytokine profile (Gapeev 2010)
- Lymphocyte percentage and total white blood cell counts changes
  - IgM and IgG levels significantly changed (Yuan 2004, El-Gohary 2017)
  - Pancytosis (an increase in RBCs, WBCs, and platelets) (Otitoloju 2012)
- Leukocyte cell surface antigens (CD antigens) expression changes
- Skin disorders/dermatitis (Johansson 2001)
  - Migration of mast cells towards the uppermost dermis
  - Mast cell degranulation
  - Histamine release
- Autoimmune changes (Grigoriev 2010*)
- Supressed phagocytic activity of neutrophils (Kolomytseva 2002)
- Increased allergies and asthma (Saravanamuttu 2016)

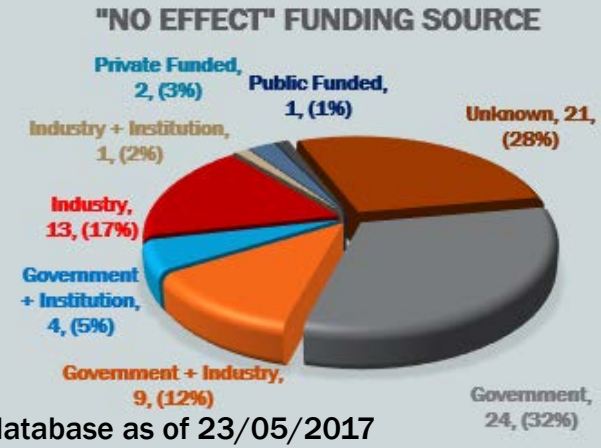
*Replicated Soviet studies conducted between 1974 and 1991 that showed immunological effects

DNA/CHROMOSOMAL DAMAGE

- Cytogenotoxic damage in immature rats was statistically higher than the mature rats (Sekeroglu 2013)
- 8-oxo-2'-deoxyguanosine (8-oxo-dG) test show DNA Base Damage (from increased oxidative stress) (Guler 2010, Burlaka 2013, Liu 2013, Gurler 2014 etc.)
- Studies link RF exposures to
  - Single Strand DNA Breaks
  - Double Strand DNA Breaks
  - Micronuclei Induction (MN)
  - Chromosomal Aberrations
    - Acentric fragments and dicentric chromosomes
- Synergistic effects with mutagenic chemicals i.e. mitomycin C (Maes 1996, Zhang 2002, Wang 2005, Baohong 2005)

ORSAA DATABASE – DNA DAMAGE PAPERS





Source: ORSAA database as of 23/05/2017

No Effect Funders	
Government	United States Air Force
	National Natural Science Foundation of China
	Ministry of Education and Human Resources Development, Korea
	Ministry of Internal Affairs and Communications.
	Ministry of Science and Technology
	Finnish Funding Agency for Technology and Innovation TEKES
	STUK (Radiation and Nuclear Safety Authority)
	National Research Council
Industry	Motorola
	France Telecom
	Association of Radio Industries and Businesses (ARIB)
	GSM Association
	Mobile Manufacturers Forum (MMF)
	Finnish mobile phone manufacturers and operator
	Telecommunications Advancement Organization of Japan
	Fondation sante´ et radio- fre´quences'
	Cellular Telecommunications & Internet Association

STUDIES SHOW MORE NEOPLASIA IN EXPOSED HUMANS AND ANIMALS

- Exposed rats show more tumours – and they live longer
  - NTP study (2016)
  - Long-term, low-level microwave irradiation of rats (CK Chou et al. 1992)
- More than 80% of people who die in Belo Horizonte (Brazil) by specific types of cancer live less than 500m from 300 identified cell phone antennas in the city (Dode 2011)
- Animal studies show low level RF exposure is a tumour promotor (Tillman 2010, and repeat study by Lerchl 2015)
- Recent Epidemiological studies are showing a stronger link between mobile phone usage and aggressive forms of brain tumours (GBM) (Hardell 2015, Yang 2016, Bortkiewicz 2017, Prasad 2017)
- Incidence of malignant neoplasms of the central nervous system associated with mobile phone usage is increasing in young adults (Sato 2016)

HUMANS ARE NOT THE ONLY SPECIES EFFECTED BY MAN MADE RF

- The impact of GSM 900 MHz radiation is greater on the visual memory than on the olfactory one. RF may have a disastrous impact on a wide range of insects using olfactory and/or visual memory, i.e. on bees. (Cammaerts 2012)
- Mobile phone-induced honeybee worker piping (Favre 2011)
- Bee populations are in decline with mobile phones and base stations being implicated – (Sainudeen 2011, Sharma 2010)
- Spatial variation in the number of house Sparrow males was negatively and highly significantly related to the strength of electric fields from both the 900 and 1800 MHz downlink frequency bands (Everaert 2007)
- http://www.dnaindia.com/mumbai/report-10-reasons-why-the-sparrow-is-fast-disappearing-from-mumbai-2190510

ARPANSA DATABASE VS TR-164 FINDINGS

Review period 01/01/2000 ~ 31/08/2012

METHODOLOGY

- ARPANSA shared its database content with ORSAA in 2016
- ORSAA imported all studies provided into its own database
- ORSAA researchers reviewed and categorised all received papers
- Full papers were used except where paper was in a foreign language (translated abstracts from Pubmed were used in these specific cases)
  - Effect was designated when author noted a statistically significant finding
  - No papers were excluded from review process
- Next 3 slides present the difference between what was available in ARPANSA's database for the review period specified (2000 – August 2012) and what TR-164 showed
- Illustrates that scientific findings have not been faithfully or correctly been represented in ARPANSA's TR-164 report

ARPANSA DB VS TR-164 FINDINGS *in vitro*

Topic	Y (TR-164)	Y (ORSAA/ARPANSA DB)	N (TR-164)	N (ORSAA/ARPANSA DB)
Genotoxic	16	34 (+9 Synergistic Effect with mutagen and +1 Effect DNA Repair)	32	39 (+2 Effect Positive)
Proliferation/Apoptosis	25	Apoptosis 26 Proliferation 33 (+1 Uncertain) Combined 49 (+1 Uncertain)	30	Apoptosis 22 (+1 Effect Positive) Proliferation 35 Combined 47 (+1 Effect Positive)
Gene Expression	4	61 (+6 Uncertain Effect)	10	14
Stress Response/Heat Shock Proteins (HSP)	4	28 (3 at thermal levels) (+1 Uncertain Effect)	17	19
Intracellular Signalling	1	10 (+1 Uncertain Effect – synergistic with potassium-induced depolarization)	3	2
Membrane Effects	17	27	4	4 (+1 Effect Positive)
Direct Effects On Proteins	15	77 (+5 Uncertain Effects)	1	3
Oxidative Stress	N/S	17 (+3 Uncertain Effects synergistic with chemicals/γ-Radiation)	N/S	11

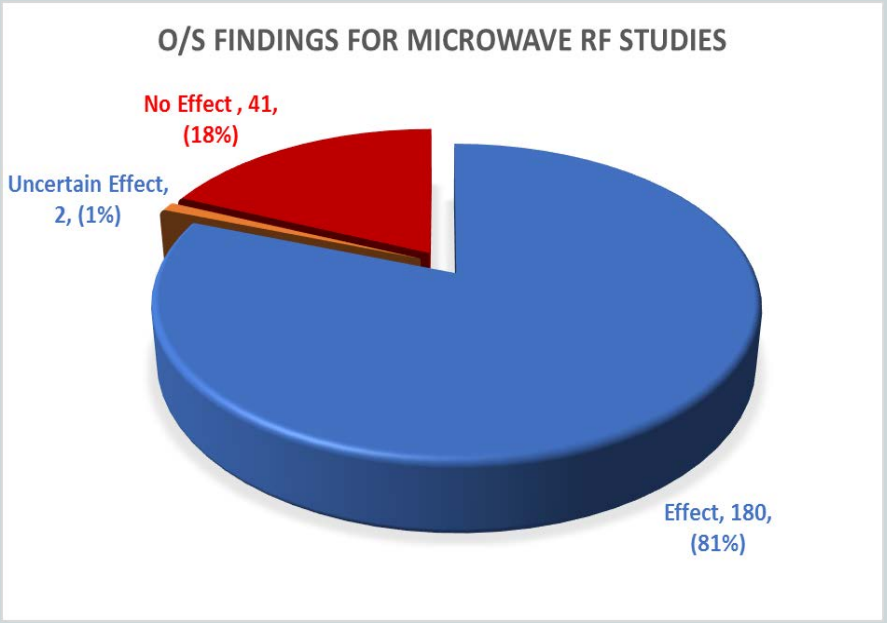
ARPANSA DB VS TR-164 FINDINGS *in vivo* (PART 1)

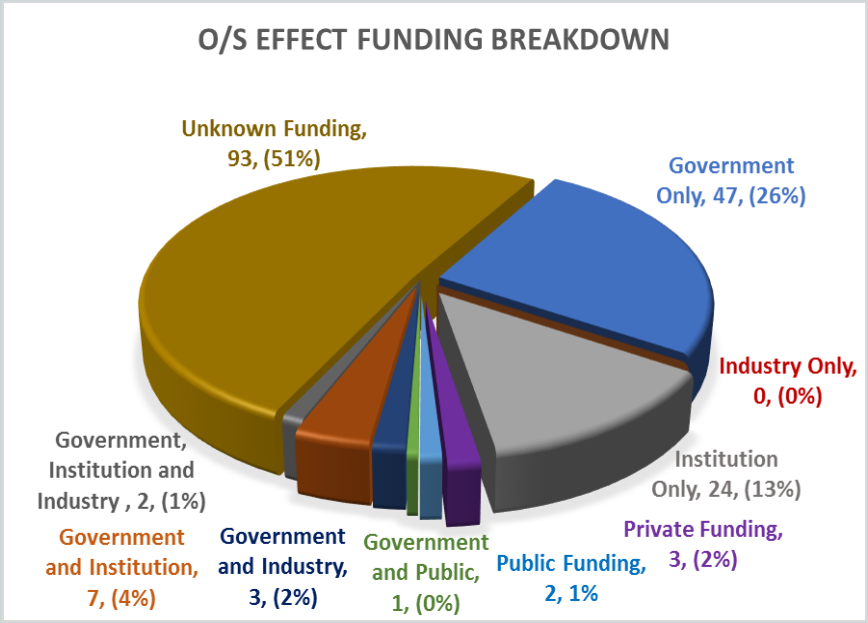
Topic	Y (TR-164)	Y (ARPANSA/ORSAA DB)	N (TR-164)	N (ARPANSA/ORSAA DB)
Cell Physiology, Injury, Apoptosis	21	72 (+1 Uncertain Effect)	17	16 (+2 Positive Protective Effect)
Neurotransmitters	1	10	1	1
Brain Electrical Activity	3	13	2	2
Blood Brain Barrier and Micro Circulation	4	10	8	15
Autonomic Function	0	2 (+1 Uncertain Effect)	2	0
Spatial Memory	7	15	4	10
General Learning	4	13 (+1 Effect – Thermal Levels)	5	9
Auditory Function	4	4 (+1 Uncertain Effect)	7	8
Genotoxicity and Mutagenesis	8	34	10	20 (+1 Protective Effect/ γ-Radiation)

ARPANSA DB VS TR-164 FINDINGS *in vivo* (PART 2)

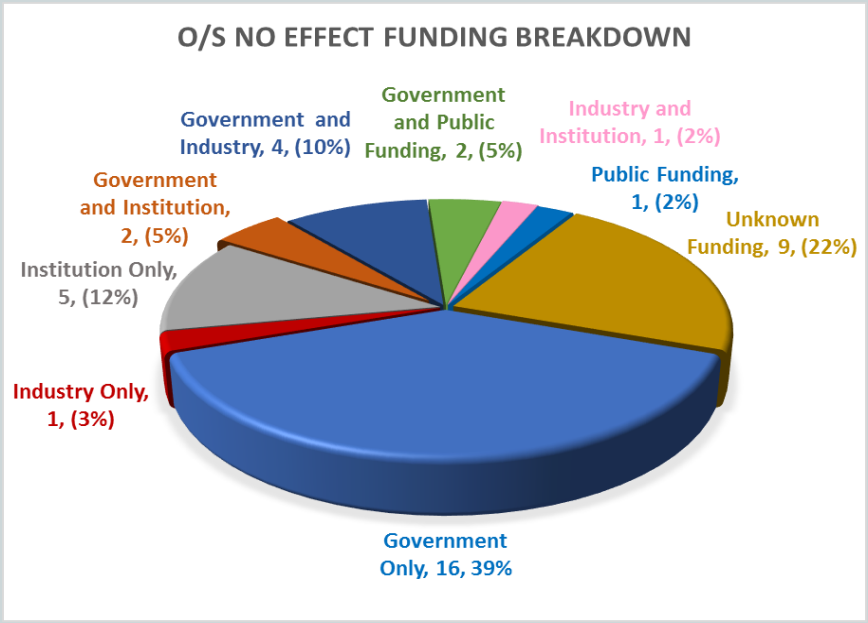
Topic	Y (TR-164)	Y (ORSAA)	N (TR-164)	N (ORSAA)
Tumour Incidence Normal Strain	1		4	
Tumour Incidence tumour prone strain	2?		3	
Implanted Tumours	3?		0	
All Tumour Studies (above)	6?	4 (+2 Uncertain Effect)	7	21 (+3 Protective Effects)
Co carcinogenesis	0	1	7	1
Co mutagen (*In vitro*)	N/S	11 (+1 Uncertain Effect)	N/S	0
Immune System and Haematological Effects	5	37 (+2 Uncertain Effect) (+13 Positive Effects)	3	16
Testicular Function	8	25 (+1 Uncertain Effect)	5	4 (+1 Positive Effect)
Pregnancy and Foetal development	9	17 (+2 Uncertain Effect)	10	23

MECHANISM FOR POTENTIAL HARM OXIDATIVE STRESS

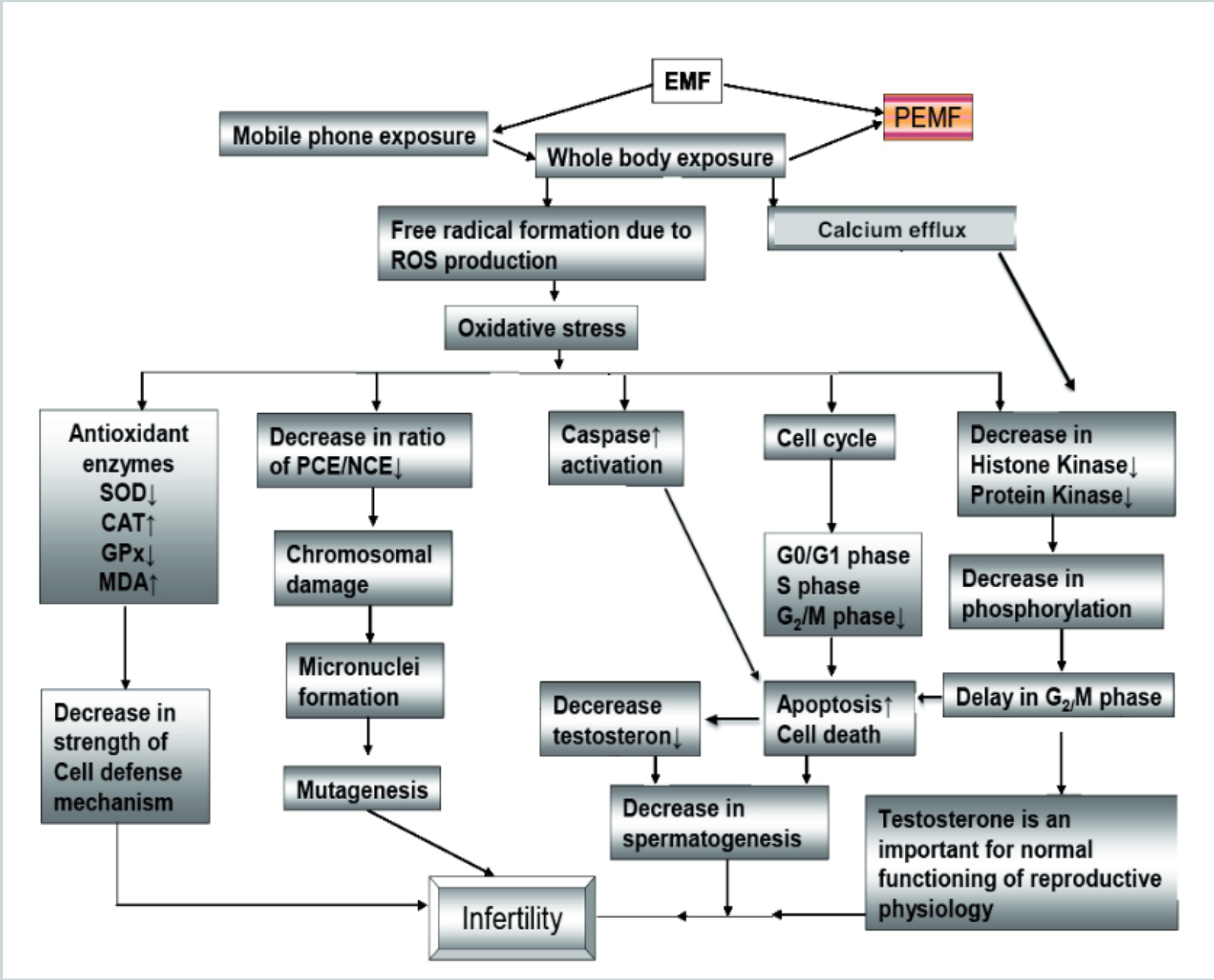




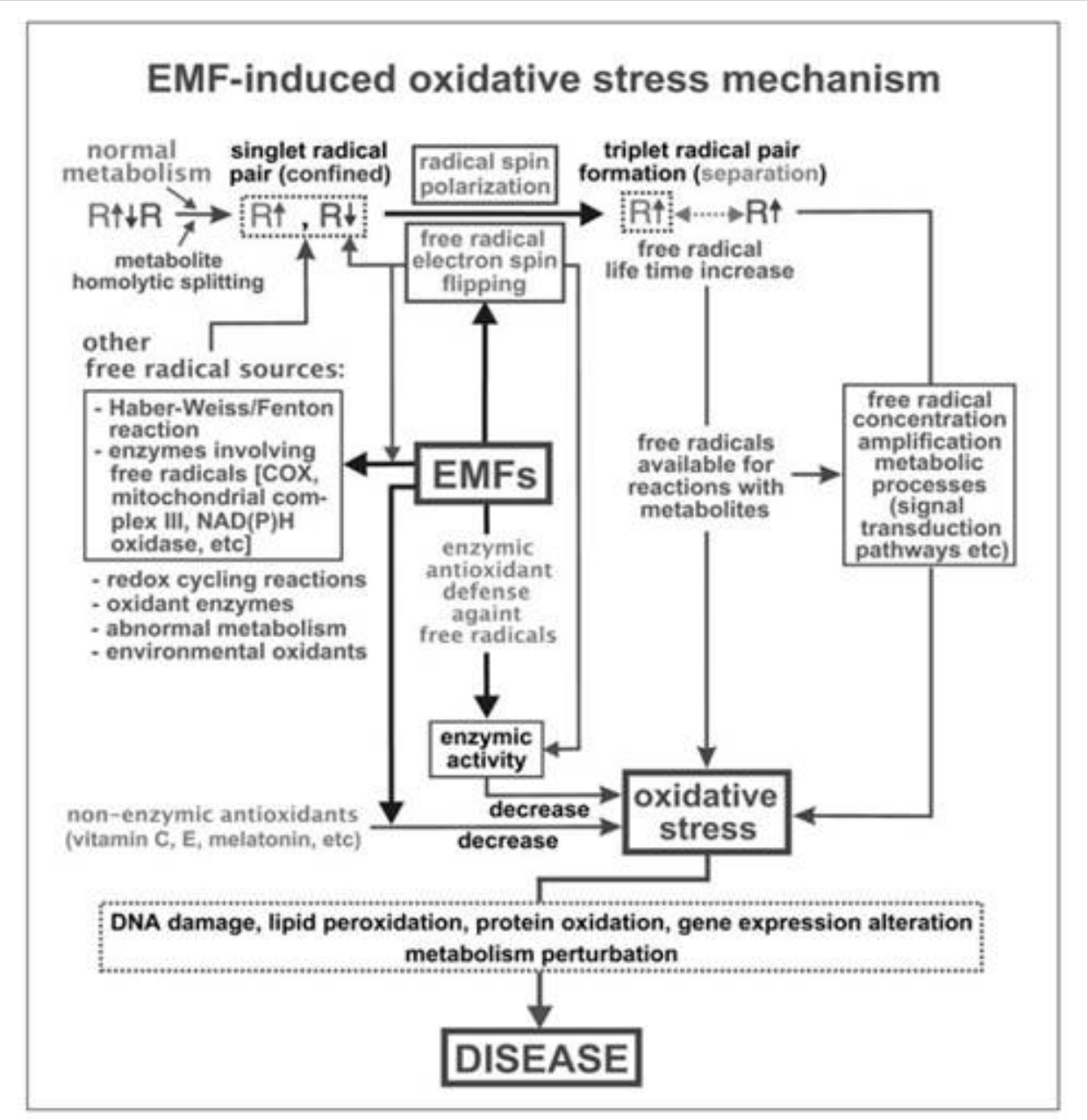
223 studies investigating oxidative stress from 1/1/2000 – to present day for microwave RF



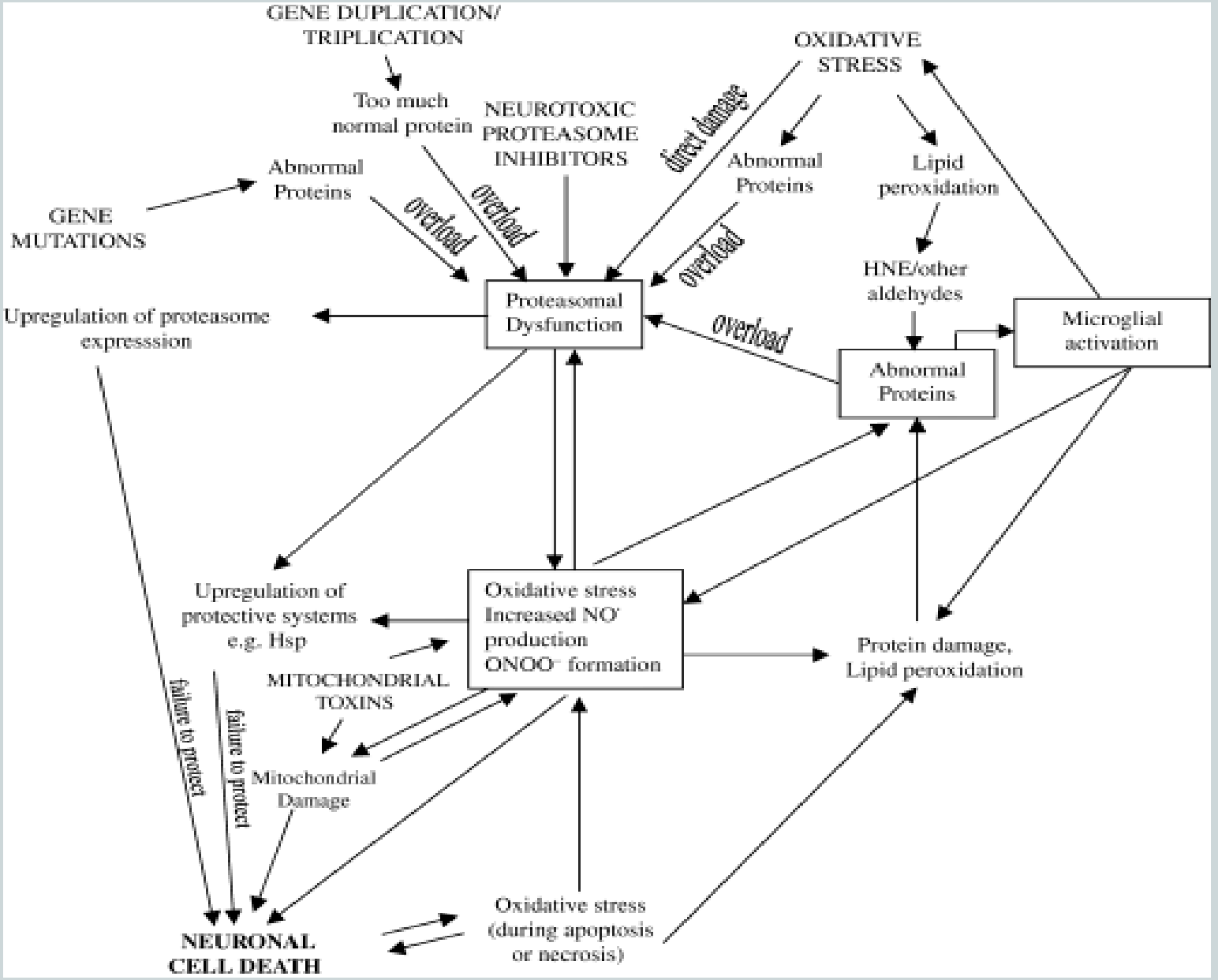
Source: ORSAA database as of 23/05/2017



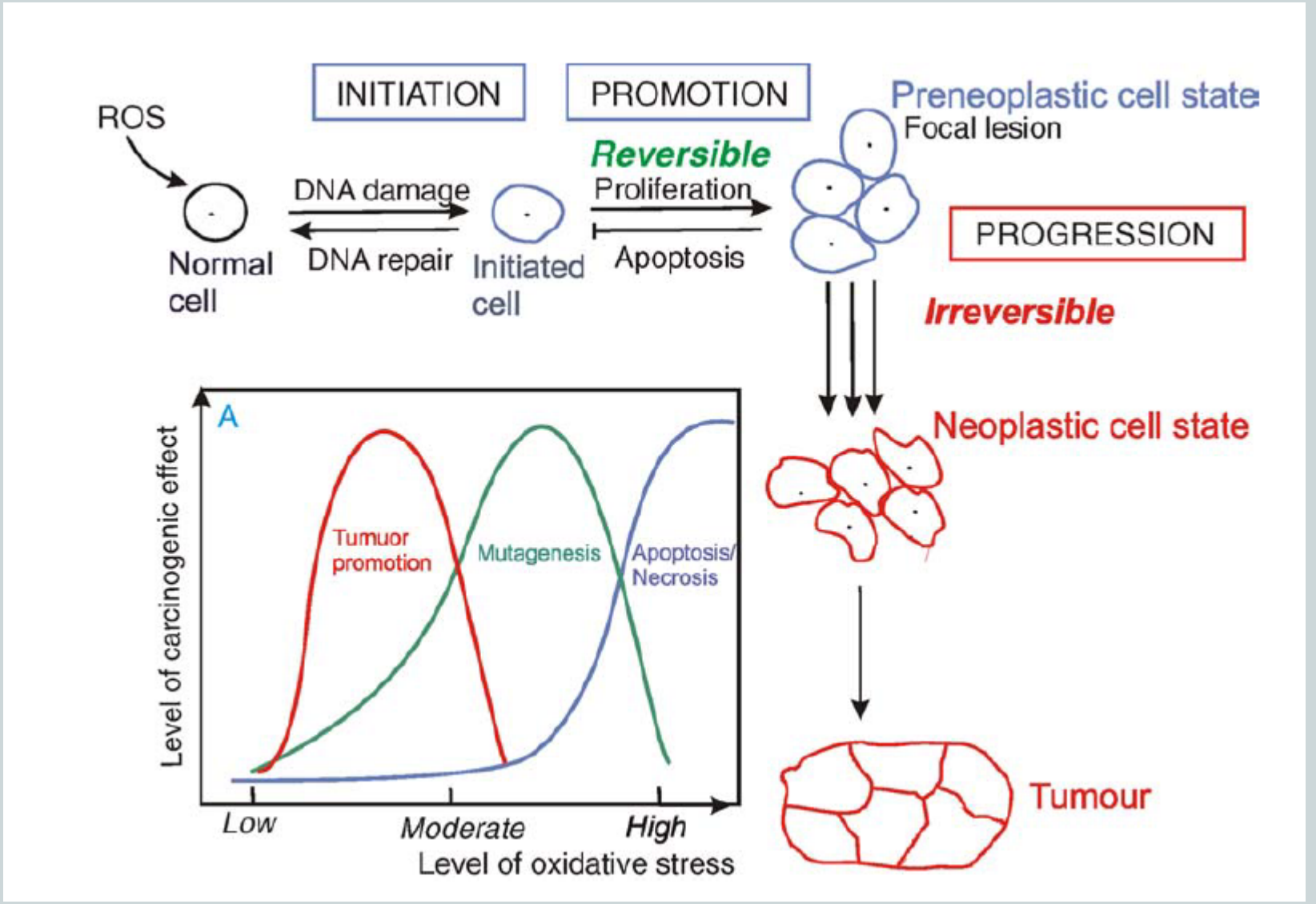
Source: Cell Phones and Male Infertility: A Review of Recent Innovations in Technology and Consequences. Agarwal 2011



Source: Oxidative stress-induced biological damage by low-level EMFs: mechanism of free radical pair electron spin-polarization and biochemical amplification, Georgiou 2010



Source: Oxidative stress and neurodegeneration: where are we now? Halliwell 2007



Source: Free radicals, metals and antioxidants in oxidative stress-induced cancer, Valko 2006

POTENTIAL CONFOUNDERS

INCONSISTENCIES IN FINDINGS?

- Differential responses to microwaves depending on part of the brain being exposed (Kim 2017)
- Different cell types respond differently to exposure
- Real vs simulated signals
- Genetic differences
- Time of day exposure occurs and when biochemical measurements are taken (during, immediately after or hours later)
- Methods for measuring effects (e.g. assays of differing sensitivity to measure DNA damage)
- Length of exposure time and number of exposures
  - Many studies are based on short term acute exposure(s)
  - Give very little insight to potential health implications of chronic long term exposures

DIFFERENT CELL TYPE RESPONSES, WINDOW EFFECTS, NON LINEAR EFFECTS

- Research shows that bio-effects have a dependency on EMF parameters such as:
  - Intensity, frequency, signal waveform, and/or repetition frequency of impulses
- Bio Effects also have a dependency on:
  - Exposure time (effects of different EMF are additive), cell type (how differentiated they are), specific point in cell growth cycle and cells homeostatic abilities
- Age dependent effects
  - Heat shock protein (HSP) expression differences in young and old rats (Walters 2001)
  - Much higher and irreversible cytogenotoxic damage observed in immature rats than in mature rats (Sekeroglu 2010)

ADAPTIVE RESPONSES

- There appears to be an adaptive response seen in organisms exposed to EMR and is highlighted in many studies
- However, such adaptation do not appear to be highly reliable, since serious functional disturbances can make an appearance sooner or later
- 2 types of changes occur when an organism is acted upon by microwaves:
  - adaptive reactions; and
  - pathological changes
- Systematic and long-term exposure results in adaptive failure and the appearance of neurasthenic vegetative, cardiovascular, and other disturbances*

*Source: Influence of Microwave Radiation on Man and Animals (1970) - NASA Translation

ADAPTIVE RESPONSES

- It is known that different cell types that were exposed to an extremely small adaptation dose of a genotoxic agent are less susceptible to the induction of a genetic damage when given a higher challenge dose of the same or similar genotoxic agent. (Jang 2013)

- Negative outcomes of an adaptive response relate to antibiotic resistance forming in micro-organisms under EMR exposure (Taheri 2017) findings such as this have implications for the management of serious infectious diseases especially in hospitals (Wi-Fi, wireless enabled equipment and super bugs – i.e. golden staph.)

CURRENT STATE OF SCIENCE

BIAS, MISREPRESENTATION OF SCIENTIFIC EVIDENCE AND CONFLICTS OF INTERESTS

- ARPANSA only accepts the position of ICNIRP (an NGO) who suggest the influence of RF-EMR on organisms is determined solely by thermal effects
- This one-sided view has been proven wrong as demonstrated by accumulated scientific evidence that is finding athermal biological effects – several thousand studies
- "No Effect" studies do not necessarily demonstrate safety
- Failure to find an effect simply means the specific parameters being tested did not result in a statistically significant finding
- Studies indicate individual variation of biological effects – with some people being more susceptible to adverse effects
- Most provocation studies are performed by psychologists and are often poorly conducted but are said to be the "gold standard"
- **International agencies are using each others inadequate and inaccurate study reviews/technical reports to support outdated and unsustainable RF protection policies**

INDUSTRY AND MILITARY FUNDING EFFECTS RESEARCH OUTCOMES

- ARPANSA did not evaluate research papers looking at potential biases and funding influence, ORSAA has
- Today, RF databases are seeded with industry sponsored "no effect" studies raising the question of reliability and trustworthiness of a large section of papers
- Significant trend toward "no effect" (majority) and a smaller number suggestive of positive effects
  - Improved reaction times
  - Improved memory
  - Increased sperm count
- **A number of Government/Industry funded studies have abstracts that conclude there are "no associations" between RF exposure and a specific endpoint but actually have statistical significant findings in favour of a RF effect(s) buried within the paper**

BALANCE OF EVIDENCE

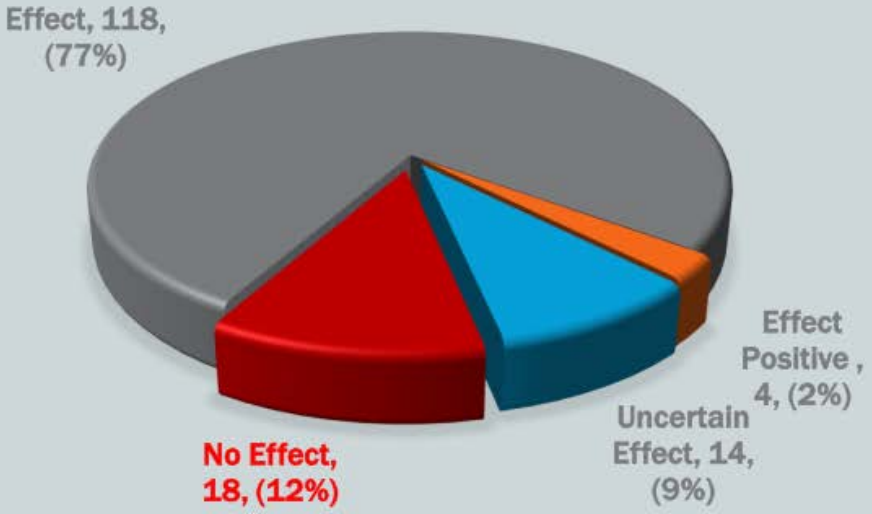
Leading EMF Effect Countries		
Country	Effect Papers	No Effect Papers
CHINA	141	13
TURKEY	131	22
USA	103	61
INDIA	80	5
SWEDEN	66	13
IRAN	50	4
RUSSIA	40	2

Leading No Effect Countries		
Country	Effect Papers	No Effect Papers
USA	103	61
DEU	38	51
JPN	33	44
ITA	61	35
FRA	41	35
GBR	22	34
KOR	26	25
AUS	36	23
FIN	20	23

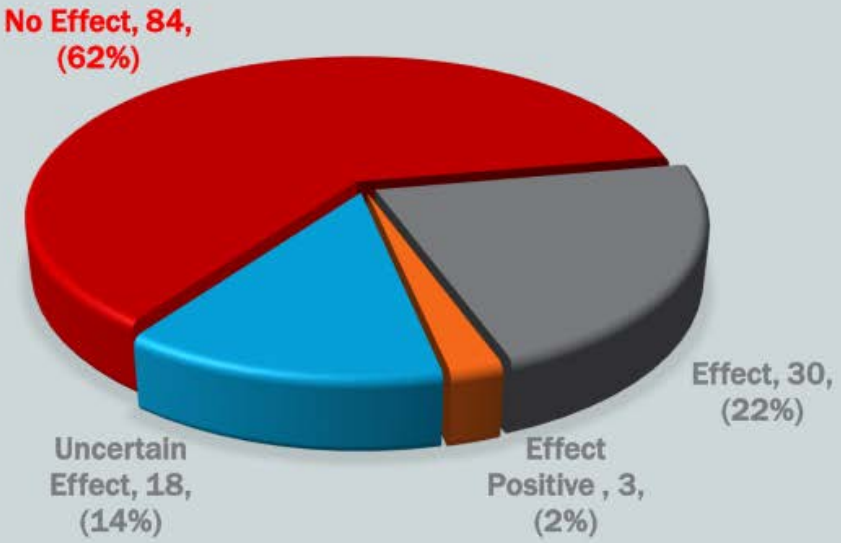
- A number of countries finding a large number of “no effects” have corporations significantly investing in wireless technology (i.e. Siemens, Samsung, Nokia, Sony, Motorola … etc.)
- ICNIRP was founded in Germany (DEU) and receives funding from the German Federal Ministry for the environment. Germany is one of the few countries finding more “no effects” than effects
- Many countries that are finding a significantly higher proportion of effects also typically have the most protective RF exposure limits (excluding USA)

Source: ORSAA database as of 23/05/2017

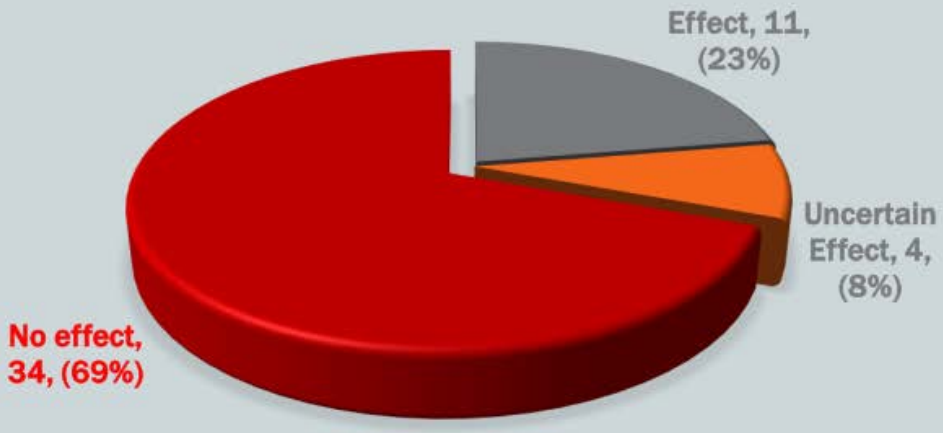
INSTITUTION ONLY FUNDED



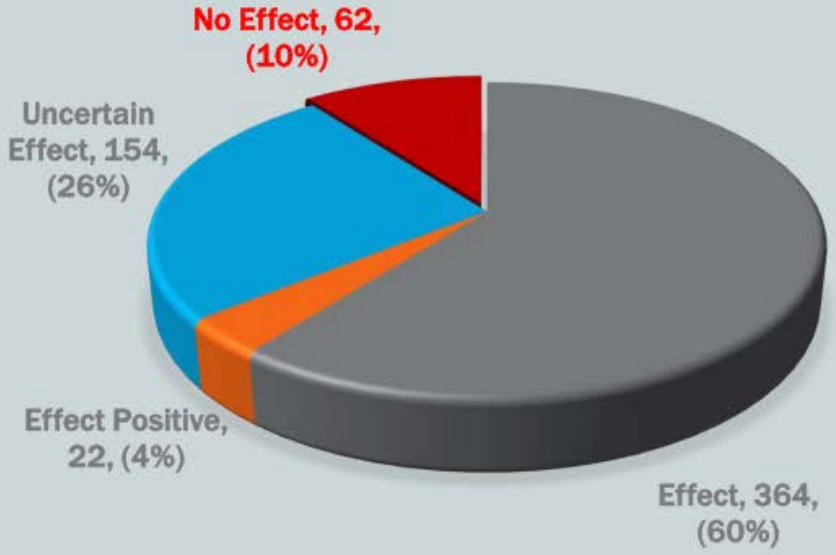
INDUSTRY ONLY FUNDING



GOVERNMENT COMMUNICATIONS AGENCY FUNDING OUTCOMES

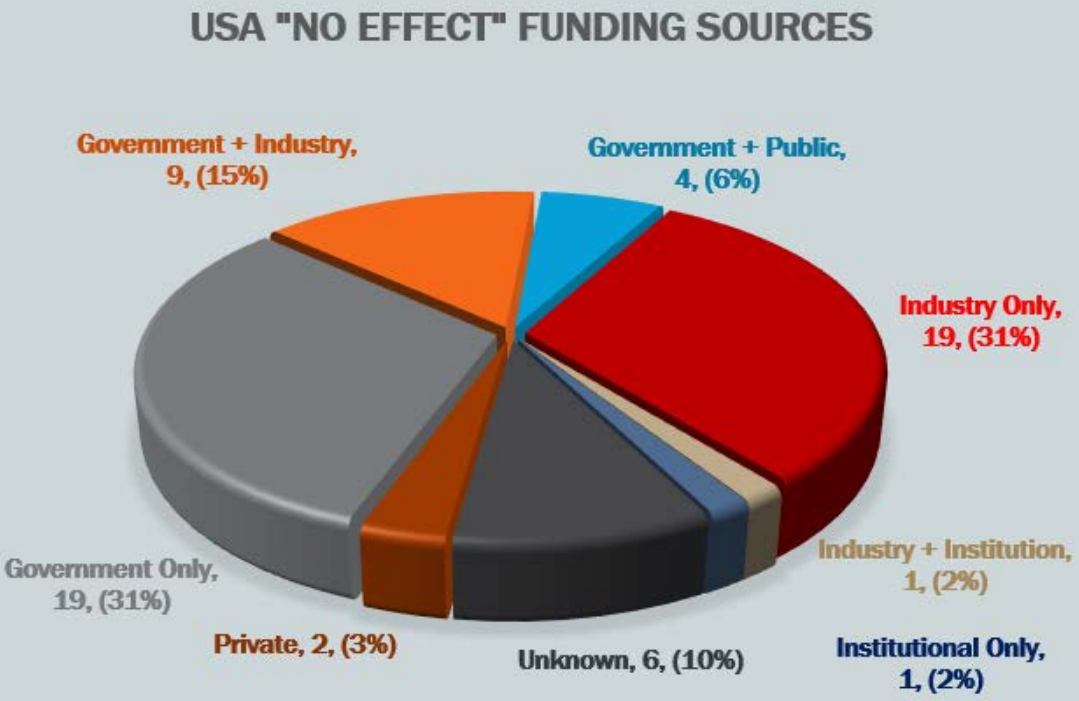


GOVERNMENT ONLY FUNDED



Source: ORSAA database as of 23/05/2017

UNITED STATES "NO EFFECT" FUNDING

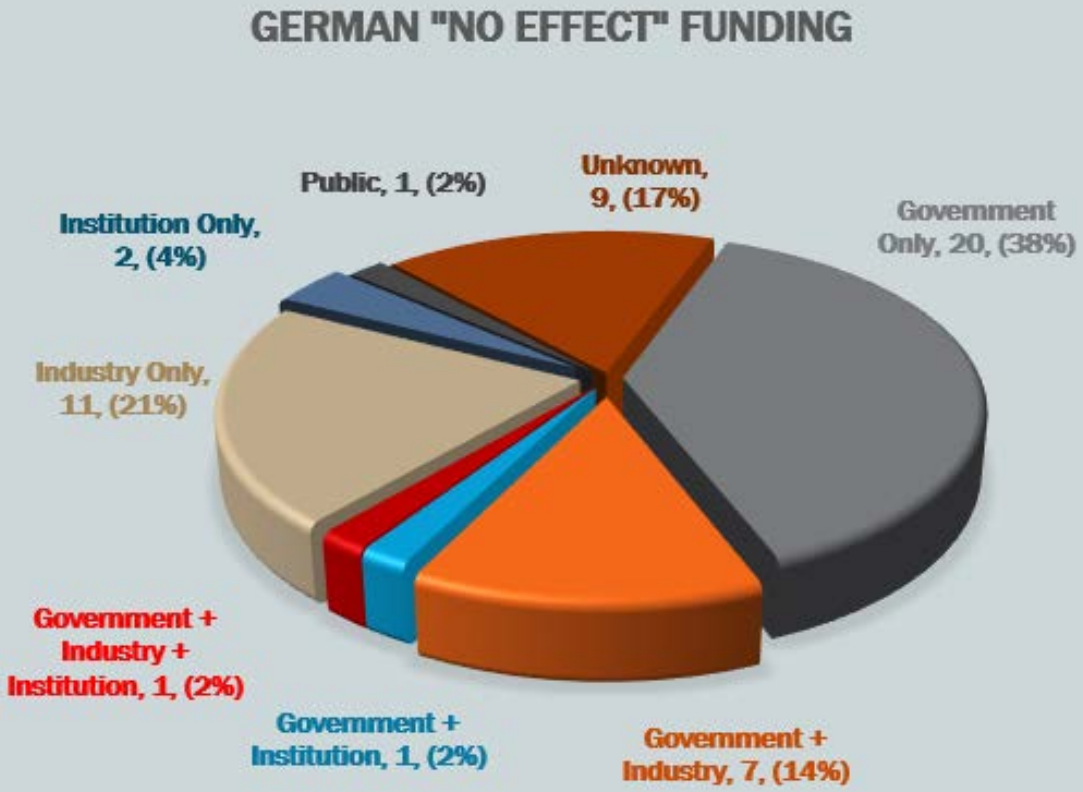


"No Effect" goes where the $$ flows??

Source: ORSAA database as of 23/05/2017

Industry Only	Count
Electric Power Research Institute (EPRI)	4
Motorola	14
Healthcare Research Initiative Consortium (CTIA)	1
Government Only	
National Cancer Institute; National Institutes of Health	5
National Institutes of Health (NIH)	1
US Airforce	10
US Naval Research	1
Government and Industry	
Wireless Technology Research; LLC; Public Health Service Grants	1
National Institute of Environmental Health Science; National Institutes of Health; Electric Power Research Institute (EPRI).	1
Motorola; Air Force	5
Mobile Manufacturers Forum (MMF); National Cancer Institute of the US Department of Health and Human Services.	1
Motorola; National Cancer Institute	1

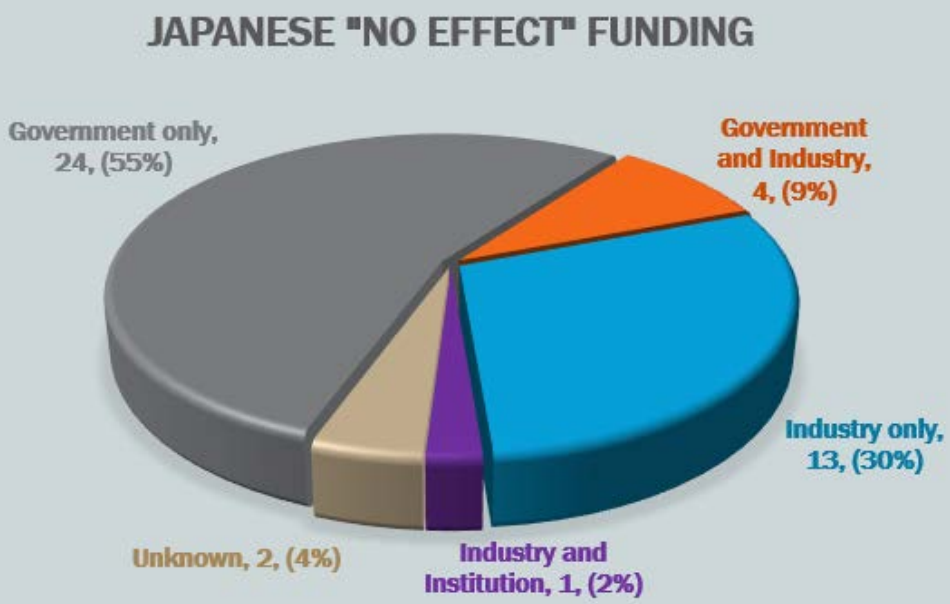
GERMAN “NO EFFECT” FUNDING



Government Only	Count
Federal Radiation Protection Agency	14
Federal Ministry for Education and Research	1
German Ministry of Defence.	1
German Federal Institute for Occasional Safety and Health	4
Government + Industry	
Federal Office for Radiation Protection, Mobile Manufacturers Forum (MMF); German Mobile Telecommunication Research Programme (DMF)	1
GSM Association; Mobile Manufacturers Forum (MMF); European Governments	2
Forschungsgemeinschaft Funk e.V.	1
Federal Office for Radiation Protection; DMF	3
Industry Funding Only	
Deutsche Telekom/T-Systems	7
Electric Power Research Institute (EPRI)	1
Research Association for Radio Applications	2
Cellular Telecommunications & Internet Association	1

Source: ORSAA database as of 23/05/2017

JAPANESE “NO EFFECT” FUNDING

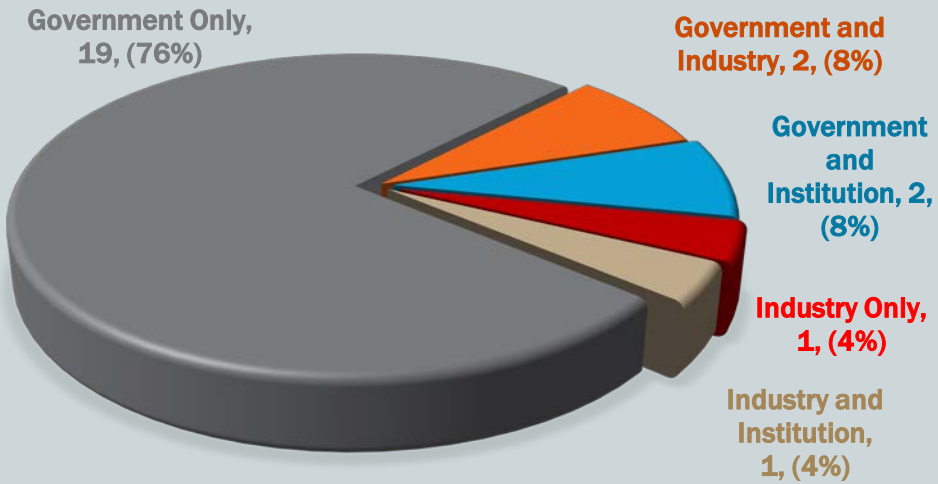


- Ministry of Internal Affairs and Communications of Japan is equivalent to Australian Communications and Media Authority (ACMA)
- Government Communications Departments can make significant amounts of money from the mobile telephone industry by selling spectrum licenses

Government Only Funding	Count
Ministry of Internal Affairs and Communications of Japan	21
Ministry of Education, Culture, and Science,& Ministry of Posts and Telecommunications, Japan	2
Ministry of Health, Labour and Welfare, Japan	1
Government and Industry	
France Telecom R & D, Aquitaine Research Council	1
Telecommunications Advancement Organization of Japan	1
Ministry of Internal Affairs and Communications (MIC), Japan, and the association of radio-industry and business (ARIB)	1
Japan Society for the Promotion of Science.	1
Industry	
Association of Radio Industries and Businesses	9
Mitsubishi Chemical Safety Institute Ltd.	1
NTT DoCoMo, Japan	3
Institution and Industry	
Central Research Institute of Electric Power Industry	1

Source: ORSAA database as of 23/05/2017

KOREAN “NO EFFECT” FUNDING

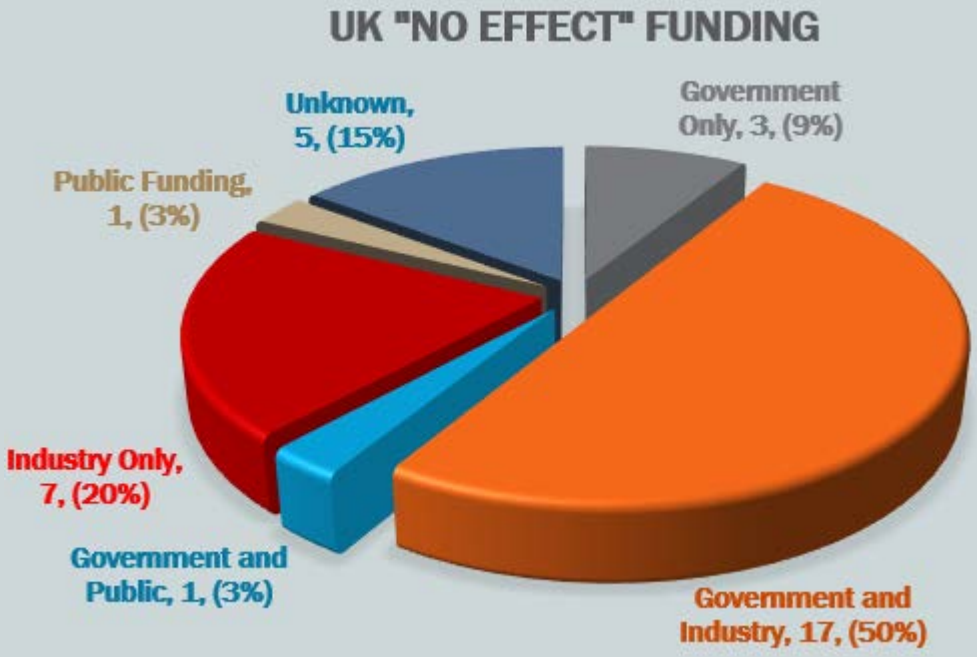


- Ministry of Information and Communication was dissolved in 2008 and combined with the former Korean Broadcasting Commission to form the Korea Communications Commission
- Government Communications Departments can make significant amounts of money from the mobile telephone industry by selling spectrum licenses

Government Only	Count
Korea Communications Commission	8
Ministry of Information and Communication, Korea	7
Ministry of Health, Welfare and Familiy Affairs; Ministry of Education, Science and Technology	1
Ministry of Education, Science and Technology	1
Ministry of Science and Technology (MOST)	1
Ministry of Health and Welfare, Korea Science and Engineering Foundation	1
Government and Industry	
Ministry of Education, Science and Technology (MEST) and by the Power Generation & Electricity Delivery of the Korea Institute of Energy Technology Evaluation and Planning	2
Government and Institution	
Ministry of Science, ICT and Future Planning/Institute for Information & Communications Technology Promotion Korea; Korea Institute of Radiological & Medical Sciences	1
Korea Communications Commission; Ewha Womans University.	1
Industry	
Electronics and Telecommunication Research Institute (ETRI)	1
Industry and Institution	
Korea Science and Engineering Foundation through the BIT Wireless Communication Devices Research Centre, Soonchunhyang University	1

Source: ORSAA database as of 23/05/2017

GREAT BRITAIN "NO EFFECT" FUNDING

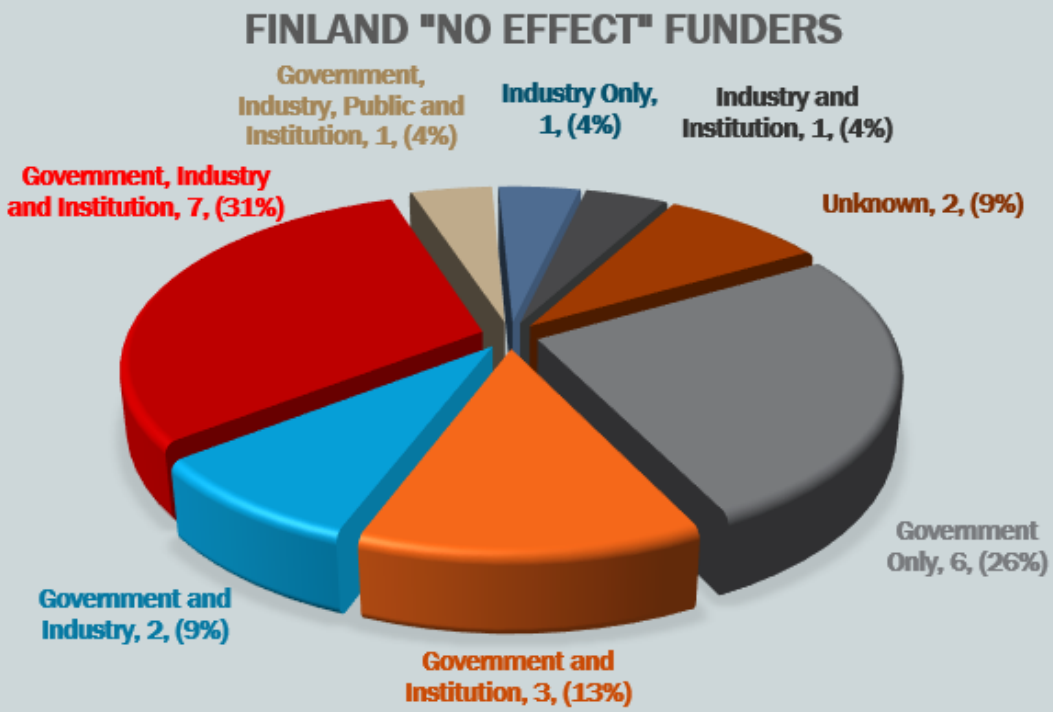


- MTHR is jointly funded by the UK Department of Health and the mobile telecommunications industry
- MTHR is supposed to act as a firewall between researchers and funders

Source: ORSAA database as of 23/05/2017

Government Only	Count
United Kingdom Department of Health Radiation Protection Programme	1
National Radiological Protection Board, Oxfordshire, UK; Brooks AFB, San Antonio	1
UK Health Protection Agency (HPA)	1
Government and Public	
UK Dept of Health Radiation Protection Research Programme, Charity Children with Cancer UK. The Childhood Cancer Research Group (CCRG) , Department of Health and the Scottish Ministers. CCRG	1
Government and Industry	
UK Mobile Telecommunications Health Research (MTHR). MTHR is jointly funded by the UK Department of Health and the mobile telecommunications industry	10
Biotechnology and Biological Sciences Research Council; MTHR Programme.	1
World Health Organisation (WHO); Genf, Switzerland; MTHR	1
European Commission Fifth Framework Program; International Union against Cancer (UICC); MTHR Programme.	2
EMF Biological Research Trust (EMFBRT), UK	1
Department of Health, UK & MTHR	1
European Commission; GSM Association; Mobile Manufacturers Forum (MMF); European Project PERFORM-A State Secretariat for Education and Research	1
Industry	
UK network operators (O2, Orange, T-Mobile, Vodafone, 3)	1
Swiss Research Foundation on Mobile Communication	1
Northwest Science Fund (NWSF)	1
Energy Networks Association (ENA),	4
Pubic Funding	
CHILDREN with CANCER UK	1

FINLAND “NO EFFECT” FUNDING



- TEKES was established by the Finland government to fund research, particularly in technology and innovation.
- TEKES is often collaborating with mobile phone manufactures with funding research relating to mobile phones and health

Source: ORSAA database as of 23/05/2017

Government Only Funders
Finnish National Technology Agency (Tekes)
Netherlands Organization for Health Research
Tekes and Ministry of Trade and Industry.
European Union (EU)
Government and Industry Funders
The Finnish Work Environment Fund, Elisa Communications Corporation, Nokia Mobile Phones, and Sonera Corporation.
Forschungsgemeinschaft Funk e.V. (FGF) and Nokia
Government and Institution Funders
Academy of Finland and Tekes
Tekes; Academy of Finland; University of Helsinki.
STUK (Finland) and Swiss Federal Institute of Technology
Government, Industry and Institution Funders
EU, Tekes, Academy of Finland, MTHR, Mobile Manufacturers Forum (MMF)
EU, Academy of Finland, GSM Association, MMF
University of Turku, Tekes, Nokia Corporation, Sonera Corporation, Elisa Communications Corporation, Benefon Oyj, Finnish 2G.
Forschungsgemeinschaft Funk e.V., University of Turku.
Finnish Cultural Foundation of Northern Savo; Finnish Graduate School of Environmental Health (SYTYKE) Finnish mobile phone manufacturers and operators; Tekes ; Ministry of Education, Finland
Government, Industry, Public and Institution Funders
European Commission; Academy of Finland; Emil Aaltonen Foundation, Finland GSM Association; MMF; Quality of Life and Management of Living Resources program of European Union. University of Tampere, Finland
Industry Only Funders
GSM Association, Mobile Manufacturers Forum (MMF)
Industry and Institution Funders
Nokia & University of Turku

AUSTRALIA'S RF STANDARD – IS IT STILL RELEVANT?

- Current RF Standard (RPS3) is based on ICNIRP 1998 guidelines aimed to prevent harm from acute exposures to thermal effects
- Evidence suggests RPS3 does not confer protection against a wide range of biological effects
- There is a vast difference between Australian RPS3 and other countries in regards to what is considered to be a safe level
- Australia has one of the least protective RF standards in the world
- In Australia we have a serious problem –
  - Ethical and scientific misconduct questions arise when evidence is misrepresented
  - Scientific judgements on risk are made by those who are not qualified to make safety claims
  - Medical experts are not involved in the evaluation of the science or risk determination
  - Absence of researchers with specialist medical and biological science credentials

ARPANSA/INDUSTRY MANTRA - "THERE IS NO ESTABLISHED EVIDENCE OF HARM"

- *"Scientific evidence is deemed to be established when it is consistent and generally accepted by the broader scientific community."**
  - Scientific community are not aligned on this issue – there is no consensus as is reflected in the very different RF standards adopted globally and the letter to UN with 220+ signatories (scientists)
  - Consistency is the wrong benchmark and should not be expected. To expect consistency shows a lack of understanding of biology, genetic differences, effect windows and non linear responses

- There is significant evidence (clear majority of papers in ARPANSA's database) of biological effects reported in scientific literature occurring at or below public exposure limits
- Some effects most definitely have the potential to be harmful: DNA damage, oxidative stress, neurological degeneration, circadian rhythm disruption, cell cycle effects & apoptosis….

*http://www.arpansa.gov.au/radiationprotection/Factsheets/is_assessingevidence.cfm

ARE THESE BIOLOGICAL EFFECTS SAFE?

None of these effects….

- Altered gene expression,
- Altered protein levels,
- Altered enzyme activity,
- Cell and tissues morphological changes,
- Apoptosis and cell damage,
- Chromosome aberrations and DNA damage,
- Oxidative stress,
- Calcium flux changes,
- Blood brain barrier breaches,
- Circadian rhythm and endocrine changes,
- Behavioural and cognitive effects,
- Cardiovascular and haematological effects,
- Immune system effects etc…..

…. repeatedly found in RF scientific literature have been demonstrated to be safe in regards to chronic exposure and long term health.

DOES THE ARPANSA ACT ALLOW ARPANSA TO ACT RESPONSIBLY?

"The object of this Act is to protect the health and safety of people, and to protect the environment, from the harmful effects of radiation"

Above would suggest yes but appears to be in conflict with next 2 points

7 Act not to prejudice Australia's defence

(1) Nothing in this Act requires or permits a person to take any action, or to refrain from taking any action, if taking the action or refraining from taking the action would be, or could reasonably be expected to be, prejudicial to Australia's defence.

RF is essential for both defensive and offensive capabilities

8 Act not to prejudice national security

(1) Nothing in this Act requires or permits a person to take any action, or to refrain from taking any action, if taking the action or refraining from taking the action would be, or could reasonably be expected to be, prejudicial to Australia's national security.

RF is an integral part of Australia's national security and surveillance programs

MISSING IN ACTION – ROBUST RISK MANAGEMENT POLICIES

- The type of risks are not clearly identified
- The probability for many risks are not being assessed
- Strategies to manage risks are not made clear
- Absence of a precautionary approach is palpable
- Inconsistent policies for radiation protection
  - Ionising radiation implements As Low As Reasonably Achievable (ALARA) in conjunction with a well defined hierarchy of controls
  - Non ionizing radiation – compliance to RPS3 (ICNIRP) limits is assumed safe without scientific validation and anything goes (cell towers and Wi-Fi located in or near sensitive locations such as homes and schools)
- Why is Australia not dealing with risks responsibly?
  - Concern that it may raise public concern and alarm?
  - Potential economic fallout and legal challenges?
- To continue avoiding the issue of not providing full public disclosure of risk is reckless and irresponsible

LACK OF DISCLOSURE

- Prevents the public from making their own informed decisions
- Keeps public in the dark of potential risks increasing the chance of injury to health
- Prevents public from taking control and executing their own strategies to use wireless devices safely or seek to apply health modalities that can proactively reduce risk of disease
- Stifles innovation and prevents encouragement of industry to improve wireless device safety
- Creates an avoidable bourgeoning health burden on government and society (increased risk of cancer, mental health problems, allergies etc.)

FAILURE TO ADVISE THE PUBLIC OF RISKS LEADS TO A RISE IN AVOIDABLE DISEASES

Events such as this one could have been avoided if the public had been informed of risks presented by medical experts (West *et al.* 2013)

Message is simple:

Do not carry a cell phone in your bra or pocket

Why? Because research shows RF exposure causes DNA damage and is also likely to be cancer promoting – evidence strengthened recently by US and German gov. funded studies (NTP data 2016, Lerchl *et al.* 2015)

HISTORY REPEATING

- "*Ethical problems arising when the trail of professional work lead to evidence of COVER-UP of serious risk and misrepresentation of scientific judgement concerning human exposures to radar or microwaves.*"

  Prof. John R. Goldsmith, M.D., M.P.H.

In relation to an investigation of US embassy staff in Moscow being exposed to microwaves
http://www.buergerwelle.de/assets/files/ethical_problems_arising-1.pdf

Profitability versus Public Health

The fight between corporate profit and public health has resulted in unnecessary disease and even death.

Corporate Ties That Bind 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**