189420

Agenda Item 122 TESTIMONY REGULAR AGENDA

GRANT PERMIT FOR WIRELESS COMMUNICATIONS SERVICES

IF YOU WISH TO **SPEAK** TO CITY COUNCIL, **PRINT** YOUR **NAME, ADDRESS, AND EMAIL.**

NAME (PRINT)	ADDRESS AND ZIP CODE *(Optional)*	Email *(Optional)*
PS 1 Michela Bedard	1002 SW Tangent St	michelabedard@gmail
✓ Maggie		
PS 1 Philip J. Wolfe	941 NW NATO PARKWAY	philip4portland@
PS 1 MARC KOLLER	12108 SW 13th CT. PORTLAND 97219	

Date 02-13-19

122/Mar 13

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McClymont, Keelan

From: Diana Richardson <licketysplit777@gmail.com>
Sent: Tuesday, February 26, 2019 9:04 PM
To: Council Clerk – Testimony
Subject: Support Moratorium on 5G

Diana Richardson <licketysplit777@gmail.com>

8:48 PM (9 minutes ago)

to :, joann, Derek.Bradley, Commissioner, jamey.duhamel, Commissioner, claire.adamsick, Fish, Asena.Lawrence

Dear Portland City Commissioners and Mayor Wheeler,

Thank you for moving to delay the vote on approving AT&T's contract for 5G. **As your constituent, I'm writing to ask that you support a 3-year moratorium on 5G in Portland and vote no on March 13, when AT&T's 5G contract comes before you for approval.** A moratorium is crucial, because Portland should not be AT&T's testing ground for this unproven technology.

5G will require placing thousands of microcell equipment boxes directly outside our homes – without any safety testing, adequate public input, or the public's consent – creating an inescapable cloud of electromagnetic radiation 24/7 that impacts our community's health, privacy, and environment.

During the Portland City Council meeting on February 13, the City's own official admitted the FCC and AT&T are trying to rush us into adopting 5G, and revealed that **the City is banned from regulating 5G based on actual or potential health or environmental impacts.** Instead of capitulating to the Trump administration's corporate FCC agenda, we should immediately take the prudent action of passing a 3-year moratorium on 5G.

I commend the City for suing the FCC over its new rules, which were designed to expedite 5G by limiting local authority. In Mayor Wheeler's own words, "The FCC's attempt to assert national control over local infrastructure choices is a misguided invasion of local authority that is contrary to law." **At the very least, the City should wait for the outcome of this lawsuit before signing a contract with AT&T that opens Portland up to risky 5G.**

5G is also facing backlash at the federal level. At a February 6 hearing, Senator Richard Blumenthal (D-CT) blasted the FCC, FDA, and industry representatives, who all admitted that they've done no research on the safety and health effects of 5G. More than 180 scientists and doctors from 35 countries recommend a moratorium on 5G until potential hazards for human health and the environment have been fully investigated by independent scientists.

Reps. Alissa Keny-Guyer and Tawna Sanchez, and Senator Laurie Monnes Anderson recently introduced a bill to the Oregon Legislature to protect children from electromagnetic radiation in schools. 5G will blanket our neighborhoods in electromagnetic radiation, putting our children's health at risk and undermining this effort.

Portlanders have made clear their desire for publicly-owned fiber optic internet. We're not clamoring for a privately-owned 5G monopoly that will charge sky-high prices and enable corporations to access and sell more of our data.

Municipal Broadband is safer, more reliable, more equitable, and more affordable than 5G. **Municipal broadband is the only way to ensure 1) permanent net neutrality, 2) data security, 3) local revenue generation that can fund affordable housing and education, and 4) subsidize broadband for low-income households and marginalized residents.**

Cities in California, New Jersey, New York, Massachusetts, and Florida have already adopted ordinances to oppose or ban 5G. Portland should join them. **Please side with the people over AT&T – Vote NO on 5G, and save Municipal Broadband!**

Thank you.

Diana Richardson
1905 SW Sunset Blvd.
Portland, OR 97239

Citations

Why public health experts are worried about 5G, the next generation of cell network
https://www.salon.com/2018/12/03/why-public-health-experts-are-worried-about-5g-the-next-generation-of-cell-network/
Salon, December, 2018

Cybersecurity Agency Warns Of 'Extremely Dangerous' Risks Of 5G Technology
https://www.eurasiareview.com/30032018-cybersecurity-agency-warns-of-extremely-dangerous-risks-of-5g-technology/
Eurasia Review, March 30, 2018

Radiation from cellphones, wi-fi is hurting the birds and the bees; 5G may make it worse
https://www.newsweek.com/migratory-birds-bee-navigation-5g-technology-electromagnetic-radiation-934830
Newsweek, May 2018

Portland City Council 2019-02-13 AM Session
https://www.youtube.com/watch?v=oJ9q6L1frqU&feature=youtu.be&t=7535
YouTube, February, 2019

White House Holds 5G Summit
https://www.multichannel.com/news/white-house-holds-5g-summit
Multichannel News, Sept. 2018

Portland, Ore., Prepares for a Fight with the FCC Over 5G Ruling
http://www.govtech.com/network/Portland-Ore-Prepares-for-a-Fight-with-the-FCC-Over-5G-Ruling.html
Oregonian, October 2018

At Senate Commerce Hearing, Blumenthal Raises Concerns on 5G Wireless Technology's Potential Health Risks
https://www.blumenthal.senate.gov/newsroom/press/release/at-senate-commerce-hearing-blumenthal-raises-concerns-on-5g-wireless-technologys-potential-health-risks

Press Release from the office of Senator Richard Blumenthal, February 2019

5G Appeal – Scientists and doctors warn of potential serious health effects of 5G
http://www.5gappeal.eu/scientists-and-doctors-warn-of-potential-serious-health-effects-of-5g/
Signatories updated as of January, 2019

Do we need warnings on Wi-Fi?
https://news.streetroots.org/2019/02/08/do-we-need-warnings-wi-fi
Street Roots, February, 2019

Municipal Broadband PDX
https://municipalbroadbandpdx.org/

USA City Ordinances To Limit And Control Wireless Facilities Small Cells In Rights Of Ways
https://ehtrust.org/usa-city-ordinances-to-limit-and-control-wireless-facilities-small-cells-in-rights-of-ways/
Environmental Health Trust, 2018

189420

Moore-Love, Karla

From: Leah Gibbs <leahgibbs@live.com>
Sent: Wednesday, February 13, 2019 11:21 AM
To: Council Clerk – Testimony
Cc: Commissioner Fish; Commissioner Fritz; Commissioner Hardesty; Commissioner Eudaly; Wheeler, Mayor
Subject: Testimony- Opposition to 5G ordinance

Dear Mayor Wheeler and Commissioners,
I was in attendance this AM and was hoping to give this testimony in person but unfortunately had other commitments that would not allow me to stay.
Leah Gibbs, DVM
406-546-9347
****

Good morning Council members and mayor wheeler.

My name is Leah Gibbs. I am a member of the Portland Metro People's Coalition and I am here to voice my strong opposition to the emergency ordinance for 5G.

You have already heard strong testimony regarding the concerns with privacy, equity and safety around the issue of 5G. I share all those concerns and I and the PMPC strongly support municipal broadband. In addition, I think it critical to understand what this decicion means to the children in our communities.

I am a mother of two young kids who attend a Portland public school.

Our children do not have lobbyists, they do not make campaign contributions but the implications of our decisions on their lives must be considered.

I am a veterinarian. I believe in science and when I was first told about health concerns about wireless radiation I thought it was laughable. However, in my mission to prove myself correct, I found that those with the biggest concerns are those that we should listen to most and I changed my mind. Those with concerns include the AAP(peds), MIT scientists and a host of other credible and respected medical and scientific experts.

There is strong scientific work published to suggest that the concerns about 5G may be outsized in children with a developing neurological system and thinner skills that allow for greater absorption of environmental radiation. Increased research by non-industry funded scientists is needed prior to proceeding with

implementation of a technology that cannot be avoided if brought to an urban area. There is no reason to rush into a contract with out of state corporate interests. We have emergencies in this city. The state of public ed, the treatment of our houseless population, the opioid crises...those are emergencies. Giving a contract to AT&T is not an emergency. I urge you to vote against this emergency ordinance.

Leah Gibbs, DVM
406-546-9347

189420

Moore-Love, Karla

From: Michela Bedard <michelabedard@gmail.com>
Sent: Wednesday, February 13, 2019 10:29 AM
To: Council Clerk – Testimony
Subject: Submitted testimony on the AT&T lease

Hello Mayor Wheeler and Commissioners,

Unfortunately I had to leave the city council meeting before I was able to testify, so I submit it here:

Re: Agenda Item 122 on 2/13 City Council meeting:

I urge the Mayor and Council to pause the Franchise Lease Agreement process currently ongoing with AT&T.

This cell location lease may seem like a standard internet franchise in the city, however the current phase in technological innovation requires municipalities to approach future internet infrastructure in a new way. Globally, internet innovation is currently at the forefront of 5G technology, which is not simply a 'bigger and better' extension of current internet technology, but an entirely new way of providing internet, tracking user data and installing small cell transmitters.

I am no expert in the health risks of this technology, and cannot speak to that. But I can speak to the massive increase in location and data surveillance that 5G will bring, and the additional locations of small cell physical infrastructure throughout our neughborhoods.

Thank you for your litigation against the FCC regarding how and when internet companies can install these small cells.

But in the interim, and certainly before the lease is approved, there is no reason for this city to allow AT&T to install locations. Portland is ahead of the game when it comes to public transit, urban zoning and green spaces. But this is an area where we do NOT need to be ahead of the game. In fact, other municipalities are 'ahead of the game' by placing a moratorium on 5G technology until it is further tested.

As the saying goes, if we are not paying for something, then we are not the clients - we are the goods. Please, don't let Portland's population be the 'goods' for this huge company without further information. There is no reason to rush this.

Michela Bedard
Constituent
1002 SW Tangent Street
(213) 804-6781

Testimony - 122
Date: Feb 13 2019
Speaker: Philip J Wolfe

Hi mayor and commissioners please allow me to demosrate my concerns and I believe the publick has not seen this before including you…

Due to connection, pls give me less than a minyute… and I will make a point

Apparently you hung up on me I was about to ask you to put the phone on speaker and put mic near the phone Well

My point I have emailed you addressing my concerns…

But mainly I want to stress that deaf community rely on VRS video relay service to make calls especially emergencies… but because 80 percent of deaf americans are unemployed due to discrimination, they relay on government assistance for rent, utilities, etc… with 5G, it will be higher and greatly impact our deaf community. This is not the way to go, pls say no to 5G and support city public owned munipicil broadband ecause it provides accessibility for ALL thank you

Questions?

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Stop SG Testmony (ORDINANCE 122)

✓	Michael Hanna	1216 SE 88th Ave. PDX 97216
NO	Michela Bedard	
✓	Martin Pall	638 NE 41st Ave. PDX 97232
✓	Robyn Gottlieb	1547 SE 88th Ave. PDX 97216
✓	Scott France	1501 SE Holly St. PDX
✓	Philip Wolfe	941 NW Naito Pkwy
✓	Kay O'Neill	3450 SW Downview Terrace PDX 97221
✓	Julia DeGraw	1216 SE 88th Ave. PDX 97216
read by someone else	Leah Gibbs	5415 NE Cesar E Chavez Blvd PDX 97211
✓	Stephen King	3738 N Kerby Ave. PDX 97227
✓	Andrew Markell	2136 SE Taylor PDX 97214
✓	Marc Koller	12108 SW 13th Ct. PDX 97219
✓	Andrew Soulek	2136 SE Taylor St. PDX 97214

41 expressions of high level concern drafted by scientists and/or medical doctors regarding health impacts of low level EMF exposures, presented over the 17 year period from 2002 through 2018. 31 of these are discussed in substantially more detail, with linkage to specific internet sites on Dr. Magda Havas' web site.

http://magdahavas.com/international-experts-perspective-on-the-health-effects-of-electromagnetic-fields-emf-and-electromagnetic-radiation-emr/

Others are derived from a list published on the internet by the Environmental Health Trust and a document drafted by Captain J. G. Flynn, retired Canadian military intelligence expert of effects of EMFs and a list from the Manhattan Neighbors Association. The citations for #s 5 and 26 comes from none of those sources.

It can be seen from this list that there has been an average of over 2.4 expressions of high level concern per year over a 17 year period, about our safety guidelines from independent scientists and/or physicians from much of the world. But those concerns have been universally ignored by those who should be protecting us from EMF effects and have also been almost universally ignored by the media.

1. **2018: International Appeal , Stop 5G on Earth and Space. Signed by over 22,570 people as of Nov. 23, 2018. https//www.5gspaceappeal.org/the-appeal**

2. **2018: Response to 2018 ICNIRP Draft Guidelines and Appendixes on Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (100 kHz to 300 GHz). Signed by 119 scientists, physicians and others from around the world.**

3. **2018: EU 5G Appeal – Scientists warn of potential serious health effects of 5G. Signed by over 180 scientists and medical doctors in 37 countries. https://www.google.com/?client=safari&channel=mac_bm**

4. **Released 2017: How to Reduce Exposure to Radiofrequency Energy from Cell Phones. Division of Environmental and Occupational Disease Control · California Department of Public Health. https://www.google.com/?client=safari&channel=mac_bm**

5. **2018: Reykjavik Appeal on wireless technology in schools February 24, 2017 http://www.stralskyddsstiftelsen.se/wp-content/uploads/2017/03/Reykjavik-Appeal-170224-2.pdf**

6. 2016: EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Authored by 15 scientists from 7 countries. https://www.degruyter.com/view/j/reveh.ahead-of-print/reveh-2016-0011/reveh-2016-0011.xml

7. 2015: Brussels International Scientific Declaration on Electromagnetic Hypersensitivity and Multiple Chemical Sensitivity

8. 2015: International EMF Scientist Appeal, Sent to the United Nations and all member states and WHO. Signed by 242 scientists who published peer-reviewed papers on EMF effects from 41 countries. Also signed by 10 scientists working in related areas. May 11, 2015, with some signatures being added subsequently.

9. 2014: Canadian Physician's Declaration to Health Canada, July 9, 2014. Signed by 55 Canadian physicians.

10. 2014: 53 scientists from 18 countries stated that "Canada's Safety Code 6 is fundamentally flawed" and called on Health Canada to protect Canadians from radiofrequency exposures. https://www.albany.edu/ihe/assets/Scientist_Declaration.pdf

11. 2014: Declaration: Scientists call for Protection from Radiofrequency Radiation Exposure

12. 2014: The Baby Safe Project. The Joint Statement on Pregnancy and Wireless Radiation.

13. 2014: International Scientists Declaration July 9, 2014. Scientists call for Protection from Radiofrequency Radiation Exposure.

14. 2014: Open letter by British medical doctors: Health and safety of Wi-Fi and mobile phones, 24 March 2014

15. 2013: European Manifesto in support of a European Citizens' Initiative (ECI)

16. 2013: American Academy of Environmental Medicine, Open letter to Superintendents of School Districts of the United States, dated May 13, 2013. The American Academy of Environmental Medicine strongly supports use of wired internet connections in schools. There is consistent emerging science that people, especially children with thinner skulls and developing nervous systems, are especially sensitive to wireless radiation. Also pointed out that 4 hours exposure to a laptop connected to Wi-Fi damaged the DNA of human sperm.

http://manhattanneighbors.org/wp-content/uploads/The-American-Academy-of-Environmental-Medicines-Open-Letter-to-the-Superintendents-of-the-School-Districts-of-the-United-States-.pdf

17. 2013: **Potenza Picena Resolution on "Radar, radiofrequency and health risk", April 20, 2013**

18. 2012: **Vienna College of Physicians statement on safer cell phone use**

19. **2012: American Academy of Pediatrics Website: Healthy Children.org Cell Phone Radiation & Children's Health: What Parents Need to Know. https://www.google.com/?client=safari&channel=mac_bm**

20. 2012: **International Doctors' Appeal 2012 (10-year follow-up to the Freiburg Appeal of 2002)**

21. 2012: **American Academy of Environmental Medicine statement on need for a moratorium on "smart meter" installation**, Jan 19, 2012

22. 2011: **International Agency for Research on Cancer (IARC) and World Health Organization (WHO) reclassification of EMFs as class 2B carcinogens**

23. 2011: **The Parliamentary Assembly Council of Europe (PACE) released Resolution 1815 on the *Potential Dangers of Electromagnetic Fields and their effect on the Environment.***

24. 2011: **Multiple Chemical Sensitivity (MCS) and Electrohypersensitivity (EHS), Summary of meeting at the WHO headquarters Geneva, May 13, 2011.**

25. 2011: **The Russian National Committee on Non-Ionizing Radiation Protection, April 2011 "*Electromagnetic fields from Mobile Phones: Health Effect on Children and Teenagers*".**

26. **2010: Scientific panel on electromagnetic field health risks: consensus points, recommendations, and rationales.** Rev Environ Health 2010;25:307–17.

27. 2010: **Seletun Statement, Norway: The International Electromagnetic Field Alliance** (IEMFA) released their report entitled *Scientific Panel on Electromagnetic Field Health Risks*

28. **2009: EU Parliament Electromagnetic Report and Resolution** entitled: *European Parliament Resolution on health concerns associated with electromagnetic fields,* adopted February 17, 2009

29. **2009: Porto Alegre Resolution, Brazil**. Scientists and doctors recognize electrohypersensitivity and are concerned that exposure to electromagnetic fields may increase the risk of cancer and chronic diseases; that exposure levels established by international agencies (IEEE, ICNIRP, ICES) are obsolete; and that wireless technology places at risk the health of children, teens, pregnant women and others who are vulnerable.

30. **2008 University of Pittsburg Cancer Institute**, The Case for Precaution in the Use of Cell Phones

31. **2008: Venice Resolution, Italy**. International Commission for Electromagnetic Safety (ICEMS) Scientists recognize biological effects at non-thermal levels

32. **2008: Russian National Committee on Non-Ionizing Radiation Protection, Moscow, Russia, April 14, 2008,** statement on *"Children and Mobile Phones: The Health of the Following Generation is in Danger."*

33. **2007: BioInitiative Report, USA** showing adverse biological effects of low level electromagnetic fields and radio frequency radiation.

34. **2007: Brussels Appeal.** 29 January 2007 Stated that Electromagnetic pollution was an infringement of article 23 of the Belgian constitution. Called for the intervention of the Federal Health Minister, Mr. Rudy Demotte. Denounced the absence of responsibility of the Federal Health Minister as regards protection of the people with respect to electromagnetic pollution under rapid development. Signed by over 500 citizens including University professors, scientists, physicians, nurses, and others. http://www.next-up.org/pdf/PressReleaseAppeldeBruxellesAppelVanBrusselCallOfBrussels01 2007.pdf

35. **2006: Benevento Resolution, Italy**. *The Precautionary EMF Approach: Rationale, Legislation and Implementation.*

36. **2005: Helsinki Appeal, Finland.** Physicians and researchers presented the Helsinki Appeal to the European Parliament.

37. **2005: Irish Doctors' Environmental Association** (IDEA)**, Ireland. Recognized electromagnetic hypersensitivity (EHS) and the need for treatments. http://www.emrpolicy.org/regulation/international/docs/idea_emr.pdf**

38. 2004. **International Association of Fire Fighters** (U.S., Canada, Mexico), **Resolution 15. Recognized need to prevent cell phone tower and other irradiation exposures in fire stations. Special concern regarding neurological effects and cancer.**

39. 2002. **Catania Resolution, Italy**. Expressed concern regarding adverse health effects. http://www.icems.eu/docs/resolutions/Catania_res.pdf

40. 2002 : **Freiburg Appeal, Germany, Oct. 2002.** Physicians request tougher guidelines for radio frequency exposure. This document was endorsed by over 3000 healthcare practitioners.

41. 2002: **Salzburg Resolution, Austria.** Recommended preliminary guidelines 0f 0.1 microW/cm2 for sum of all emissions from mobile phone stations. This was 1/10,000· of the current ICNIRP guidelines and those in Canada and the US (1000 microW/cm2) and was 1/100th the guidelines in Switzerland, Italy, Russia, China (10 microW/cm2).

Assembled by Martin L. Pall, PhD, Professor Emeritus

January 23, 2019

Prof. Martin Pall received his BA degree in Physics at Johns Hopkins University, with honors, Phi Beta Kappa and his PhD degree in Biochemistry and Genetics at Caltech, two of the top institutions in the world. His PhD training focused on how to determine biological mechanisms. The PhD training and the Physics have each been central to his ground breaking recent work on how low intensity electromagnetic fields (EMFs) impact the cells of our bodies and the many health consequences produced by that mechanism. Pall's Hirsch index is currently at 36 and has gone up rapidly since he "retired," showing high level of recognition for his research generally.

Pall's first paper on EMFs, published in 2013, showed that low intensity EMFs act by activating voltage-gated calcium channels (VGCCs). This was shown by findings that EMF effects can be blocked or greatly lowered by 5 types of calcium channel blockers, drugs specific for blocking the VGCCs. It was also shown by evidence of immediate increases in calcium signaling following EMF exposures and by further findings that the EMFs act by through the voltage sensor that controls VGCC opening (discussed further below). *Surprisingly, all of the EMFs ranging from the extremely high millimeter wave EMFs to be used with 5G through microwave frequencies, radiofrequencies, intermediate frequencies, extremely low frequencies including 50 Hz and 60 Hz from our power wiring through static electrical fields and static magnetic fields all act via VGCC activation.*

Much of Pall's subsequent work, in the 7 papers that have followed, has been to greatly expand our understanding of what EMF effects are produced via VGCC activation, how they are produced and why the VGCCs are so stunningly sensitive to activation by these weak EMFs. Before going into all of those important findings, let's look at how the VGCC breakthrough has been treated by the biomedical research community.

The 2013 paper, the first paper Pall published on the VGCC mechanism was placed onto the Global Medical Discovery web site as one of the best medical papers of 2013. At this writing, late January, 2019, the paper has been cited over 200 times according to the Google scholar database. This shows an unusual amount of interest from the scientific community, especially because that was Pall's first paper on EMFs and it involves a new paradigm of EMF action, and such new paradigm's usually face much inertia before they are widely accepted. Still, wide acceptance is not universal acceptance, even among the independent scientists working in this area. Pall has given 44 invited professional talks on EMFs over the past 6 years, again showing an unusual amount of interest. These include a talk at the French parliament on EHS, a talk at the Swedish parliament and a talk at the US National Institutes of Health. Two talks that are not included in the 44, because they were not invited talks, were given in September 2016 at one of the U.S. Senate Office Buildings and at the US FCC. Essentially everything that is discussed below with regard to EMFs, has been discussed in Pall's invited professional talks.

<u>How the Physics Predicts the Very High Level VGCC Sensitivity to Low Intensity EMFs</u>

The VGCC protein molecule contains a four domain structure with each domain carrying an alpha helix containing 5 positive charges. Those four charged alpha helixes act

together as what is called the ***voltage sensor***, the structure that responds to electrical changes across the plasma membrane to open the channel. It has been shown that not only 4 distinct types of VGCCs, but also a voltage gated sodium channel, potassium channel and chloride channel are all activated by EMFs, suggesting that the EMFs act on the voltage sensor. In plants, EMFs apparently act via activation of some other channels, known as TPC channels, which also contain a similar voltage sensor. The voltage-gated sodium, potassium and chloride channels apparently play only minor roles in producing EMF effects, so that to a first approximation, effects can be explained as being predominantly from VGCC activation.

How then can these very weak EMFs activate the voltage sensor? Pall has analyzed the known structure and location of the voltage sensor in the plasma membrane and based on two laws of physics, Coulomb's law and Ohm's law. The forces on the voltage sensor are calculated to be approximately 7.2 million times stronger than the forces on singly electrically charged groups in the aqueous parts of our cells and bodies. This means that the forces of these weak EMFs are stunningly strong and are therefore, more than sufficient to activate the VGCCs. Because heating is the basis of the current safety guidelines and heating is mainly produced by the forces on singly charged groups in the aqueous parts of our cells and bodies, this predicts that the current safety guidelines may allow us to be exposed to EMFs that are approximately 7.2 million times too strong. *The biology tells us that the VGCCs are the main targets of the EMFs. The physics tells us that the voltage sensor is the direct target and why it is so sensitive to these very weak EMFs.* The industry has been telling us for years that the electrical forces of these weak EMFs are too weak to do anything, and these calculations tell us why the industry has been completely wrong about this.

<u>What Are the Biomedical Consequences of EMFs Activating the VGCCs?</u>

The immediate consequence of VGCC activation is that one gets a very large influx of calcium ions into the cell through the plasma membrane that surrounds our cells, leading to very large increases in intracellular calcium [Ca2+]i. [Ca2+]i increases produce in turn, different downstream effects that, individually or collectively produce each of the extremely well documented effects following EMF exposures. <u>These explained effects include:</u> 1. Neurological neuropsychiatric effects including insomnia, fatigue, depression, anxiety, loss of concentration, memory dysfunction, headache and other pain, stress, agitation and sensory dysfunction. These are all extremely common in our societies around the world and we know they can be caused by EMF exposures. 2. Reproductive effects including disruption of the structure of the testis and ovaries, lowered sperm count, lowered sperm motility and other measures of lowered sperm quality; lowered female fertility including lowered numbers of oocytes; increase spontaneous abortion; lowered levels of each of the three sex hormones; lowered libido. We have reason to think that these are already far advanced in every single technologically advanced country on earth. 3. DNA effects including single strand and double strand breaks in cellular DNA and oxidized bases in the cellular DNA. These have important roles in producing germ line mutation (producing mutant babies) and in causing cancer. 4. Oxidative stress and free radical damage. These have important roles

in causing essentially all common and many not so common chronic diseases. 5. Increased levels of apoptosis (programmed cell death) which has particularly important roles in causing the reproductive effects and also the neurodegenerative diseases including Alzheimer's. 6. Excessive [Ca2+]i, which is the cause of everything else. 7. Hormonal (that is endocrine) effects in all or almost all hormone systems. 8. Cancer which is caused by the DNA effects and other effects, leading to increases in not only initiation of cancer, but also increased tumor promotion and progression including tissue invasion and metastasis. 9. Therapeutic effects. 10. Life threatening cardiac effects producing aberrant electrical control of the heart beat. We are having an epidemic of young, apparently healthy athletes dying in the middle of an athletic competition, due to sudden cardiac death. Are these deaths caused by EMF exposures? 11. Breakdown of the blood-brain barrier. 12. Stress responses including heat shock responses (without heating) and AMPK activation. There are other effects, but where the primary role of EMFs in causation can still be questioned. These include: 1. Very early onset Alzheimer's dementia's and other dementias. We are seeing people age 30 coming down with Alzheimer's disease and young people said to be addicted to Wi-Fi internet connections coming down with what are called digital dementias. 2 & 3. Autism and ADHD, where late prenatal and early postnatal exposures seem to be the most important. The excessive [Ca2+]i caused by such early exposures, is thought to disrupt the formation of synapses in the developing brain. 4. Electromagnetic hypersensitivity (EHS); while the mechanism of EHS is still somewhat uncertain, it is clear that excessive [Ca2+]i produces sensitivity syndromes and that oxidative stress and sensitivity in the brain each have important roles in EHS. *Each of these 16 different important EMF effects and apparent effects can be caused by downstream effects of VGCC activation.*

Several of these effects are found to start slowly following most types of exposure but that the EMFs act cumulatively to produce more and more severe effects. The slow onsets are the types that are most difficult for us to perceive when we are experiencing them. As effects become more severe, they become apparently irreversible. Effects that show this pattern include the neurological/neuropsychiatric effects, the reproductive effects and the cardiac effects. The mutational consequences of the DNA effects are inherently cumulative and irreversible. Other effects that show this cumulative nature and apparent irreversibility are some but not other of the hormonal effects, Alzheimer's and other dementias and the perinatal exposures involved in producing autism and ADHD. The two cumulative effects that are of most concern to Prof. Pall are the neurological/neuropsychiatric effects which have high prevalence in our societies and the reproductive effects, which also have high prevalence. Either of these alone can produce extinction. We can estimate how long this is likely to take based on a combination of human epidemiological studies and rodent studies (where most things go approximately 15 times faster than they do in humans). Those rough estimates suggest that the neurological/neuropsychiatric effects could well lead to a disastrous crash in our collective brain function within 5 to 7 years in technologically advanced countries, simply based on the exposures we already have. Somewhat similarly, we could well see a reproductive crash essentially to zero within about 5 years based on our current exposures with some countries crashing much more rapidly. In either of these cases we will have no future. Of course increasing exposures beyond our current exposures from

5G, further expansion of 4G increased radar usage in cars and other exposure may be expected to produce much faster demise.

The Crash of Our Safety Guidelines: It Gets Even Worse

Our current safety guidelines are currently based on average intensities, usually averaged over 6 minutes and the estimated heating produced by these intensities in the tissues of our bodies. They do not take into consideration non-thermal effects including, of course, those produced via VGCC activation. However there are multiple, additional types of evidence that each show that these safety guidelines are deeply flawed, not only because of the cutoff levels used to claim safety of the exposures below that level, but equally or more importantly, the average intensities we are using are almost completely unpredictive of biological effects. How do we know this?

There are 13 reviews that have shown that pulsed EMFs are, in most cases much more biologically active than are non-pulsed EMFs *of the same average intensity*. This is very important for two distinct reasons. Each of our wireless communication devices communicate in part or in whole via pulsations. These devices are, therefore, potentially and Pall believes actually much more dangerous. Secondly, these findings also show that average intensities tell us very little about biological effects. It follows from the second of these consequences, that the safety guidelines are not measuring the right thing. What should we be measuring??

There is also a large, related literature showing that nanosecond pulses, defined as individual pulses that are between 1 nanosecond and 1 microsecond long, produce substantial biological effects. When these are averaged over 6 minutes, the intensities are so low that they are many orders of magnitude below the cutoff levels used in our safety guidelines. This is then, another situation where safety guidelines fail to predict biological effects. It should be added that there are studies where the effects produced by both nanosecond pulses and pulsed EMFs (described in the previous paragraph) have each been shown to be blocked by calcium channel blockers, showing that each of these act via VGCC activation.

There is, in addition, a large literature showing that there are intensity windows, that is specific ranges in intensities where EMFs produce maximum biological effects but where intensities that are *either lower or higher produce than those within the window, produce much lower effects*. What these findings show, is that dose-response curves are neither linear nor monotone (non-monotone means that effects do not always increase with increasing exposures nor do they always decrease with decreasing exposures). This contradicts the assumptions of the industry and regulatory agencies that dose response curves are linear or, at least monotone. Some of these intensity windows have been shown to occur at average intensities 3, 4 or 5 or more orders of magnitude below the safety guideline cutoffs. So again, the industry and regulatory agency assumptions that there is an average intensity below which we are always safe and above which we are a substantial risk of effects is shown to be false, such that the whole structure of the regulatory system is deeply flawed.

There is also a large literature where specific research groups have examined multiple cell types using identical methodologies and found that different cell types differ widely in how susceptible they are to microwave or other frequency radiation. This means that any regulatory scheme that just uses physics to predict biological effects, as is the case with our current safety guidelines, is inherently deeply flawed. It also means that biological safety testing which is the only reliable to test for safety or lack thereof, should focus on using cells in culture that are known to be highly sensitive to EMFs and are grown in a way that maintains that high level sensitivity. Pall has published two papers providing information on how such testing can be done.

There are two other issues that are each important, but possibly only in certain contexts. There are studies that have shown that certain very specific EMF frequencies, are frequency windows producing maximum effects at extremely low intensities, but shifting the frequency by only a very tiny amount produces vastly lower effects. These have been interpreted in terms of resonance effects with a target. In recent years, Dr. Belyaev has been the most active scientist in this area of research. There have been no studies done, to my knowledge, as to whether the voltage sensor may be the target of such resonance effects. It is not clear that most of the exposures we have are greatly influenced by these frequency windows. However it has been argued that the 2450 MHz frequency used for Wi-Fi is close enough to such a frequency window to be of concern. Pall has, however, another concern. These very specific frequency windows can be used to make microwave weapons vastly more biologically active. Currently, human populations are completely undefended, either physically or legally from such microwave weapons and military or diplomatic personnel may also have little or no defense, as well.

The last area of concern here is that artificial EMFs are all polarized whereas most natural EMFs are non-polarized. Polarized EMFs have the property that the forces they produce on electrically charged groups are much greater than those produced by non-polarized EMFs. It follows from this that the voltage sensor will be much more sensitive to activation by polarized EMFs. Pall's main concern about this is not with regard to the regulatory scheme but rather with regard to the apparent corruption of the scientific literature. Since about 2003, most if not all industry sponsored experimental studies have used reverberation exposure chambers to expose rodents or cell in culture to EMFs, to assess possible effects. However, these exposure chambers greatly decrease polarization and some of them may also produce substantial amounts of destructive interference, with both of these greatly lowering any effects see. When such studies have been touted either by the industry or by regulatory agencies, this will have the effect of corrupting their assessment of the literature.

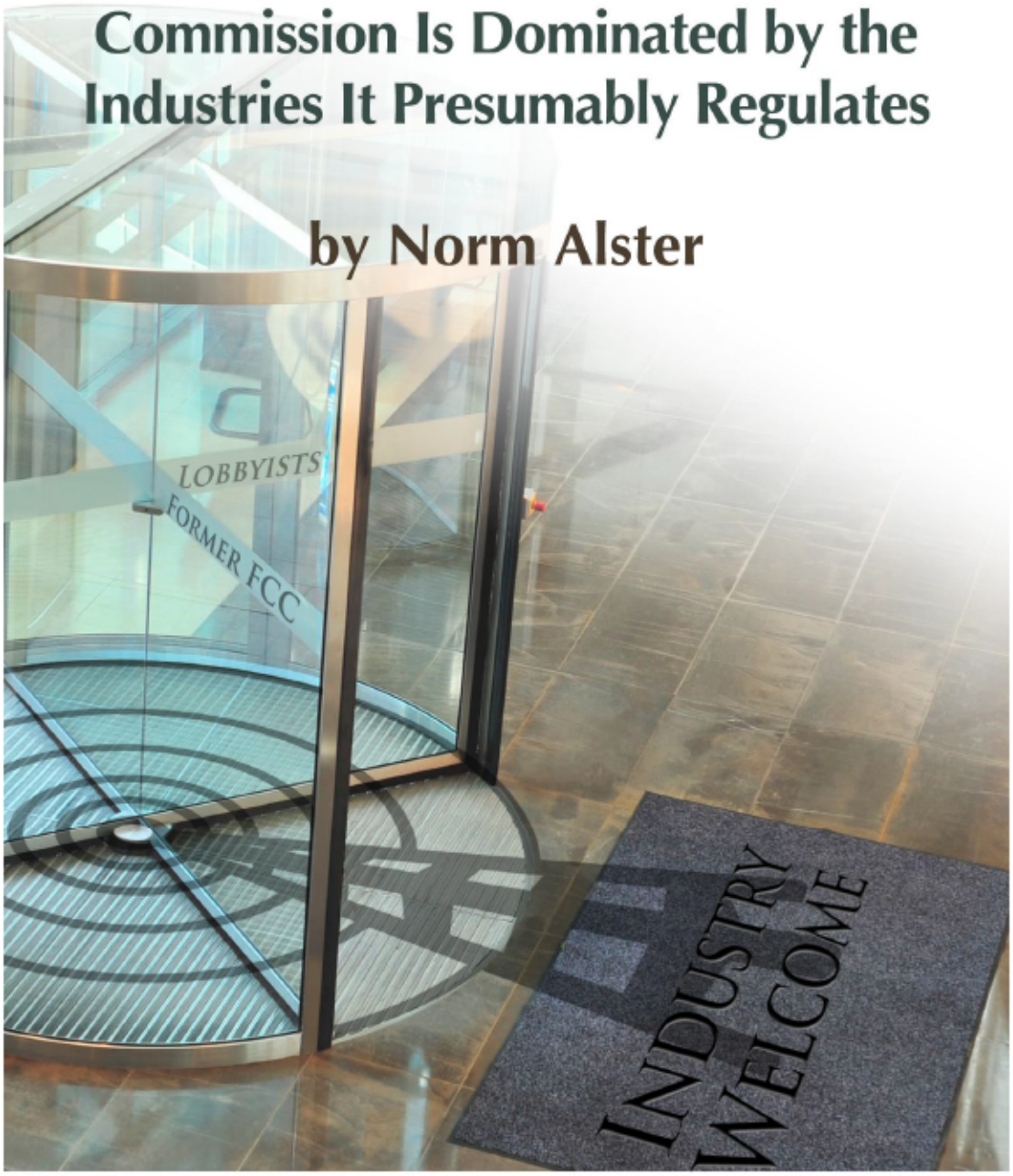
Dr. Pall's final statement:

Healthy skepticism is always the basis of the best science. I know that many of you will be skeptical, as you should be. It is the skeptics that most need to hear my talk and I welcome you to raise your most challenging questions.

Captured Agency:

How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates

by Norm Alster



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Captured Agency

How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates

By Norm Alster

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Chapter One: The Corrupted Network

Renee Sharp seemed proud to discuss her spring 2014 meeting with the Federal Communications Commission.

As research director for the non-profit Environmental Working Group, Sharp doesn't get many chances to visit with the FCC. But on this occasion she was able to express her concerns that lax FCC standards on radiation from wireless technologies were especially hazardous for children.

The FCC, however, should have little trouble dismissing those concerns.

Arguing that current standards are more than sufficient and that children are at no elevated risk from microwave radiation, wireless industry lobbyists don't generally have to set up appointments months in advance. They are at the FCC's door night and day.

Indeed, a former executive with the Cellular Telecommunications Industry Association (CTIA), the industry's main lobbying group, has boasted that the CTIA meets with FCC officials –500 times a year."[1]

Sharp does not seem surprised. –There's no question that the government has been under the influence of industry. The FCC is a captured agency," she said.[2]

Captured agency.

That's a term that comes up time and time again with the FCC. Captured agencies are essentially controlled by the industries they are supposed to regulate. A detailed look at FCC actions—and non-actions—shows that over the years the FCC has granted the wireless industry pretty much what it has wanted. Until very recently it has also granted cable what it wants. More broadly, the FCC has again and again echoed the lobbying points of major technology interests.

Money—and lots of it—has played a part. The National Cable and Telecommunications Association (NCTA) and CTIA have annually been among Washington's top lobbying spenders. CTIA alone lobbied on at least 35 different Congressional bills through the first half of 2014. Wireless market leaders AT&T and Verizon work through CTIA. But they also do their own lobbying, spending nearly $15 million through June of 2014, according to data from the Center for Responsive Politics (CRP). In all, CTIA, Verizon, AT&T, T-Mobile USA, and Sprint spent roughly $45 million lobbying in 2013. Overall, the Communications/Electronics sector is one of Washington's super heavyweight lobbyists, spending nearly $800 million in 2013-2014, according to CRP data.

But direct lobbying by industry is just one of many worms in a rotting apple. The FCC sits at the core of a network that has allowed powerful moneyed interests with limitless access a variety of ways to shape its policies, often at the expense of fundamental public interests.

As a result, consumer safety, health, and privacy, along with consumer wallets, have all been overlooked, sacrificed, or raided due to unchecked industry influence. The cable industry has consolidated into giant local monopolies that control pricing while leaving consumers little choice over content selection. Though the FCC has only partial responsibility, federal regulators have allowed the Internet to grow into a vast hunting grounds for criminals and commercial interests: the go-to destination for the surrender of personal information, privacy and identity. Most insidious of all, the wireless industry has been allowed to grow unchecked and virtually unregulated, with fundamental questions on public health impact routinely ignored.

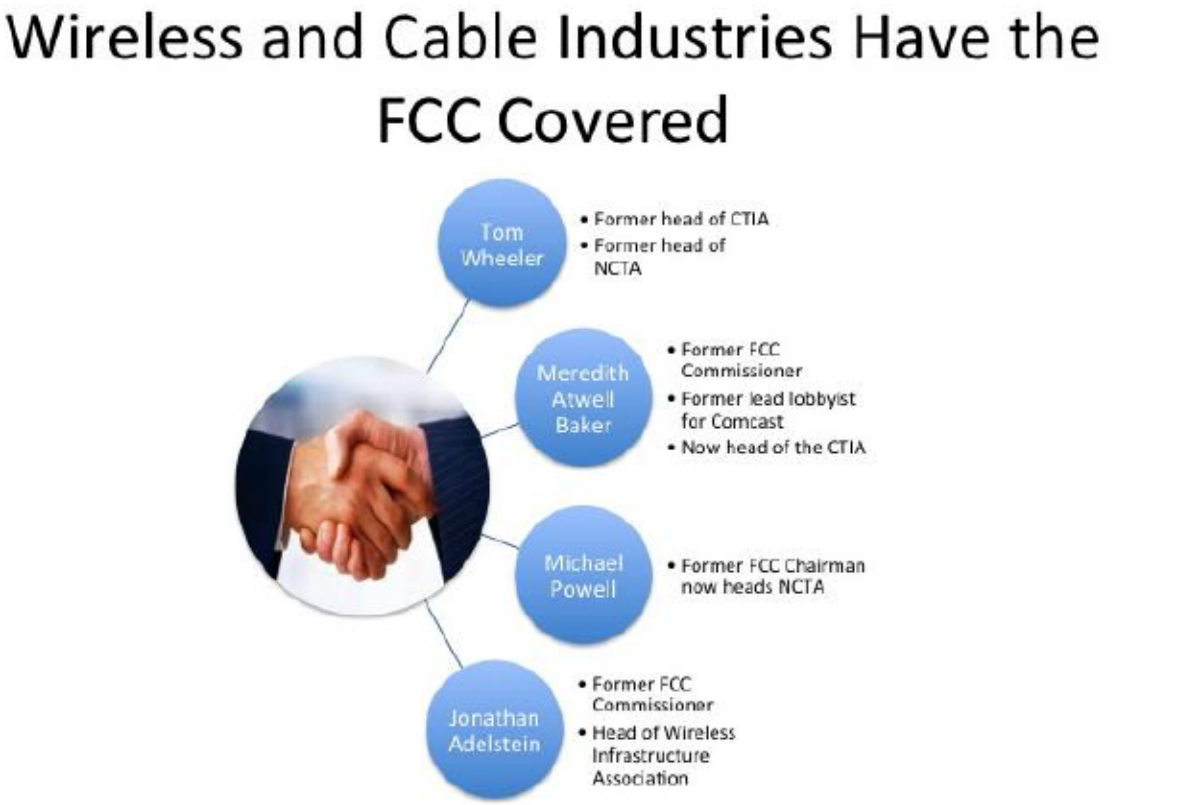
Industry controls the FCC through a soup-to-nuts stranglehold that extends from its well-placed campaign spending in Congress through its control of the FCC's Congressional oversight committees to its persistent agency lobbying. "If you're on a committee that regulates industry you'll be a major target for industry," said Twaun Samuel, chief of staff for Congresswoman Maxine Waters.[3] Samuel several years ago helped write a bill aimed at slowing the revolving door. But with Congress getting its marching orders from industry, the bill never gained any traction.

Industry control, in the case of wireless health issues, extends beyond Congress and regulators to basic scientific research. And in an obvious echo of the hardball tactics of the tobacco industry, the wireless industry has backed up its economic and political power by stonewalling on public relations and bullying potential threats into submission with its huge standing army of lawyers. In this way, a coddled wireless industry intimidated and silenced the City of San Francisco, while running roughshod over local opponents of its expansionary infrastructure.

On a personal level, the entire system is greased by the free flow of executive leadership between the FCC and the industries it presumably oversees. Currently presiding over the FCC is Tom Wheeler, a man who has led the two most powerful industry lobbying groups: CTIA and NCTA. It is Wheeler who once supervised a $25 million industry-funded research effort on wireless health effects. But when handpicked research leader George Carlo concluded that wireless radiation did raise the risk of brain tumors, Wheeler's CTIA allegedly rushed to muffle the message. "You do the science. I'll take care of the politics," Carlo recalls Wheeler saying.[4]

Wheeler over time has proved a masterful politician. President Obama overlooked Wheeler's lobbyist past to nominate him as FCC chairman in 2013. He had, after all, raised more than $700,000 for Obama's presidential campaigns. Wheeler had little trouble earning confirmation from a Senate whose Democrats toed the Presidential line and whose Republicans understood Wheeler was as industry-friendly a nominee as they could get. And while Wheeler, at the behest of his Presidential sponsor, has taken on cable giants with his plans for net neutrality and shown some openness on other issues, he has dug in his heels on wireless.

Newly ensconced as chairman of the agency he once blitzed with partisan pitches, Wheeler sees familiar faces heading the industry lobbying groups that ceaselessly petition the FCC. At CTIA, which now calls itself CTIA - The Wireless Association, former FCC commissioner Meredith Atwell Baker is in charge.



And while cell phone manufacturers like Apple and Samsung, along with wireless service behemoths like Verizon and AT&T, are prominent CTIA members, the infrastructure of 300,000 or more cellular base stations and antenna sites has its own lobbying group: PCIA, the Wireless Infrastructure Association. The President and CEO of PCIA is Jonathan Adelstein, another former FCC commissioner. Meanwhile, the cable industry's NCTA employs former FCC chairman Michael Powell as its president and CEO. Cozy, isn't it?

FCC commissioners in 2014 received invitations to the Wireless Foundation's May 19th Achievement Awards Dinner. Sounds harmless, but for the fact that the chief honoree at the dinner was none other than former wireless lobbyist but current FCC Chairman Tom Wheeler. Is this the man who will act to look impartially at the growing body of evidence pointing to health and safety issues?

The revolving door also reinforces the clout at another node on the industry-controlled influence network. Members of congressional oversight committees are prime targets of

industry. The cable industry, for example, knows that key legislation must move through the Communications and Technology Subcommittee of the House Energy and Commerce Committee. Little wonder then that subcommittee chairman Greg Walden was the second leading recipient (after Speaker John Boehner) of cable industry contributions in the last six years (through June 30, 2014). In all, Walden, an Oregon Republican, has taken over $108,000 from cable and satellite production and distribution companies.[5] But he is not alone. Six of the top ten recipients of cable and satellite contributions sit on the industry's House oversight committee. The same is true of senators on the cable oversight committee. Committee members were six of the ten top recipients of campaign cash from the industry.[6]

Cable & Satellite Campaign Contributions

Top House Recipients Funded

Recipient	Amount
John A. Boehner	$135,425
Greg Walden	$108,750
Bob Goodlatte	$93,200
John Conyers Jr.	$84,000
Mike Coffman	$82,137
Fred Upton	**$73,500**
Lee Terry	**$65,916**
Henry A. Waxman	**$65,000**
Cory Gardner	**$64,500**
Anna G. Eshoo	**$60,500**

Cellular Industry Campaign Contributions

Top House Recipients Funded

Recipient	Amount
Henry A. Waxman	**$41,500**
Scott H. Peters	$40,300
Greg Walden	**$35,750**
Fred Upton	**$32,250**
Bob Goodlatte	$31,250
Lee Terry	**$29,600**
Anna G. Eshoo	**$27,000**
Doris O. Matsui	**$25,500**
John Shimkus	**$24,000**
Peter J. Roskam	$21,100

Cable & Satellite Campaign Contributions

Top Senate Recipients Funded

Recipient	Amount
Edward J. Markey	**$320,500**
Kirsten E. Gillibrand	$194,125
Mitch McConnell	$177,125
Harry Reid	$175,600
Charles E. Schumer	$175,450
Mark L. Pryor	**$172,950**
Michael F. Bennet	$159,000
Richard Blumenthal	**$148,800**
Claire McCaskill	**$138,185**
Mark Udall	$136,625

Cellular Industry Campaign Contributions

Top Senate Recipients Funded

Recipient	Amount
Edward J. Markey	**$155,150**
Mark R. Warner	$74,800
Harry Reid	$73,600
Mark L. Pryor	**$71,900**
Roy Blunt	**$57,400**
John McCain	$56,261
Charles E. Schumer	$53,300
Roger F. Wicker	$51,300
Barbara Boxer	$49,578
Kelly Ayotte	$43,333

The compromised FCC network goes well beyond the revolving door and congressional oversight committees. The Washington social scene is one where money sets the tone and throws the parties. A look at the recent calendar of one current FCC commissioner shows it would take very disciplined and almost saintly behavior on the part of government officials to resist the lure of lavishly catered dinners and cocktail events. To paraphrase iconic investigative journalist I.F. Stone, if you're going to work in Washington, bring your chastity belt.

All that free liquor, food and conviviality translates into the lobbyist's ultimate goal: access. "They have disproportionate access," notes former FCC commissioner Michael Copps. "When you are in a town where most people you see socially are in industry, you don't have to ascribe malevolent behavior to it," he added.[7]

Not malevolent in motive. But the results can be toxic. And blame does not lie solely at the feet of current commissioners. The FCC's problems predate Tom Wheeler and go back a long way.

Indeed, former Chairman Newton Minow, enduringly famous for his 1961 description of television as a "vast wasteland," recalls that industry manipulation of regulators was an issue even back then. "When I arrived, the FCC and the communications industry were both regarded as cesspools. Part of my job was to try to clean it up."[8]

More than 50 years later, the mess continues to pile up.

Chapter Two: Just Don't Bring Up Health

Perhaps the best example of how the FCC is tangled in a chain of corruption is the cell tower and antenna infrastructure that lies at the heart of the phenomenally successful wireless industry.

It all begins with passage of the Telecommunications Act of 1996, legislation once described by South Dakota Republican senator Larry Pressler as —the most lobbied bill in history." Late lobbying won the wireless industry enormous concessions from lawmakers, many of them major recipients of industry hard and soft dollar contributions. Congressional staffers who helped lobbyists write the new law did not go unrewarded. Thirteen of fifteen staffers later became lobbyists themselves.[9]

Section 332(c)(7)(B)(iv) of the Act remarkably—and that adverb seems inescapably best here—wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.

Congress Silences Public

Section 332(c)(7)(B)(iv) of the Communications Act provides:

> No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

In preempting local zoning authority—along with the public's right to guard its own safety and health— Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

Is there any reason to believe that the relatively low level radiofrequency emissions of these facilities constitute a public health threat? Certainly, cell phones themselves, held close to the head, have been the focus of most concern on RF emissions. Since the impact of RF diminishes with distance, industry advocates and many scientists dismiss the possibility that such structures pose health risks.

But it's not really that simple. A troubling body of evidence suggests exposure to even low emission levels at typical cellular frequencies between 300 MHz and 3 GHz can have a wide range of negative effects.

In a 2010 review of research on the biological effects of exposure to radiation from cell tower base stations, B. Blake Levitt and Henry Lai found that "some research does exist to warrant caution in infrastructure siting."[10] They summarized the results on one 2002 study that compared the health of 530 people living at various distances within 300 meters of cell towers with a control group living more than 300 meters away. "Results indicated increased symptoms and complaints the closer a person lived to a tower. At <10 m, symptoms included nausea, loss of appetite, visual disruptions, and difficulties in moving. Significant differences were observed up through 100 m for irritability, depressive tendencies, concentration difficulties, memory loss, dizziness, and lower libido."[11]

A 2007 study conducted in Egypt found similar results. Levitt and Lai report, "Headaches, memory changes, dizziness, tremors, depressive symptoms, and sleep disturbance were significantly higher among exposed inhabitants than controls."[12]

Beyond epidemiological studies, research on a wide range of living things raises further red flags. A 2013 study by the Indian scientists S. Sivani and D. Sudarsanam reports: "Based on current available literature, it is justified to conclude that RF-EMF [electro magnetic fields] radiation exposure can change neurotransmitter functions, blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium efflux, and gene and protein expression in certain types of cells even at lower intensities."[13]

The article goes on to detail the effects of mobile tower emissions on a wide range of living organisms: "Tops of trees tend to dry up when they directly face the cell tower antennas. . . . A study by the Centre for Environment and Vocational Studies of Punjab University noted that embryos of 50 eggs of house sparrows were damaged after being exposed to mobile tower radiation for 5-30 minutes. . . . In a study on cows and calves on the effects of exposure from mobile phone base stations, it was noted that 32% of calves developed nuclear cataracts, 3.6% severely."[14]

Does any of this constitute the conclusive evidence that would mandate much tighter control of the wireless infrastructure? Not in the estimation of industry and its captured agency. Citing other studies—often industry-funded—that fail to establish health effects, the wireless industry has dismissed such concerns. The FCC has typically echoed that position.

Keep in mind that light regulation has been one factor in the extraordinary growth of wireless—CTIA says exactly that in a Web post that credits the Clinton Administrations light regulatory touch.

July 25, 2013

CTIA BLOG

CTIA is an international nonprofit trade association that has represented the wireless communications industry since 1984.

But our position as the world's leader was no accident. It started with the Clinton Administration that had the foresight to place a "light regulatory touch" on the wireless industry, which was in its infancy at the time. That light touch has continued through multiple Administrations.

Obviously, cellular technology is wildly popular because it offers many benefits to consumers. But even allowing for that popularity and for the incomplete state of science, don't some of these findings raise enough concern to warrant some backtracking on the ham-fisted federal preemption of local zoning rights?

In reality, since the passage of the 1996 law, the very opposite has occurred. Again and again both Congress and the FCC have opted to stiffen—rather than loosen—federal preemption over local zoning authority. In 2009, for example, the wireless industry convinced the FCC to impose a –shot clock" that requires action within 90 days on many zoning applications. –My sense is that it was an industry request," said Robert Weller, who headed up the FCC's Office of Engineering and Technology when the shot clock was considered and imposed.[15]

And just last November, the FCC voted to further curb the rights of local zoning officials to control the expansion of antenna sites Again and again, Congress and the FCC have extended the wireless industry carte blanche to build out infrastructure no matter the consequences to local communities.

The question that hangs over all this: would consumers' embrace of cell phones and Wi-Fi be quite so ardent if the wireless industry, enabled by its Washington errand boys, hadn't so consistently stonewalled on evidence and substituted legal intimidation for honest inquiry? (See Appendix for online study of consumer attitudes on wireless health and safety.)

Document searches under the Freedom of Information Act reveal the central role of Tom Wheeler and the FCC in the tower siting issue. As both lobbyist and FCC chairman, Wheeler has proved himself a good friend of the wireless industry.

In January of 1997, CTIA chieftain Wheeler wrote FCC Wireless Telecommunications Bureau Chief Michele C. Farquhar citing several municipal efforts to assert control over siting. Wheeler, for example, asserted that one New England state had enacted a law requiring its Public Service Commissioner to issue a report on health risks posed by wireless facilities.[16] He

questions whether such a study—and regulations based on its results—would infringe on FCC preemption authority.

FCC bureau chief Farquhar hastily reassured Wheeler that no such study could be consulted in zoning decisions. –Therefore, based on the facts as you have presented them, that portion of the statute that directs the State Commissioner to recommend regulations based upon the study's findings would appear to be preempted,"[17] the FCC official wrote to Wheeler. She emphasized that the state had the right to do the study. It just couldn't deny a siting application based on anything it might learn.

The FCC in 1997 sent the message it has implicitly endorsed and conveyed ever since: study health effects all you want. It doesn't matter what you find. The build-out of wireless cannot be blocked or slowed by health issues.

Now let's fast forward to see Wheeler on the other side of the revolving door, interacting as FCC chairman with a former FCC commissioner who is now an industry lobbyist.

A March 14, 2014 letter[18] reveals the chummy relationship between Wheeler and former commissioner Jonathan Adelstein, now head of PCIA, the cellular infrastructure lobbying group. It also references FCC Chairman Wheeler seeking policy counsel from lobbyist Adelstein:

Wheeler Still Willing to Help

From: Jonathan Adelstein [mailto:adelstein@pcia.com]
Sent: Friday, March 14, 2014 12:24 PM
To: [redacted]
Cc: Renee Gregory; Jonathan Campbell
Subject: How to Spur Wireless Broadband Deployment

Tom – It was great to see you the other night at the FCBA event, and wonderful to see how much fun you're having (if that's the right word). I know I enjoyed my time there (thanks to your help with Daschle in getting me that role in the first place!).

Thanks for asking how we think the FCC can help spur wireless broadband deployment. The infrastructure proceeding perfectly tees up many of the top issues the FCC needs to address. As you requested, I've summarized briefly in the attached letter some of the key steps you can take now.

"Tom – It was great to see you the other night at the FCBA event, and wonderful to see how much fun you're having (if that's the right word). I know I enjoyed my time there (thanks to your help with Daschle in getting me that role in the first place!)."

"Thanks for asking how we think the FCC can help spur wireless broadband deployment," the wireless lobbyist writes to the ex-wireless lobbyist, now running the FCC.

Adelstein's first recommendation for FCC action: *"Amend its rules to categorically exclude DAS and small deployments* [Ed. note: these are compact tower add-ons currently being widely deployed] *from environmental and historic review."* Adelstein outlined other suggestions for further limiting local antenna zoning authority and the FCC soon did its part. Late last year, the agency proposed new rules that largely (though not entirely) complied with the antenna industry's wish list.

James R. Hobson is an attorney who has represented municipalities in zoning issues involving the FCC. He is also a former FCC official, who is now of counsel at Best, Best and Krieger, a Washington-based municipal law practice. "The FCC has been the ally of industry," says Hobson. Lobbyist pressure at the FCC was intense even back in the 70s, when he was a bureau chief there. "When I was at the FCC, a lot of my day was taken up with appointments with industry lobbyists." He says of the CTIA that Wheeler once headed: "Their reason for being is promoting the wireless industry. And they've been successful at it."[19]

The FCC's deferential compliance has allowed industry to regularly bypass and if necessary steamroll local authorities. Violation of the FCC-imposed "shot clock," for example, allows the wireless license applicant to sue.

The FCC's service to the industry it is supposed to regulate is evidently appreciated. The CTIA web site, typically overflowing with self-congratulation, spreads the praise around in acknowledging the enabling contributions of a cooperative FCC. In one brief summation of its own glorious accomplishments, CTIA twice uses the word "thankfully" in describing favorable FCC actions.

In advancing the industry agenda, the FCC can claim that it is merely reflecting the will of Congress. But the agency may not be doing even that.

Remember the key clause in the 96 Telecom Act that disallowed denial of zoning permits based on health concerns? Well, federal preemption is granted to pretty much any wireless outfit on just one simple condition: its installations must comply with FCC radiation emission standards. In view of this generous carte blanche to move radiation equipment into neighborhoods, schoolyards and home rooftops, one would think the FCC would at the very least diligently enforce its own emission standards. But that does not appear to be the case.

Indeed, one RF engineer who has worked on more than 3,000 rooftop sites found vast evidence of non-compliance. Marvin Wessel estimates that "10 to 20% exceed allowed radiation standards."[20] With 30,000 rooftop antenna sites across the U.S. that would mean that as many as 6,000 are emitting radiation in violation of FCC standards. Often, these emissions can be 600% or more of allowed exposure levels, according to Wessel.

Antenna standards allow for higher exposure to workers. In the case of rooftop sites, such workers could be roofers, painters, testers and installers of heating and air conditioning

equipment, to cite just a few examples. But many sites, according to Wessel, emit radiation at much higher levels than those permitted in occupational standards. This is especially true of sites where service providers keep adding new antenna units to expand their coverage. –Some of these new sites will exceed ten times the allowable occupational radiation level," said Wessel.[21] Essentially, he adds, this means that nobody should be stepping on the roof.

–The FCC is not enforcing its own standard," noted Janet Newton, who runs the EMF Policy Institute, a Vermont-based non-profit. That group several years ago filed 101 complaints on specific rooftop sites where radiation emissions exceeded allowable levels. –We did this as an exercise to hold the FCC's feet to the fire," she said. But the 101 complaints resulted in few responsive actions, according to Newton.[22]

Former FCC official Bob Weller confirms the lax—perhaps negligible is the more appropriate word—FCC activity in enforcing antenna standards. –To my knowledge, the enforcement bureau has never done a targeted inspection effort around RF exposure," he said.[23] Budget cuts at the agency have hurt, limiting the FCC's ability to perform field inspections, he added. But enforcement, he adds, would do wonders to insure industry compliance with its limited regulatory compliance requirements. –If there were targeted enforcement and fines issued the industry would pay greater attention to ensuring compliance and self-regulation," he allowed.

Insurance is where the rubber hits the road on risk. So it is interesting to note that the rating agency A.M. Best, which advises insurers on risk, in 2013 topped its list of –emerging technology-based risks" with RF Radiation:

> *"The risks associated with long-term use of cell phones, although much studied over the past 10 years, remain unclear. Dangers to the estimated 250,000 workers per year who come in close contact with cell phone antennas, however, are now more clearly established. Thermal effects of the cellular antennas, which act at close range essentially as open microwave ovens can include eye damage, sterility and cognitive impairments. While workers of cellular companies are well trained on the potential dangers, other workers exposed to the antennas are often unaware of the health risks. The continued exponential growth of cellular towers will significantly increase exposure of these workers and others coming into close contact with high-energy cell phone antenna radiation,"* A.M. Best wrote.[24]

So what has the FCC done to tighten enforcement? Apparently, not very much. Though it does follow up on many of the complaints filed against sites alleged to be in violation of standards it takes punitive actions very rarely. (The FCC did not provide answers to written questions on details of its tower enforcement policies.)

The best ally of industry and the FCC on this (and other) issues may be public ignorance.

An online poll conducted for this project asked 202 respondents to rate the likelihood of a series of statements.[25] Most of the statements were subject to dispute. Cell phones raise the risk of certain health effects and brain cancer, two said. There is no proof that cell phones are harmful, another declared. But among the six statements there was one statement of indisputable fact: "The U.S. Congress forbids local communities from considering health effects when deciding whether to issue zoning permits for wireless antennae," the statement said.

Though this is a stone cold fact that the wireless industry, the FCC and the courts have all turned into hard and inescapable reality for local authorities, just 1.5% of all poll respondents replied that it was "definitely true."

Public ignorance didn't take much cultivation by the wireless industry on the issue of local zoning. And maybe it doesn't matter much, considering the enormous popularity of wireless devices. But let's see how public ignorance has been cultivated and secured—with the FCC's passive support—on the potentially more disruptive issue of mobile phone health effects.

Chapter Three: Wireless Bullies and the Tobacco Analogy

Issues of cable and net neutrality have recently attracted wide public attention (more on that in Chapter Six). Still, the bet here remains that future judgment of the FCC will hinge on its handling of wireless health and safety issues.

And while the tower siting issue is an egregious example of an industry-dominated political process run amuck, the stronger health risks appear to reside in the phones themselves. This is an issue that has flared up several times in recent years. Each time, industry has managed to beat back such concerns. But it's worth noting that the scientific roots of concern have not disappeared. If anything, they've thickened as new research substantiates older concerns.

The story of an FCC passively echoing an industry determined to play hardball with its critics is worth a further look. The CTIA's own website acknowledges the helpful hand of government's "light regulatory touch" in allowing the industry to grow.[26]

Former congressman Dennis Kucinich ventures one explanation for the wireless industry's success in dodging regulation: "The industry has grown so fast its growth has overtaken any health concerns that may have gained attention in a slow growth environment. The proliferation of technology has overwhelmed all institutions that would have attempted safety testing and standards," Kucinich said.[27]

But the core questions remain: Is there really credible evidence that cell phones emit harmful radiation that can cause human health problems and disease? Has the FCC done an adequate job in protecting consumers from health risks? Or has it simply aped industry stonewalling on health and safety issues?

Before wading into these questions, some perspective is in order.

First, there's simply no denying the usefulness and immense popularity of wireless technology. People depend on it for safety, information, entertainment and communication. It doesn't take a keen social observer to know that wireless has thoroughly insinuated itself into daily life and culture.

The unanswered question, though, is whether consumers would embrace the technology quite so fervently if health and safety information was not spun, filtered and clouded by a variety of industry tactics.

To gain some insight into this question, we conducted an online survey of 202 respondents, nearly all of whom own cell phones, on Amazon's Mechanical Turk Web platform (see Appendix). One striking set of findings: many respondents claim they would change behavior—reduce wireless use, restore landline service, protect their children—if claims on health dangers of wireless are true.

It is not the purpose of this reporter to establish that heavy cell phone usage is dangerous. This remains an extremely controversial scientific issue with new findings and revised scientific conclusions repeatedly popping up. Just months ago, a German scientist who had been outspoken in denouncing the view that cell phones pose health risks reversed course. In an April 2015 publication, Alexander Lerchl reported results confirming previous research on the tumor-promoting effects of electromagnetic fields well below human exposure limits for mobile phones. "Our findings may help to understand the repeatedly reported increased incidences of brain tumors in heavy users of mobile phones," the Lerchl team concluded.[28] And in May 2015, more than 200 scientists boasting over 2,000 publications on wireless effects called on global institutions to address the health risks posed by this technology.

But the National Cancer Institute still contends that no cell phone dangers have been established. A representative of NCI was the sole known dissenter among the 30 members of the World Health Organization's International Agency for Research on Cancer (IARC) when it voted to declare wireless RF "possibly carcinogenic."[29] If leading scientists still can't agree, I will not presume to reach a scientific conclusion on my own.

IARC RF working group: Official press release

International Agency for Research on Cancer

World Health Organization

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IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as **possibly carcinogenic to humans (Group 2B)**, based on an increased risk for **glioma**, a malignant type of brain cancer, associated with wireless phone use.

But let's at least look at some of the incriminating clues that health and biology research has revealed to date. And let's look at the responses of both industry and the FCC.

The most widely cited evidence implicating wireless phones concerns gliomas, a very serious type of brain tumor. The evidence of elevated risk for such tumors among heavy cell phone users comes from several sources.

Gliomas account for roughly half of all malignant brain tumors, which are relatively rare. The annual incidence of primary malignant brain tumors in the U.S. is only 8.2 per 100,000 people, according to the International Radio Surgery Association.

Still, when projected over the entire U.S. population, the public health impact is potentially very significant.

Assuming roughly four new glioma cases annually in the U.S. per 100,000 people, yields over 13,000 new cases per year over a total U.S. population of 330 million. Even a doubling of that rate would mean 13,000 new gliomas, often deadly, per year. A tripling, as some studies have found, could mean as many as 26,000 more new cases annually. Indeed, the respected online site Medscape in January 2015 reported results of Swedish research under the headline: *Risk for Glioma Triples With Long-Term Cell Phone Use*.[30]

And here's some eye-opening quantitative perspective: the wars in Iraq and Afghanistan, waged now for more than a decade each, have together resulted in roughly 7,000 U.S. deaths.

Preliminary—though still inconclusive—research has suggested other potential negative health effects. Swedish, Danish and Israeli scientists have all found elevated risk of salivary gland tumors. One Israeli studied suggested elevated thyroid cancer risk. Some research has found that men who carry their phones in their pockets may suffer sperm count damage. One small study even suggests that young women who carry wireless devices in their bras are unusually vulnerable to breast cancer.

And while industry and government have never accepted that some portion of the population is unusually sensitive to electromagnetic fields, many people continue to complain of a broad range of symptoms that include general weakness, headaches, nausea and dizziness from exposure to wireless.

Some have suggested that the health situation with wireless is analogous to that of tobacco before court decisions finally forced Big Tobacco to admit guilt and pay up. In some ways, the analogy is unfair. Wireless research is not as conclusively incriminating as tobacco research was. And the identified health risks with wireless, significant as they are, still pale compared with those of tobacco.

But let's not dismiss the analogy outright. There is actually a very significant sense in which the tobacco-wireless analogy is uncannily valid.

People tend to forget that the tobacco industry—like the wireless industry—also adopted a policy of tone-deaf denial. As recently as 1998, even as evidence of tobacco toxicity grew overwhelming, cigarette maker Phillip Morris was writing newspaper advertorials insisting there was no proof smoking caused cancer.

It seems significant that the responses of wireless and its captured agency—the FCC—feature the same obtuse refusal to examine the evidence. The wireless industry reaction features stonewalling public relations and hyper aggressive legal action. It can also involve undermining the credibility and cutting off the funding for researchers who do not endorse cellular safety. It is these hardball tactics that look a lot like 20th century Big Tobacco tactics. It is these hardball tactics—along with consistently supportive FCC policies—that heighten suspicion the wireless industry does indeed have something to hide.

Begin with some simple facts issuing from meta-analysis of cellular research. Dr. Henry Lai, emeritus professor of bioengineering at the University of Washington, has reviewed hundreds of published scientific papers on the subject. He wanted to see how many studies demonstrated that non-ionizing radiation produces biological effects beyond the heating of tissue. This is critical since the FCC emission standards protect only against heating. The assumption behind these standards is that there are no biological effects beyond heating.

But Dr. Lai found that just over half—actually 56%—of 326 studies identified biological effects. And the results were far more striking when Dr. Lai divided the studies between those that were industry-funded and those that were independently funded. Industry-funded research identified biological effects in just 28% of studies. But fully 67% of non-industry funded studies found biological effects (Insert Slide—Cell Phone Biological Studies).

A study conducted by Swiss and British scientists also looked at how funding sources affected scientific conclusions on the possible health effects of cell phone usage. They found that of studies privately funded, publicly funded and funded with mixed sponsorship, industry-funded studies were –least likely to report a statistically significant result."[31] –The interpretation of results from studies of health effects of radiofrequency radiation should take sponsorship into account," the scientists concluded.[32]

So how does the FCC handle a scientific split that seems to suggest bias in industry-sponsored research?

In a posting on its Web site that reads like it was written by wireless lobbyists, the FCC chooses strikingly patronizing language to slight and trivialize the many scientists and health and safety experts who've found cause for concern. In a two page Web post titled –Wireless Devices and Health Concerns," the FCC four times refers to either –some health and safety interest groups," –some parties," or –some consumers" before in each case rebutting their presumably groundless concerns about wireless risk.[33] Additionally, the FCC site references the World Health Organization as among those organizations who've found that –the weight of scientific

evidence" has not linked exposure to radiofrequency from mobile devices with –any known health problems."

Yes, it's true that the World Health organization remains bitterly divided on the subject. But it's also true that a 30 member unit of the WHO called the International Agency for Research on Cancer (IARC) was near unanimous in pronouncing cell phones –possibly carcinogenic" in 2011. How can the FCC omit any reference to such a pronouncement? Even if it finds reason to side with pro-industry scientists, shouldn't this government agency also mention that cell phones are currently in the same potential carcinogen class as lead paint?

Now let's look a bit more closely at the troublesome but presumably clueless crowd of –some parties" that the FCC so cavalierly hastens to dismiss? Let's begin with **Lennart Hardell**, professor of Oncology and Cancer Epidemiology at the University Hospital in Oreboro, Sweden.

Until recently it was impossible to gain any real sense of brain tumor risk from wireless since brain tumors often take 20 or more years to develop. But the cohort of long-term users has been growing. In a study published in the International Journal of Oncology in 2013, Dr. Hardell and Dr. Michael Carlberg found that the risk of glioma—the most deadly type of brain cancer—rose with cell phone usage. The risk was highest among heavy cell phone users and those who began to use cell phones before the age of 20.[34]

Indeed, those who used their phones at least 1640 hours (which would be roughly 30 minutes a day for nine years) had nearly three times the glioma incidence. Drs. Hardell and Carlberg also found that gliomas tend to be more deadly among heavy wireless callers.[35]

Perhaps of greatest long-term relevance, glioma risk was found to be four times higher among those who began to use mobile phones as teenagers or earlier. These findings, along with the established fact that it generally takes decades for tumors induced by environmental agents to appear, suggest that the worst consequences of omnipresent wireless devices have yet to be seen.

In a 2013 paper published in *Reviews on Environmental Health*, Drs. Hardell and Carlberg argued that the 2011 finding of the IARC that identified cell phones as a –possibly carcinogenic" needs to be revised. The conclusion on radiofrequency electromagnetic fields from cell phones should now be –eell phones are not just a possible carcinogen." They can now be –regarded as carcinogenic to humans" and the direct cause of gliomas (as well as acoustic neuromas, a less serious type of tumor).[36] Of course, these views are not universally accepted.

The usual spin among industry supporters when presented with research that produces troubling results is along the lines of: —We might pay attention if the results are duplicated." In fact, the Hardell results were echoed in the French CERENAT study, reported in May of 2014. The CERENAT study also found higher risk among heavy users, defined as those using their phones at least 896 hours (just 30 minutes a day for five years). –These additional data support

previous findings concerning a possible association between heavy mobile phone use and brain tumors," the study concluded.[37]

Cell phones are not the only wireless suspects. Asked what he would do if he had policy-making authority, Dr. Hardell swiftly replied that he would –ban wireless use in schools and pre-schools. You don't need Wi-Fi," he noted.[38] This is especially interesting in view of the FCC's sharply hiked spending to promote and extend Wi-Fi usage, as well as its consistent refusal to set more stringent standards for children (more on all this later). But for now let's further fill out the roster of the FCC's unnamed –some parties."

Martin Blank is a Special Lecturer in Physiology and Cellular Biophysics at Columbia University. Unlike Dr. Hardell, who looks at broad epidemiological effects over time, Dr. Blank sees cause for concern in research showing there is biological response at the cellular level to the type of radiation emitted by wireless devices. –The biology tells you unequivocally that the cell treats radiation as a potentially damaging influence," Dr. Blank said in a late 2014 interview.[39]

–The biology tells you it's dangerous at a low level," he added. Though some results have been difficult to replicate, researchers have identified a wide range of cellular responses including genetic damage and penetration of the blood brain barrier. Dr. Blank specifically cited the –eellular stress response" in which cells exposed to radiation start to make proteins.

It is still not clear whether biological responses at the cellular level translate into human health effects. But the research seems to invalidate the basic premise of FCC standards that the only biological effect of the type of radiation produced by wireless devices is tissue heating at very high power levels. But the standards-setting agencies –ignore the biology," according to Dr. Blank. He describes the FCC as being –in industry's pocket."[40]

Sweden's Lund University is annually ranked among the top 100 universities in the world. **Leif Salford** has been chairman of the Department of Neurosurgery at Lund since 1996. He is also a former president of the European Association for Neuro-Oncology. In the spring of 2000, Professor Salford told me that wireless usage constituted –the world's largest biological experiment ever."[41]

He has conducted numerous experiments exposing rats to cellular-type radiation. Individual experiments have shown the radiation to penetrate the blood-brain barrier, essential to protecting the brain from bloodstream toxins. Professor Salford also found that rats exposed to radiation suffered loss of brain cells. –A rat's brain is very much the same as a human's. They have the same blood-brain barrier and neurons. We have good reason to believe that what happens in rat's brains also happens in humans," he told the BBC in 2003. Dr. Salford has also speculated that mobile radiation could trigger Alzheimer's disease in some cases but emphasized that much more research would be needed to establish any such causal relationship. Does this man deserve to be dismissed as one of a nameless and discredited group of –some parties?"

And what about the **American Academy of Pediatrics (AAP),** which represents 60,000 American doctors who care for children? In a December 12, 2012 letter to former Ohio Congressman Dennis Kucinich, AAP President Dr. Thomas McInerny writes: –Children are disproportionately affected by environmental exposures, including cell phone radiation. The differences in bone density and the amount of fluid in a child's brain compared to an adult's brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults."[42]

In a subsequent letter to FCC officials dated August 29, 2013, Dr. McInerny points out that –children, however, are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation." Current FCC exposure standards, set back in 1996, –do not account for the unique vulnerability and use patterns specific to pregnant women and children," he wrote. (Insert slide: A Plea from Pediatricians). Does an organization representing 60,000 practitioners who care for children deserve to be brushed off along with –some health and safety interest groups?"

So what is the FCC doing in response to what at the very least is a troubling chain of clues to cellular danger? As it has done with wireless infrastructure, the FCC has to this point largely relied on industry –self-regulation." Though it set standards for device radiation emissions back in 1996, the agency doesn't generally test devices itself. Despite its responsibility for the safety of cell phones, the FCC relies on manufacturers' good-faith efforts to test them. Critics contend that this has allowed manufacturers undue latitude in testing their devices.

Critics further contend that current standards, in place since cell phones were barely in use, are far too lax and do not reflect the heavy usage patterns that have evolved. Worse still, industry is allowed to test its own devices using an imprecise system that makes no special provision for protecting children and pregnant women. One 2012 study noted that the procedure widely used by manufacturers to test their phones –substantially underestimates" the amount of RF energy absorbed by 97% of the population, —especially children." A child's head can absorb over two times as much RF energy. Other persons with smaller heads, including women, are also more vulnerable. The authors recommend an alternative computer simulation technique that would provide greater insight into the impact of cellular radiation on children and on to the specific RF absorption rates of different tissues, which vary greatly.[43]

Acting on recommendations of the General Accounting Office, the FCC is now reconsidering its standards for wireless testing and allowed emissions. On the surface, this may seem to represent an effort to tighten standards to promote consumer health and safety. But many believe the FCC's eventual new standard will actually be weaker, intensifying any health risk from industry's self-reported emission levels. –They're under great pressure from industry to loosen the criteria," notes Joel Moskowitz, director of the Center for Family and Community Health at UC Berkeley's School of Public Health.[44] One fear is that the FCC could measure the allowed radiation absorption level (SAR) over a wider sample of tissue, effectively loosening the

standard allowable energy absorption. One FCC official, who asked that his name not be used, contended that a decision had not yet been made to loosen the standard.

But to this point, there is little evidence the FCC is listening to anyone beyond its familiar friends in the wireless industry. Carl Blackman, a scientist at the Environmental Protection agency until retiring in 2014, notes that the FCC does rely to some degree on an inter-agency governmental group for advice on health matters. The group includes, for example, representatives from the EPA and the FDA.

Blackman served on that advisory group and he says that it has been divided. Though some government advisers to the FCC find evidence of wireless health risks convincing, others remain skeptical, said Blackman. Root of the skepticism: even though numerous researchers have found biological and health effects, the mechanism for action by non-ionizing radiation on the human body has still not been identified. "I don't think there's enough of a consensus within the Radio Frequency Inter-agency Working Group for them to come out with stricter standards," he says.[45]

But political pressures also figure mightily in all this. The EPA, notably, was once a hub of research on RF effects, employing as many as 35 scientists. However, the research program was cut off in the late 80s during the Regan presidency. Blackman says he was personally "forbidden" to study health effects by his "supervisory structure."[46] He termed it "a political decision" but recognized that if he wanted to continue to work at the EPA he would have to do research in another area.

Blackman is cautious in imputing motives to the high government officials who wanted his work at EPA stopped. But he does say that political pressure has been a factor at both the EPA and FCC: "The FCC people were quite responsive to the biological point of view. But there are also pressures on the FCC from industry." The FCC, he suggests, may not just be looking at the scientific evidence "The FCC's position—like the EPA's—is influenced by political considerations as well."[47]

Still, the FCC has ultimate regulatory responsibility and cannot indefinitely pass the buck on an issue of fundamental public health. Remarkably, it has not changed course despite the IARC classification of cell phones as possibly carcinogenic, despite the recent studies showing triple the glioma risk for heavy users, despite the floodtide of research showing biological effects, and despite even the recent defection of core industry booster Alex Lerchl. It is the refusal of both industry and the FCC to even acknowledge this cascade of warning signs that seems most incriminating.

Of course, industry behavior goes well beyond pushing for the FCC's willful ignorance and inaction. Industry behavior also includes self-serving public relations and hyper aggressive legal action. It can also involve undermining the credibility of and cutting off the funding for researchers who do not endorse cellular safety. It is these hardball tactics that recall 20th century Big Tobacco tactics. It is these tactics that heighten suspicion that the wireless industry does

indeed have a dirty secret. And it is those tactics that intensify the spotlight on an FCC that so timidly follows the script of the fabulously wealthy, bullying, billion-dollar beneficiaries of wireless.

Chapter Four: You Don't Need Wires To Tie People Up

So let's look a little more deeply at some of the actions of an industry group that boasts of 500 meetings a year with the FCC. Lobbying is one thing. Intimidation is another. CTIA has shown its skill at—and willingness to use—both.

Outright legal bullying is a favored tactic. The City of San Francisco passed an ordinance in 2010 that required cell phone manufacturers to display more prominently information on the emissions from their devices. This information was already disclosed—but often buried—in operator manuals and on manufacturer websites. The idea was to ensure that consumers saw information already mandated and provided.

Seeing this as a threat to its floodtide of business, the industry sued the City of San Francisco. The City, fearing a prolonged legal fight with an industry that generates hundreds of billions of dollars in annual revenue, backed down.

On May 12, 2015, Berkeley, California's City Council unanimously passed a similar ordinance. Joel Moskowitz, director of the Center for Family and Community Health at the University of California-Berkeley's School of Public Health, has been involved in the effort. Berkeley, he says, didn't want to run into the same legal threats that paralyzed San Francisco. So it tried to draft the most inoffensive and mild language possible. The proposed Cell Phone Right to Know ordinance: "To assure safety, the Federal Government requires that cell phones meet radio frequency (RF) exposure guidelines. If you carry or use your phone in a pants or shirt pocket or tucked into a bra when the phone is ON and connected to a wireless network, you may exceed the federal guidelines for exposure to RF radiation. This potential risk is greater for children. Refer to the instructions in your phone or user manual for information about how to use your phone safely."[48]

Sounds pretty inoffensive, no? Not to the CTIA, which indicated that it was prepared to sue, according to Berkeley City Attorney Zach Cowan.[49] (On June 8th, CTIA did indeed sue the City of Berkeley.)

Well, from the industry point of view, why not throw around your weight? Smash mouth legal tactics have been highly successful thus far as industry has managed to throttle several efforts to implicate manufacturers in cases where heavy users suffered brain tumors.

But one current case has advanced in district court in Washington to the point where the judge allowed plaintiffs to present expert witness testimony. The industry response: file a legal action seeking to invalidate long-held court methods for qualifying expert witnesses.

This is a very rich industry that does not hesitate to outspend and bully challengers into submission. Meanwhile, amidst the legal smoke and medical confusion, the industry has

managed to make the entire world dependent on its products. Even tobacco never had so many hooked users.

Such sustained success in the face of medical doubt has required industry to keep a lid on critics and detractors. Many scientists who've found real or potential risk from the sort of microwave radiation emanating from wireless devices have learned there is a price to be paid for standing up to the industry juggernaut. A few prominent examples:

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In 1994, University of Washington researchers Henry Lai and N.P. Singh found that rats exposed to microwave radiation suffered DNA damage to their brain cells. This was a scary finding since DNA damage can lead to mutations and possibly cancer.

The reaction from industry was swift. Motorola was at that time the U.S. market leader in cell phones. In a memorandum obtained by the journal Microwave News, Motorola PR honcho Norm Sandler outlined how the company could "downplay the significance of the Lai study." One step: "We have developed a list of independent experts in this field and are in the process of recruiting individuals willing and able to reassure the public on these matters," Sandler wrote. After outlining such measures, he concluded that Motorola had "sufficiently war-gamed" the issue. The practices of lining up industry-friendly testimony and "war-gaming" researchers who come up with unfavorable results have been persistent themes with this industry.

Motorola "War-Games" Bad News

Motorola, Microwaves and DNA Breaks: "War-Gaming" the Lai-Singh Experiments

"We have developed a list of independent experts in this field and are in the process of recruiting individuals willing and able to reassure the public on these matters."

"I think we have sufficiently war-gamed the Lai-Singh issue..."

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After Lai's results were published, Motorola decided to sponsor further research on microwaves and DNA damage. Oftentimes, lab results cannot be reproduced by other

researchers, particularly if experiments are tweaked and performed a bit differently. Non-confirming studies raise doubt, of course, on the original work.

Motorola lined up Jerry Phillips, a scientist at the Veteran's Administration Medical Center in Loma Linda, California, and Phillips tested the effect of radiation at different frequencies from those tested by Lai and Singh. Nevertheless, Phillips found that at some levels of exposure, DNA damage increased, while at other levels it decreased. Such findings were –eonsistent" with the sorts of effects produced by chemical agents, Phillips said in an interview.[50] In some cases, the radiation may have activated DNA repair mechanisms, reducing the overall microwave effect. But what was important, Phillips explained, is that there were *any* biological effects at all. The wireless industry has long contended—and the FCC has agreed—that there is no evidence that non-ionizing radiation at the frequencies and power levels used by cell phones is biologically active.

Understanding the potential impact of –biological effect" findings, Motorola again turned to damage control, said Phillips. He recalls receiving a phone call from a Motorola R&D executive. –I don't think you've done enough research,'" Phillips recalls being told. The study wasn't ready for publication, according to the Motorola executive. Phillips was offered more money to do further research without publishing the results of what he'd done.

But Phillips felt he'd done enough. Despite warnings for his own boss to –give Motorola what it wants," Phillips went ahead and published his findings in 1998. Since then, Phillips' industry funding has dried up. Meanwhile, as many other researchers report, government funding to do independent research on microwave radiation has dried up, leaving the field at least in the U.S. to industry-funded scientists. –There is no money to do the research," Said Phillips. –It's not going to come from government because government is controlled by industry."[51]

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Om P. Gandhi is Professor of Electrical and Computer Engineering at the University of Utah and a leading expert in dosimetry—measurement of non-ionizing radiation absorbed by the human body. Even before cell phones were in wide use, Professor Gandhi had concluded that children absorb more emitted microwave radiation. –The concentration of absorbed energy is 50 to 80% greater," he explained.[52]

These conclusions were not acceptable to Professor Gandhi's industrial sponsors. In 1998, he recalls, an executive from a cell phone manufacturer—which he did not want to identify—told him directly that if he did not discontinue his research on children his funding would be cut off. Professor Gandhi recalled replying: –I will not stop. I am a tenured professor at the University of Utah and I will not reject my academic freedom." Professor Gandhi also recalled some of his thought process: –I wasn't going to order my students to alter their results so that I can get funding." His industry sponsors cancelled his contract and asked for a return of funds.

Professor Gandhi believes that some cell phone users require extra protection because their heads are smaller and more absorptive. –Children, as well as women and other individuals with smaller heads absorb more concentrated energy because of the proximity of the radiating antenna to the brain tissue," he said. And yet the FCC has not acted to provide special protection for these groups. Asked why not, Professor Gandhi conceded that he doesn't know. He does note, however, that recent standards-setting has been dominated by industry representatives.[53]

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While the mobile industry refuses to admit to even the possibility that there is danger in RF radiation, giant insurance companies see things differently. Several insurers have in recent years issued reports highlighting product liability risk with cell phones. This is important because it is evidence that where money is on the line professionals outside the industry see the risk of legal liability.

Legal exposure could be one reason—perhaps the central one—the industry continues to stonewall. Should legal liability be established, one key question will be how much wireless executives knew—and at what point in time. Meanwhile, the combination of public relations denials, legal intimidation and the selective application of pressure on research follows a familiar pattern. –The industry is basically using the tobacco industry playbook," UC Berkeley's Moskowitz said in a recent radio interview.[54]

That playbook has thus far been highly successful in warding off attention, regulation and legal incrimination.

Chapter Five: $270 Billion . . . and Looking for Handouts

The FCC's network of corruption doesn't just shield industry from needed scrutiny and regulation on matters of public health and safety. Sometimes it just puts its hand directly into the public pocket and redistributes that cash to industry supplicants.

Such is arguably the case with the Universal Service Fund. Originally established to extend telephone service to rural and urban areas that industry would find difficult or uneconomical to wire, the USF is now shifting from subsidizing landline phone service to subsidizing the extension of broadband Internet. USF monies also support the Lifeline program, which subsidizes cell phone service to low-income consumers, and the E-Rate program, which subsidizes Internet infrastructure and service to schools and libraries.

Since 1998, more than $110 billion has been allocated to Universal Service programs, notes Charles Davidson, director of the Advanced Communications Law & Policy Institute at New York Law School. The FCC has allocated over $40 billion to the E-Rate program alone.

Who pays the freight for these high-cost programs? You do.

Technically, landline and wireless phone companies are assessed for the Universal Service fund's expenditures. But the FCC also allows those companies to pass on such charges to their subscribers, which they do. Both landline and wireless subscribers pay a monthly Universal Service charge that is tacked on to their phone bills. That charge has been rising and recently amounted to a 16% surcharge on interstate calls.

Consumers who pay for these programs might be interested to learn that both the E-Rate and Lifeline programs have been riddled with fraud. Government watchdogs have repeatedly found the programs to be inefficient and prone to inflated and fraudulent claims. But the programs have been a windfall for tech and telecom industry beneficiaries. Wherever the FCC presides, it seems, these industries reap a windfall.

The General Accounting Office (GAO) has issued several reports citing fraud, waste and mismanagement, along with inadequate FCC oversight of the subsidy program. Bribery, kickbacks and false documentation can perhaps be expected in a handout program mandated by Congress and only indirectly supervised by the FCC.

But the scope of fraud has been impressive. The most striking corruption has marred the E-Rate program, which subsidizes Internet hardware, software and service for schools and libraries, and the Lifeline cell phone subsidies.

In recent years, several school districts have paid fines to settle fraud cases involving bribery, kickbacks, non-competitive bidding of contracts and false documentation in the E-Rate

program. More eye opening perhaps are the settlements of fraud claims by tech giants like IBM, Hewlett Packard and AT&T. The HP case, for example, involved some colorful bribery allegations, including gifts of yachts and Super Bowl tickets. HP settled for $16 million. An HP official and a Dallas Independent School District official both received jail sentences.

The Lifeline program has also been riddled with fraud. A Wall Street Journal investigation of the five top corporate beneficiaries of Lifeline showed that 41% of more than 6 million subsidy claimants –couldn't demonstrate their eligibility or didn't respond to requests for certification."[55] AT&T, Verizon, and Sprint Nextel were three of the major Lifeline beneficiaries.

The FCC has initiated several efforts to clean up USF programs and seems honestly determined to bring greater accountability and efficiency to its subsidy efforts. Nevertheless, problems with fraud persist, as reported recently by the FCC's own top investigator.

Congress established the FCC's Office of Inspector General in 1989 to —provide objective and independent investigations, audits and reviews of the FCC's programs and operations." Here's what the FCC's internal investigative unit said in a September 30, 2014 report to Congress about its Office of Investigation (OI): –*The bulk of the work of OI involves investigating and supporting civil and criminal investigations/prosecutions of fraud in the FCC's federal universal service program.*"[56]

OFFICE OF INVESTIGATION

The bulk of the work of OI involves investigating and supporting civil and criminal investigations/prosecutions of fraud in the FCC's federal universal service program.

Fraud—as pervasive and troubling as it has been—is just one of the problems with the programs of universal service. It may not even be the fundamental problem. More fundamental issues concern the very aim, logic and efficiency of programs to extend broadband and wireless technology at public expense. Though the aims of extending service to distant impoverished areas seem worthy on the surface, there are many reasons to think the major beneficiaries of these programs are the technology companies that win the contracts.

Lobbyists have long swarmed over the FCC looking to get an ever-growing piece of the USF honeypot. An FCC report on meetings with registered lobbyists details a 2010 meeting with representatives of the International Society for Technology in Education and other education lobbyists. Topics discussed, according to the FCC report, included "the need to raise the E-Rate's annual cap."[57]

The CTIA, leaving no stone unturned in its efforts to pump up member revenues, last year responded to a House hearing on the USF by grousing that "current USF-supported programs skew heavily toward support of wireline services. . . . The concentration of USF monies to support wireline services is inconsistent with technological neutrality principles and demonstrated consumer preferences," CTIA wrote..[58] An industry that generates hundreds of billions of dollars in equipment and service revenues annually bellies up for a bigger slice of the $8 billion a year USF.

The grousing has paid off. The FCC recently announced that it will raise spending on E-Rate from what had been a cap of $2.4 billion a year to $3.9 billion. A significant portion of new outlays will go to Wi-Fi—yet another wireless industry victory at the FCC. But the CTIA is by no means the only industry group pressing the FCC.

Leading the roster of active lobbyists on E-Rate issues is the Software and Information Industry Association. Beginning in 2006, SIAA led all lobbyists with 54 mentions of E-Rate in its filings, according to the Center for Responsive Politics. SIAA board members include executives from tech heavyweights Google, Oracle and Adobe Systems.

Tech business leaders—many of them direct beneficiaries of FCC programs—made a direct pitch to FCC Chairman Wheeler last year to hike E-Rate funding. "The FCC must act boldly to modernize the E-Rate program to provide the capital needed to upgrade our K-12 broadband connectivity and Wi-Fi infrastructure within the next five years," the executives wrote.[59]

There were dozens of corporate executive signees to this letter, including the CEOs of many Fortune 500 giants. But let's just consider the participation of three: top executives of Microsoft, Google and HP all joined the call to expand E-Rate subsidies. Consider the simple fact that these three tech giants alone had revenues of $270 billion—more than a quarter of a trillion dollars—in a recent four-quarter period. Together, they produced nearly $40 billion in net income. And yet their top executives still thought it necessary to dun the FCC—and really, they were surreptitiously hitting up the public—for ramped-up spending on what was then a $2.4 billion a year program.

Is that greed? Arrogance? Or is it simply behavior conditioned by success in repeatedly getting what they want at the public trough? Almost never mentioned in these pleas for higher subsidies is the fact that ordinary American phone subscribers are the ones footing the bill for the E-Rate program—not the FCC or the telecom industry.

Much of the added spending, as noted, will go towards the installation of wireless networks. And yet Wi-Fi does not have a clean bill of health. When Lennart Hardell, professor of Oncology and Cancer Epidemiology at the University Hospital in Orebro, Sweden, was asked what he would do if given policy authority over wireless health issues, he replied swiftly that he would ~~–~~ban wireless use in schools and pre-school." Noting that there are wired alternatives, Professor Hardell flatly stated: ~~–~~You don't need Wi-Fi."[60] And yet the FCC, prodded by an industry ever on the lookout for incremental growth opportunities, is ignoring the health of youngsters to promote expanded Wi-Fi subsidies in schools across the U.S.

And what about the merit of the program itself? Overlooking the fraud and lobbying and Wi-Fi safety issues for a moment, shouldn't schools and libraries across the country be equipped with the best electronic gear, accessing the Internet at the fastest speeds? Doesn't the government owe that to its younger citizens, especially those disadvantaged by the long-referenced digital divide?

Well, maybe. But answers to these questions hinge on even more fundamental question: Do students actually learn more or better with access to the latest high-speed electronic gadgetry?

It would be foolish to argue that nobody benefits from access to high-speed Internet. But the benefits are nowhere near as broad or rich as corporate beneficiaries claim. Some researchers, for example, have concluded that computers don't seem to have positive educational impact—they may even have negative impact—when introduced into the home or freely distributed to kids from low income backgrounds.

Duke University researchers Jacob Vigdor and Helen Ladd studied the introduction of computers into North Carolina homes. They found that the academic performance of youngsters given computers actually declined. *"The introduction of home computer technology is associated with modest but statistically significant and persistent negative impacts on student math and reading test scores,"* the authors wrote in a National Bureau of Economic Research Working Paper.[61] The impact was actually most negative on the poorer students.

A study in the Journal of International Affairs examined the impact of the global One Laptop Per Child Program (OLPC), which has distributed millions of computers to children around the world. Researchers Mark Warschauer and Morgan Ames conclude: *"The analysis reveals that provision of individual laptops is a utopian vision for the children in the poorest countries, whose educational and social futures could be more effectively improved if the same investments were instead made on more proven and sustainable interventions. Middle- and high-income countries may have a stronger rationale for providing individual laptops to children, but will still want to eschew OLPC's technocratic vision. In summary, OLPC represents the latest in a long line of technologically utopian schemes that have unsuccessfully attempted to solve complex social problems with overly simplistic solutions."*[62]

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Can One Laptop Per Child Save the World's Poor?

"...In summary, One Laptop Per Child represents the latest in a long line of technologically utopian development schemes that have unsuccessfully attempted to solve complex social problems with overly simplistic solutions."

Access to computers in the home may not work educational magic. But what about computers in the classroom? Don't they have educational value there?

The anecdotal evidence is mixed at best. Consider how students in Los Angeles, newly equipped with flashy iPads at a mind-boggling taxpayer cost of more than $1 billion, went about using the new tools to improve their educational performance. "Instead of solving math problems or doing English homework, as administrators envisioned, more than 300 Los Angeles Unified School District students promptly cracked the security setting and started tweeting, posting to Facebook and playing video games."[63]

But let's cut through the self-serving corporate claims and the troubling anecdotes to hear from someone who actually has had extensive and unique field experience. Kentaro Toyama was co-founder of Microsoft's research lab in India. Over more than five years he oversaw at least a dozen projects that sought to address educational problems with the introduction of computer technology. His conclusion: "The value of technology has been over-hyped and over-sold."

The most important factor in improving schools, says Toyama, now the W.K Kellogg Associate Professor of Community Information at the University of Michigan, is good teachers. Without good, well-trained teachers, adequate budgets and solid school administration, technology does little good. "Technology by itself never has any kind of positive impact," he said.[64]

The only schools in his experience that benefited from increased technology investment were those where "the teachers were very good, the budgets adequate." The richer schools, in essence. But as both Vigdor and Warschauer found, the introduction of technology has by itself little if any positive effect. For a public conditioned to believe in the virtues of new technology, such testimony is a bracing dose of cold reality.

But what about cost? Doesn't technology in the schools more efficiently replace alternative investments? Cost reductions are often the most persuasive argument for technology, Toyama agrees. But even these have been overstated. The costs of introducing new technology run far beyond initial hardware and software investments, said Toyama. In reality, the total costs of ownership—including maintenance, training, and repair—typically run to five or ten times the initial cost, according to Toyama. He said of the investment in technology for cost benefits: "I would say that in the long run—and even in the medium run and the short-run—that's probably the worst and most misguided conclusion to come to."[65]

He adds: "The inescapable conclusion is that significant investments in computers, mobile phones and other electronic gadgets in education are neither necessary nor warranted for most school systems. In particular, the attempt to use technology to fix underperforming class rooms . . . is futile. And for all but wealthy, well-run schools, one-to-one computer programs cannot be recommended in good conscience."[66]

But that doesn't keep industry lobbyists from recommending them. And it hasn't kept the FCC for spending scores of billions subsidizing technology to the very groups least likely to benefit from it.

Unmoved by the arguments of researchers and educators like Vigdor, Warschauer, and Toyama, the FCC keeps moving to increase technology subsidies. Ignoring research that disputes the value of technology in closing the so-called "digital divide," the FCC has even pioneered a new slogan: "the Wi-Fi gap."

In announcing that it was lifting E-Rate's annual budget from $2.4 billion to $3.9 billion and stepping up investment in wireless networking, FCC chairman Wheeler exulted that "10 million students are going to experience new and better opportunities."[67] The impact on consumer pocketbooks (and potentially on youngsters' health from daily Wi-Fi exposure) were not mentioned.

The two Republican members of the FCC did at least recognize the pocketbook impact. "It always seems easier for some people to take more money from the American people via higher taxes and fees rather than do the hard work," said Commissioner Michael O'Reilly.[68]

The subsidized provision of high-speed Internet service is yet another pet project of the FCC. Julius Genachowski, chairman from 2009 to 2013, championed the transition of the USF from landline phone service to broadband. Universal broadband Internet connections would begin to absorb the monies collected from consumers to extend basic phone service.

As with government subsidies for cell phone service, classroom technology, and Wi-Fi, there are basic questions about the wisdom of subsidizing broadband. Charles Davidson and Michael Santorelli of the New York Law School found that spending billions to extend broadband is a flawed approach since there are many largely ignored reasons people choose not to adopt

broadband. ―Everybody is pushing broadband non-stop,‖ noted Davidson, director of the Law School‘s Advanced Communications Law and Policy Institute. ―I think the FCC is focused on the wrong set of issues,‖ he said.[69]

Already, he explained, over 98% of Americans have access to wired or wireless broadband. The issue is not one of supply. It‘s one of demand. Many people—for a variety of reasons—don‘t really care about broadband, he contends. Price is one issue. Also powerful factors—but given almost no attention—are privacy and security concerns. ―In our view, they should be focused on barriers to meaningful broadband utilization: privacy and security,‖ said Davidson.[70]

But consumer privacy (more on this subject in Chapter Seven) has no well-funded lobby with limitless access to the FCC.

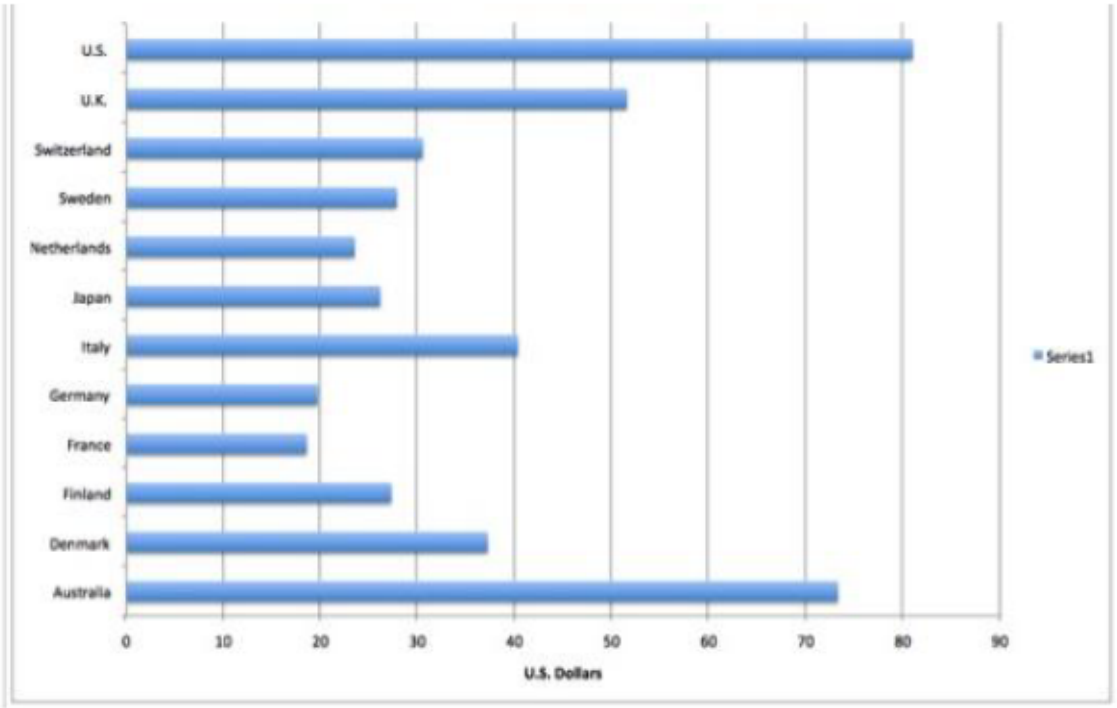
Chapter Six: The Cable Connection

The network has also been active in diluting FCC control of the cable television industry. Over the years, cable has devolved into major de facto local monopolies. Comcast and Time Warner Cable, whose merger proposal was dropped in April, are dominant forces in both cable television and broadband Internet subscriptions. Somehow, though, they have managed to steer clear of one another in specific markets, giving each pricing power where it faces little local competition.

It's interesting that cable companies annually rank in consumer polls among the "most hated" or "most disliked" American corporations. Indeed, Comcast and Time Warner Cable often top the "most hated" list.[71] Why would these companies—providers of the TV programming that has so expanded consumer options in recent decades—be so widely scorned? After all, the U.S. has been a leader in developing both cable technology and diverse television programming.

The problem is that it hasn't been anything close to a leader in bringing down subscriber prices. Industry consultants typically measure pricing by the metric of average revenue per subscriber. Industry trackers at IHS compared the price of U.S. pay television (which includes satellite services) to those in more than 60 other countries. U.S. prices were the highest, with only Australia even coming close. The average revenue per subscriber in the U.S. in 2013 was $81. But in France it was just $18.55. In Germany it was $19.68. In Japan it was just over $26.

Pay TV Monthly Revenue Per Person:



And U.S. cable prices have risen in recent years at rates three or more times the rate of inflation. This has been going on for some time. From 1995 to 2013 cable rates increased at a 6.1% annual clip. The Consumer Price Index, by contrast, rose by just 2.4% annually. Former FCC commissioner Michael Copps says the FCC shares a major part of the blame. "The FCC is as culpable for allowing that as much as the companies for imposing it," he said.[72]

One area where the FCC has contributed to the problem is in its traditional rubber-stamping of merger agreements. The proposed Comcast/Time Warner Cable deal has been shelved, largely because of Justice Department reservations. But a long run of earlier FCC-sanctioned deals allowed Comcast and Time Warner Cable to grow to the market dominance—and attendant pricing power—they currently command.

Lofty monthly cable bills pinch consumers. But it's more than that. Subscribers paying $80 a month are often paying for a lot of channels they don't watch and don't want. The FCC has never required cable operators to charge for what consumers actually want to watch. Kevin Martin, who chaired the FCC from 2005 to 2009, pushed to "debundle" programming in hopes of lowering bills. But the issue was never resolved. Only recently have viable competitive alternatives to cable's "bundled" packages become available. The satellite service Dish, for example, months ago introduced its Sling offering that enables consumers to opt for smaller and cheaper packages.

In fairness to cable operators, it should be pointed that programmers often require operators to take unwanted or fledgling channels along with their stars. New York cable operator Cablevision Systems filed suit against Viacom in 2013, charging that in order to get popular channels like MTV and Nickelodeon it was also forced to take low-rated channels like Nicktoons and VH1 Soul. But the simple truth is that no matter who is to blame, the cable consumer pays high prices, typically for some programming he doesn't want. As it often does when powerful interests pursue dubious practices, the FCC has for the most part idly stood by.

Still, the FCC isn't entirely to blame. Some factors in the growth of the cable giants cannot be laid at its doorstep. Local municipalities often granted monopoly or duopoly status in granting franchises to cable network builders. With the huge capital investments required to cable metropolitan areas, this once seemed to make sense.

And over the years, the cable giants have used a variety of tactics to weaken what little local competition they may have had. Active lobbyists on the local level, the cable giants have managed to convince a growing number of states to outlaw municipal systems that could threaten private corporate incumbents. The FCC for many years declined to tangle with the states in this matter, partly due to the opposition of Republican commissioners. But the Wheeler-led Commission did vote recently to override state laws that limit the build-out of municipal cable systems.

Still, many years of industry subservience will be difficult to swiftly undo. One linchpin merger shows how FCC decision-making has been thoroughly undermined by the revolving door, lobbying, and carefully targeted campaign contributions. All conspired in Comcast's pivotal 2011 buyout of NBC Universal, a deal which reinforced Comcast's domination of both cable and broadband access. This deal also set the stage for the recent headline-grabbing acrimony over the issue of net neutrality.

In 2011, mighty Comcast proposed to acquire NBC Universal. A series of mergers including the 1986 acquisition of Group W assets and the 2002 acquisition of AT&T's cable assets had already vaulted Comcast into cable market leadership. In bidding for NBC Universal, a huge step towards vertical integration, Comcast was once again raising the stakes. NBC Universal would give Comcast a treasure trove of programming, including valued sports content like NFL football and the Olympics.

Suddenly, the issue was not just cable subscriber base size—where Comcast had already bought its way to dominance. NBC Universal would also allow Comcast to consolidate its growing power as a broadband Internet provider. And with NBC Universal's programming assets, Comcast would gain new leverage when negotiating prices to carry the competing programming content of rivals. This would prompt a new round of debate over net neutrality. Couldn't a programming-rich Comcast slow down rival services—or charge them more to carry their programming?

To short-circuit any potential opposition to the merger, Comcast assembled a superstar cast of lobbyists. As Susan Crawford reports in her 2013 book, "Comcast hired almost eighty former government employees to help lobby for approval of the merger, including several former chiefs of staff for key legislators on congressional antitrust committees, former FCC staffers and Antitrust Division lawyers, and at least four former members of Congress.[73] Such "profligate hiring," Crawford observes, pretty much silenced the opposition to the deal. If Comcast had already retained one member of a lobbying firm, the firm could not under conflict of interest rules object to the deal. And Comcast had locked up key lobbying shops. Money was both weapon and silencer.

Of course, Comcast had always been a big spender on lobbying, with outlays exceeding $12 million every year since 2008. Lobbying costs peaked in 2011 at $19.6 million, according to the Center for Responsive Politics.

For its part, the FCC had a long history of approving most media mergers. So it was hardly a great surprise when the agency, after exacting some relatively minor concessions from Comcast, rubber-stamped the deal. Comcast would thus broaden its footprint as local monopoly distributor of cable. And with its new programming assets, it would enhance its leverage in negotiating deals to carry its rivals' programming. It would also fortify its position of growing strength as broadband Internet gatekeeper.

The most telling footnote to the deal would come just four months later. FCC Commissioner Meredith Atwell Baker, who voted to approve the merger in January 2011, left the FCC to become a top-tier Comcast lobbyist in May. It was the ultimate—and perhaps most telling—glide of the revolving door.

Baker's was a high-profile defection. But it was neither the first nor the last. Comcast had successfully convinced other FCC officials to take their expertise and government contacts to the cable giant. Comcast has long been a master at spinning the revolving door to its own advantage. "Comcast has been very good at hiring everyone who is very smart," said Crawford.[74]

Approval of the NBC Universal deal was another in the long string of FCC merger approvals that made Comcast a nationwide monopolist that could dictate both pricing and viewer programming choice.

But the deal may have had another unintended consequence. It set the stage for Comcast's subsequent battles on net neutrality. "Those mergers gave additional oomph to the issue of net neutrality," noted former commissioner Copps. Speaking specifically of Comcast's buyout of NBC Universal, IHS senior analyst Eric Brannon agreed. "That merger laid the grounds for net neutrality."

In allowing Comcast to acquire major programming assets, the deal would sharpen questions about the power of gatekeepers like Comcast to control the flow of traffic from rival Web services. So in bowing to lobbyist pressure, the FCC would bring on itself a whole new set of pressures by focusing public attention on the issue of net neutrality.

With activists rounding up comments from the public and hip TV personalities like HBO's John Oliver also beating the drums, net neutrality quickly grew into a popular issue that won the support of President Obama, and by proxy, his hand-picked appointee Tom Wheeler. When the FCC ruled in February of 2015 that it would seek Title II authority to regulate the Internet and presumably block any favoritism by broadband gatekeepers, it seemed to finally cast its lot with the public against steamrolling corporate interests

The issue had simmered for years but reached full boil when movie purveyor Netflix, which had argued that its service was slowed down by Comcast, signed a side deal ensuring better download speeds for its wares. This triggered an outburst of public concern that Comcast was now in position to operate "fast" and "slow" lanes, depending on whether a rival programmer could afford to ensure that Comcast provide adequate download speed.

With nearly 4 million comments—many supplied or encouraged by public interest groups—filed to the FCC, net neutrality was a bankable political issue. And there's no question, net neutrality attracted public interest because it gave cable viewers—long furious at the treatment by the monopolists who send them monthly bills—issues of both viewing pleasure and economics.

But it also fed into the longstanding sentimental but increasingly unrealistic view of the Internet as the last bastion of intellectual freedom. Internet romanticists have long seen the Web as a place that somehow deserves special rules for breaking the stranglehold of traditional media and offering exciting new communications, information retrieval and shopping efficiencies.

Yes, the Internet is a modern marvel. This is beyond dispute. But some of the favors it has won from government over the years have had unfortunate unintended consequences.

In the 1990s, for example, net access providers were repeatedly exempted as an ~~–~~infant industry" from paying access charges to the Baby Bells even though they had to connect users through local phone networks. The long distance companies were then paying as much as $30 billion a year for the privilege. But the Internet was exempted.

As the late 90s approached, the Internet was no longer an infant industry. Still, the exemption from access charges was extended. That exemption essentially allowed AOL in the late 90s to offer unlimited unmetered online time, a key factor in boosting usage and siphoning advertisers from print media. Why buy an ad in print that might get viewed with the transitory flip of a page when you can get round-the-clock attention online?[75] FCC decisions to grant the Internet access-charge exemptions arguably accelerated the decline of print media and much of the quality journalism print advertising could once support.

Meanwhile, retailers on the Internet were making inroads into brick and mortar retail business with the help of a Supreme Court-sanctioned exemption from collecting sales tax.[76] This judicial coddling of the Internet was the death knell for many smaller mom and pop local businesses, already challenged to match online pricing. And that's not all. The special favors continue virtually every year, as Congress proposes and/or passes legislation to extend special tax exemptions to Internet services.

Well, maybe tax breaks aren't such a bad idea for such an innovative and transformational emerging technology. For all its faults, the Internet—gateway to all goods, repository of all things, wizardly guide to all knowledge, enabler of universal self-expression—is undeniably cool.

But let's not deny that the combination of tax advantages and deregulation was toxic. Allow an industry to emerge with advantages over useful existing industries that largely play by the rules—well, maybe that can be rationalized. But then fail to hold the upstart industry to the same rules, allowing it more leeway to trample fundamental rights because it has the technical capacity to do so. Well, then you have a cruel Faustian bargain.

With the see-no-evil deregulatory gospel loosing all constraints, the Web would devolve into a playground for corporate snoops and criminals. For all its wonders, the Internet comes at a cost: the loss of control over personal data, the surrender of personal privacy, sometimes even the confiscation of identity.

Perhaps the most favorable consequence of net neutrality—and one that has gotten surprisingly little attention—is that it could set the stage for privacy reform. (More on this in Chapter Seven). The FCC can now choose to exercise its Title II powers to enforce privacy standards over broadband Internet. Privacy is one area where the FCC has done a pretty good job in the past.

Worth remembering, though, is that the hard-fought public victory over Net Neutrality may be transitory. AT&T and others have threatened to go to court to upend the FCC rules. And there's a fair chance a Republican Congress will legislate against Title II.

Meanwhile, though, one supreme irony has begun to unfold in the marketplace.

Modern-day laissez fair ideologues love to invoke the wisdom of markets as represented by the "mysterious hand" of Adam Smith. Unfortunately, in the absence of effective regulation, the putatively wise "mysterious hand" generally seems to work its magic for those with huge financial resources and the political access it buys.

In the current cable situation, however, the mysterious hand may actually be working in consumer-friendly ways. Years of regulation that favored the cable companies have now backfired as the market reacts to monopolistic pricing and content control.

Whereas cable giants have commanded premium monthly subscriber prices to deliver packages of largely unwatched channels, the market is now beginning to burst with new "debundled" options that are whittling away at cable's vast subscriber base.

Satellite service Direct TV, as noted, now offers its streaming video Sling TV package of popular networks that includes live sports and news. Amazon, Apple, CBS, HBO, Netflix, Sony, and others offer a variety of streaming video options that allow viewers to cut the cable cord. Suddenly, consumers have the cherry-picking capability that bundled—and expensive—cable packages have never allowed.

In this case, at least, the unintended consequences of the FCC's pro-industry policies may be producing an unexpected pro-consumer twist.

Chapter Seven: What about Privacy?

Has any issue gotten as much lip service—and as little meaningful action?

For all the various congressional bills, corporate self-regulatory schemes and presidential Privacy Bill of Rights proposals, the simple truth remains that no personal information is safe on the Internet. Data brokers have built a multi-billion dollar business exchanging information used to build profiles of Net users. Your shopping and surfing habits, your health history, your banking data, your network of social ties, perhaps even your tax filings are all potentially exposed online. Both legal and criminal enterprises amass this information. And it doesn't go away.

At any given moment people you don't know somehow know where you are. They may very well know when you made your last bank deposit, when you had your last asthma attack or menstrual period. Corporations encourage and pay for every bit of information they can use or sell. Creepy? Perhaps, but as Jeff Chester, president of the Center for Digital Democracy points out: "The basic business model that drives online is advertising."[77]

The FCC largely escapes blame on this one. It is the Federal Trade Commission that has had primary responsibility for protecting Internet privacy. The FCC does have some limited authority, which, some critics say, could have been exercised more vigorously. But for the most part the FCC is not to blame for the rampant online abuse of personal privacy and identity.

The FCC does however have privacy authority over the phone, cable and satellite industries. Until recently, at least, the FCC has kept privacy issues at bay among the companies in these industries. "The FCC has generally taken privacy very seriously," noted Harold Feld, a senior vice president at the non-profit Public Knowledge.[78]

But dynamics now in place suggest that privacy may be the next great testing ground for the FCC. A new chance, perhaps, to champion public interest. Even before the opportunity for privacy enforcement under Title II regulatory powers, the FCC faces new challenges from phone companies, now itching to monetize their vast consumer data stashes the way Net companies have. The commonly used term is "Google envy."

"Until now, ISPs (Internet Service Providers) have mostly not gotten into hot water on privacy—but that's changing," observed Jonathan Mayer, a fellow at the Center for Internet and Society.[79] Verizon and AT&T, major providers of mobile Internet access, have each introduced "super cookies" that track consumer behavior even if they try to delete older, less powerful, forms of cookies. AT&T is actually charging its customers an extra $30 a month *not* to be tracked.

Showdowns loom.

In adopting Title II to enforce net neutrality, the FCC has made broadband Internet access a telecom service subject to regulation as a –common carrier." This reclassification means that the FCC could choose to invoke privacy authority under Title II's Section 222. That section, previously applied to phone and cable companies, mandates the protection of consumer information. Such information—called CPNI for Customer Proprietary Network Information—has kept phone companies from selling data on whom you call, from where you call and how long you spend on the phone. Consumers may have taken such protection for granted on their phone calls. But they have no such protection on their Internet activity—which, as noted, has been a multi-billion dollar safe house hideaway for corporate and criminal abusers of personal privacy.

Now, though, the FCC could put broadband Internet communications under Section 222 protection. To Scott Cleland, a telecom industry consultant who has often been ahead of the analytic pack, this would be a momentous decision.

When the smoke clears—and it hasn't yet—the FCC could make consumer identifiers like IP addresses the equivalent of phone numbers. Suddenly, the Internet companies that have trafficked in all that personal data would be subject to the same controls as the phone and cable companies.

Cleland argues that the risk for privacy abuses extends beyond broadband access providers like Comcast and Verizon to Internet giants like Google and Facebook that have until now flourished with all that personal data. –They are at risk and they are going to live under the uncertainty their business model could be ruled illegal by the FCC," Cleland said.[80]

Much has been written about the legal challenges broadband access providers intend to mount against the FCC's new rules. But Cleland argues that a very different type of legal action could engulf companies that have benefited from the use and sale of private data. Trial lawyers, he argues, will see opportunity in rounding up massive class action suits of Internet users whose privacy has been violated. What sorts of privacy abusers face legal action? Anyone who has –collected CPNI via some type of cookie," according to Cleland.

–Right now, edge providers like Google, Facebook and Twitter are at risk of being sued by trial lawyers," he said.[81]

Sounds great for consumers who care about privacy on the Internet and how it has been abused. But the FCC, Cleland was reminded, has never been a consumer advocate. –Bingo," replied Cleland. That's what makes the FCC's potential move into privacy protection so important and so surprising, he suggests.

There are other signs that the FCC under Tom Wheeler might actually become more consumer-friendly on the issue of data privacy. While Wheeler has brought some former associates from lobbying groups to the FCC, he has also peppered his staff with respected

privacy advocates. Indeed, he named Gigi Sohn, longtime president of the non-profit Public Knowledge, as Counsellor to the Chairman in April.

Another appointee with a privacy background is Travis LeBlanc, head of the FCC's Enforcement Bureau. In previous employment in California's Office of the Attorney General, LeBlanc was active in enforcing online privacy. LeBlanc has stated an interest in privacy and has already taken action against two firms that exposed personal information—including social security numbers—on unprotected Internet servers.

But many aspects of LeBlanc's approach to regulating Internet privacy under Title II remain unclear. Unfortunately, the FCC declined repeated requests to make LeBlanc available for an interview. (It also declined to answer written questions on its enforcement intentions in both privacy and cell tower infrastructure emissions.)

It remains to be seen if LeBlanc and his superiors at the FCC are really willing to take on privacy enforcement. Such a stance would require great courage as the entire Internet infrastructure is built around privacy abuse. It is also questionable whether the FCC would have the courage to challenge Google—a rare corporate ally in the battles over Net Neutrality.

Chapter Eight: Dependencies Power the Network of Corruption

As a captured agency, the FCC is a prime example of institutional corruption. Officials in such institutions do not need to receive envelopes bulging with cash. But even their most well-intentioned efforts are often overwhelmed by a system that favors powerful private influences, typically at the expense of public interest.

Where there is institutional corruption, there are often underlying dependencies that undermine the autonomy and integrity of that institution. Such is the case with the FCC and its broader network of institutional corruption.

As noted earlier, the FCC is a single node on a corrupt network that embraces Congress, congressional oversight committees and Washington social life. The network ties the public sector to the private through a frictionless revolving door—really no door at all.

Temptation is everywhere in Washington, where moneyed lobbyists and industry representatives throw the best parties and dinners. Money also allows industry to control other important factors, like the research agenda. All of this works together to industry's advantage because—as with other instances of institutional corruption—there are compromising dependencies. Policy makers, political candidates and legislators, as well as scientific researchers are all compromised by their dependence on industry money.

Dependency #1 – So much of the trouble here comes back to the core issue of campaign finance. Cable, cellular and educational tech interests know where to target their funds for maximum policy impact. And the contributions work, seemingly buying the silence of key committee congressmen—even those with past records as progressives. Key recipients of industry dollars include Massachusetts Senator Ed Markey and, until he retired, California Democrat Henry Waxman. Though they have intermittently raised their voices on such issues as data privacy and cellular health and safety, neither has shown any great inclination to follow through and take up what would have to be a long and tough fight on these issues.

Dependency #2 – Democrats might be expected to challenge industry now and then. They traditionally have done so, after all. But this is the post-*Citizens United* era where the Supreme Court has turned government into a giant auction house.

Bid the highest price and you walk home with the prize—your personal congressman, legislative loophole, even an entire political party.

Such is the case with technology industries and the Democrats. The communications/electronics industry is the third largest industry group in both lobbying and campaign contributions, according to the Center for Responsive Politics. In just 2013 and 2014, this industry sector spent well over $750 million on lobbying.[82]

Only the finance/insurance/real estate and health industries outspend the tech sector on lobbying. But those industry groups lean Republican. Over 62% of the finance/insurance/real estate campaign contributions go to the GOP. Health contributions lean Republican 57% to 43%. But the technology group leans sharply to Democrats, who got 60% of contributions in the 2013-2014 election cycle.[83] The two next largest industry groups—energy/natural resources and agribusiness—also lean heavily Republican. So of the top five industry groups whose money fuels and often tilts elections four are strongly Republican. The Democrats need the tech industry—and they show that dependence with consistent support, rarely raising such public interest issues as wireless health and safety and Internet privacy.

Dependency #3 – Spectrum auctions give the wireless industry a money-making aura. In recent Congressional testimony, an FCC official reminded legislators that the FCC has over the years been a budget-balancing revenue-making force.[84] Indeed, the auctions of electromagnetic spectrum, used by all wireless communications companies to send their signals, have yielded nearly $100 billion in recent years. The most recent auction to wireless providers produced the unexpectedly high total of $43 billion. No matter that the sale of spectrum is contributing to a pea soup of electromagnetic –smog" whose health consequences are largely unknown. The government needs money and Congress shows its appreciation with consistently pro-wireless policies.

Dependency #4 – Science is often the catalyst for meaningful regulation. But what happens when scientists are dependent on industry for research funding? Under pressure from budget cutters and deregulators, government funding for research on RF health effects has dried up. The EPA, which once had 35 investigators in the area, has long since abandoned its efforts.[85] Numerous scientists have told me there's simply no independent research funding in the U.S. They are left with a simple choice: work on industry-sponsored research or abandon the field.

Chapter Nine: A Modest Agenda for the FCC

Nobody is proposing that cell phones be banned. Nor does anyone propose the elimination of the Universal Service program or other radical reforms. But there are some steps—and most are modest—that the FCC can take now to right some of the wrongs that result from long years of inordinate industry access and influence:

1. Acknowledge that there may be health risks in wireless communications. Take down the dismissive language. Maturely and independently discuss the research and ongoing debate on the safety of this technology.

2. In recognition of this scientific uncertainty, adopt a precautionary view on use of wireless technology. Require prominent point-of-sale notices suggesting that users who want to reduce health risks can adopt a variety of measures, including headphones, more limited usage and storage away from at-risk body parts.

3. Back off the promotion of Wi-Fi. As Professor Lennart Hardell has noted, there are wired alternatives that do not expose children to wireless risk.

4. Petition Congress for the budgetary additions needed to expand testing of emissions on antenna sites. It was Congress after all that gave industry carte blanche for tower expansion so long as they comply with FCC standards. But there is evidence of vast non-compliance and Congress needs to ensure that tower infrastructure is operating within the law.

5. Acknowledge that children and pregnant women may be more vulnerable to the effects of RF emissions and require special protection.

6. Promote cable debundling as a way to lighten consumer cable bills, especially for those customers who don't care about high-cost sports programming.

7. Apply more rigorous analysis to properly assess the value of technology in education. Evidence continues to pile up that technology in education is not as valuable as tech companies claim. Pay less attention to tech CEOs—pay more attention to the researchers who've actually studied the impact of trendy technology fixes on learning

8. Take over enforcement of personal privacy rights on the Internet. Of all the basic suggestions here, this would require the most courage as it would involve challenging many of the entrenched powers of the Internet.

Chapter Ten: Stray Thoughts

Some concluding thoughts:

Why do so many of the most dubious FCC policies involve technology?

In large part, of course, because the FCC has authority over communications and that is a sector that has been radically transformed—along with so many others—by technology.

Let's be clear, though. The problem is not technology, which unarguably brings countless benefits to modern life. The problem is with the over-extension of claims for technology's usefulness and the worshipful adulation of technology even where it has fearful consequences. Most fundamentally, the problem is the willingness in Washington—for reasons of both venality and naïveté—to give technology a free pass.

Personally, I don't believe that just because something can be done it should heedlessly be allowed. Murder, rape and Ponzi schemes are all doable—but subject to prohibition and regulation. Government regulators have the responsibility to examine the consequences of new technologies and act to at least contain some of the worst. Beyond legislators and regulators, public outrage and the courts can also play a role—but these can be muffled indefinitely by misinformation and bullying.

There are precedents for industries (belatedly perhaps) acting to offset the most onerous consequences of their products. In responding to a mix of litigation, public demand and regulatory requirement, the auto industry, for example, has in the last 50 years substantially improved the safety and environmental footprint of its products.

Padded instrument panels, seat belts, air bags, and crumple zones have all addressed safety issues. Environmental concerns have been addressed with tightened emissions and fuel consumption standards. The response to new safety challenges is ongoing. Before side air bags were widely deployed, sedan drivers side-swiped by much larger SUVs were at vastly disproportionate risk of death and dismemberment.[86] But the deployment of side air bags has –substantially" reduced the risk of collision deaths.[87] Overall, auto fatality rates per 100,000 persons have dropped by nearly 60% in the U.S. since 1966.[88] Today, automakers continue to work on advanced safety features like collision avoidance.

It can be argued that most of these safety improvements came decades after autos were in wide usage and only in response to outrage at Ralph Nader's 1965 revelations on the auto industry.[89] No matter the catalysts. The simple truth remains that the auto industry—and its regulators—have for the last half-century been addressing safety and environmental issues.

But with the overwhelming application of money and influence, information and communications technologies have almost totally escaped political scrutiny, regulatory control, and legal discipline.

Should the Internet have been allowed to develop into an ultra-efficient tool for lifting personal information that includes financial records, health histories and social security numbers? Should wireless communications be blindly promoted even as new clues keep suggesting there may be toxic effects? Should local zoning authorities and American citizens be stripped of the right to protect their own health? Should education be digitized and imposed just because technology companies want to develop a new market and lock in a younger customer base?

All these questions can perhaps be rolled up in one: do we all just play dead for the corporate lobbyists and spinners who promote the unexamined and unregulated application of their products?

Finally, a word about the structure of the FCC. With five commissioners—no more than three from the same party—the structure seems to make some kind of sense.

But in practice, it works out poorly. The identification of commissioners by party tends to bring out the worst in both Republicans and Democrats. Instead of examining issues with clear-sighted independence, the commissioners seem to retreat into the worst caricatures of their parties. The Republicans spout free market and deregulatory ideology that is most often a transparent cover for support of business interests. The Democrats seems satisfied if they can implement their pet spending programs—extension of broadband wireless to depressed urban and rural schools, cell phone subsidies for low income clients. The result is a Commission that fulminates about ideology and spends heavily to subsidize powerful interests.

Perhaps one solution would be to expand the Commission to seven by adding two public interest Commissioners. The public interest only rarely prevails at the FCC. So it would represent vast improvement if both Republican and Democrat commissioners had to vie for support of public interest representatives in order to forge a majority. The public interest, in other words, would sometimes carry the swing votes.

It‘s very hard to believe, though, that Congress would ever approve such a plan. It simply represents too much of a threat to the entrenched political power of the two parties. Why would they ever agree to a plan that dilutes that power?

It‘s also worth noting that the public interest is not always easy to define. Sometimes there are arguably conflicting definitions. Still, an FCC with public interest commissioners is an idea worth consideration. It would at least require party apologists to defend how they so consistently champion the moneyed interests that have purchased disproportionate access and power in Washington.

Appendix—Survey of Consumer Attitudes

What does the public believe about the science and politics of wireless health research? Under what conditions would people change wireless usage patterns? Is the FCC currently trusted to protect public health? How would confirmation of health risks affect trust in the FCC?

These are some of the questions Ann-Christin Posten[90] and Norm Alster[91] hoped to answer with an April 2015 online survey of 202 respondents. Participants were recruited through Amazon's Mechanical Turk online platform. All were U.S. residents and had achieved qualifying approval rates in prior Mechanical Turk surveys.

Participants were asked how likely they believed the following statements to be true:

Statement 1. Prolonged and heavy cell phone use can have a variety of damaging effects on health.

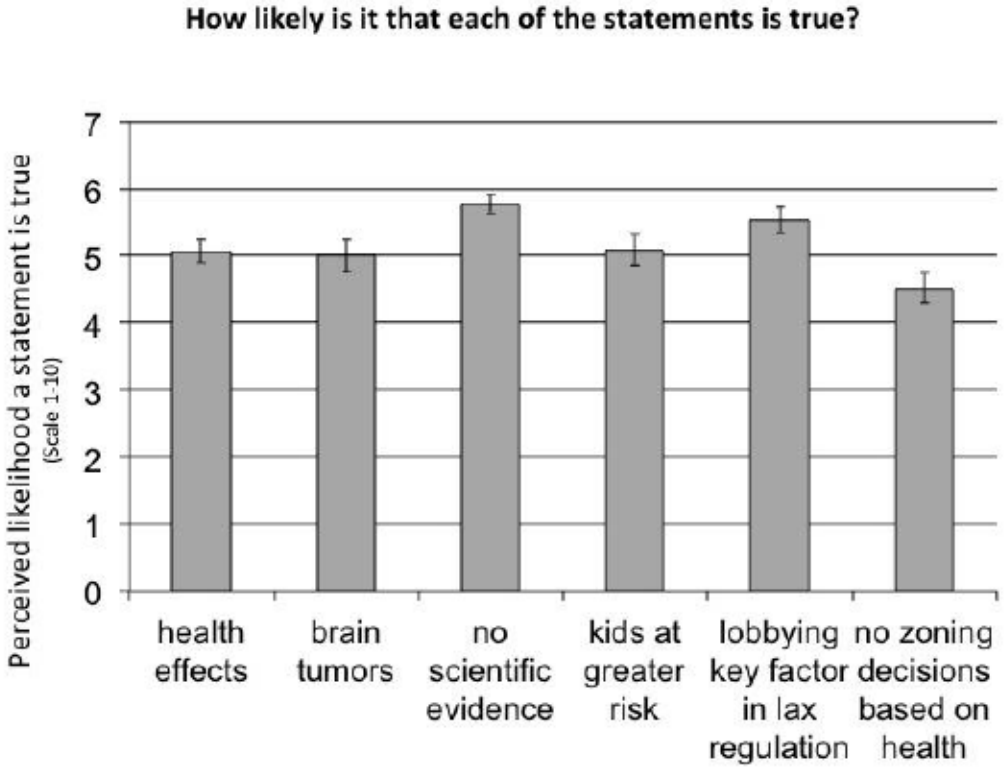
Statement 2. Prolonged and heavy cell phone use triples the risk of brain tumors.

Statement 3. There is no scientific evidence that proves that wireless phone usage can lead to cancer or a variety of other problems.

Statement 4. Children and pregnant women are especially vulnerable to radiation from wireless phones, cell towers and Wi-Fi

Statement 5. Lobbying and campaign contributions have been key factors in keeping the government from acknowledging wireless hazards and adopting more stringent regulation.

Statement 6. The U.S. Congress forbids local communities from considering health concerns when deciding whether to issue zoning permits for wireless antennae.

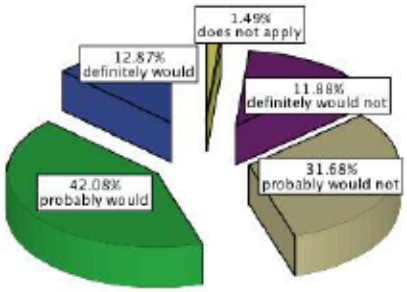


Two findings seem especially interesting:

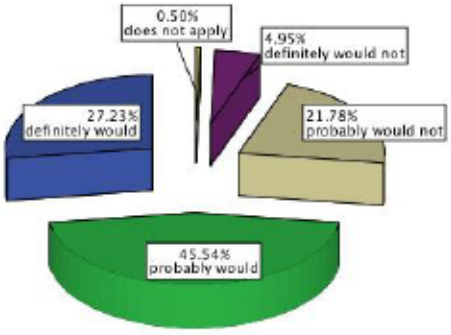
1. Statement 3 received a higher credibility rating than Statements 1 and 2. The different credibility levels are statistically significant. Respondents are more likely to trust in wireless safety than to believe there are general or specific health risks.

2. The only statement that is a matter of uncontested fact is Statement 6 on the outlawing of opposition to antenna sites on health grounds. (All other statements have been both proclaimed and denied.) And yet Statement 6 was least likely to be believed. Just 1.5% of respondents recognized this as an –absolutely true" statement. Over 14% thought this statement was —nbtrue at all." Answers to this question would seem to reflect public ignorance on the political background to wireless health issues.

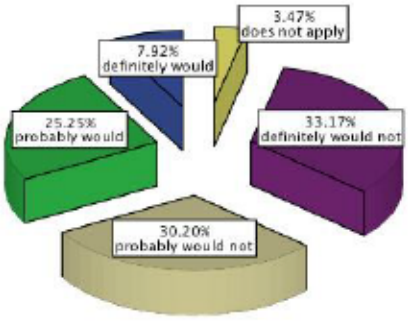
Participants were also asked how they would change behavior if claims of wireless health risks were established as true:



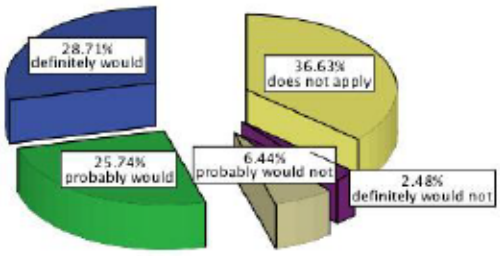
**If statement 1 was true,
I would start using headphones.**



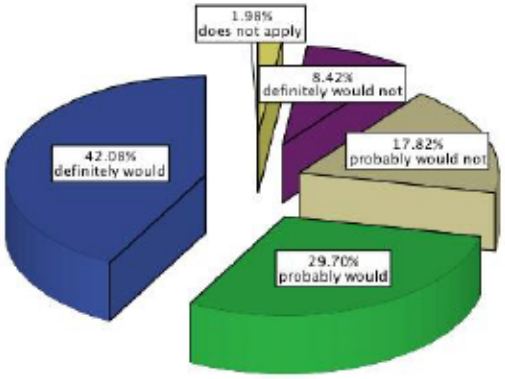
**If statement 1 was true,
I would restrict the amount of time
I spend on the phone.**



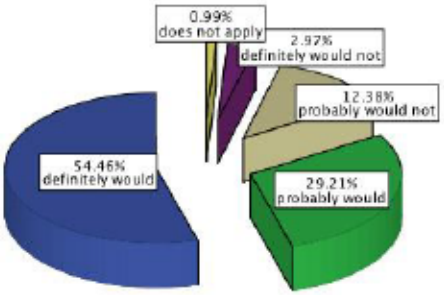
**If statement 1 was true,
I would start up a new land line
account for home use.**



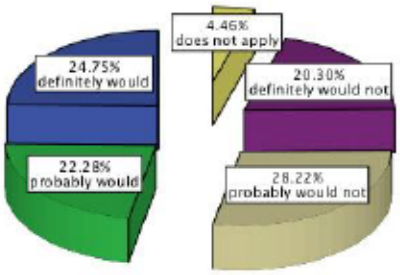
**If statement 1 was true,
I would restrict my children's cell phone use.**



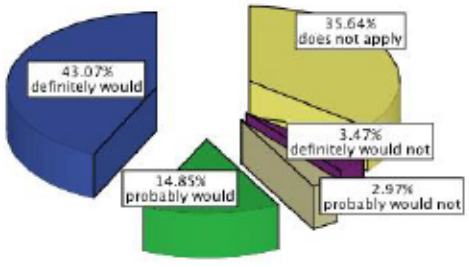
If statement 2 was true,
I would start using headphones.



If statement 2 was true,
I would restrict the amount of time
I spend on the phone.



If statement 2 was true,
I would start up a new land line
account for home use.



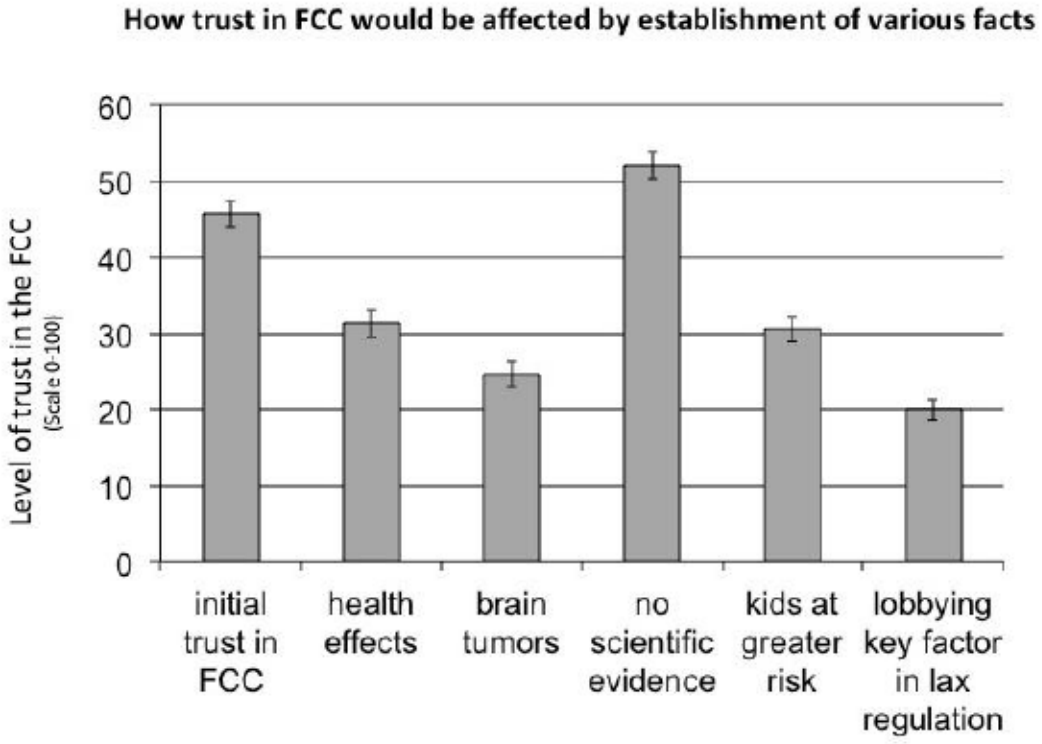
If statement 2 was true,
I would restrict my children's cell phone use.

The greatest impact on behavior came when respondents were asked to assume it is true that prolonged and heavy cell phone use triples the risk of brain tumors. More than half said they would –definitely" restrict the amount of time spent on the phone. Just over 43% would –definitely" restrict their children's phone use. Perhaps most surprisingly, close to 25% would –definitely" start up a new landline phone account. (This last response suggests it may be foolishly premature for the phone giants to exit the landline business just yet.)

The inclination of consumers to change behavior should negative health effects be confirmed suggests the stakes are enormous for all companies that derive revenue from wireless usage.

This survey points to—but cannot answer—some critical questions: Do wireless companies better protect themselves legally by continuing to deny the validity of all troublesome research? Or should they instead be positioning themselves to maintain consumer trust? Perhaps there is greater financial wisdom in listening to the lawyers right now and denying all chance of harm. If so, however, why would anyone seriously concerned about health listen to the industry—or to its captured agency? That's a question the FCC will eventually need to answer.

Trust could eventually become a central issue. Respondents were initially asked to describe their level of trust in the wireless industry and in the FCC as its regulator. Not surprisingly, establishment of any of the presumed health risks—or confirmation of inordinate industry pressure—resulted in statistically significant diminution of trust in both the industry and the FCC.



On a scale of 1 to 100, the FCC had a mean baseline trust level of 45.66. But if the tripling of brain tumor risk is established as definitely true, that number falls all the way to 24.68. If ~~"~~lobbying and campaign contributions" have been ~~"~~key factors" in keeping the government from acknowledging wireless hazards, the trust level in the FCC plummets to 20.02. All results were statistically significant.

It's clear that at this point confirmation of health dangers—or even of behind-the-scenes political pressures—from wireless will substantially diminish public trust in the FCC. Skeptics might argue that this gives the FCC motive to continue to downplay and dismiss further evidence of biological and human health effects. Those of a more optimistic bent might see in these findings reason to encourage an FCC concerned about public trust to shake itself loose from special interests.

Endnotes

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[70] Id.

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5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them

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Summary:

We know that there is a massive literature, providing a high level of scientific certainty, for each of eight pathophysiological effects caused by non-thermal microwave frequency EMF exposures. This is shown in from 12 to 35 reviews on each specific effect, with each review listed in Chapter 1, providing a substantial body of evidence on the existence of each effect. Such EMFs:

1. Attack our nervous systems including our brains leading to widespread neurological/neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in essentially all chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce cancer and also mutations in germ line cells which produce mutations in future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lower sex hormones, lower libido and increased levels of spontaneous abortion and, as already stated, attack the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and excessive calcium signaling.
8. Attack the cells of our bodies to cause cancer. Such attacks are thought to act via 15 different mechanisms during cancer causation.

There is also a substantial literature showing that EMFs also cause other effects including life threatening cardiac effects (Chapter 3). In addition substantial evidence suggests EMF causation of very early onset dementias, including Alzheimer's, digital and other types of dementias (Chapter 3); and there is evidence that EMF exposures in utero and shortly after birth can cause ADHD and autism (Chapter 5).

Each of these effects is produced via the main mechanism of action of microwave/lower frequency EMFs, activation of voltage-gated calcium channels (VGCCs) (Chapter 2). Each of them is produced via what are called downstream effects of VGCC activation. It follows from this that we have a good understanding not only that these effects occur, but also how they can occur. The extraordinary sensitivity of the VGCC voltage sensor to the forces of the EMFs tells us that the current safety guidelines allow us to be exposed to EMF levels that are something like

7.2 million times too high. That sensitivity is predicted by the physics. Therefore, the physics and the biology are each pointing to the same mechanism of action of non-thermal EMFs.

The different effects produced are obviously very deep concerns. They become much deeper and become existential threats when one considers that several of these effects are both cumulative and eventually irreversible. There is substantial evidence for the cumulative nature and eventual irreversibility of the neurological/neuropsychiatric effects, of the reproductive effects, the mutational DNA effects, the cardiac effects, of some but not other of the hormonal effects (Chapter 3); any causation of ADHD and autism may add additional concerns (here the cumulative nature is probably limited to the perinatal period). When we know that sperm counts have dropped by more than 50% throughout the technologically advanced countries on earth, it is difficult to avoid the conclusion that the vast majority of the population in those countries is already substantially impacted. The same conclusion can be made based on the widespread nature of the neuropsychiatric effects in those countries. Both of those effects will get much much worse even with no increase in current exposures, due to the cumulative nature and irreversibility of these effects. I expect we will see crash in human reproduction almost to zero as happened in the Magras and Xenos mouse study which I estimate to occur within about 5 years, without any increases in our exposures. Obviously 4G and 5G will make the situation much worse. Similarly I expect that the deterioration in brain function that we are already seeing will seal our fate if we fail to act rapidly and vigorously. Our collective brain function may become completely incapable of dealing with such a mega-crisis situation.

Now it can be argued that some of these may not develop as I expect, although those expectations are based on the best available evidence. One may even be able to argue this for all of those expectations. However, when we have substantial risk of multiple existential threats to every single technologically advanced country on earth, failure to act vigorously means there is a very high probability of complete destruction of these societies. And the chaos which would inevitably ensue, in a world that still has nuclear weapons, may well lead to extinction. In the face of these types or risk, the only reasonable course is to move with great vigor to stop new exposures and lower current exposures. One can still access the internet, using wired connections. And we can lower cell phone tower and cell phone radiation substantially. Smart meters, if needed, can work via wired connections.

Over 60% of this document (Chapters 5 & 6), is focused on the failures of statements from SCENIHR, the telecommunications industry, the U.S. FCC and the U.S. FDA to reflect the science. Their statements repeatedly omit much, often all of the most important science. Their statements are rife not only with omissions, but also with easily demonstrable falsehoods and with false logic. These have often occurred at times where we know that they knew better. These have occurred along with vigorous efforts by the telecommunications industry to corrupt the science by attacking individual scientists whose only fault is that they have obtained important findings that the industry does not like. These attacks have occurred along with vigorous efforts to corrupt two agencies that have important regulatory roles.

There are also possible concerns about individual industry-linked research studies. All wireless communication devices put out polarized EMFs that carry information via pulsations. Both the pulsations and the polarization make these EMFs much more biologically active. There are three other factors that also influence the production of effects. Several industry-linked studies may have used these factors, along with using very tiny numbers of individual animals in their studies, to produce studies which may have been designed to fail (Chapter 5). It is not clear at this point whether this type of concern is quite limited or whether it is very broad.

The European Commission has done nothing to protect European citizens from any of these very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect American citizens. The U.S. FCC has been much worse than that, acting vigorously with wanton disregard for our health.

Preface

The document that follows was, in its original form, sent to many of the authorities of the European Union, in conjunction with other documents sent to the same people by a group of European scientists. It was in response two documents that were, in turn, written by Mr. Ryan and Dr. Vinciūnas responding to a large group of European and other international scientists expressing great concern about the safety of 5G. I was asked by the leaders of the group of scientists to write my own response to those two documents. Mr. Ryan made the statement that "There is consistent evidence presented by national and international bodies (International Commission on Non Ionising Radiation Protection - ICNIRP, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) that exposure to electromagnetic fields does not represent a health risk, if it remains below the limits set by Council Recommendation 1999/519/EC1." In fact, that is not either the ICNIRP or SCENIHR position – their position, and similar positions have been taken by the U.S. FCC, FDA and the National Cancer Institute, is that the evidence is inconsistent or conflicting and therefore, in their view, no conclusions can be drawn. Some of these organization have also stated that there is no known mechanism by which effects can be produced. What is shown below is that there is a vast amount of evidence in the independent scientific literature that conflicts with both the conclusion about lack of demonstrated effects and the conclusion about lack of mechanism.

The European Commission, according to the Ryan and Vinciūnas documents and the U.S. National Cancer Institute, according to their web site, are each depending on the SCENIHR 2015 document to make judgments about EMF effects. Consequently, the reliability of SCENIHR 2015 is an essential element in determining the reliability of both of their assessments.

The document that is presented below, differs from the document that was emailed to EU authorities in three different ways: 1. The original document was sent as an email with multiple attachments. In this document attachments are simply provided as citations. The current document is a stand-alone document. 2. Some material is inserted to discuss positions taken by the U.S. FCC, FDA and National Cancer Institute, so as to be particularly relevant to the U.S. situation. 3. Substantial additional evidence is also provided.

The revised document contains seven chapters followed by a citation list for the entire document:

Chapter 1. Eight Extremely Well-Documented Effects of Non-Thermal EMF Exposures: Role of Pulsations, Other Factors that Influence EMF Effects

Both the earlier Ryan document and the more recent Arūnas document each fail to pay any attention to the extensive scientific literature that has been accumulated on non-thermal electromagnetic field (EMF) effects. The scientific consensus of independent scientists based on information accumulated over the last 7 decades is just the opposite of what each of them states. I am copying into this document, at the end of Chapter 1, a series of 8 extremely well-documented effects of such EMF exposure, together with a list of review articles, most of them being peer reviewed articles published in well respected journals in the PubMed database, *that have each reviewed a body of evidence demonstrating the existence of each such effect*.

What are the effects produced by non-thermal exposures to microwave frequency EMFs, where we have an extensive scientific literature? Each of the following effects has been documented in from 12 to 34 reviews, listed at the end of Chapter 1.

1. Three types of cellular DNA attacks, producing single strand breaks in the cellular DNA, double strand breaks in cellular DNA and oxidized bases in cellular DNA. Each of these DNA changes have roles in cancer causation and in producing the most important mutational changes in humans and diverse animals. Double stranded DNA breaks produce chromosomal breaks, rearrangements, deletions and duplications and copy number mutations; they also produce gene amplification, an important mechanism in cancer causation. Single strand breaks in cellular DNA cause aberrant recombination events leading to copy number mutations. Oxidized bases cause point mutations. When these occur in somatic cells, they can each have roles in causing cancer. When these occur in germ line cells (and they have be shown to occur in sperm following EMF exposures), they cause the three most important types of mutations in future generations, chromosomal mutations, copy number mutations and point mutations. (21 different reviews documenting these types of cellular DNA damage)
2. A wide variety of changes leading to lowered male fertility, lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, lowered libido (18 reviews). Human sperm count has dropped to below 50% of what used to be considered normal throughout the technologically advanced countries of the world [1]. Reproductive rates have fallen below replacement levels in every technologically advanced country of the world, with a single exception. These include every EU country, the U.S., Canada, Japan, South Korea, Taiwan, Singapore, Australia and New Zealand. Reproduction averages, in these countries, about 73% of replacement levels according to 2015 or 2016 data. A study on mouse reproduction [2] showed that radio/microwave frequency EMF exposure at doses well within our current safety guidelines produced substantial dose-dependent decreases in reproduction within

the first set of litters; further exposure produced dose-dependent complete or almost complete sterility that was found to be largely irreversible. When we have a technology that is universally present in these technologically advanced countries, that we know impacts reproduction, and reproduction has already dropped well below replacement levels, and we may be facing a catastrophic and irreversible decline in reproduction and there are more and more plans to expose us still further, don't you think that we should take note of the science? Mr. Ryan and Dr. Vinciūnas seem to be saying not at all. (Please note that the U.S. FCC and FDA also completely ignore this existential threat)

3. Neurological/neuropsychiatric effects (25 reviews). My own paper on this [3] and two earlier reviews cited in it found that there are whole series of repeatedly found EMF effects which have also become extremely widespread complaints in our technologically advanced societies, namely: sleep disturbance/insomnia; fatigue/tiredness; headache; depression/depressive symptoms; lack of concentration/attention/cognitive dysfunction; dizziness/vertigo; memory changes; restlessness/tension/anxiety/stress/agitation; irritability. These findings are not just based on epidemiological findings but are also based on profound impacts of EMFs, at levels well within our safety guidelines, on brain structure and function and also on the mechanism of non-thermal EMF action discussed below. When we have these neuropsychiatric effects becoming more and more common in technologically advanced societies all over the world, and *we know each of these is caused EMF exposures*, shouldn't we take note of this relationship?
4. Apoptosis/cell death (13 reviews). The two most important consequences of large increases in apoptosis (programmed cell death) are in causation of the neurodegenerative diseases and lowered reproduction although there are others.
5. Oxidative stress/free radical damage (19 reviews). Oxidative stress has roles in all or almost all chronic diseases. It is reported to have essential roles in producing the reproductive effects and the attacks on cellular DNA and may also have roles in producing the neurological effects and some of the cancer-causing effects shown to be produced here by EMF exposures.
6. Widespread endocrine (that is hormonal) effects (12 reviews). The steroid hormone levels drop with EMF exposure, whereas other hormone levels increase with initial exposure. The neuroendocrine hormones and insulin levels often drop with prolonged EMF exposure, possibly due to endocrine exhaustion.
7. Increases in intracellular calcium ([Ca2+]i) levels following EMF exposure (15 reviews). Calcium signaling also increases following EMF exposure.
8. Cancer causation (35 reviews). Brain cancer, salivary cancer, acoustic neuromas and two other types of cancer go up with cell phone use. People living near cell phone towers have increased cancer rates. Other types of EMFs are each implicated. Short wave radio, radio ham operators and people exposed to radar all are reported to have increased cancer incidence. Perhaps most telling, heavy-long term cell phone users have the highest incidence of brain cancer and have predominantly cancer increases on the ipsilateral side of the head (the side they use their cell phones), as opposed to the contralateral side. I have a paper [7], focused not on whether EMFs cause cancer but rather on ***how*** they can cause cancer. The paper shows that "downstream effects" of the main target of the EMFs in the cells of our bodies, can cause cancer in 15 different ways, including increases in cancer initiation, promotion and progression. Progression effects include both tissue invasion and metastasis. Each of these cancer causation effects are caused via mechanisms produced by downstream effects of the main non-thermal EMF mechanism, as discussed in Chapter 2.
9. Therapeutic effects of such EMFs. Such EMFs when focused on a specific region of the body where there is some dysfunction and when used at specific intensities, can have therapeutic effects. In my 2013 paper [4], I cited 12 different reviews where EMF

stimulation of bone growth was used therapeutically. There are something like 4000 papers on various therapeutic effects. Strangely, the telecommunications industry does not acknowledge these therapeutic effects, preferring rather to maintain the fiction that there are no non-thermal effects.

There is another set of reviews, 13 in this case, with each showing that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed EMFs. This is particularly important because all wireless communication devices communicate via pulsations, making them potentially much more dangerous. It follows from this that if you wish to study the effects of Wi-Fi, cell phones, cordless phones, cell phone towers, smart meters or 5G, you had better study the real thing or at least something that pulses very much like the real thing. There are many studies that don't do this, but falsely claim to be genuine Wi-Fi, cell phone or cordless phone studies. Other factors that influence the occurrence of non-thermal EMF effects include the frequency being used, the polarization of the EMFs and the cell type being studied [4,5,8-11]. Furthermore there are intensity "windows" that produce maximum biological effects, such that both lower and higher intensities produce much less effect [5,8,9]. These window effect studies clearly show that dose-response curves are both non-linear and non-monotone, such that it is difficult or impossible to predict effects based on relative intensity even when all other factors are the same. The role of each of these factors is completely ignored by ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute as well as by many other industry-friendly groups. When each of these organizations concludes that "results are inconsistent" they are comparing studies based on superficial similarities but not on these demonstrated causal factors. What is being observed, therefore, is genuine biological heterogeneity, not inconsistency. It has been known since the beginning of modern science in the 16th century that how you do your studies is important in determining what results are obtained. How is it possible that ICNIRP, SCENIHR, the U.S. FCC, FDA and National Cancer Institute have forgotten this important fact?

The primary literature studies demonstrating roles of pulsation, frequency, polarization, cell type and intensity windows in determining biological effects are entirely dependent on having genuine effects to study. None of these studies could have been done without an effect to study. Consequently, the claims that there are no well-documented EMF effects are nonsense, based not only on the eight extremely well-documented effects summarized above, but also on the entire literature demonstrating the role of pulsation, frequency, polarization, cell type and intensity windows.

Now I haven't said anything about how these non-thermal EMF effects are produced. I am taking much of Chapter 2 from a recent paper [11].

Reviews each showing important health-related non-thermal effects of microwave frequency electromagnetic fields (EMFs).

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Specific effects and reviews each reporting the effect in multiple primary literature studies:

Cellular DNA damage: Single strand and double strand breaks in cellular DNA and oxidized bases in cellular DNA, leading to chromosomal and other mutational changes:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Goldsmith JR. 1997 Epidemiologic evidence relevant to radar (microwave) effects. Environ Health Perspect 105(Suppl 6):1579-1587.
3. Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.
4. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
5. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
6. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117.
7. Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.
8. Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.
9. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
10. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
11. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
12. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
13. Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.
14. Pall, M. L. 2015 Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. Rev. Environ. Health 3, 99-116. doi: 10.1515/reveh-2015-0001.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
17. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
18. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.

19. Pall ML. 2018 How cancer can be caused by microwave frequency electromagnetic field (EMF) exposures: EMF activation of voltage-gated calcium channels (VGCCs) can cause cancer including tumor promotion, tissue invasion and metastasis via 15 mechanisms. Chapter 7 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 163-184.
20. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
21. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Lowered fertility, including tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovarian remodeling, oocyte (follicle) loss, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
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6. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
7. Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.
8. Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1
9. La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
10. Carpenter DO. 2013 Human disease resulting from exposure to electromagnetic fields. Rev Environ Health 2013;28:159-172.
11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
12. Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. 2014 Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. Environ Int 70:106-112.
13. Liu K, Li Y, Zhang G, Liu J, Cao J, Ao L, Zhang S. 2014 Association between mobile phone use and semen quality: a systematic review and meta-analysis. Andrology 2:491-501.

14. K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.
15. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
16. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276
17. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
18. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Neurological/neuropsychiatric effects:

1. Marha K. 1966 Biological Effects of High-Frequency Electromagnetic Fields (Translation). ATD Report 66-92. July 13, 1966 (ATD Work Assignment No. 78, Task 11). http://www.dtic.mil/docs/citations/AD0642029 (accessed March 12, 2018)
2. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
3. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by by Haigh. Consultants Bureau, New York/London, 146 pages.
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7. Lai H. 1994 Neurological effects of radiofrequency electromagnetic radiation. In: Advances in Electromagnetic Fields in Living Systems, Vol. 1, J.C. Lin, Ed., Plenum Press, New York, pp. 27-88.
8. Grigor'ev IuG. 1996 [Role of modulation in biological effects of electromagnetic radiation]. Radiats Biol Radioecol 36:659-670.
9. Lai, H 1998 Neurological effects of radiofrequency electromagnetic radiation. http://www.mapcruzin.com/radiofrequency/henry_lai2.htm.
10. Aitken RJ, De Iuliis GN. 2007 Origins and consequences of DNA damage in male germ cells. Reprod Biomed Online 14:727-733.
11. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
12. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
13. Khurana VG, Hardell L, Everaert J, Bortkiewicz A, Carlberg M, Ahonen M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int J Occup Environ Health 16:263-267.

14. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
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19. Hecht, Karl. 2016 Health Implications of Long-Term Exposures to Electrosmog. Brochure 6 of A Brochure Series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy. http://kompetenzinitiative.net/KIT/wp-content/uploads/2016/07/KI_Brochure-6_K_Hecht_web.pdf (accessed Feb. 11, 2018)
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21. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. 2016 EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health DOI 10.1515/reveh-2016-0011.
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23. Lai H. 2018. A Summary of Recent Literature (2007–2017) on Neurological Effects of Radio Frequency Radiation. Chapter 8 in Mobile Communications and Public Health, Marko Markov, Ed., CRC press, pp 185-220.
24. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
25. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses):

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
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6. Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018
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10. Pall ML. 2016 Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression. J Chem Neuroanat 75(Pt B):43-51. doi: 10.1016/j.jchemneu.2015.08.001.
11. Batista Napotnik T, Reberšek M, Vernier PT, Mali B, Miklavčič D. 2016 Effects of high voltage nanosecond electric pulses on eukaryotic cells (in vitro): A systematic review. Bioelectrochemistry. 2016 Aug;110:1-12. doi: 10.1016/j.bioelechem.2016.02.011.
12. Asghari A, Khaki AA, Rajabzadeh A, Khaki A. 2016 A review on Electromagnetic fields (EMFs) and the reproductive system. Electron Physician. 2016 Jul 25;8(7):2655-2662. doi: 10.19082/2655.
13. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.

Oxidative stress/free radical damage (important mechanisms involved in almost all chronic diseases; direct cause of cellular DNA damage):

1. Raines, J. K. 1981. Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories. Greenbelt, Maryland: National Aeronautics and Space Administration 1981; 116 p.
2. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
3. Hazout A, Menezo Y, Madelenat P, Yazbeck C, Selva J, Cohen-Bacrie P. 2008 [Causes and clinical implications of sperm DNA damages]. Gynecol Obstet Fertil ;36:1109-1117
4. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
5. Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.
6. Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.
7. Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.
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9. LaVignera et al 2012 La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.
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11. Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.
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13. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, Kysylenko S. 2015 Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. Electromagnetic Biol Med: Early Online 1-16. ISSN: 1536-8378.
14. Hensinger P, Wilke E. 2016. Mobilfunk-Studienergebnisse bestätigen Risiken Studienrecherche 2016-4 veröffentlicht. Umwelt Medizin Gesellshaft 29:3/2016.
15. Houston BJ, Nixon B, King BV, De Iuliis GN, Aitken RJ. 2016 The effects of radiofrequency electromagnetic radiation on sperm function. Reproduction 152:R263-R276.
16. Dasdag S, Akdag MZ. 2016 The link between radiofrequencies emitted from wireless technologies and oxidative stress. J Chem Neuroanat 75(Pt B):85-93.
17. Wang H, Zhang X. 2017 Magnetic fields and reactive oxygen species. Int J Mol Sci. 2017 Oct 18;18(10). pii: E2175. doi: 10.3390/ijms18102175.
18. Pall ML. 2018 Wi-Fi is an important threat to human health. Environ Res 164:404-416.
19. Wilke I. 2018 Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. Umwelt Medizin Gesselshaft 2018 Feb 31 (1).

Endocrine, that is hormonal effects:

1. Glaser ZR, PhD. 1971 Naval Medical Research Institute Research Report, June 1971. Bibliography of Reported Biological Phenomena ("Effects") and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation. Report No. 2 Revised. https://scholar.google.com/scholar?q=Glaser+naval+medical+microwave+radio-frequency+1972&btnG=&hl=en&as_sdt=0%2C38 (Accessed Sept. 9, 2017)
2. Tolgskaya MS, Gordon ZV. 1973. Pathological Effects of Radio Waves, Translated from Russian by B Haigh. Consultants Bureau, New York/London, 146 pages.
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4. Hardell, L., Sage, C. 2008. Biological effects from electromagnetic field exposure and public exposure standards. Biomed. Pharmacother. 62, 104-109.
5. Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.
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Pulsed EMFs are, in most cases much more biologically active than are non-pulsed EMFs. This is important because all wireless communication devices communicate via pulsations and because the "smarter" the devices are, the more they pulse because the pulsations convey the information. What should be obvious is that you cannot study such pulsation roles if there were no biological effects produced by such EMFs. *The pulsation studies alone tell us that there are many such EMF effects.*

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Each of these reviews, typically cite from 5 to over 100 primary literature citations, each showing that non-thermal EMF exposures produce the effect under which they are listed. It follows from this, that there are not only 11 or more reviews documenting each of these effects, but there is also a massive primary literature documenting these effects as well. It follows from this that the ICNIRP, FCC and International Safety Guidelines, which are entirely based only on thermal effects are inadequate and there have been petitions and other statements of international groups of scientists expressing great concern about this. *It follows that the ICNIRP, FCC and International safety guidelines are completely unscientific and cannot be relied upon to protect our safety.*

Chapter 2: How Each Such EMF Effect Is Produced via Voltage-Gated Calcium Channel Activation: Role of the Voltage Sensor in Producing the Extraordinary Sensitivity to EMF Effects

The Pall, 2013 [4] study showed that in 24 different studies (there are now a total of 26 [5]), effects of low-intensity EMFs, both microwave frequency and also lower frequency EMFs, could be blocked by calcium channel blockers, drugs that are specific for blocking voltage-gated calcium channels (VGCCs). There were 5 different types of calcium channel blockers used in these studies each thought to be highly specific, each structurally distinct and each binding to a different site on the VGCCs. *In studies where multiple effects were studied, all studied effects were blocked or greatly lowered by calcium channel blockers.* These studies show that EMFs produce diverse non-thermal effects via VGCC activation in many human and animal cells and even in plant cells where some similar calcium channels are involved [6]. Furthermore, many different effects shown to be produced in repeated studies by EMF exposures, including the effects discussed above, can each be produced by downstream effects of VGCC activation, via increased intracellular calcium [Ca2+]i, as discussed below.

Various EMFs act via VGCC activation, as shown by calcium channel blocker studies. These include microwave frequency EMFs, nanosecond pulse EMFs, intermediate frequency EMFs, extremely low frequency EMFs and even static electrical fields and static magnetic fields.

It is important to discuss why the VGCCs are so sensitive to activation by these low-intensity EMFs. Each of the VGCCs have a voltage sensor which is made up of 4 alpha helixes, each designated as an S4 helix, in the plasma membrane. Each of these S4 helixes has 5 positive charges on it, for a total of 20 positive charges making up the VGCC voltage sensor [5,8]. Each of these charges is within the lipid bilayer part of the plasma membrane. The electrical forces on the voltage sensor are extraordinarily high for three distinct reasons [5,8]. 1. The 20 charges on the voltage sensor make the forces on voltage sensor 20 times higher than the forces on a single charge. 2. Because these charges are within the lipid bilayer section of the membrane where the dielectric constant is about $1/120^{th}$ of the dielectric constant of the aqueous parts of the cell, the law of physics called Coulomb's law, predicts that the forces will be approximately 120 times higher than the forces on charges in the aqueous parts of the cell. 3. Because the plasma membrane has a high electrical resistance whereas the aqueous parts of the cell are highly

conductive, the electrical gradient across the plasma membrane is estimated to be concentrated about 3000-fold. The combination of these factors means that comparing the forces on the voltage sensor with the forces on singly charged groups in the aqueous parts of the cell, the forces on the voltage sensor are approximately 20 X 120 X 3000 = 7.2 million times higher [5,8]. The physics predicts, therefore, extraordinarily strong forces activating the VGCCs via the voltage sensor. It follows that the biology tells us that the VGCCs are the main target of the EMFs and the physics tells us why they are the main target. *Thus the physics and biology are pointing in exactly the same direction.*

We have, then, very strong arguments that the EMFs act directly on the voltage-sensor to activate the VGCCs. There are several other types of evidence, each providing important evidence supporting this view:

1. In a study published by Pilla [12], it was found that pulsed EMFs produced an "instantaneous" increase in calcium/calmodulin-dependent nitric oxide synthesis in cells in culture. What this study [12] showed was that following EMF exposure, the cells in culture, must have produced a large increase in [Ca2+]i, this in turn produced a large increase in nitric oxide synthesis, the nitric oxide diffused out of the cells and out of the aqueous medium above the cells into the gas phase, where the nitric oxide was detected by a nitric oxide electrode. This entire sequence occurred in less than 5 seconds. This eliminates almost any conceivable indirect effect, except possibly via plasma membrane depolarization. Therefore, it is likely that the pulsed EMFs are acting directly on the voltage sensors of the VGCCs and possibly the voltage-gated sodium channels, to produce the [Ca2+]i increase.

2. There are also additional findings pointing to the voltage sensor as the direct target of the EMFs. In addition to the VGCCs, there are also voltage-gated sodium, potassium and chloride channels, with each of these having a voltage sensor similar to those found in the VGCCs. Lu et al [13] reported that voltage gated sodium channels, in addition to the VGCCs were activated by EMFs. Tabor et al [14] found that Mauthner cells, specialized neurons with special roles in triggering rapid escape mechanisms in fish, were almost instantaneously activated by electrical pulses, which acted via voltage-gated sodium channel activation to subsequently produce large [Ca2+]i increases. Zhang et al [15] reported that in addition to the VGCCs, potassium and chloride channels were each activated by EMFs, although these other voltage-gated ion channels had relatively modest roles, compared with the VGCCs, in producing biological effects. Each of these three studies [13-15] used specific blockers for these other voltage-gated ion channels to determine their roles. The Tabor et al [14] study also used genetic probing to determine the role of the voltage-gated sodium channels. Lu et al [13] also used whole cell patch clamp measurements to measure the rapid influx of both sodium and calcium into the cell via the voltage-gated channels following EMF exposure. Sodium influx, particularly in electrically active cells, acts in the normal physiology to depolarize the plasma membrane, leading to VGCC activation such that the voltage-gated sodium channels may act primarily via indirect activation of the VGCCs. In summary then, we have evidence that in animal including human cells, seven distinct classes of voltage-gated ion channels are each activated by EMF exposures: From Ref. [4], four classes of voltage-gated ion channels were shown from calcium channel blocker studies, to be activated by EMFs, L-type, T-type, N-type and P/Q –type VGCCs. In this paragraph we have evidence that three other channels are also activated, voltage-gated sodium channels, voltage-gated potassium channels and voltage-gated chloride channels. Furthermore the plant studies strongly suggest that the so called TPC channels, which contain a similar voltage sensor, are activated in plants allowing calcium influx into plants to produce similar EMF-induced responses [6]. In summary, then we have evidence for eight different ion channels being activated by EMF exposure, four classes of VGCCs, one class each of voltage-gated sodium,

potassium and chloride channels and also one class of plant channel, with each of these channels having a similar voltage-sensor regulating its opening. One can put those observations together with the powerful findings from the physics, that the electrical forces on the voltage-sensor are stunningly strong, something like 7.2 million times stronger than the forces on the singly charged groups in the aqueous phases of the cell. Now you have a stunningly powerful argument that the voltage sensor is the predominant direct target of the EMFs.

3. The most important study on this subject, was published by Tekieh et al [16]. It showed that microwave frequency EMFs directly activate the VGCCs in isolated membranes. A variety of microwave frequencies were used in these studies and each such frequency produced VGCC activation in a completely cell-free system. This study clearly shows that the EMF activation of the VGCCs is direct and not due to some indirect regulatory effect.

How then does the estimated sensitivity of the voltage-sensor, about 7.2 million times greater forces than the forces on singly charged groups, compare with previous estimates of levels of EMF exposure needed to produce biological effects? The ICNIRP 2009 [17] safety guidelines allowed for 2 to 10 W/m^2 exposure, depending upon frequency. In contrast, the Bioinitiative Working Group 2007 [18] proposed a precautionary target level of 3 to 6 $\mu W/m^2$ or about a million-fold lower, using a safety factor of 10. If one uses a more commonly used safety factor of 50 to 100, then the 7.2 million-fold sensitivity of the voltage-sensor, predicted by the physics, falls right in the middle of the Bioinitiative Working Group 2007 calculations. So again, it can be argued that the physics and the biology are pointing in the same direction, in this case pointing to the same approximate range of sensitivity.

You may be wondering why I am spending so much time and space going through each of these studies. The answer is that a well over a trillion dollar (or trillion euro) set of industries, the telecommunications industry, has been putting out propaganda for over two decades, arguing that there cannot be a mechanism of action of these non-thermal EMFs to produce biological effects; and that these EMFs are too weak to do anything and that only thermal effects are documented. It is essential to dot every **i** and cross every **t** with regard to the main mechanism of action of non-thermal effects. That is exactly what has been done here.

<u>How Can the Diverse Effects of Such EMF Exposures Be Produced by VGCC Activation?</u>

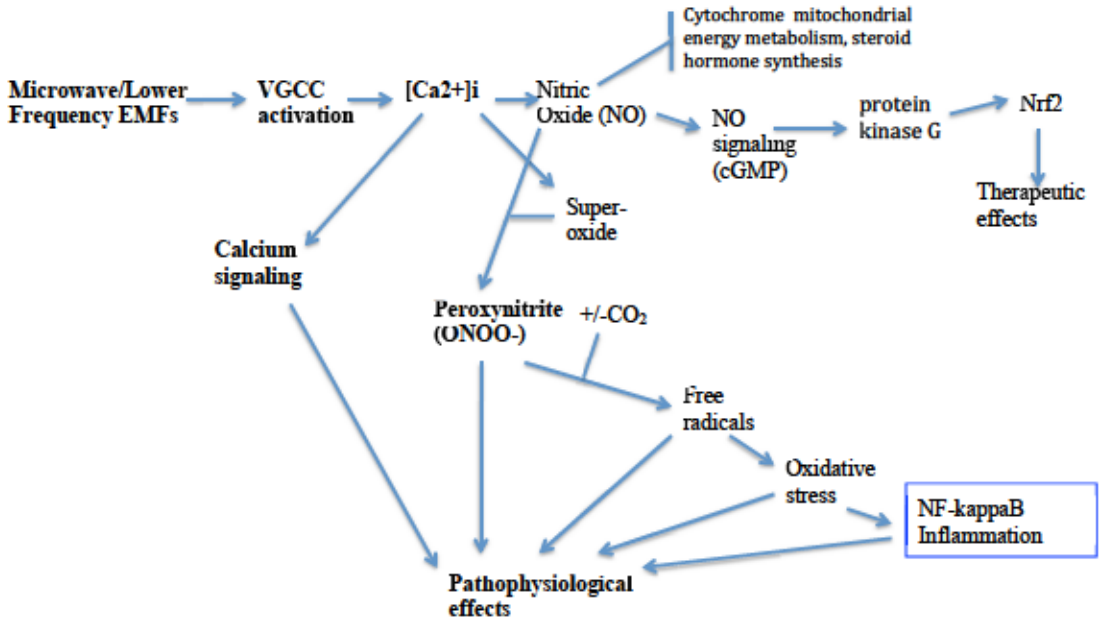

Fig. 1 How EMFs Act via VGCC Activation to Produce Various Effects

The mechanisms by which various effects can be generated by VGCC activation are outlined in Fig. 1. Going across the top of Fig. 1, it can be seen that increased intracellular calcium [Ca2+]i can increase nitric oxide (NO) synthesis, stimulating the NO signaling pathway (going to the right from top, center), to produce therapeutic effects. NO (very top) can also bind to cytochromes and inhibit their activity. NO binding to the terminal oxidase in the mitochondria inhibits energy metabolism and lowers, therefore, ATP. NO binding to cytochrome P450s, lowers synthesis of steroid hormones, including estrogen, progesterone and testosterone. The P450 lowering also lowers detoxification and vitamin D activity. Most of the pathophysiological effects are produced by the peroxynitrite/free radical/oxidative stress pathway center to lower right (Fig. 1) and also by excessive calcium signaling pathway (slightly left of center, Fig. 1). Some of the ways these are thought to produce various well-established EMF effects are outlined in Table 1.

Table 1. How Eight Established Effects of EMFs Can Be Produced by VGCC Activation

EMF effect	Probable mechanism(s)
Oxidative stress	Produced by elevated levels of peroxynitrite and the free radical breakdown products of peroxynitrite and its CO_2 adduct. Four studies of EMF exposure, cited in [4] showed that oxidative stress following exposure was associated with major elevation of 3-nitrotyrosine, a marker of peroxynitrite, thus confirming this interpretation. Two other studies each found 3-nitrotyrosine elevation, both following 35 GHz exposures [19,20].
Lowered male/female fertility, elevated spontaneous abortion, lowered libido	Both the lowered male fertility and lowered female fertility are associated with and presumably caused by the oxidative stress in the male and female reproductive organs. Spontaneous abortion is often caused by chromosomal mutations, so the germ line mutations may have a causal role. Lowered libido may be caused by lowered estrogen, progesterone and testosterone levels. It seems likely that

	these explanations may be oversimplified. One additional mechanism that may be important in producing lowered fertility is that VGCC activation and consequent high [Ca2+]i levels is known to have a key role in avoiding polyspermy. Consequently, if this response is triggered before any fertilization of an egg has occurred, it may prevent any sperm from fertilizing and egg.
Neurological/ neuropsychiatric effects	Of all cells in the body, the neurons have the highest densities of VGCCs, due in part to the VGCC role and [Ca2+]i role in the release of every neurotransmitter in the nervous system. Calcium signaling regulates synaptic structure and function in 5 different ways, each likely to be involved here. Oxidative stress and apoptosis are both thought to have important roles. Lowered sleep and increased fatigue are likely to involve lowered nocturnal melatonin and increased nocturnal norepinephrine.
Apoptosis	Apoptosis can be produced by excessive Ca2+ levels in the mitochondria and by double strand breaks in cellular DNA; it seems likely that both of these mechanisms are involved following EMF exposure. A third mechanism for triggering apopotosis, endoplasmic reticulum stress (see bottom row in this Table), may also be involved.
Cellular DNA damage	Cellular DNA damage is produced by the free radical breakdown products of peroxynitrite directly attacking the DNA [7].
Changes in non-steroid hormone levels	The release of non-steroid hormones is produced by VGCC activation and [Ca2+]i elevation. The immediate effects of EMF exposures is to increase hormone release and to raise, therefore, hormone levels. However many hormone systems become "exhausted" as a consequence of chronic EMF exposures. The mechanism of exhaustion is still uncertain, but it may involve oxidative stress and inflammation.
Lowered steroid hormone	Steroid hormones are synthesized through the action of cytochrome P450 enzymes; activity of these hormones is inhibited by binding of high levels of nitric oxide (NO) leading to lowered hormone synthesis.
Calcium overload	Produced by excessive activity of the VGCCs; secondary calcium overload is produced by oxidative stress activation of TRPV1, TRPM2 and possibly some other TRP receptors, opening the calcium channel of these receptors.
Heat shock protein induction	There is a large literature showing that excessive [Ca2+]i induces very large increases in heat shock proteins. This is thought to be produced by complex calcium signaling changes involving the endoplasmic reticulum, mitochondria and the cytosol and also involving excessive [Ca2+]i producing increasing protein misfolding [21-23]. It should be noted that some calcium is essential for proper protein folding in the endoplasmic reticulum such that only excessive calcium leads to misfolding and consequent endoplasmic reticulum stress.

Each of the seven established EMF effects, discussed above, can be generated through the mechanisms outlined in Fig. 1, as shown by Table 1. An eighth, heat shock protein induction can also be so explained (Table 1). Several other such effects, including EMF causation of

cataracts, breakdown of the blood-brain barrier, lowered nocturnal melatonin are also so explained, as discussed earlier [5]. The primary mechanism for therapeutic effects was discussed in [4,24,25] and was also shown to be generated via such VGCC downstream effects. Fifteen mechanisms for EMF cancer causation are described in ref [7]; these are far too complex to describe in this document so the reader is referred to ref [7].

It can be seen, in summary, that we are far beyond the issue whether there are non-thermal EMF effects. Rather many researchers have identified many established effects of EMF exposure. The main direct targets of non-thermal EMF exposure, the VGCCs have also been identified and how these get activated by EMF exposure acting on the VGCC voltage-sensor has also been determined. And finally we have identified how a wide variety of these effects can be generated via downstream effects produced by such VGCC activation.

Our current safety guidelines are based only on heating (thermal) effects. Heating is produced predominantly by forces on singly charged groups in the aqueous phases of the cell but the forces on the voltage sensor are approximately 7.2 million times higher. Therefore, our current safety guidelines are allowing us to be exposed to EMFs that are approximately 7.2 million times too strong. That 7.2 million figure is somewhat similar to the estimate given by the Bioinitiative Report and by the Building Biologists, based on completely different considerations.

It should be obvious, that non-thermal EMFs:

1. Attack our nervous systems including our brains leading to widespread neuropsychiatric effects and possibly many other effects. This nervous system attack is of great concern.
2. Attack our endocrine (that is hormonal) systems. In this context, the main things that make us functionally different from single celled creatures are our nervous system and our endocrine systems – even a simple planaria worm needs both of these. Thus the consequences of the disruption of these two regulatory systems is immense, such that it is a travesty to ignore these findings.
3. Produce oxidative stress and free radical damage, which have central roles in all common chronic diseases.
4. Attack the DNA of our cells, producing single strand and double strand breaks in cellular DNA and oxidized bases in our cellular DNA. These in turn produce both cancer and mutations in germ line cells with germ line mutations producing mutations impacting future generations.
5. Produce elevated levels of apoptosis (programmed cell death), events especially important in causing both neurodegenerative diseases and infertility.
6. Lower male and female fertility, lowered sex hormones, lowered libido, increased levels of spontaneous abortion and, as already stated, attacks on the DNA in sperm cells.
7. Produce excessive intracellular calcium [Ca2+]i and increased calcium signaling.
8. Act in the cells of our bodies via 15 different mechanisms to cause cancer.

By attacking all of these important systems in the body, EMFs attack everything we care about including our health (in many ways), our reproductive systems, the integrity of our genomes and our ability to produce healthy offspring.

There are 79 different reviews listed at the end of Chapter 1, with each documenting the existence of one or more of these various non-thermal EMF effects. What, then, do the two organization reports that the EU authorities and U.S. authorities rely upon, ICNIRP and SCENIHR 2015, have to say about these independent reviews. The answer is absolutely nothing! Neither one of them

uses any of these independent reviews to assess EMF effects. This whole area is discussed in much more detail in Chapter 5, below.

Chapter 3. Strong Evidence for Cumulative and Irreversible EMF Effects

Two questions that must be raised about the effects of these low-intensity EMFs producing biological effects is are they cumulative and are they reversible? I am aware of several different types of evidence for cumulative effects and also for irreversible effects.

Three of the human occupational exposure studies from the 1970's reviewed in the Raines, National Aeronautics and Space Administration (NASA) study [26], showed that effects increased substantially with increasing time of exposure to a particular type and intensity of EMF. While these three studies each show cumulative effects but they provide no data on possible irreversibility of these neurological/neuropsychiatric effects. However the largest review of such occupational exposures (Hecht [28]) does provide substantial evidence on the cumulative nature and irreversibility of these neurological/neuropsychiatric effects.

Hecht [28] reviewed 60 different studies of occupational exposures that were done between 1960 and 1990 in the Soviet Union and East Germany. These were occupational exposure studies of over 3500 people, who were exposed to microwave frequency EMFs at intensities of less than $1/1000^{th}$ of our safety guidelines. These studies [28] found that these EMFs produced neuropsychiatric effects similar to those found in my much more recent study [3], listed in Chapter 1 as well as on cardiac effects. Neither the neuropsychiatric findings nor the cardiac findings were unique however. Similar neuropsychiatric effects have been found to be caused by low intensity EMF exposures [27,29-34]. Cardiac effects have also been found in humans [26,29,30,32,34,35] similar to those found by Hecht [28].

Hecht [28] reports that exposures at those very low intensities for up to 3 years produced increased sympathetic nervous system activity, apparently in response to the EMF stress, following the classic stress sequence described by Hans Selye in 1953. No other effects were apparent during this circa 3 year period. However longer exposure produced observable neurological/neuropsychiatric and cardiac effects as well as other effects which were initially modest. Exposures of 3 to 5 years typically produced effects that could be largely reversed after 2 to 3 years in a no-EMF exposure environment. Hecht states that "if detected early, effective therapy is possible." However longer than 4 to 5 years exposures produced more severe effects which did not reverse when the persons were subsequently put into a no-EMF exposure environment. These and other effects continued to worsen with 10 years of exposure or longer. This cumulative nature of such EMF exposures was noted in two earlier reviews cited by Hecht et al [36,37]. These studies, then, provide very large amounts of evidence both for the cumulative nature of these neuropsychiatric effects, as well as the apparent irreversibility of these effects as they become more severe. Hecht also notes that "decline in health status increasingly amplifies EMF effects." This a pattern of increasing apparent sensitivity produced by previous exposure is similar to that described in the Western literature on electromagnetic hypersensitivity (EHS), something that Hecht recognizes [28]. EHS something that is discussed very briefly below in this section.

There are strong similarities between the Hecht [28] findings on microwave frequency EMFs in humans and the impacts of such EMFs on cellular and organ histology in rodents, as were reviewed in Tolgskaya and Gordon [38] and discussed in Pall [3]. In rodents, initially non-thermal exposures over periods of 1 to 2 months produced modest changes in structure of the brain and of the neurons. When such exposures ceased, most of the structural changes

disappeared – that is the changes were largely reversed when the animals were placed back into a no-EMF environment. However more months of exposure produced much more severe impacts on brain and neuronal structure and these were irreversible [38, 3]. More recent, Western country and other country studies cited in [3], provide much further support for brain impacts similar to those found in Soviet and also other country brain studies reviewed by Tolgskaya and Gordon[38]. Tolgskaya and Gordon [38,3] also reported findings that in histological studies, the nervous system was the most sensitive organ in the body, followed closely by effects on the heart and the testis, although many other organs were also impacted. Thus, the Tolgskaya and Gordon review [38,3] provides very important support for the findings of neurological/neuropsychiatric effects, the cardiac effects, discussed immediately above and below, and the reproductive effects discussed in Chapter 1. By comparing the animal studies with the human studies, one can see the striking similarities, with the major difference being that the effects in rodents are much more rapid than the effects on humans. Given the much higher metabolic rates in rodents and much lower life spans in rodents, the timing difference is not surprising. With regard to the issues of cumulative nature and irreversibility, both rodent and human studies provide strong support for both neurological and neuropsychiatric effects showing both cumulative nature and irreversibility and show a similar pattern of cumulative effects with the cardiac effects.

What are the cardiac effects discussed briefly above, that are produced by non-thermal microwave frequency EMF exposures? The effects include tachycardia (rapid heartbeat) where some people with apparent EHS, on blinded exposure to cordless phone radiation have instantaneous tachycardia, an effect that is also essentially instantaneously reversible on cessation of exposure [28,35,36]. So tachycardia can be an almost instantaneous response to EMFs and it is sometimes also found with arrhythmia. Prolonged exposures produce both arrhythmias and bradycardia (slow heart beat) [26-30,32]. Similar EMF cardiac effects were seen in animal studies, with the earliest of these going back to the late 1960s.

Some of the early studies on long-term EMF cardiac effects are listed in Table 2, below. They show that such chronic exposures produce bradycardia and sometimes arrhythmia. The early Soviet studies (labeled USSR) reported similar findings to those found in the western studies (Table 2).

Table 2. Chronic Exposure, Non-Thermal EMF Cardiac Effects from NASA Review [26]

Study	Effects Reported
Schwan 1977	Cardiology changes
Dwyer 1978	Bradycardia, hypotension
Sadicikova (USSR)	Bradycardia, hypo & hypertension, cardiac pain, systolic murmur
Kalyada (USSR)	"cardiovascular changes"
Sadichikova (USSR)	Changes in cardiovascular system
Pressman 1970	QRS interval in ECG increased (bradycardia), also arrhythmia
Domanski (USSR)	Bradycardia, hypotension, ECG changes (shows both bradycardia and arrhythmia)
Lerner (1980)	Bradycardia
Stuchley (1978)	Bradycardia (measured in 2 ways), hyper & hypotension, cardiac pain, systolic murmur.

Arrhythmias, especially when they are accompanied by bradycardia, are often associated with sudden cardiac death. We are having an epidemic of young, apparently healthy athletes dying in

the middle of an athletic competition of apparent sudden cardiac death, which may, therefore be possibly caused by EMF exposures [39]. Some of these individuals have been saved from death [39] and subsequently found to be suffering from bradycardia and arrhythmias. Another type of cardiac effect is that when apparent EHS people are exposed to Wi-Fi, cell phone, cell phone tower or smart meter radiation, they are reported to suffer from heart palpitations. Each of these four types of cardiac effects, tachycardia, arrhythmias, bradycardia and heart palpitations involve aberrations in the electrical control of the heartbeat. How can these be produced?

The heartbeat is controlled by pacemaker cells in what is called the sino-atrial node of the heart. Those pacemaker cells have been shown to have very high densities of the T-type VGCCs which may make these cells particularly susceptible to direct effects of the EMFs (recall that EMFs act via VGCC activation). The T-type and the L-type VGCCs have essential roles in controlling the heartbeat. It follows that EMF exposures, acting directly on the pacemaker cells of the heart, can produce tachycardia responses. Furthermore, gene mutations in a VGCC gene that produce increased VGCC activity can produce both tachycardia and arrhythmia in young babies carrying those mutations; these young children die of sudden cardiac death at a very young age. How then do we get bradycardia? Bradycardia is produced when EMFs chronically impact the sino-atrial node, such that the dysfunction involved in heart failure, which is very complex, produces dysfunction of the pacemaker cells of the heart, producing bradycardia [40].

It follows from this that EMF-produced bradycardia and chronic arrhythmias are likely to be caused by heart-failure-like changes that particularly impact the sino-atrial node of the heart, including the tissue remodeling found in heart failure. This model has been confirmed by the findings of Liu et al [41], who found that pulsed microwave frequency EMF produced tissue remodeling that specifically impacted the sino-atrial node of the heart with remodeling changes similar to those found in heart failure [40]. Heart failure develops in a cumulative fashion and, based on current medicine at least, is an irreversible process involving tissue remodeling and a large number of other biochemical and physiological changes [41]. It seems likely, therefore, that the EMF effects on the heart are both cumulative and irreversible.

You will recall, from the discussion at the beginning of Chapter 1, that there are 18 reviews documenting that EMF produces lowered fertility. These act via diverse mechanisms. These include tissue remodeling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovary remodeling and oocyte apoptosis, lowered estrogen, progesterone and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, and lowered libido. We already have sperm count drops to below 50% of normal in every technologically advanced country on earth [1]. We also have fertility drops to well below replacement levels in every technologically advanced country on earth, with one exception. Clinical observations argue that while there are sometimes technical fixes that allow some reproduction, infertility appears to be inherently irreversible. The Magras and Xenos [2] in mice, also discussed in Chapter 1 shows that radiofrequency radiation exposures well below our safety guidelines, produce immediate drops in mouse reproduction in the first litter. Further exposures to the same EMF levels produced a crash in reproduction essentially to zero, a crash that appeared to be essentially irreversible.

We don't know that humans will behave very similarly to mice. We do know that the EMFs produce the diverse effects on human reproduction listed in the previous paragraph. My prediction is that even if exposures level off where they are now, we will start seeing crashes in reproduction within about 5 years. If we go ahead with 5G, that crash may be almost instantaneous.

Mutation accumulation produced by cellular DNA damage is likely to be both cumulative and irreversible, as well, because later mutations are highly unlikely to reverse previously occurring mutations. It has been estimated that all we need to have is an increase in germ line mutation of 2 ½ to 3-fold, to become over time, extinct from the very high levels of mutations in each newborn. From the high levels of DNA damage produced in human sperm from common EMF exposures, we may be already well above that level.

It follows from this that we already face four existential threats produced by microwave frequency EMF exposures to the survival of every technologically advanced society on earth:

1. Cumulative and irreversible neurological/neuropsychiatric effects.
2. Cumulative and irreversible reproductive effects.
3. Cumulative and irreversible cardiac effects, leading to sudden cardiac death.
4. DNA effects in germ line, including sperm cells, leading to major impacts on our gene pool and high mutation frequencies.

Any one of these can destroy us on its own and with the ever increasing exposures and especially the vast increases in exposure that the 5G rollout will inevitably produce, that destruction is likely to be imminent. These don't even take into consideration the cancer effects, the hormonal effects or other effects produced by increased oxidative stress or increased apoptotic cell death. There is extraordinary evidence for each of these effects of EMF exposure, which have been repeatedly documented in the reviews listed in Chapter 1.

The following information is derived from an abstract that I used for a talk at the Neuroscience 2016 meeting in Los Angeles, a meeting that was focused on Alzheimer's disease and similar dementias. The discussion here raises the question of whether Alzheimer's and other dementias may be still another set of irreversible diseases where cumulative effects of microwave frequency EMFs may have important causal roles. Dementias and other types of neurological deaths have had unexplained rapid recent increases [42-44]. The parallel between these increases and the increases in cell phone and other EMF exposures suggested that such exposures may cause dementia increases [45]. Reports show people circa age 30 developing Alzheimer's or other very early onset dementias and even younger people are reported to develop digital dementias, dementias caused by heavy use of digital devices [46-48]. One of the questions being raised here, is whether digital dementias are caused, at least in part, by the EMF exposures produced by these digital devices and the Wi-Fi fields involved in their usage, rather than solely by such things as screen time, as is often assumed. As you have seen in chapter 2, microwave and lower frequency EMFs act via activation of the VGCCs, leading to increases in intracellular calcium ([Ca2+]i) and downstream effects including increased Ca2+ signaling, NO, superoxide, peroxynitrite, free radicals, oxidative stress, NF-kappaB and mitochondrial dysfunction.

Each of these downstream effects have been shown to have important roles in causing Alzheimer's disease and other neurodegenerative diseases [49-51]. These all suggest plausible mechanisms for action for EMFs causing Alzheimer's disease. Furthermore the amyloid-beta protein (Aβ) which has an specific role in causing Alzheimer's disease, is produced in increasing amounts by elevated [Ca2+]i, and small Aβ aggregates form Ca2+ channels in the plasma membrane and aggregates also raise [Ca2+]i via increased VGCC and RYRr activity, suggesting a vicious cycle between Aβ and [Ca2+]i in Alzheimer's disease. This argues that increased intracellular calcium levels, produced by the EMFs increases Aβ and increased Aβ increases intracellular calcium, in what may be the central mechanism in causing Alzheimer's disease.

Four rodent studies support an EMF role in Alzheimer's disease. A series of short pulses of EMFs in young rats, produced the following in the equivalent of middle aged rats: elevated brain Aβ and oxidative stress; lowered cognition and memory [52,53]. 900 MHz exposures produces oxidative stress, increased Aβ and lowered miR-107, all found in Alzheimer's disease brains [52-55]. There are many animal studies showing roles for [Ca2+]i through both VGCCs and RYRs in causing Alzheimer's disease in rodent models; these include studies with calcium channel blockers and studies of transgenic mice with varying VGCC and RYR expression. Very low EMF exposures can produce, however, protective responses [56,57]; this is not surprising because EMF therapy is thought to act via NO signaling and protein kinase G (see Fig.1, Chapter 2) and this pathway is reported to protect from Alzheimer's disease. Epidemiological studies have shown that exposure of humans of 50/60 Hz EMFs, which also act via VGCC activation, can cause elevated Alzheimer's disease incidence [58,59]. Interestingly, a 1997 article in Microwave News, discussing two such epidemiological findings on EMFs and Alzheimer's disease in humans, found that occupational exposures to EMFs produced as much as a four-fold increase in Alzheimer's disease [59A]. That same article [59A] suggested a similar mechanism to the mechanism suggested here, namely that increased [Ca2+]i following EMF exposure produces increases in Aβ. In conclusion, a wide range of studies support the view that low intensity microwave frequency exposures acting via VGCC activation and [Ca2+]i, can produce increases in Aβ and other causal factors of Alzheimer's disease in humans and in animals and EMFs have been shown to produce Alzheimer's effects in rats.

These various findings on EMFs and Alzheimer's disease, the increasingly early onset of dementias and the occurrence of digital dementias, all suggest we may have another very high level threat caused by EMF exposures, possibly involving cumulative EMF effects and leading to severe, irreversible brain damage.

Chapter 4 EMFs Including Wi-Fi May Be Particularly Damaging to Young People

Most arguments that have been made that microwave frequency EMFs may be much more damaging to young children have centered on the much smaller skulls and skull thickness in young children, increasing the exposure of their brains to EMFs [60, 61]. However there are other arguments to be made. EMFs have been shown to be particularly active in producing effects on embryonic stem cells [62-71]. Because such stem cells occur at much higher cell densities in children, with stem cell densities the highest in the fetus and decreasing with increasing age [62, 63], impacts on young children are likely to be much higher than in adults. The decreased DNA repair and increased DNA damage following EMF exposure, in conjunction with the increased cell division in young children, strongly suggest that young children may be increasingly susceptible to cancer following such exposures [62-64, 71]. Two reviews discussed in the next chapter provide further evidence on higher cancer susceptibility of children. EMF action on stem cells may also cause young children to be particularly susceptible to disruption of brain development [66,71], something that may be relevant to autism causation.

It is my belief that the role of [Ca2+]i in synapse development is also relevant to the possible EMF causation of autism. The Hecht review of Soviet occupational exposure studies [28] reports that "younger persons show a greater sensitivity to electromagnetic fields than adults." These are all very problematic issues and we cannot rule out the possibility that there are other problematic issues as well. Redmayne and Johansson [72] reviewed the literature showing that there are age-related effects, such that young people are more sensitive to EMF effects. It follows from these various findings that the placement of Wi-Fi into schools around the country and the not uncommon placing of cell phone towers on schools may well both be a high level threats to the health of our children as well being a threat to teachers and any very sensitive fetuses teachers

may be carrying, as well. Mr. Barrie Trower, a retired military intelligence expert from the U.K. has been going around the world, at his expense, speaking against Wi-Fi in schools. His knowledge on this is based in part on classified information which he is unable to discuss, but has given him great concern.

Chapter 5: The Importance of the SCENIHR 2015 Document and the Many Omissions, Flaws and Falsehoods in That Document

One thing that I think we can all agree upon, is that the SCENIHR 2015 [73] document is an important document. The reason for its importance is that previous industry-friendly documents, and there have been many of them, have only reviewed very limited amounts of the literature on EMF effects. Consequently all of these other documents are open to the criticism that they have cherry picked what little data they have chosen to discuss. SCENIHR 2015 [73] has a reference list of almost 48 pages in length, going from page 233 to 280. So it appears that SCENIHR 2015 may have done a much more thorough and defensible review of the literature. Our assessement of SCENIHR 2015 [73] is important because of the confidence expressed in this document both by Mr. Ryan and Dr. Vinciūnas and also by the U.S. National Cancer Institute. The question that is being raised here is whether SCENIHR 2015 is thorough and defensible or not.

The Speit/Schwarz Controversy: How SCENIHR Has Put Out Seven Falsehoods in Support of the Industry Progaganda Position

I am going to start by discussing a single particularly important issue from [73]. At the end of Table 5 in [73]. there is a claim that a 2013 study by Speit et al [74] was unable to replicate the findings of a 2008 study published by Schwarz et al [75]. In Table 5 they state further that Speit el al found "No effect on DNA integrity (MN) and DNA migration (comet); Repetition study of Schwarz et al, 2008." What is called loss of DNA integrity here, measured by formation of micronuclei (MN), is caused by the formation of double strand breaks in cellular DNA. The comet assay measures single strand breaks in cellular DNA. Schwarz et al [75] found strong evidence that there were large increases in both single strand and double strand breaks in cellular DNA following very low intensity exposures to a cell phone-like pulsed radiation, but SCENIHR claims that Speit et al [74] were unable to repeat the earlier study. Elsewhere (p.89, bottom) SCENIHR states that "By using the same exposure system and the same experimental protocols as the authors of the original study, they failed to confirm the results. They did not find any explanation for these conflicting results (Speit et al, 2013)."

A careful examination of both [74] and [75] finds the following: 1. Speit et al [74] used a lymphocytic cell line, HL-60; Schwarz et al [75] studied human fibroblasts. This is a big difference because, as we have already said, different cell types behave differently. 2. Speit et al [74] used 1800 MHz radiation; Schwarz et al [75] used 1950 MHz radiation (the frequency of UMTS, also called 3G). Again we have a potentially important difference because effects are influenced by the frequency used. 3. Speit et al [74] used a continuous wave EMF; Schwarz et al [75] used a highly pulsed EMF, with high levels of both KHz and MHz pulsations to mimic the pulsation pattern of 3G cell phones. This is expected to produce very large differences between the two studies. 4. Speit et al [74] used a reverberation exposure chamber; Schwarz et al [75] did not use any exposure chamber. This could be another very large difference between the two studies, a difference that will be discussed toward the end of this chapter. 5. So where did the claim come from that Speit was trying to repeat the Schwarz study? Speit et al [74] says in their paper that they were trying to repeat another study (not Schwarz) that was described in a report but was never published. 6. Speit et al [74] do not even cite the Schwarz et al [75] paper, so obviously they did not intend to repeat Schwarz. We have then SCENIHR 2015 stating three

multifaceted falsehoods that Speit et al [74] tried to repeat the earlier studies of Schwarz et al [75], that they were unable to repeat those Schwarz et al [75] studies and that they used identical methodology to that used by Schwarz et al [75]. In addition to those three are four underlying falsehoods – namely that the two studies used very different methodologies, notably differing in the cell type studied, differing in the frequency used, differing widely in the in pulsations used and differing in the use of an exposure chamber. *Each of these falsehoods are SCENIHR's not Speit et al [74]'s, each of them can be easily seen to be false by even a superficial reading of these two papers*.

As you might guess, there is a major story behind all of this. The very low intensity exposure used in the Schwarz et al [75] study produced large numbers of DNA breaks, larger than that produced by 1600 chest X-rays. This conclusion can be made by comparing the results of Schwarz et al [75] with the earlier study of Lutz and Adlkofer [76]. From this comparison, it seems clear that non-ionizing radiation similar to 3G radiation can be much more dangerous to the DNA of our cells than is a similar energy of ionizing radiation. When this was found, the industry went into attack mode, attacking the two Professors who collaborated in [75], Prof. Franz Adlkofer in Germany and Prof. Hugo Rüdinger in Austria. The first couple of years of these attacks have been described in some detail on pp 117-131 in Dr. Devra Davis' book Disconnect [77]. Before the SCENIHR 2015 document was drafted, it was clear that the publishers who had published Adlkofer's and Rüdinger's work, not just the Schwarz et al [75] study but other papers by the same research group, had long since rejected the industry propaganda claims. In addition. Adlkofer had won a lawsuit in the German courts against his main accuser. He has subsequently since won a second such lawsuit. The last paragraph on p.89 in SCENIHR 2015 is word for word industry propaganda. What is clear is that SCENIHR is wittingly or unwittingly serving as a propagandist for the industry in and that process, SCENIHR has no difficulty in putting forth seven obvious, individually important falsehoods.

One question that needs to be raised is how is it possible for microwave frequency EMFs to produce much more cellular DNA damage than a comparable energy level of ionizing radiation? Both ionizing radiation and microwave/lower frequency EMFs act via free radicals to attack the DNA. If you examine Fig. 1, Chapter 2, you will see how low intensity microwave frequency EMFs can act (p. 20). The free radicals that attack the DNA are breakdown products peroxynitrite.. The sequence of events leading to those free radicals starts, of course with the extraordinarily high sensitivity of the VGCC voltage sensor to the electrical forces of the EMFs that open the VGCC calcium channels. Following that there are three steps in the process leading to peroxynitrite elevation *each of which have high levels of amplification*. The first of these is that when the VGCC channels are open, they allow the influx of about a million calcium ion per second into the cell. The second amplification is that elevated intracellular calcium $[Ca2+]_i$ activates the synthesis of both nitric oxide (NO) and superoxide. The third amplification is that the formation of peroxynitrite is proportional to the product of nitric oxide concentration *times* the superoxide concentration. When you have three sequential amplification mechanisms, you can get a very large response, in this case free radical attack on cellular DNA, from a very small initial signal. That is where much of the existential crises are coming are from, with EMFs threatening the survival of every technologically advanced country on earth.

Going back to falsehoods perpetrated by SCENIHR regarding Speit/Schwarz, here are two possible interpretations for those seven falsehoods. One is that SCENIHR is simply an industry propaganda organ. The second is that we have a group of scientists (SCENIHR) who are largely incompetent and that it is just coincidence that these seven falsehoods serve the industry propaganda case. Either of these interpretations completely destroy the claims of confidence in

SCENIHR that Mr. Ryan and Dr. Vinciūnas made in the documents they wrote that were referred to in the Preface of this document.

I have written here another 27 pages critiquing the SCENIHR 2015 [73] document. If you are already convinced that the SCENIHR claims that there are no established non-thermal EMF effects are false and that we have eight extremely well documented effects (Chapter 1) and that we have detailed mechanisms of how these effects are produced (Chapter 2), then I suggest you skip to the summary of Chapter 5 starting on p. 57 and then go on to the consider the U.S. situation in Chapter 6 and 5G in Chapter 7. If, however, you are not so convinced, you need to read the intervening 27 pages.

22 Reviews on EMF Effects, 20 of Which Are Ignored by SCENIHR, Two of Which Are Discussed in [73] but Essentially Dismissed

Now let's go on to consider how SCENIHR 2015 [73] considers the many independent reviews, listed in Chapter 1, which disagree with them and also fall into the 2009 through 2013 period that SCENIHR claims to have thoroughly considered. See Table 3.

Table 3: 2009 to 2013 Reviews that Should Have Been Cited and Discussed in SCENIHR 2015

Citation	Brief Summary	What does SCENIHR 2015 say about it?
[78] Khurana VG, Teo C, Kundi M, Hardell L, Carlberg M. 2009 Cell phones and brain tumors: a review including the long-term epidemiologic data. Surg Neurol 72:205-214.	Meta-analysis study of cell phone usage and brain cancer. The results indicate that using a cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma. CONCLUSION: The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.	Nothing. Review is not cited and not discussed.
[79] Desai NR, Kesari KK, Agarwal A. 2009 Pathophysiology of cell phone radiation: oxidative stress and carcinogenesis with focus on the male reproductive system. Reproduct Biol Endocrinol 7:114.	This review identifies the plasma membrane as a target of RF-EMW. In addition, the effects of RF-EMW on plasma membrane structures (i.e. NADH oxidase, phosphatidylserine, ornithine decarboxylase) and voltage-gated calcium channels are discussed. We explore the disturbance in reactive oxygen species (ROS) metabolism caused by RF-EMW and delineate NADH oxidase mediated ROS formation as playing a central role in oxidative stress (OS) due to cell phone radiation (with a focus on the male reproductive system). This review also addresses: 1) the controversial effects of RF-EMW on mammalian cells and sperm DNA as well as its effect on apoptosis, 2) epidemiological, in vivo animal and in vitro studies on	Nothing. Review is not cited and not discussed.

	the effect of RF-EMW on male reproductive system.	
[80] Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Effects of cell phone exposure on the cardiovascular system, sleep and cognitive function, as well as localized and general adverse effects, genotoxicity potential, neurohormonal secretion and tumour induction. The proposed mechanisms by which cell phones adversely affect various aspects of human health, and male fertility in particular, are explained, and the emerging molecular techniques and approaches for elucidating the effects of mobile phone radiation on cellular physiology using high-throughput screening techniques, such as metabolomics and microarrays, are discussed. A novel study is described, which is looking at changes in semen parameters, oxidative stress markers and sperm DNA damage in semen samples exposed in vitro to cell phone radiation.	Nothing. Review is not cited and not discussed.
[81] Ruediger HW. 2009 Genotoxic effects of radiofrequency electromagnetic fields. Pathophysiology. 16:89-102.	101 publications are exploited which have studied genotoxicity of radiofrequency electromagnetic fields (RF-EMF) in vivo and in vitro. Of these 49 report a genotoxic effect and 42 do not. In addition, 8 studies failed to detect an influence on the genetic material, but showed that RF-EMF enhanced the genotoxic action of other chemical or physical agents. Variation in results may in part be explained by the different cellular systems and from the variety of analytical methods being used. Taking altogether there is ample evidence that RF-EMF can alter the genetic material of exposed cells in vivo and in vitro and in more than one way. This genotoxic action may be mediated by microthermal effects in cellular structures, formation of free radicals, or an interaction with DNA-repair mechanisms.	Nothing. Review is not cited and not discussed.
[82] Phillips JL, Singh NP, Lai H. 2009 Electromagnetic fields and DNA damage. Pathophysiology 16:79-88.	A major concern of the adverse effects of exposure to non-ionizing electromagnetic field (EMF) is cancer induction. Since the majority of cancers are initiated by damage to a cell's genome, studies have been carried out to investigate the effects of electromagnetic fields on DNA and chromosomal structure. Additionally, DNA damage can lead to changes in cellular functions and cell death. Single cell gel electrophoresis, also known as the 'comet assay', has been widely used in EMF research to determine DNA damage, reflected as single-strand breaks, double-strand breaks, and crosslinks. Studies have also been carried out to investigate chromosomal conformational changes and micronucleus formation in cells after exposure to EMF. This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have	Nothing. Review is not cited and not discussed.

	investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area.	
[83] Davanipour Z, Sobel E. 2009 Long-term exposure to magnetic fields and the risks of Alzheimer's disease and breast cancer: Further biological research. Pathophysiology 16:149-156.	Extremely low frequency (ELF) and radio frequency (RF) magnetic fields (MFs) pervade our environment. Whether or not these magnetic fields are associated with increased risk of serious diseases, e.g., cancers and Alzheimer's disease, is thus important when developing a rational public policy. Our objective was to provide an unbiased review of the current knowledge and to provide our general and specific conclusions. RESULTS: The evidence indicates that long-term significant occupational exposure to ELF MF may certainly increase the risk of both Alzheimer's disease and breast cancer. There is now evidence that two relevant biological processes (increased production of amyloid beta and decreased production of melatonin) are influenced by high long-term ELF MF exposure that may lead to Alzheimer's disease. There is further evidence that one of these biological processes (decreased melatonin production) may also lead to breast cancer. Finally, there is evidence that exposures to RF MF and ELF MF have similar biological consequences. CONCLUSION: It is important to mitigate ELF and RF MF exposures through equipment design changes and environmental placement of electrical equipment.	Nothing. Review is not cited and not discussed.
[84] Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Latest epidemiological data reveal a significant increase in risk of development of some types of tumors in chronic (over 10 years) users of mobile phone. It was detected a significant increase in incidence of brain tumors (glioma, acoustic neuroma, meningioma), parotid gland tumor, seminoma in long-term users of mobile phone, especially in cases of ipsilateral use (case-control odds ratios from 1.3 up to 6.1). Two epidemiological studies have indicated a significant increase of cancer incidence in people living close to the mobile telephony base station as compared with the population from distant area. These data raise a question of adequacy of modern safety limits of electromagnetic radiation (EMR) exposure for humans. For today the limits were based solely on the conception of thermal mechanism of biological effects of RF/MW radiation. Meantime the latest experimental data indicate the significant metabolic changes in living cell under the low-intensive (non-thermal) EMR exposure. Among reproducible biological effects of low-intensive MWs are reactive oxygen species overproduction, heat shock proteins	Nothing. Review is not cited and not discussed.

	expression, DNA damages, apoptosis. Practical steps must be done for reasonable limitation of excessive EMR exposure, along with the implementation of new safety limits of mobile telephony devices radiation, and new technological decisions, which would take out the source of radiation from human brain.	
[85] Carpenter DO. 2010 Electromagnetic fields and cancer: the cost of doing nothing. Rev Environ Health 25:75-80.	Concern of health hazards from EMFs has increased as the use of cell phones and other wireless devices has grown in all segments of society, especially among children. While there has been strong evidence for an association between leukemia and residential or occupational exposure to ELF EMFs for many years, the standards in existence are not sufficiently stringent to protect from an increased risk of cancer. For RF EMFs, standards are set at levels designed to avoid tissue heating, in spite of convincing evidence of adverse biological effects at intensities too low to cause significant heating. Recent studies demonstrate elevations in rates of brain cancer and acoustic neuroma only on the side of the head where individuals used their cell phone. Individuals who begin exposure at younger ages are more vulnerable. These data indicate that the existing standards for radiofrequency exposure are not adequate. While there are many unanswered questions, the cost of doing nothing will result in an increasing number of people, many of them young, developing cancer.	Nothing. Review is not cited and not discussed.
[86] Giuliani L, Soffritti M (Eds). 2010 NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER, RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY Volume 5, National Institute for the Study and Control of Cancer and Environmental Diseases "Bernardino Ramazzini" Bologna, Italy 2010, 400 page monograph.	Contains entire articles on: 1. Influence of mobile phone radiation on cognitive function. 2. Impact of DECT cordless phone radiation on heart rate variability and on the autonomic nervous system. 3 & 4. Two articles on the impact of radiofrequency radiation on the blood-brain barrier. 5 & 6. Two articles on microwave/radiofrequency radiation and cancer causation. 7. Epidemiological studies of EMF impact on human reproduction.	Nothing. Review is not cited and not discussed.
[87] Khurana, V. G., Hardell, L., Everaert,	We identified a total of 10 epidemiological studies that assessed for putative health effects of mobile phone	Nothing. Review is not

J., Bortkiewicz, A., Carlberg, M., Ahonen, M. 2010 Epidemiological evidence for a health risk from mobile phone base stations. Int. J. Occup. Environ. Health 16, 263-267.	base stations (cell phone antennae). Seven of these studies explored the association between base station proximity and neurobehavioral effects and three investigated cancer. We found that eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from base stations. None of the studies reported exposure above accepted international guidelines, suggesting that current guidelines may be inadequate in protecting the health of human populations. We believe that comprehensive epidemiological studies of long-term mobile phone base station exposure are urgently required to more definitively understand its health impact.	cited and not discussed.
[88] Levitt, B. B., Lai, H. 2010. Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays. Environ. Rev. 18, 369-395. doi.org/10.1139/A10-018	Both anecdotal reports and some epidemiology studies, reviewed in this study, have found headaches, skin rashes, sleep disturbances, depression, decreased libido, increased rates of suicide, concentration problems, dizziness, memory changes, increased risk of cancer, tremors, and other neurophysiological effects in populations near base stations. Cardiac effects were also reported. Symptoms reported may be classic microwave sickness, first described in 1978. Nonionizing electromagnetic fields are among the fastest growing forms of environmental pollution. Some extrapolations can be made from research other than epidemiology regarding biological effects from exposures at levels far below current exposure guidelines.	Nothing. Review is not cited and not discussed.
[89] Kang N, Shang XJ, Huang YF. 2010 [Impact of cell phone radiation on male reproduction]. Zhonghua Nan Ke Xue 16:1027-1030.	With the popularized use cell phones, more and more concern has been aroused over the effects of their radiation on human health, particularly on male reproduction. Cell phone radiation may cause structural and functional injuries of the testis, alteration of semen parameters, reduction of epididymal sperm concentration and decline of male fertility. This article presents an overview on the impact of cell phone radiation on male reproduction.	Nothing. Review is not cited and not discussed.
[90] Yakymenko, I., Sidorik, E., Kyrylenko, S., Chekhun, V. 2011. Long-term exposure to microwave radiation provokes cancer growth: evidences from radars and mobile communication systems. Exp. Oncol. 33(2), 62-70.	The carcinogenic effect of MW irradiation is typically manifested after long term (up to 10 years and more) exposure. Nevertheless, even a year of operation of a powerful base transmitting station for mobile communication reportedly resulted in a dramatic increase of cancer incidence among population living nearby. In addition, model studies in rodents unveiled a significant increase in carcinogenesis after 17-24 months of MW exposure both in tumor-prone and intact animals. To that, such metabolic changes, as overproduction of reactive oxygen species, 8-hydroxi-2-deoxyguanosine formation, or ornithine	Nothing. Review is not cited and not discussed.

	decarboxylase activation under exposure to low intensity MW confirm a stress impact of this factor on living cells. We also address the issue of standards for assessment of biological effects of irradiation. It is now becoming increasingly evident that assessment of biological effects of non-ionizing radiation based on physical (thermal) approach used in recommendations of current regulatory bodies, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines, requires urgent reevaluation. We conclude that recent data strongly point to the need for re-elaboration of the current safety limits for non-ionizing radiation using recently obtained knowledge. We also emphasize that the everyday exposure of both occupational and general public to MW radiation should be regulated based on a precautionary principles which imply maximum restriction of excessive exposure.	
[91] Yakimenko IL, Sidorik EP, Tsybulin AS. 2011 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999). 2011 Mar-Apr;83(2):20-28.	Review is devoted to the analysis of biological effects of microwaves. The results of last years' researches indicated the potential risks of long-term low-level microwaves exposure for human health. The analysis of metabolic changes in living cells under the exposure of microwaves from mobile communication systems indicates that this factor is stressful for cells. Among the reproducible effects of low-level microwave radiation are overexpression of heat shock proteins, an increase of reactive oxygen species level, an increase of intracellular Ca2+, damage of DNA, inhibition of DNA reparation, and induction of apoptosis. Extracellular-signal-regulated kinases ERK and stress-related kinases p38MAPK are involved in metabolic changes. Analysis of current data suggests that the concept of exceptionally thermal mechanism of biological effects of microwaves is not correct. In turn, this raises the question of the need to revaluation of modern electromagnetic standards based on thermal effects of non-ionizing radiation on biological systems.	Nothing. Review is not cited and not discussed.
[92] Gye MC, Park CJ. 2012 Effect of electromagnetic field exposure on the reproductive system. Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.2012.39.1.1 . Clin Exp Reprod Med 39:1-9. doi.org/10.5653/cerm.	The safety of human exposure to an ever-increasing number and diversity of electromagnetic field (EMF) sources both at work and at home has become a public health issue. To date, many *in vivo* and *in vitro* studies have revealed that EMF exposure can alter cellular homeostasis, endocrine function, reproductive function, and fetal development in animal systems. Reproductive parameters reported to be altered by EMF exposure include male germ cell death, the estrous cycle, reproductive endocrine hormones, reproductive organ weights, sperm motility, early embryonic development, and pregnancy success. At	Nothing. Review is not cited and not discussed.

2012.39.1.1	the cellular level, an increase in free radicals and [Ca(2+)]i may mediate the effect of EMFs and lead to cell growth inhibition, protein misfolding, and DNA breaks. The effect of EMF exposure on reproductive function differs according to frequency and wave, strength (energy), and duration of exposure. In the present review, the effects of EMFs on reproductive function are summarized according to the types of EMF, wave type, strength, and duration of exposure at cellular and organism levels.	
[93] La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	The use of mobile phones is now widespread. A great debate exists about the possible damage that the radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile phones exerts on different organs and apparatuses. The aim of this article was to review the existing literature exploring the effects of RF-EMR on the male reproductive function in experimental animals and humans. Studies have been conducted in rats, mice, and rabbits using a similar design based upon mobile phone RF exposure for variable lengths of time. Together, the results of these studies have shown that RF-EMR decreases sperm count and motility and increases oxidative stress. In humans, 2 different experimental approaches have been followed: one has explored the effects of RF-EMR directly on spermatozoa and the other has evaluated the sperm parameters in men using or not using mobile phones. The results showed that human spermatozoa exposed to RF-EMR have decreased motility, morphometric abnormalities, and increased oxidative stress, whereas men using mobile phones have decreased sperm concentration, decreased motility (particularly rapid progressive motility), normal morphology, and decreased viability. These abnormalities seem to be directly related to the duration of mobile phone use.	Nothing. Review is not cited and not discussed.
[94] Biointiative Working Group, David Carpenter and Cindy Sage (eds). 2012 Bioinitiative 2012: A rationale for biologically-based exposure standards for electromagnetic radiation. http://www.bioinitiative.org/participants/why-we-care/	Sections on EMF effects: SECTION 4: EVIDENCE FOR INADEQUACY OF THE STANDARDS SECTION 5: EVIDENCE FOR EFFECTS ON GENE AND PROTEIN EXPRESSION SECTION 6: EVIDENCE FOR GENOTOXIC EFFECTS – RFR AND ELF DNA DAMAGE SECTION 7: EVIDENCE FOR STRESS RESPONSE (STRESS PROTEINS) SECTION 8: EVIDENCE FOR EFFECTS ON IMMUNE FUNCTION SECTION 9: EVIDENCE FOR EFFECTS ON NEUROLOGY AND BEHAVIOR SECTION 10: EFFECTS OF EMF FROM WIRELESS COMMUNICATION UPON THE	Nothing. Review is not cited and not discussed.

	BLOOD-BRAIN BARRIER SECTION 11: EVIDENCE FOR BRAIN TUMORS AND ACOUSTIC NEUROMAS SECTION 12: EVIDENCE FOR CHILDHOOD CANCERS (LEUKEMIA) SECTION 13: EVIDENCE FOR EFFECTS ON MELATONIN: ALZHEIMER'S DISEASE AND BREAST CANCER SECTION 14: EVIDENCE FOR BREAST CANCER PROMOTION SECTION 15: EVIDENCE FOR DISRUPTION BY THE MODULATING SIGNAL SECTION 16: PLAUSIBLE GENETIC AND METABOLIC MECHANISMS FOR BIOEFFECTS OF VERY WEAK ELF MAGNETIC FIELDS ON LIVING TISSUE SECTION 17 EVIDENCE BASED ON EMF MEDICAL THERAPEUTICS SECTION 18: FERTILITY AND REPRODUCTION EFFECTS OF EMF SECTION 19: FETAL AND NEONATAL EFFECTS OF EMF SECTION 20: FINDINGS IN AUTISM CONSISTENT WITH EMF AND RFR	
[4] Pall, ML. 2013. Electromagnetic fields act via activation of voltage-gated calcium channels to produce beneficial or adverse effects. J Cell Mol Med 17:958-965. doi: 10.1111/jcmm.12088.	The direct targets of extremely low and microwave frequency range electromagnetic fields (EMFs) in producing non-thermal effects have not been clearly established. However, studies in the literature, reviewed here, provide substantial support for such direct targets. Twenty-three studies have shown that voltage-gated calcium channels (VGCCs) produce these and other EMF effects, such that the L-type or other VGCC blockers block or greatly lower diverse EMF effects. Furthermore, the voltage-gated properties of these channels may provide biophysically plausible mechanisms for EMF biological effects. Downstream responses of such EMF exposures may be mediated through Ca(2+) /calmodulin stimulation of nitric oxide synthesis. Potentially, physiological/therapeutic responses may be largely as a result of nitric oxide-cGMP-protein kinase G pathway stimulation. A well-studied example of such an apparent therapeutic response, EMF stimulation of bone growth, appears to work along this pathway. However, pathophysiological responses to EMFs may be as a result of nitric oxide-peroxynitrite-oxidative stress pathway of action. A single such well-documented example, EMF induction of DNA single-strand breaks in cells, as measured by alkaline comet assays, is reviewed here. Such single-strand breaks are	This was cited. Sole statement is: "(see Pall, 2013 for a review of studies suggesting effects through voltage-gated calcium channels)." None of the important implications listed on the left are used in any way in the rest of the SCENIHR 2015 document See text for further discussion..

	known to be produced through the action of this pathway. Data on the mechanism of EMF induction of such breaks are limited; what data are available support this proposed mechanism. Other Ca(2+) - mediated regulatory changes, independent of nitric oxide, may also have roles. This article reviews, then, a substantially supported set of targets, VGCCs, whose stimulation produces non-thermal EMF responses by humans/higher animals with downstream effects involving Ca(2+) /calmodulin-dependent nitric oxide increases, which may explain therapeutic and pathophysiological effects.	
[95] Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	The aim of the study was to discuss the mechanisms and risk factors of EMR changes on reproductive functions and membrane oxidative biology in females and males. It was reported that even chronic exposure to EMR did not increase the risk of reproductive functions such as increased levels of neoantigens abort. However, the results of some studies indicate that EMR induced endometriosis and inflammation and decreased the number of follicles in the ovarium or uterus of rats. In studies with male rats, exposure caused degeneration in the seminiferous tubules, reduction in the number of Leydig cells and testosterone production as well as increases in luteinizing hormone levels and apoptotic cells. In some cases of male and female infertility, increased levels of oxidative stress and lipid peroxidation and decreased values of antioxidants such as melatonin, vitamin E and glutathione peroxidase were reported in animals exposed to EMR. In conclusion, the results of current studies indicate that oxidative stress from exposure to Wi-Fi and mobile phone-induced EMR is a significant mechanism affecting female and male reproductive systems.	This was listed on p.285 under ***Literature identified but not cited.*** SCENIHR chose not to cite or discuss this paper, although they had identified it.
[96] Ledoigt G, Belpomme D. 2013 Cancer induction molecular pathways and HF-EMF irradiation. Adv Biol Chem 3:177-186.	The response of cells to different types of electromagnetic fields can be induced by low-level (athermal) high frequency (HF) electromagnetic fields (EMFs) exposure associated with mobile phone technologies. There are many examples of biological effects involving the epigenome. EMFs could trigger protein activation mediated by ligands, such as Ca2+, that alter the conformation of binding proteins, especially the NADPH plasmic membrane oxidase, so inducing increased formation of reactive oxygen species (ROS) that may alter proteomic functions. Classical anti-apoptotic and procarcinogenic signaling pathways that are commonly found activated in human malignancies and in inflammation mainly involve the tran-	Nothing. Review is not cited and not discussed.

	scription factor NF-κB. The microenvironment that exists during chronic inflammation can contribute to cancer progression. The data support the proposition that long term HF-EMF exposure associated with improper use of cell phones can potentially cause cancer.	
[97] Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	BACKGROUND: Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. An increased risk of brain tumors is a major concern. The International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) evaluated the carcinogenic effect to humans from RF-EMF in May 2011. It was concluded that RF-EMF is a group 2B, i.e., a "possible", human carcinogen. Bradford Hill gave a presidential address at the British Royal Society of Medicine in 1965 on the association or causation that provides a helpful framework for evaluation of the brain tumor risk from RF-EMF. METHODS:All nine issues on causation according to Hill were evaluated. Regarding wireless phones, only studies with long-term use were included. In addition, laboratory studies and data on the incidence of brain tumors were considered. RESULTS: The criteria on strength, consistency, specificity, temporality, and biologic gradient for evidence of increased risk for glioma and acoustic neuroma were fulfilled. Additional evidence came from plausibility and analogy based on laboratory studies. Regarding coherence, several studies show increasing incidence of brain tumors, especially in the most exposed area. Support for the experiment came from antioxidants that can alleviate the generation of reactive oxygen species involved in biologic effects, although a direct mechanism for brain tumor carcinogenesis has not been shown. In addition, the finding of no increased risk for brain tumors in subjects using the mobile phone only in a car with an external antenna is supportive evidence. Hill did not consider all the needed nine viewpoints to be essential requirements. CONCLUSION:Based on the Hill criteria, glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones and regarded as carcinogenic to humans, classifying it as group 1 according to the IARC classification. Current guidelines for exposure need to be urgently revised.	Nothing. Review is not cited and not discussed. The Hill criteria are THE well-accepted way of analyzing biological plausiblility of epidemiologic al evidence. It is unacceptable for SCENIHR not to consider this review when attempting to analyze epidemiologic al evidence of EMF cancer causation.
[98] Hardell L, Carlberg M, Hansson Mild K. 2013 Use of	The International Agency for Research on Cancer (IARC) at WHO evaluation of the carcinogenic effect of RF-EMF on humans took place during a 24-31 May	This paper is cited and discussed

mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	2011 meeting at Lyon in France. The Working Group consisted of 30 scientists and categorised the radiofrequency electromagnetic fields from mobile phones, and from other devices that emit similar non-ionising electromagnetic fields (RF-EMF), as Group 2B, i.e., a 'possible', human carcinogen. The decision on mobile phones was based mainly on the Hardell group of studies from Sweden and the IARC Interphone study. We give an overview of current epidemiological evidence for an increased risk for brain tumours including a meta-analysis of the Hardell group and Interphone results for mobile phone use. Results for cordless phones are lacking in Interphone. The meta-analysis gave for glioma in the most exposed part of the brain, the temporal lobe, odds ratio (OR)=1.71, 95% confidence interval (CI)=1.04-2.81 in the ≥10 years (>10 years in the Hardell group) latency group. Ipsilateral mobile phone use ≥1640h in total gave OR=2.29, 95% CI=1.56-3.37. The results for meningioma were OR=1.25, 95% CI=0.31-4.98 and OR=1.35, 95% CI=0.81-2.23, respectively. Regarding acoustic neuroma ipsilateral mobile phone use in the latency group ≥10 years gave OR=1.81, 95% CI=0.73-4.45. For ipsilateral cumulative use ≥1640h OR=2.55, 95% CI=1.50-4.40 was obtained. Also use of cordless phones increased the risk for glioma and acoustic neuroma in the Hardell group studies. Survival of patients with glioma was analysed in the Hardell group studies yielding in the >10 years latency period hazard ratio (HR)=1.2, 95% CI=1.002-1.5 for use of wireless phones. This increased HR was based on results for astrocytoma WHO grade IV (glioblastoma multiforme). Decreased HR was found for low-grade astrocytoma, WHO grades I-II, which might be caused by RF-EMF exposure leading to tumour-associated symptoms and earlier detection and surgery with better prognosis. Some studies show increasing incidence of brain tumours whereas other studies do not. It is concluded that one should be careful using incidence data to dismiss results in analytical epidemiology. The IARC carcinogenic classification does not seem to have had any significant impact on governments' perceptions of their responsibilities to protect public health from this widespread source of radiation.	very briefly. See text for discussion.
[99] Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that	Mobile phones are two-way microwave radios that also emit low levels of electromagnetic radiation. Inconsistent results have been published on potential risks of brain tumors tied with mobile phone use as a result of important methodological differences in study design and statistical power. Some studies have	Nothing. Review is not cited and not discussed.

radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	examined mobile phone users for periods of time that are too short to detect an increased risk of brain cancer, while others have misclassified exposures by placing those with exposures to microwave radiation from cordless phones in the control group, or failing to attribute such exposures in the cases. In 2011, the World Health Organization, International Agency for Research on Cancer (IARC) advised that electromagnetic radiation from mobile phone and other wireless devices constitutes a "possible human carcinogen," 2B. Recent analyses not considered in the IARC review that take into account these methodological shortcomings from a number of authors find that brain tumor risk is significantly elevated for those who have used mobile phones for at least a decade. Studies carried out in Sweden indicate that those who begin using either cordless or mobile phones regularly before age 20 have greater than a fourfold increased risk of ipsilateral glioma. Given that treatment for a single case of brain cancer can cost between $100,000 for radiation therapy alone and up to $1 million depending on drug costs, resources to address this illness are already in short supply and not universally available in either developing or developed countries. Significant additional shortages in oncology services are expected at the current growth of cancer. No other environmental carcinogen has produced evidence of an increased risk in just one decade. Empirical data have shown a difference in the dielectric properties of tissues as a function of age, mostly due to the higher water content in children's tissues. High resolution computerized models based on human imaging data suggest that children are indeed more susceptible to the effects of EMF exposure at microwave frequencies. If the increased brain cancer risk found in young users in these recent studies does apply at the global level, the gap between supply and demand for oncology services will continue to widen. Many nations, phone manufacturers, and expert groups, advise prevention in light of these concerns by taking the simple precaution of "distance" to minimize exposures to the brain and body. We note that brain cancer is the proverbial "tip of the iceberg"; the rest of the body is also showing effects other than cancers.	

Of these 22 reviews, 19 are found in the PubMed database, the most widely used medical database in the world, so there is no excuse for not discussing these 19, but only two of them were discussed (see below). With regard to the eight different types of effects that I consider established non-thermal EMF effects, each of them were reviewed in multiple studies described in Table 3 as follows: Cancer 12 reviews [78,82,83-87,90,94,96-98]; Oxidative stress/free

radicals 8 reviews [79,80,84,90,92,-96]; Cellular DNA damage 10 review [4,79,80-82,84,90-92,94]; Apoptosis/cell death 3 reviews [79,82,91]; Lowered fertility 7 reviews [80,86,89,92-95]; Neurological/neuropsychiatric effects 4 reviews [80,87,88,94]; Calcium overload 4 reviews [4,91,92,96]; Endocrine effects 2 reviews [92,95]. It is not clear why so many important reviews on effects are not found in SCENIHR 2015 [73]. What is perhaps surprising, is that these reviews also document many other effects, none of which are clearly acknowledged by SCENIHR. These include stress responses; breakdown of the blood-brain barrier; fetal and neonatal effects; therapeutic effects; Alzheimer's disease; increased nitric oxide; endometriosis; changes in protein levels (proteomics) and changes in gene expression; NF-kappaB elevation; increased suicide; changes in protein kinase activity including ERK and p32MAPK; mechanisms associated with oxidative stress including elevated NADPH/NADH oxidase increased lipid peroxidation and decreased enzymatic antioxidant activity, increased ornithine decarboxylase; and autism. It can be seen from this that the SCENIHR 2015 document seems to be systematically avoiding considering substantial bodies of evidence regarding a very large range of repeatedly reported EMF effects, each of which challenges the SCENIHR position that no effects are established.

Three specific issues regarding apparent cancer causation by EMFs need to be discussed here. Five of these reviews each review a body of evidence showing that cancer rates are higher on the side of the head where people use their cell phones and cordless phones, the ipsilateral side, as opposed to the opposite side of the head, called the contralateral side [78,84,85,98,99]. These are very important studies because they are not likely to be affcctcd by how complete the reporting data are, or whether there are affects produced by chemicals, ionizing radiation or other EMFs; each of these factors should not be specific for the side of the head impacted. The contralateral side of the head serves as a control that can be compared with the ipsilateral side of the head. What is strange about the SCENIHR 2015 document, is that it avoids discussing all of these data presented in these five reviews. That is even true for [98] which is discussed very briefly in SCENIHR 2015. Only one body of evidence from [98] is discussed in SCENIHR 2015 but several others are not discussed, including the two bodies of evidence which each find statistically significant rises in ipsilateral cancer as compared with contralateral cancer. The ipsilateral findings produce very strong arguments that cell phones and/or cordless phones do cause brain cancer in humans. The best evidence suggests that both cell phones and cordless phones do cause cancer. What does SCENIHR 2015 [73] say about ipsilateral cancer? [73] states, on p. 74 that "ORs for glioma were higher in subjects who reported phone use mostly on the same side of the head (ipsilateral) as their tumour than for use on the opposite side (contralateral). For meningioma, ORs for temporal lobe tumours were slightly lower than for other locations, while a similar pattern as for glioma of higher ipsilateral ORs compared to contralateral ORs was seen." On p. 76, SCENIHR states that "Afterwards, in an attempt to quantify the relationship, Interphone and the Hardell studies were analysed in a meta-analytical approach (Hardell et al., 2013a), an OR of 1.71 (CI: 1.04-2.81) was found for temporal glioma among ipsilateral mobile phone users of 10+ years of use…." On p. 77, regarding a study designed to assess the reliability of self-reported cell phone usage in young brain cancer patients, a study **not** designed to assess ipsilateral effects in patients whose cancer cases may likely have been caused by cell phone usage, the SCENIHR 2015 document states "No clear patterns were seen when comparing ipsilateral and contralateral use." That is not surprising. It can be seen from this that 2 out of 3 studies that SCENIHR discussed argue that there is increased ipsilateral cancer and argue therefore that cell phones or cordless phones do cause cancer. Furthermore, they ignore large amounts of data, cited in [78,84,85,98,99] that provide further support for this view. When SCENIHR wishes to take the opposite position from that taken in these reviews, it is incumbent on SCENIHR to cite them, to discuss the data and opinion presented in those reviews and then and only then can they argue for their position. Having failed to do those things, SCENIHR loses credibility in any argument that they are doing what they can to protect our

health. The same is true for all of the other effects where they similarly fail to cite large numbers of obviously relevant reviews, each arguing for various health effects produced by EMF exposures.

Two other findings from these reviews are important in assessing EMF cancer causation. Refs. [85 and 99] each provide evidence that younger people are more susceptible to cancer causation by EMFs than are adults. SCENIHR takes the opposite view but cannot argue credibly without considering those who differ. The other finding found in [97] is that the epidemiological evidence on cancer causation by microwave frequency EMFs satisfies most of the Hill criteria. The Hill criteria are THE well-accepted criteria that allow one to distinguish chance associations from causal roles in epidemiology. Because epidemiology is the main basis for the arguments that SCENIHR makes against the conclusion that EMFs cause cancer, it is essential that SCENIHR carefully examine the Hill criteria. They fail to do so. They also ignored this study where these criteria were examined and where it was concluded that the majority of the Hill criteria argue that EMFs do cause cancer. This again, undercuts any claim that SCENIHR has carefully considered critically important findings with regard to EMF health effects.

There are several places in the SCENIHR 2015 document, where they state that no mechanisms have been identified by which claimed effects of EMFs can be produced. These can be found by searching the SCENIHR 2015 document using "mechanism" as the search term. However [4] clearly states that the VGCC activation mechanism triggered by EMF exposure can produce, via this mechanism, cellular DNA damaging effects, can produce therapeutic effects and can produce oxidative stress effects. It can be seen, therefore that SCENIHR has no problem making repeated claims that have been falsified by information that they presumably have examined. It also can be seen from this, that even in the cases where SCENIHR cites and very briefly discusses a review that disagrees with them, one can have no assurance that the information is used by SCENIHR in its assessment of health impacts. The causation of cellular DNA damage by EMFs acting via VGCC activation also has important implications with regard to cancer causation. Because almost all cases of cancer start with mutagenic DNA damage in the cell destined to become a cancer cell, this shows how EMFs can initiate the process of carcinogenesis.

It is clear that the SCENIHR 2015 document neither cited nor discussed 20 out of 22 reviews that have documented non-thermal effects of EMFs. In addition, the most important findings of the two that were cited in the document were ignored in the document as well. Therefore SCENIHR has systematically avoided discussing the most important implications of reviews that fell into the time frame they purport to have studied and disagreed with SCENIHR on the existence of important effects. The question can be raised, however, as to whether the SCENIHR has done a better job in its consideration of primary literature citations. To answer that question, I am using a database of important primary literature, regarding effects of cell phone EMFs that we are commonly exposed to.

<u>23 Genuine Cell Phone Studies, Each of Which Should Be Discussed in SCENIHR 2015, 20 of Which Are Not.</u>

Panagopoulos et al [100] showed that whereas 46 out of 48 studies on genuine cell phone radiation showed health-related effects, the majority of studies on simulated cell phones reported no statistically significant effects. They [100] interpreted the difference of results as having been caused by the lowered pulsation rate of the "simulated" cell phone exposures. While I am sure that is part of the explanation, there may be other possible differences that are discussed later in this chapter.

Of those 48 genuine cell phone studies, 23 fell into the time frame (Jan. 2009 through Dec. 2013) reviewed in SCENIHR, 2015. Because of the importance of cell phones and therefore cell phone radiation in our lives, I am using these 23 as a database of primary literature studies that should all be covered in the SCENIHR 2015 [73] document. How many of these 23 were reviewed and cited in SCENIHR 2015? The answer is four (17%) and I will discuss how each of them were discussed below. I have inserted 17 of these into Table 4 below, but six were left out, because they are easy to summarize. These six are all Drosophila studies, none of which were discussed in SCENIHR 2015 [73] but are easy to summarize. All six Drosophila studies were focused on lowered fertility following EMF exposure, with the majority of these focused on lowered female fertility. Four of the six found increased apoptosis following cell phone EMF exposaure and four of the six also found cellular DNA damage following exposure. These are important because of the similarities of each of these effects to effects found in mammals. They are also important because they found DNA damage in Drosophila eggs, whereas mammalian eggs no similar studies have been done because of the difficulty in doing so. Two of these six Drosophila studies, also identified a low intensity exposure window which produced much larger effects than did lower or higher intensities. These exposure windows make it difficult or impossible to predict EMF effects based on EMF intensities. However, the industry and industry friendly groups such as SCENIHR repeatedly make such false predictions.

In mammals there are many studies showing DNA damage in sperm following EMF exposure. This DNA damage in germ line cells is particularly importance because of the importance of mutations passed onto progeny. Table 4 summarizes the other 17 genuine cell phone radiation findings that that SCENIHR 2015 [73] should be discussing, 15 of which were not discussed or cited in SCENIHR 2015.

Table 4: Genuine Cell Phone Studies that Fell into the 2009 through 2013 SCENIHR 2015 period

Citation studied	Cell Phone Effects Reported	SCENIHR comments
1. Mailankot M, Kunnath AP, Jayalekshmi H, Koduru B, Valsalan R. 2009 Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. Clinics (Sao Paulo) 64:561-565.	The present study was designed to evaluate the effects of RF-EMR from mobile phones on free radical metabolism and sperm quality. MATERIALS AND METHODS: Male albino Wistar rats (10-12 weeks old) were exposed to RF-EMR from an active GSM (0.9/1.8 GHz) mobile phone for 1 hour continuously per day for 28 days. Controls were exposed to a mobile phone without a battery for the same period. The phone was kept in a cage with a wooden bottom in order to address concerns that the effects of exposure to the phone could be due to heat emitted by the phone rather than to RF-EMR alone. Animals were sacrificed 24 hours after the last exposure and tissues of interest were harvested. RESULTS: One hour of exposure to the phone did not significantly change facial temperature in either group of rats. No significant difference was observed in total sperm count between controls and RF-EMR exposed groups. However, rats exposed to RF-EMR exhibited a significantly reduced percentage of motile sperm. Moreover, RF-EMR exposure resulted in a significant increase in lipid peroxidation and low GSH content in the testis and epididymis.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

	CONCLUSION: Given the results of the present study, we speculate that RF-EMR from mobile phones negatively affects semen quality and may impair male fertility.	
2. Gul A, Celebi H, Uğraş S. 2009 The effects of microwave emitted by cellular phones on ovarian follicles in rats. Arch Gynecol Obstet 280:729-733. doi: 10.1007/s00404-009-0972-9.	The aim of this study was to investigate whether there were any toxic effects of microwaves of cellular phones on ovaries in rats. METHODS: In this study, 82 female pups of rats, aged 21 days (43 in the study group and 39 in the control group) were used. Pregnant rats in the study group were exposed to mobile phones that were placed beneath the polypropylene cages during the whole period of pregnancy. The cage was free from all kinds of materials, which could affect electromagnetic fields. A mobile phone in a standby position for 11 h and 45 min was turned on to speech position for 15 min every 12 h and the battery was charged continuously. On the 21st day after the delivery, the female rat pups were killed and the right ovaries were removed. The volumes of the ovaries were measured and the number of follicles in every tenth section was counted. RESULTS: The analysis revealed that in the study group, the number of follicles was lower than that in the control group. The decreased number of follicles in pups exposed to mobile phone microwaves suggest that intrauterine exposure has toxic effects on ovaries. CONCLUSION: We suggest that the microwaves of mobile phones might decrease the number of follicles in rats by several known and, no doubt, countless unknown mechanisms.	Not cited and not discussed by SCENIHR.
3. Imge EB, Kiliçoğlu B, Devrim E, Cetin R, Durak I. 2010 Effects of mobile phone use on brain tissue from the rat and a possible protective role of vitamin C - a preliminary study. Int J Radiat Biol 86:1044-1049. doi: 10.3109/09553002.2010.501838.	To evaluate effects of mobile phone use on brain tissue and a possible protective role of vitamin C. MATERIALS AND METHODS: Forty female rats were divided into four groups randomly (Control, mobile phone, mobile phone plus vitamin C and, vitamin C alone). The mobile phone group was exposed to a mobile phone signal (900 MHz), the mobile phone plus vitamin C group was exposed to a mobile phone signal (900 MHz) and treated with vitamin C administered orally (per os). The vitamin C group was also treated with vitamin C per os for four weeks. Then, the animals were sacrificed and brain tissues were dissected to be used in the analyses of malondialdehyde (MDA), antioxidant potential (AOP), superoxide dismutase, catalase (CAT), glutathione peroxidase (GSH-Px), xanthine oxidase, adenosine deaminase (ADA) and 5'nucleotidase (5'-NT). RESULTS: Mobile phone use caused an inhibition in 5'-NT and CAT activities as compared to the control group. GSH-Px activity and the MDA level were also found to be reduced in the mobile phone group but not significantly. Vitamin C caused a significant increase in the activity of GSH-Px and non-significant increase in the activities of 5'-NT,	Not cited and not discussed by SCENIHR.

	ADA and CAT enzymes. CONCLUSION: Our results suggest that vitamin C may play a protective role against detrimental effects of mobile phone radiation in brain tissue.	
4. Sharma VP, Kumar NR. 2010 Changes in honeybee behavior under the influence of cell phone radiation. Curr Science 98: 1376-1378.	Honeybee behaviour and biology has been affected by electrosmog since these insects have magnetite in their bodies which helps them in navigation. There are reports of sudden disappearance of bee populations from honeybee colonies. The reason is still not clear. We have compared the performance of honeybees in cellphone radiation exposed and unexposed colonies. A significant ($p < 0.05$) decline in colony strength and in the egg laying rate of the queen was observed. The behaviour of exposed foragers was negatively influenced by the exposure, there was neither honey nor pollen in the colony at the end of the experiment.	Not cited and not discussed by SCENIHR.
5. Vecchio F, Babiloni C, Ferreri F, Buffo P, Cibelli G, Curcio G, van Dijkman S, Melgari JM, Giambattistelli F, Rossini PM. 2010 Mobile phone emission modulates inter-hemispheric functional coupling of EEG alpha rhythms in elderly compared to young subjects. Clin Neurophysiol 121:163-171. doi: 10.1016/j.clinph.2009.11.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate--after a prolonged exposure--inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young subjects [Vecchio et al., 2007]. Here we tested the hypothesis that this effect can vary on physiological aging as a sign of changes in the functional organization of cortical neural synchronization. METHODS: Eyes-closed resting EEG data were recorded in 16 healthy elderly subjects and 5 young subjects in the two conditions of the previous reference study. The GSM device was turned on (45 min) in one condition and was turned off (45 min) in the other condition. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha 1 (about 6-8 Hz), alpha 2 (about 8-10 Hz), and alpha 3 (about 10-12 Hz). The aging effects were investigated comparing the inter-hemispheric EEG coherence in the elderly subjects vs. a young group formed by 15 young subjects (10 young subjects of the reference study; Vecchio et al., 2007). RESULTS: Compared with the young subjects, the elderly subjects showed a statistically significant ($p<0.001$) increment of the inter-hemispheric coherence of frontal and temporal alpha rhythms (about 8-12 Hz) during the GSM condition. CONCLUSIONS: These results suggest that GSM-EMFs of a mobile phone affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms as a function of the physiological aging. SIGNIFICANCE: This study provides further evidence that physiological aging is related to changes in the functional organization of cortical neural synchronization.	Was cited and discussed – see text.
6. Kumar NR,	The present study was carried out to find the effect of cell	Not cited

Sangwan S, Badotra P. 2011 Exposure to cell phone radiations produces biochemical changes in worker honey bees. Toxicol Int. 2011 Jan;18(1):70-2. doi: 10.4103/0971-6580.75869.	phone radiations on various biomolecules in the adult workers of Apis mellifera L. The results of the treated adults were analyzed and compared with the control. Radiation from the cell phone influences honey bees' behavior and physiology. There was reduced motor activity of the worker bees on the comb initially, followed by en masse migration and movement toward "talk mode" cell phone. The initial quiet period was characterized by rise in concentration of biomolecules including proteins, carbohydrates and lipids, perhaps due to stimulation of body mechanism to fight the stressful condition created by the radiations. At later stages of exposure, there was a slight decline in the concentration of biomolecules probably because the body had adapted to the stimulus.	and not discussed by SCENIHR.
7. Favre D. 2011 Mobile phone-induced honeybee worker piping. Apidologie 42:270-279.	Electromagnetic waves originating from mobile phones were tested for potential effects on honeybee behavior. Mobile phone handsets were placed in the close vicinity of honeybees. The sound made by the bees was recorded and analyzed. The audiograms and spectrograms revealed that active mobile phone handsets have a dramatic impact on the behavior of the bees, namely by inducing the worker piping signal. In natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony.	Not cited and not discussed by SCENIHR.
8. Cammaerts MC, Debeir O, Cammaerts R. 2011. Changes in Paramecium caudatum (protozoa) near a switched-on GSM telephone. Electromagn Biol Med. 2011 Mar;30(1):57-66. doi: 10.3109/15368378.2011.566778.	The protozoan Paramecium caudatum was examined under normal conditions versus aside a switched-on GSM telephone (900 MHz; 2 Watts). Exposed individuals moved more slowly and more sinuously than usual. Their physiology was affected: they became broader, their cytopharynx appeared broader, their pulse vesicles had difficult in expelling their content outside the cell, their cilia less efficiently moved, and trichocysts became more visible. All these effects might result from some bad functioning or damage of the cellular membrane. The first target of communication electromagnetic waves might thus be the cellular membrane.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.
9. Çam ST, Seyhan N. 2012 Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88:420-424. doi: 10.3109/09553002.2012.666005.	To analyze the short-term effects of radiofrequency radiation (RFR) exposure on genomic deoxyribonucleic acid (DNA) of human hair root cells. SUBJECTS AND METHODS: Hair samples were collected from eight healthy human subjects immediately before and after using a 900-MHz GSM (Global System for Mobile Communications) mobile phone for 15 and 30 min. Single-strand DNA breaks of hair root cells from the samples were determined using the 'comet assay'. RESULTS: The data showed that talking on a mobile phone for 15 or 30 min significantly increased ($p < 0.05$) single-strand DNA breaks in cells of hair roots close to the phone. Comparing the 15-min and 30-min data using the paired t-	Not cited and not discussed by SCENIHR.

	test also showed that significantly more damages resulted after 30 min than after 15 min of phone use. CONCLUSIONS: A short-term exposure (15 and 30 min) to RFR (900-MHz) from a mobile phone caused a significant increase in DNA single-strand breaks in human hair root cells located around the ear which is used for the phone calls.	
10. Vecchio F, Tombini M, Buffo P, Assenza G, Pellegrino G, Benvenga A, Babiloni C, Rossini PM. 2012 Mobile phone emission increases inter-hemispheric functional coupling of electroencephalographic α rhythms in epileptic patients. Int J Psychophysiol 84:164-171. doi: 10.1016/j.ijpsycho.2012.02.002.	It has been reported that GSM electromagnetic fields (GSM-EMFs) of mobile phones modulate - after a prolonged exposure - inter-hemispheric synchronization of temporal and frontal resting electroencephalographic (EEG) rhythms in normal young and elderly subjects (Vecchio et al., 2007, 2010). Here we tested the hypothesis that this can be even more evident in epileptic patients, who typically suffer from abnormal mechanisms governing synchronization of rhythmic firing of cortical neurons. Eyes-closed resting EEG data were recorded in ten patients affected by focal epilepsy in real and sham exposure conditions. These data were compared with those obtained from 15 age-matched normal subjects of the previous reference studies. The GSM device was turned on (45 min) in the "GSM" condition and was turned off (45 min) in the other condition ("sham"). The mobile phone was always positioned on the left side in both patients and control subjects. Spectral coherence evaluated the inter-hemispheric synchronization of EEG rhythms at the following frequency bands: delta (about 2-4 Hz), theta (about 4-6 Hz), alpha1 (about 6-8 Hz), alpha2 (about 8-10 Hz), and alpha3 (about 10-12 Hz). The effects on the patients were investigated comparing the inter-hemispheric EEG coherence in the epileptic patients with the control group of subjects evaluated in the previous reference studies. Compared with the control subjects, epileptic patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha rhythms (about 8-12 Hz) in the GSM than "Sham" condition. These results suggest that GSM-EMFs of mobile phone may affect inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients. If confirmed by future studies on a larger group of epilepsy patients, the modulation of the inter-hemispheric alpha coherence due to the GSM-EMFs could have clinical implications and be related to changes in cognitive-motor function.	Was cited and discussed – see text.
11. Al-Damegh MA. 2012 Rat testicular impairment induced by electromagnetic radiation from a conventional cellular	OBJECTIVE: The aim of this study was to investigate the possible effects of electromagnetic radiation from conventional cellular phone use on the oxidant and antioxidant status in rat blood and testicular tissue and determine the possible protective role of vitamins C and E in preventing the detrimental effects of electromagnetic	Listed under literature identified but not cited.

telephone and the protective effects of the antioxidants vitamins C and E. Clinics 67:785-792	radiation on the testes. MATERIALS AND METHODS: The treatment groups were exposed to an electromagnetic field, electromagnetic field plus vitamin C (40 mg/kg/day) or electromagnetic field plus vitamin E (2.7 mg/kg/day). All groups were exposed to the same electromagnetic frequency for 15, 30, and 60 min daily for two weeks. RESULTS: There was a significant increase in the diameter of the seminiferous tubules with a disorganized seminiferous tubule sperm cycle interruption in the electromagnetism-exposed group. The serum and testicular tissue conjugated diene, lipid hydroperoxide, and catalase activities increased 3-fold, whereas the total serum and testicular tissue glutathione and glutathione peroxidase levels decreased 3-5 fold in the electromagnetism-exposed animals. CONCLUSION: Our results indicate that the adverse effect of the generated electromagnetic frequency had a negative impact on testicular architecture and enzymatic activity. This finding also indicated the possible role of vitamins C and E in mitigating the oxidative stress imposed on the testes and restoring normality to the testes.	SCENIHR knew about this paper but decided not to discuss it.
12. Aldad TS, Gan G, Gao X-B, Taylor HS. 2012 Fetal radiofrequency radiation from 800-1900 MH-rated cellular telephone affects neurodevelopment and behavior in mice. Scientific Rep 2, article 312.	Neurobehavioral disorders are increasingly prevalent in children, however their etiology is not well understood. An association between prenatal cellular telephone use and hyperactivity in children has been postulated, yet the direct effects of radiofrequency radiation exposure on neurodevelopment remain unknown. Here we used a mouse model to demonstrate that in-utero radiofrequency exposure from cellular telephones does affect adult behavior. Mice exposed in-utero were hyperactive and had impaired memory as determined using the object recognition, light/dark box and step-down assays. Whole cell patch clamp recordings of miniature excitatory postsynaptic currents (mEPSCs) revealed that these behavioral changes were due to altered neuronal developmental programming. Exposed mice had dose-responsive impaired glutamatergic synaptic transmission onto layer V pyramidal neurons of the prefrontal cortex. We present the first experimental evidence of neuropathology due to in-utero cellular telephone radiation. Further experiments are needed in humans or non-human primates to determine the risk of exposure during pregnancy.	Was cited and discussed, see text.
13. Liu C, Gao P, Xu SC, Wang Y, Chen CH, He MD, Yu ZP, Zhang L, Zhou Z. 2013 Mobile phone radiation induces mode-dependent	A mouse spermatocyte-derived GC-2 cell line was exposed to a commercial mobile phone handset once every 20 min in standby, listen, dialed or dialing modes for 24 h. DNA damage was determined using an alkaline comet assay. RESULTS: The levels of DNA damage were significantly increased following exposure to MPR in the listen, dialed and dialing modes. Moreover, there	Not cited and not discussed by SCENIHR.

DNA damage in a mouse spermatocyte-derived cell line: a protective role of melatonin. Int J Radiat Biol. 2013. 89: 993-1001. doi: 10.3109/09553002.2013.811309.	were significantly higher increases in the dialed and dialing modes than in the listen mode. Interestingly, these results were consistent with the radiation intensities of these modes. However, the DNA damage effects of MPR in the dialing mode were efficiently attenuated by melatonin pretreatment. CONCLUSIONS: These results regarding mode-dependent DNA damage have important implications for the safety of inappropriate mobile phone use by males of reproductive age and also suggest a simple preventive measure: Keeping mobile phones as far away from our body as possible, not only during conversations but during 'dialed' and 'dialing' operation modes. Since the 'dialed' mode is actually part of the standby mode, mobile phones should be kept at a safe distance from our body even during standby operation. Furthermore, the protective role of melatonin suggests that it may be a promising pharmacological candidate for preventing mobile phone use-related reproductive impairments.	
14. Koca O, Gökçe AM, Öztürk MI, Ercan F, Yurdakul N, Karaman MI. 2013 Effects of intensive cell phone (Philips Genic 900) use on the rat kidney tissue. Urol J. 2013 Spring;10:886-891.	To investigate effects of electromagnetic radiation (EMR) emitted by cell phones on the rat kidney tissue. MATERIALS AND METHODS: Twenty-one male Albino rats were divided into 3 groups, each comprising 7 rats. Group 1 was exposed to a cell phone in speech mode for 8 hours/day for 20 days and their kidneys were removed. Group 2 was exposed to EMR for 20 days and then their kidneys were removed after an interval of 20 days. Cell phone used in the present study was Philips Genie 900, which has the highest specific absorption rate on the market. RESULTS: Light microscopic examination of the kidney tissues obtained from the first group of rats revealed glomerular damage, dilatation of Bowman's capsule, formation of large spaces between the tubules, tubular damage, perivascular edema, and inflammatory cell infiltration. The mean severity score was 4.64 ± 1.7 in group 1, 4.50 ± 0.8 in group 2, and 0 in group 3. While there was no significant difference between group 1 and group 2 ($P > .05$), the mean severity scores of groups 1 and 2 were significantly higher than that of the control group ($P = .001$ for each). CONCLUSION: Considering the damage in rat kidney tissue caused by EMR-emitting cell phones, high-risk individuals should take protective measures.	Not cited and not discussed by SCENIHR.
15. Meo SA, Al Rubeaan K. 2013 Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile	Extensive use of mobile phones has been accompanied by a common public debate about possible adverse effects on human health. No study has been published so far to establish any association between the fastest growing innovation of mobile phone and fasting blood glucose. The aim was to determine the effects of exposure to electromagnetic field radiation generated by mobile	Not cited and not discussed by SCENIHR.

phones on fasting blood glucose. Int J Occup Med Environ Health 26:235-241. doi: 10.2478/s13382-013-0107-1.	phones on fasting blood glucose in Wistar Albino rats. MATERIALS AND METHODS: 40 Male Albino rats (Wistar Strain) were divided into 5 equally numerous groups. Group A served as the control one, group B received mobile phone radiation for less than 15 min/day, group C: 15-30 min/day, group D: 31-45 min/day, and group E: 46-60 min/day for a total period of 3 months. Fasting blood glucose was determined by using Spectrophotometer and serum insulin by Enzyme-linked Immunosorbent Assay (ELISA). The Homeostatic Model (HOMA-B) was applied for the assessment of β-cell function and (HOMA-IR) for resistance to insulin. RESULTS: Wister Albino rats exposed to mobile phone radiation for longer than 15 min a day for a total period of 3 months had significantly higher fasting blood glucose ($p < 0.015$) and serum insulin ($p < 0.01$) compared to the control group. HOMA-IR for insulin resistance was significantly increased ($p < 0.003$) in the groups that were exposed for 15-30 and 46-60 min/day compared to the control rats. CONCLUSION:The results of the present study show an association between long-term exposure to activated mobile phones and increase in fasting blood glucose and serum insulin in Albino rats.	
16. Tsybulin O, Sidorik E, Brieieva O, Buchynska L, Kyrylenko S, Henshel D, Yakymenko I. 2013 GSM 900 MHz cellular phone radiation can either stimulate or depress early embryogenesis in Japanese quails depending on the duration of exposure. Int J Radiat Biol 89:756-763. doi: 10.3109/09553002.2013.791408.	Our study was designed to assess the effects of low intensity radiation of a GSM (Global System for Mobile communication) 900 MHz cellular phone on early embryogenesis in dependence on the duration of exposure. MATERIALS AND METHODS: Embryos of Japanese Quails were exposed in ovo to GSM 900 MHz cellular phone radiation during initial 38 h of brooding or alternatively during 158 h (120 h before brooding plus initial 38 h of brooding) discontinuously with 48 sec ON (average power density 0.25 μW/cm(2), specific absorption rate 3 μW/kg) followed by 12 sec OFF intervals. A number of differentiated somites were assessed microscopically. Possible DNA damage evoked by irradiation was assessed by an alkaline comet assay. RESULTS: Exposure to radiation from a GSM 900 MHz cellular phone led to a significantly altered number of differentiated somites. In embryos irradiated during 38 h the number of differentiated somites increased ($p < 0.001$), while in embryos irradiated during 158 h this number decreased ($p < 0.05$). The lower duration of exposure led to a significant ($p < 0.001$) decrease in a level of DNA strand breaks in cells of 38-h embryos, while the higher duration of exposure resulted in a significant ($p < 0.001$) increase in DNA damage as compared to the control. CONCLUSION: Effects of GSM 900 MHz cellular phone radiation on early embryogenesis can be either stimulating or deleterious depending on the duration of exposure.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

17. Luo Q, Jiang Y, Jin M, Xu J, Huang HF. 2013 Proteomic analysis on the alteration of protein expression in the early-stage placental villous tissue of electromagnetic fields associated with cell phone exposure. Reprod Sci 20:1055-1061. doi: 10.1177/1933719112473660.	To explore the possible adverse effects and search for cell phone electromagnetic field (EMF)-responsive proteins in human early reproduction, a proteomics approach was employed to investigate the changes in protein expression profile induced by cell phone EMF in human chorionic tissues of early pregnancy in vivo. METHODS: Volunteer women about 50 days pregnant were exposed to EMF at the average absorption rate of 1.6 to 8.8 W/kg for 1 hour with the irradiation device placed 10 cm away from the umbilicus at the midline of the abdomen. The changes in protein profile were examined using 2-dimensional electrophoresis (2-DE). RESULTS: Up to 15 spots have yielded significant change at least 2- to 2.5-folds up or down compared to sham-exposed group. Twelve proteins were identified-procollagen-proline, eukaryotic translation elongation factor 1 delta, chain D crystal structure of human vitamin D-binding protein, thioredoxin-like 3, capping protein, isocitrate dehydrogenase 3 alpha, calumenin, Catechol-O-methyltransferase protein, proteinase inhibitor 6 (PI-6; SerpinB6) protein, 3,2-trans-enoyl-CoA isomerase protein, chain B human erythrocyte 2,3-bisphosphoglycerate mutase, and nucleoprotein. CONCLUSION: Cell phone EMF might alter the protein profile of chorionic tissue of early pregnancy, during the most sensitive stage of the embryos. The exposure to EMF may cause adverse effects on cell proliferation and development of nervous system in early embryos. Furthermore, 2-DE coupled with mass spectrometry is a promising approach to elucidate the effects and search for new biomarkers for environmental toxic effects.	Listed under literature identified but not cited. SCENIHR knew about this paper but decided not to discuss it.

If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated, as being caused be cell phone radiation, in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here. One question that needs to be raised with regard to SCENIHR is why so many clearly important primary literature studies of cell phone radiation (perhaps the most important source of human microwave irradiation) are not discussed in SCENIHR 2015. I will discuss certain particular articles that I think are particularly important for *particular reasons*. Subsequently, I will discuss the three articles that SCENIHR does discuss.

One of the more interesting studies not discussed by SCENIHR, is #11 in Table 4. This was published by a woman scientist in Saudi Arabia. What it shows is that 15, 30 or 60 minutes per day of cell phone radiation disrupts the structure of the rat testis and also produces high levels of oxidative stress as shown by measuring 5 different markers of oxidative stress. Such studies have been done for several decades, with oxidative stress having been shown in many different organs

following EMF exposures. What is particularly important in this study is that high levels of two different antioxidants, vitamin C and vitamin E, were each shown to produce substantial protection of the testis structure from the EMF effects while partially normalizing the oxidative stress elevation. What this clearly shows is that the oxidative stress causes the testis tissue disruption. So we don't just have evidence for two effects, testis disruption and oxidative stress but we have strong evidence that one causes the other. It is exactly these connections that are essential for the progression of the science!

13 is another study not discussed by SCENIHR which is particularly important. It looks at cell phone radiation DNA damage produced in a mouse spermatocyte-derived cell line. What it finds is that DNA damage is particularly high when the cell phone is in the dialed or dialing mode, as opposed to a listen mode. They also state that the radiation levels in the three modes correspond, at least roughly, to the DNA damage effects seen. They also show that pretreatment with melatonin (which is known to have antioxidant effects) greatly lowers the DNA damage produced by the cell phone EMF exposures. This is similar to the study discussed immediately above because it again shows that one effect, DNA damage is produced by another effect, namely oxidative stress/free radical elevation. You will recall that as discussed in Chapter 2, cellular DNA damage following EMF exposure is produced by the attacks by on the DNA by peroxynitrite derived free radicals. This study provides confirmation for that mechanism.

#14 is another study not discussed by SCENIHR which is also particularly important. It looks at the impact of cell phone radiation on kidney structure of rats, using six different measures of kidney structure. There were two groups of rats that were exposed to cell phone radiation which were both compared with each other and with normal unexposed control rats. The two exposed groups differed from each other in one group the kidney structure was assessed immediately following the 20 day exposure period. The second exposure group was also exposed for 20 days but was given 20 days subsequently with no exposure to see if the kidney structure spontaneously recovered. There was no recovery seen in the second group, showing that the kidney damage was effectively irreversible. In Chapter 3, several tissue remodeling type effects produced by EMF exposure appeared to be irreversible. Study #14 may add an additional such effect to that list.

#15 is another study not discussed by SCENIHR which is also particularly important. In this study control (unexposed) rats were compared with rats exposed to cell phone radiation for: less than 15 minutes per day, 15 to 30 minutes per day, 31 to 45 minutes per day or 45 to 60 minutes per day. Rats exposed to over 15 minutes per day of cell phone radiation showed type 2 diabetes onset-like effects, with higher fasting glucose levels and higher serum insulin levels. This appears to be, therefore a study showing important hormone dysfunction. It should be noted that the same research group has found similar changes in people living near cell phone towers [101]. Consequently, this is still another situation where findings in experimental animal studies appear to be directly applicable to humans.

Of the papers that were discussed, it is my opinion that the Aldad et al paper (#12, Table 4) is perhaps the most important. The paper starts out discussing the very large increase in ADHD that we have had in recent years, an increase which suggests that one or more environmental changes must be involved. This paper is from a distinguished laboratory, Hugh Taylor's laboratory at Yale, and was published in one of the highly respected Nature journals and the paper, at this writing has been cited 89 times, showing a high level of scientific interest in it. The paper showed that prenatal exposure of pregnant mice to cell phone radiation produced three highly statistically significant changes in the adult mice. These were a decrease in measured memory function, increase in hyperactivity and increase in anxiety. They also showed that there was a dose dependent decrease in an important neurological parameter, the frequency of miniature

excitatory postsynaptic currents, allowing the authors to conclude "that these behavioral changes were due to altered neuronal developmental programming." SCENIHR states the following about this study: "Neurodevelopment from a functional point of view was studied by Aldad et al. (2012) who exposed mice in utero and investigated them as adults for certain behavioural traits and electrophysiological characteristics. Exposure is poorly described but is reported to be to a muted telephone (900-1800 MHz) during the entire gestation period. After blinded investigations, the authors concluded that exposed animals displayed hyperactivity, memory deficiencies, decreased anxiety, and impaired glutamatergic transmission. Although the study employs relevant biological end-points, it cannot be used for any conclusions regarding pre-natal mobile phone exposure and functional development of the brain." SCENIHR fails to tell us why they claim the exposures were poorly described nor do they provide any reasoning on why "it cannot be used for any conclusions regarding pre-natal mobile phone exposure and development of the brain." It is hard to see how such results could be found unless there are substantial effects of pre-natal exposure. Because the study used genuine cell phone radiation, the effects seen are disturbing. It would be reasonable for SCENIHR to call for more studies of this type to see if they can be replicated. Having said that there have been five subsequent studies that I found where pre-natal mouse exposure to non-thermal EMFs produced substantial and somewhat similar adult neurological effects and or behavioral effects [102-106]. These five included exposures to Wi-Fi and to DECT (cordless phone) EMFs. These studies provide, then, strong evidence that prenatal exposures to EMFs can in animals, produce ADHD-like effects even into adulthood. They also show that during the late prenatal period, the developing brain is particularly sensitive to the effects of microwave frequency EMFs and raise the issue of how long after birth such sensitivity is also seen. It is common for SCENIHR and other industry friendly organizations to treat experimental studies as if they had the weaknesses of epidemiological studies. They don't because they can and do in these cases, directly demonstrate causation. In epidemiology, causation can be inferred but not directly demonstrated. What about epidemiological evidence with regard to EMF causation of ADHD? There are two such studies that each provide evidence for an association between prenatal cell phone exposures and development of ADHD [107,108]. SCENIHR knew about both of these, since it discusses one of them which is, in turn, based on the earlier one. Why then did SCENIHR not make the connection of those two studies with at Aldad study (#12 in Table 4)? That is of course an important failure, given that the Aldad study greatly strengthens the argument for EMF causation of ADHD.

Given the current situation where there are a total of 6 studies showing that pre-natal EMF exposures, including cell phone, Wi-Fi and cordless phone EMFs can cause ADHD-like effects in mice and two human epidemiological studies suggesting a similar mechanism in humans and the parallel between the huge increase in ADHD in humans and the huge increase in microwave frequency EMF exposures, is there any other type of evidence that supports a causal role for EMFs? It turns out there is. EMFs act primarily via VGCC activation (Chapter 20. Genetic polymorphism studies show that elevated VGCC activity has a role in causing ADHD [109], acting to a substantial extent prenatally. This is the way real science works. It is not the way that SCENIHR works.

The Vecchio et al 2010 paper (#5, Table 4) was discussed in SCENIHR 2015 as follows: "A study by Vecchio et al. (2010) analysed age-dependent EMF effects on alpha activity in waking EEGs in 16 older (47-84 years) and 15 younger subjects (20-37 years). Participants were exposed to a GSM signal (902.40 MHz, modulation frequencies: 8.33 and 217 Hz) for 45 min with a maximum SAR of 0.5 W/kg emitted by a commercially available mobile phone which was set using a test card in a double-blind cross-over paradigm. EEG was recorded for 5 min prior to and following exposure at 19 electrodes. The authors found an increased inter-hemispheric coherence of frontal alpha EEG activity after GSM exposure which was statistically significant for the

elderly subjects but not for the young ones. This might point to a GSM-EMF related inter-hemispheric synchronization of alpha rhythms as a function of physiological aging." Another related study (#by the same research group was also cited and discussed SCENIHR 2015 [73] as follows: "Vecchio et al. (2012a) used the same study design to investigate an exposure effect in patients with epilepsy. Data from 10 patients were compared to results from 15 age- matched controls from previous studies. Patients showed a statistically significant higher inter-hemispheric coherence of temporal and frontal alpha-rhythms under exposure as compared to control subjects. According to the authors, these results might indicate a GSM exposure effect on inter-hemispheric synchronization of the dominant (alpha) EEG rhythms in epileptic patients."

What do I have to say about the two Vecchio studies? They are both based on an earlier 2007 study which showed that increased EEG coherence between the two hemispheres of the brain was produced by genuine cell phone EMF exposure. What the 2010 study (#5 in Table 4) shows is that the EMF-induced increased coherence is much higher in older adults than it is in younger adults. What the 2012 study (#10 in Table 4) shows is that the EMF-induced coherence seen in people with epilepsy is also much higher than in people without epilepsy. These three studies then provide large amounts of evidence for a neurological effect of cell phone radiation that is influenced by two variables, age and epilepsy. These findings should be looked at the context of the 23 reviews, listed in Chapter 1, each showing that EMFs produce both neurological and/or neuropsychiatric impacts on the brain. Here we have still another neurological effect, one that is influenced by age and epileptic condition. There are, then three important findings in these studies. One is that while we have had quite lot of evidence showing that children are more sensitive to EMF effects than adults, this is the first clear finding, to my knowledge, that suggests that older people may be more sensitive to a neurological effect. The linkage to epilepsy should not be surprising as some EHS people are reported to have seizures triggered by very low intensity EMF exposures. Finally, the communication between the two hemispheres of the brain has been known for over half a century to be through what is called the corpus callosum, a structure deeply buried in the middle of the brain, linking the two hemispheres. These effects increasing the coherence between the two hemispheres are probably produced, therefore, through the impact of the EMFs on the corpus callosum. That implies, in turn, that the EMFs act much more deeply in the brain than the industry claims is possible.

The problem with SCENIHR is that it lives in a totally fictional universe where none of those EMF effect reviews exist or at least none of them have any relevance to the SCENIHR world. Neither of the two Vecchio et al studies, discussed in the previous two paragraphs, are used by SCENIHR [73] to make any conclusions about EMF effects or lack thereof – they are only cited in the quote that I gave you. We know that because because the citations are by author's last name and are, therefore easily searchable. Similarly, the Aldad et al (#12) study discussed two paragraphs further up, was also never cited except in the quotation given. So none of these three papers are used to assess any effects of EMFs or lack of effects. The same thing is true of the two reviews from Table 3 that were cited and discussed in [73]. They also were only cited in the quoted section and are never used to assess EMF effects or the mechanism of EMF action. As previously noted, there are several statements in SCENIHR 2015 [73] regarding lack of any available mechanism to explain claimed EMF effects, something that is directly contradicted by one of those cited and discussed reviews [4]. The consequence of all of that is that we have two very large and very consequential bodies of literature, the reviews on EMF effects and the literature on genuine cell phone radiation effects, which are entirely missing from any SCENIHR 2015 [73] conclusion.

<u>Is There Another Systematic Effort by Industry to Corrupt the Literature that Has Been Followed to Some Extent by SCENIHR?</u>

The important roles of pulsation, window effects, frequency, cell type and polarization in determining biological activity of EMFs were discussed in Chapter 1, where it was noted that SCENIHR fails to pay attention to any of these roles. That failure shows up in many places in the document. In Tables 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 of SCENIHR 2015 [73], the discussion of each table centers on how many studies found apparent effects and how many did not. But these numbers are irrelevant to the issue of whether there are effects or not. In fact one can argue that the industry, knowing about the roles of each of these factors, could fund any number of studies designed to give apparent negative results just by manipulating these factors to minimize responses and by only studying tiny numbers of individuals to produce low statistical power. This approach closely describes the approach used in seven studies of what were claimed to be genuine Wi-Fi studies that were described by Foster and Moulder [110] in Table 4 of their paper. Those seven studies were shown [11] to all have used an EMF that was not genuine Wi-Fi, despite claims to the contrary. They each used one of two types of reverberation exposure chamber for their rodent exposures, with each type of chamber greatly lowering the polarization of the EMFs [11] and also generating some level of destructive interference from variable path lengths produced by the reverberations. Each of these changes from genuine Wi- Fi is predicted to lower effects. Foster and Moulder [110] concluded that there was no effect in any of these studies. However tiny numbers of rodents were studied, between 3 and 15 in each class, such that these studies have very low statistical power to conclude anything substantive.

It is not possible to conclude no effect even with large studies. At most one can claim that there is no statistically significant evidence of an effect. With tiny numbers, a claim of no effect is complete nonsense. This problem with "no effect" claims is documented in a section of Rothman et al., Modern Epidemiology, 3rd Edition, a highly respected source of information, cited over 19,000 times according to the Google Scholar database. It states (p. 151, bottom) that: "A common misinterpretation of significance tests is that there no difference between two observed groups because the null test is not statistically significant, in that P is greater that the cutoff for declaring statistical significance (again, usually 0.05). This interpretation confuses a descriptive issue (whether two observed groups differ) with an inference about the superpopulation. The significance test refers only to the superpopulation, not the observed groups. To say that the difference is not statistically significant means only that one cannot reject the null hypothesis that the superpopulation groups are the same; it does not imply that the two groups are the same." All such claims of "no effect" are, therefore flawed. When they are made regarding very small studies with very low statistical power, they are particularly deeply flawed.

Were these seven studies designed to fail? I don't think we can say for certain but they certainly *look* as if they may have been. They also raise the serious question about whether the industry may be corrupting the science, by using their knowledge of the roles of pulsation, window effects, frequency, cell type and polarization.

The SCENIHR 2015 document has 127 places in the 221 pages of text where the term "no effect" was found (these can be easily found by searching the document using "no effect" for the search terms (that also picks up "no effects" statements. The first two of these 127 places are used properly, to describe the null hypothesis. *Each of the other 125 should not be there*, with each of those 125 overstating the case and therefore, improperly supporting the industry propaganda case.

In any case, the only way to show that there are inconsistencies or conflicts in the EMF literature is to carefully repeat studies finding such effects, not to flood the literature with studies done under other conditions. The logic used throughout SCENIHR 2015 [73] of just counting numbers of studies is deeply flawed.

Summary of Flaws in SCENIHR 2015

The first set of flaws, is that SCENIHR is perfectly willing to make statements which they know or should have known are false. The most egregious example of this is the Speit/Schwarz controversy described at the beginning of this chapter where there are seven clear falsehoods *created by SCENIHR*, each of which greatly strengthens the telecommunications industry propaganda positions. There are many others, described in this chapter that are substantive, but less egregious than the Speit/Schwarz falsehoods.

There is a vast literature, both in the review literature and in the primary literature studies, that disagrees strongly with the SCENIHR positions and is completely ignored by SCENIHR. In a few cases, such studies are cited and very briefly discussed by SCENIHR but then they have no impact on the assessments that SCENIHR makes in the SCENIHR 2015 document [73]. In most cases, they are neither cited nor discussed. The situation here is similar to an organization that has two sets of books, the fake books that are used in public and then a genuine set of books that includes all of the data that are too inconvenient to be included in the fake set of books.

The finally, we have three additional considerations which interact with each other to produce the completely bogus logic used by SCENIHR and by other organizations that have taken positions similar those taken by SCENIHR. One of those considerations comes from our knowledge that pulsation pattern, cell type, polarization and frequency can all influence biological effects and that there are exposure windows that produce much larger effects than are seen with either lower or higher intensities. Our knowledge of these factors mean that it is possible for the telecommunications industry to foster any number of studies where it is unlikely that statistically significant evidence of effects will be seen. I have presented examples where this may have been done. One of the most bizarre things about the SCENIHR 2015 document [73] is that there is a sentence on p. 101 where they state "In some of these cases, the effect seemed to be dependent on the cell type investigated and by the electromagnetic parameters applied (frequency, modulation)." Modulation and pulsation are the same thing. They know about these three factors and therefore, they know that these factors may explain differences in results obtained by different studies. But they still falsely assume that such differences imply inconsistencies in results and falsely assume that it makes sense to simply count apparent positive and apparent negative studies as a way of assessing whether there are effects or not.

SCENIHR has often falsely stated that these studies show no effects as opposed to lack of statistical significance of any effects. SCENIHR 2015 document has 125 places where such bogus claims of "no effect" are found. They repeatedly claim the literature is inconsistent but studies done under different conditions are *not* inconsistent because they are more likely to be due to genuine biological heterogeneity of responses. The false logic described here is used, in turn, to support another highly pervasive false logic. I've documented where SCENIHR has simply counted numbers of studies showing so many findings of effects and some other number of findings of "no effect." But these numbers are meaningless, when the studies are done under different conditions and where the "no effect" numbers can easily be inflated by studies designed to produce such results. They are also, of course, meaningless, when large numbers of studies that show effects are eliminated by SCENIHR by the simple process of pretending they don't exist. You can see from this, that the entire logical framework behind the SCENIHR 2015 [73] document is completely bogus.

Lastly, before going on to the situation in the U.S. and with 5G, there is one other thing I want to state here. In 2005, Dr. Jared Diamond published a book [111] entitled "Collapse: How

Societies Choose to Fail or Succeed." In it he documents how each society that "chose to fail," chose paths that had some short term gains but also had much more severe longer-term consequences. This is exactly what we have been doing with the EMFs, except that the consequences are much more severe than the collapse of one society – here all of the advanced technology societies on earth are at great risk.

Chapter 6: The U.S. Early Role in Recognizing Non-Thermal EMF Effects and How This Was Abandoned Starting in 1986: U.S. Failure to Research Health Impacts of Cell Phone Towers, Cell Phones, Wi-Fi, Smart Meters and Now 5G. What Is the Current Position of U.S. Government Agencies?

We in the U.S. often take great pride in our scientific research. That is, of course, especially true of U.S. scientists, of which I am one. We have far more Nobel laureates than any other country so we think of ourselves as being the #1 science country in the world. But we have had, over the past 20 years, almost no scientific primary literature studies, either laboratory studies or epidemiological studies, on non-thermal microwave frequency EMF effects. We had much more such research in this area 35 years ago,

In terms of non-thermal effects of microwave frequency (sometimes called radiofrequency) EMFs, the U.S. government published documents acknowledging the existence of large numbers of such non-thermal effects. This included the 1971 U.S. Office of Naval Medical Research Institute Report [30] and the 1981 report from the National Aeronautics and Space Administration (NASA) [26]. The most recent such report acknowledging widespread non-thermal EMF effects was the NCRP report [112] published in 1986. It follows that for the past 32 years, the U.S.government has been in denial on what *had been* repeatedly recognized by our government and is of great importance to protecting our health. 1986 turns out to be a key year because in that year, the U.S. Environmental Protection Agency (EPA) shut down its in house research program studying non-thermal EMF effects. In 1986, the U.S. Office of Naval Research, which had been funding grants in this area, stopped funding any new grants – the already funded grants were funded to the end of the grant period but no new grants were funded past 1986. A few years later, I think it was in late 1994, a similar shutdown of grants went into effect at the NIEHS, the part of the National Institutes of Health (NIH) which supports environmental health research. In 1999, the last U.S. agency that had been funding some research in this area, The Department of Energy also shut down what little research it had been funding.

The consequences of those shutdowns is that of the 17 studies on people living near cell phone towers, not a single study has been done in the U.S. Of the 23 studies of effects of genuine Wi-Fi EMFs, each of them showing effects [11], not a single study was done in the U.S. Of the over 50 studies on genuine cell phone radiation effects, only single one was done in the U.S, the NTP cell phone cancer study required by the Congress. So we have a situation where the U.S. government is encouraging EMF exposures and, in many cases, making it impossible to avoid EMF exposures while doing nothing or almost nothing to ensure our safety. There are a tiny number of studies that somehow sneak through, such as the Aldad et al study (#12 in Table 4) discussed in the preceding chapter, which was funded through the Child and Human Development Institute of the NIH, but these are few and far between.

How did these shutdowns happen? I don't know about 1986 but have some useful information from 1994/1995.

Attacks by the Telecommunications Industry on Two U.S. Scientists

Dr. Henry Lai from the University of Washington and a collaborator, NP Singh were using the alkaline comet assay, discussed earlier in this document to measure single stranded breaks in cellular DNA. They found a substantial elevation of the levels following low level EMF exposure in late1994. Before that finding had even been published, they found that they were targets of a severe attack from the telecommunications industry. A key document providing evidence of this was what was called the "War-Gaming" memo [113], where an executive named Norm Sandler, head of the Corporate Communications Department of Motorola (at that time the largest cell phone company) sent the memo to Michael Kehs of a public relations campaign in Washington DC (dated Dec. 13, 1994), describing their planned response to these at that time, unpublished findings. The memo stated that "While this work raises some interesting questions about possible biological effects, it is our understanding that there are too many uncertainties—related to the methodology employed, the findings that have been reported and the science that underlies them—to draw any conclusions about its significance at this time. Without additional work in this field, there is absolutely no basis to determine whether the researchers found what they report finding—or that the results have anything at all to do with DNA damage or health risks, especially at the frequencies and power levels of power levels of wireless communication devices.

In discussing the frequency differentiation issue, we should be able to say that Lai-Singh and Sarkar were not conducted at cellular (that is cell phone) frequencies."

(My comments are as follows: It is true that Lai/Singh used a different frequency from that used by cell phones. So the industry was correct about that. But the findings also show that the industry claims that there cannot be any non-thermal effects are wrong, and that may be more important. Singh had a reputation of being a genuine international expert on comet assays, so I doubt that methodology was a problem. If this had nothing to do with DNA damage or health risks, Motorola would not be worrying about these findings. There were at that time (1994) previously published studies of EMF effects on cellular DNA including the concurrent Sarkar findings and including findings of chromosome breaks and rearrangements reported in [30]).

Further down, the memo: "I think we have sufficiently war-gamed the Lai-Singh issue, assuming that SAG (Scientific Advisory Group, a group linked to the telecom industry) and the CTIA (the umbrella telecom lobbying, publicity and legal organization) have done their homework. We want to run this by George Carlo and fill him in on contacts we have made."

Under Excerpts from Confidential Working Draft #3. Question and Response:

Q. How can Motorola downplay the significance of the Lai study when one of your own expert consultants is on record telling Microwave News that the results—if replicated—could throw previous notions of RF safety into question?
R. It is not a question of downplaying the significance of the Lai study. In his comments to Microwave News, Dr. Sheppard raised the key question: Can it be replicated and interpreted? We will wait and see."
(My comments: Replication needed to be done, so that was a valid point. The interpretation was and is clear – it is that EMF exposures produce large increases in the numbers of single strand breaks in the cellular DNA.)

"Action Planned: In addition to response materials prepared by SAG (see attached copies) we will work with SAG to identify appropriate experts to comment in general on the science of DNA research, in addition to any experts SAG may be able to recommend to publicly comment on one or both of these particular studies.

Then they talk about Media Strategy where Motorola stays in the background with SAG and CTIA in front."

Three important things happened to Dr. Henry Lai at about this time [114,115]. In November 1994, before the War-Gaming memo had been written, a representative of the industry called the NIH claiming that money had been misspent from the Henry Lai grant for the DNA studies. Dr. Lai faxed the NIH an explanation which was accepted. However, the cutoff of new NIEHS funding appears to have occurred at this time, such that the industry pressure is likely to have been important. Furthermore [114] "The industry made a full-court press to discredit the DNA break study. A consistent and coordinated message was put out to marginalize Lai and Singh. For instance, in November 1994 (note: this was also before the War-Gaming memo was written), Q. Balzano, then a senior Motorola executive, wrote to us (Microwave News) that "Even if it is validated, the effects it purports to show may be inconsequential." (My comment is that DNA breaks produced at intensity levels well below safety guidelines are *not* inconsequential. If they were, the industry would not be worrying so much about them). Ron Nessen, the CTIA's top spokesman told a Florida newspaper that "It's not very relevant." He also tried to cast doubt on the comet assay pioneered by Singh to measure DNA breaks. It "may not be scientifically valid." Quite a number of months later, the head of the WTR (successor organization to SAG) wrote a 6 page letter to the President of the University of Washington to try to get him to fire both Lai and Singh [114, 115]. Neither was fired, but this is what you face when you get results that the telecommunications industry does not like.

(My comments: The basic findings of the Lai and Singh studies have been replicated more than two dozen times, at this writing. There have also been many replicates of the findings of increased micronucleus formation and oxidized bases in the DNA following non-thermal EMF exposures. All of that replication and the 21 reviews that were listed in Chapter 1 each showing non-thermal cellular DNA damage have still not gotten the telecommunications industry to admit that these DNA effects are occurring. The industry apparently does not care about the replication but cares, rather, about having talking points. Furthermore, when the industry was trying to get Dr. Lai's research funding cut off or later was trying to get both Lai and Singh fired, they were trying to *prevent* replication rather than encouraging it).

So Dr. Henry Lai was the first major scientist who came under vicious attack from the telecommunications industry and their allies, but he was certainly not the last. There are many such scientists including Prof. Adlkofer in Germany and Prof. Rüdinger in Austria. I know of nine others who have been attacked in the U.S. or in Europe. But here is a situation where the U.S. instead of leading world science in the right direction has been leading it into corruption. There are others.

I want to talk about another especially important case of such an attack on a U.S. scientist, that of Professor Om Gandhi. Gandhi is a professor at the University of Utah who, for many years was doing modeling of cell phone EMF exposures on the brains of humans. He was modeling such exposures for a substantial period of time of time based on the head of what was called standard anthropomorphic man (SAM). SAM was modeled from a 6 foot 2 inch, 200 pound man, a man in the upper 10% of men for head size and estimated skull thickness. He was doing such cell phone modeling for the telecommunications industry and received an important honor for this research. Because the safety guidelines are based only on thermal effects, the modeling was aimed at determining heating of the human brain by cell phone radiation.

Prof. Gandhi became concerned about the fact that both the head size and skull thickness of SAM was greater than that of most men and essentially all women and children and consequently began modeling a typical woman and typical 10 year old child, When he did that he found that the cell phone EMF exposures to the brain were much too high, even based on their own standards, standards that were and are only based on heating. The timing of these events was from 1975 through 1996. I will be quoting on what occurred subsequently. I have received permission from Dr. Devra Davis to make these quotes from pages 81 through 88 of her book Disconnect [77]. I will use a different font for those quotes so that you can see them easily.

Based on the new work he had produced, Gandhi called for a revision of the safety standards that regulated cell phones. The industry was stunned. For years, Gandhi had been one of those on whom they had counted. If Gandhi's work went uncontested, it would mean that children, women and men with smaller heads could not safely use some electronic devices or that these devices would have to be redesigned to emit less radio frequency radiation. The industry's first response was to cut off all of Gandhi's funding.

Going to p. 86 from [77]:

Gandhi explained that something has gone very wrong with standard setting in the United States in the past few years.

"Starting in the late 1980s, I chaired the committee to set standards for radio-frequency exposures before all cell phones ever existed. About a decade ago, C.K. Chou, then at the City of Hope Hospital, replaced me. Within two years, Chou had moved. He became a senior executive with Motorola—a clear conflict of interest. The committee that advises as to cell phone standards is supposed to be independent and had never before been led by someone from the very industry it advises. Under Chou's leadership, the committee relaxed standards for cell phones as of 2005. Having spent my entire life developing models of the brain, I know how things work. I also know that what we have done here is to ratchet up exposures, without actually telling people we have done so. Today's standards for cell phones have more than doubled the amount of radio-frequency radiation allowed into the brain."

The next quote starts at 2002, before the more than doubling of those radiation standards (pp. 87-88 from [77]).

By 2002 the gloves were off and the industry made it clear to Gandhi that they would take him on directly. Gandhi remembers being told by an industry colleague who was once a student and friend, "If you insist on publishing these papers saying that children get more exposed than adults and saying our test procedure is not valid, you can expect that we will not fund you."

Gandhi replied, "I am a university professor. I don't need your money."

Next industry tried to place an article by Chou critiquing Gandhi's models in the journal of which Gandhi had been editor and chief and in which he had published dozens of articles, and asked that either his (that is Gandhi's) article criticizing the grounds for setting standards be removed, or that they be allowed to publish Chou's rejoinder.

Gandhi reports that four different peer reviews of Chou's critique of my work indicated that Chou's critique of my work was 'scientific junk.' Only when the editor of the journal balked did the industry finally relent. Despite this success in beating back one attempt to discredit Gandhi's work, the effort to increase allowable amounts of radio frequency radiation was won on a major front. As the new chief of the standard-setting committee, Chou masterminded changes in the standards, and the committee, which now included a large majority of industry experts, issued new recommendations, ignoring Gandhi's analysis showing that these would effectively double exposures.

(I want to comment on this. I've published three papers on the physics of EMF action [4,5,11]. In each of them, I have taken the industry arguments about the physics seriously. Even though it was clear that the industry arguments were wrong, because of the clear existence of so many effects that occur at non-thermal levels of exposure, the industry arguments claiming that there could only be thermal effects were substantive and therefore, had to be considered. What I find, in the previous six paragraph, is that the industry itself is ready to throw out its own arguments, when they conflict with their ability to make massive profits. The issues here are very simple. Anyone with the most elementary understanding of the geometry of the head and a high school knowledge or physics, will know that a person with a smaller head and thinner skull will be exposed to higher brain levels of radiation from cell phones.)

What is obvious about this is that the industry does not care about health impacts, as long as they can maintain some deniability. What is also obvious is that the telecommunications industry can act to systematically corrupt an organization that, in effect, regulates the telecommunications industry. That in turn means that other organizations that, in effect, regulate the industry must be scrutinized for possible corruption. Those include ICNIRP, SCENIHR, WHO, the FCC and the FDA.

<u>When Have Somewhat Similar Things Happened in Other Situations in the U.S.?</u>

Is this approach to obfuscating the science unusual? Not really, but it appears to be much more extreme than usual, with the telecommunications industry and EMF effects. I suggest looking at the book on "Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health" by Dr. David Michaels. I've cited a book review of that book here [116]. The review starts out with the statement that "Creating doubt – at least enough to derail government regulation – is an art form long practiced and highly perfected by some sectors of private industry. In the book, Professor David Michaels vividly demonstrates how each such industry channels some of its profit to 'product defense firms' and 'self interested scientists' who conduct research designed to cast doubt on the science that supports regulation." (I will add that it also casts doubt on the science that may support lawsuits, as well.) "As a result of the doubt created, regulation is long-delayed and thousands of people (or perhaps millions) suffer and die unnecessarily." The industries that are covered in the book include tobacco, lead, asbestos, Merck (the maker of Vioxx), global warming, chromium, beryllium, artificial butter flavoring (diacetyl, the cause of often fatal popcorn lung). I think you will see parallels with what went on with SCENIHR (Chapter 5) and with the telecommunications industry actions (this chapter). Part of the problem with these precedents, is that nobody went to prison, despite the many deaths and injuries that were perpetrated and in most of these cases, the industries involved ended up making more money than they lost in the subsequent lawsuits. The precedent has been set that you can get away with almost anything if you are big enough and powerful enough and rich enough. That

may have been sufficient to encourage the telecommunications industry to follow a similar, although, in my opinion, much more aggressive pathway.

One question that can be asked is whether there are any major international political figures who appear to have a good understanding of the EMF/health issue? When I was asked that question, I was able to come up with only one person. That person is President Vladimir Putin of Russia. This inference comes from an interview of Dr. Dietrich Klinghardt, who practices in Seattle, by Dr. Joseph Mercola, that occurred in December 2017, an interview that was entirely focused on EMF health effects [117]. In that context Dr. Klinghardt states that a lecture that Putin gave to the Russian assembly said, "We do not need to go to war with America. America is committing collective suicide by the way they are using electricity. We just have to wait until they are all in the psychiatric hospital." When I saw that, I asked myself whether it is plausible that Vladimir Putin has a deep understanding of the neuropsychiatric effects of the EMFs? And then I thought, of course, Vladimir Putin was the head of the KGB when the latter studies reviewed by Dr. Karl Hecht [28] were being done in the Soviet Union. The most important effects that were shown to be produced by the EMFs, in those studies, were the neuropsychiatric effects. Furthermore, the Putin statement apparently shows not only a substantial understanding of those effects but also the fact that they are cumulative and become irreversible, as shown in those studies [28] and in other studies discussed in Chapter 4. One thing that I would add is that President Putin apparently practices what he preaches. He avoids smart phones [118].

It is my opinion, that the CIA and other international intelligence agencies should examine these issues very carefully to assess whether they see the kinds of threats that I see. Those agencies are very good at obtaining information from various sources and determining probable threats to national and international security. It should not be difficult to come to an assessment, especially because some of us have done much of the work that needs to be done. The threat here is self-inflicted, it is not caused by any foreign power or set of powers. But it is the most serious national or international security threat that we have faced, in my opinion, with the exception of nuclear annihilation.

Propaganda:

In the initial days of the controversy regarding cell phones, in 1993, the industry developed a huge public relations effort in the face of lawsuits and adverse press reports impacting the industry. Paul Staiano, President of Motorola General Systems stated in a 1993 ABC 20/20 interview [119] that, “Forty years of research and more than ten thousand studies have proved that cellular phones are safe.” So I asked how many studies of cell phone safety or lack there of had been published by the end of 1993. The way I did that was to search in the PubMed database under (cell phones or cellular phones or mobile phones). I found about 11,000 hits, roughly 99% of them having nothing to do with health safety, and then looked at the few studies that had been published before the end of 1993. The only study I found that had any connection with health or safety, was one on driving safety while using a cellular phone, giving equivocal results with regard to driving safety. So there, were apparently no studies done on cell phone safety at that time. Furthermore, even if there had been any studies, they could not possibly show that “cellular phones are safe.” At most they might show that there was no statistically significant evidence of an effect but that only shows that you have not proven an effect, not that you have proven the opposite. It can be seen, therefore, that this propaganda statement is complete nonsense. Furthermore, we know that the Panagopoulos et al [100] review, showed that 46 out of 48 genuine cell phone studies that they reviewed showed effects. So the facts are exactly opposite of the industry propaganda on this. If this was the beginning of propaganda in the U.S. let’s look at something much more recent.

Berezow and Bloom Op-Ed Document: Recommendation to Limit Maryland School Wi-Fi Is Based on "Junk Science"

Berezow and Bloom, [120] start their 2017 op-ed with the claim that "The CEHPAC, an agency within Maryland's Department of Health and Mental Hygeine, has recommended that schools reduce or eliminate students' exposure to Wi-Fi because it believes wireless signals might cause cancer. *This is pure, unadulterated junk science. At least three separate, major areas of scientific knowledge can unambiguously confirm that wireless radiation is completely safe* (italics added)."

They continue with the physics [120], stating that "CEHPAC fails to realize that all radiation is not created equal. The energy of nuclear radiation, X-rays and UV light is high enough to damage our bodies and cause cancer. But other forms of radiation are energetically weak by comparison. They cannot cause cancer." This argument has validity with regard to individual photons, as I stated in my first paper on the activation of VGCCs by EMFs [4], but it is completely bogus with regard to EMFs as a whole. It has been known for 70 years that a person walking in front of a high powered radar machine will rapidly die, but Berezow and Bloom claim that cannot happen because the fields are "energetically weak." Furthermore, as discussed in Chapter 2 and elsewhere [5,11], the voltage sensor that controls the opening of the VGCCs is extraordinarily sensitive to electrical forces of EMFs, with the forces on the voltage sensor being approximately 7.2 million times greater than the forces on singly charged groups in the aqueous parts of our cells and tissues. It can be seen, therefore, that Berezow and Bloom [120] while claiming to be experts, are profoundly ignorant of the relevant physics.

Berezow and Bloom [120] state that "According to the NIH's National Cancer Institute [121], well performed studies that included over one million people showed no connection between cell phone use and cancer." There is no such statement in the NCI 2016 [121] document – I suggest the reader look it up – it differs substantially from the op-ed characterization of it. The NCI 2016 [121] document, states that "there is currently no consistent evidence that non-ionizing radiation increases cancer risk" (sole supporting citation in NCI 2016 [121] was SCENIHR 2015 [73]). It has been shown above in Chapter 5, that SCENIHR 2015 is not a credible source of information on this and as shown, in Chapter 1, there are 35 different reviews that each provide strong evidence that EMFs do cause cancer. So claiming, that EMF causation of cancer is, in Berezow & Bloom's words, "pure, unadulterated junk science" is nonsense. What is amazing here is that the U.S. NTP study, published by Wyde et al [122], clearly shows that cell phones do cause cancer but it was completely left out of the Berezow & Bloom statement.

Let's go to their third "major area of scientific knowledge" – Berezow and Bloom [120] state that "the only known health effects from Wi-Fi are due to psychosomatics." That is, "people who believe that something will make them sick will report feeling ill, even if nothing is happening externally." Some of the Wi-Fi studies (Table 1 in [11]) are cell culture studies, some are animal model studies where EMF exposures are compared with sham exposures. While there may be a very weak argument regarding some but not other human studies when they are not done blinded, there is no argument that effects in any of the other studies are caused by "psychosomatics." Berezow and Bloom do not look at any of the 23 studies of Wi-Fi reviewed in [11], each of which showed effects and it is clear that most of them cannot possibly be due to psychosomatics. What is surprising here, is that the trillion dollar set of telecommunication industries, having been working on their propaganda for over a quarter of a century, is unable to produce a more convincing argument.

Have There Been Individual Research Studies Designed to Fail and Therefore Corrupt the Scientific Literature?

The first example, that I am aware of, where false science has been produced to supposedly show that an important EMF observation was unrepeatable also came from the U.S. It was described in Dr. Davis' book [77]. Dr. Allen H. Frey (pronounced Fry) published a paper in 1975 in Annals of the New York Academy of Science showing that low intensity pulsed EMF exposures produced a breakdown of the blood-brain barrier, the barrier in the blood vessels in the brain and the brain tissue that protects the brain from toxic chemicals and also infectious agents. The methodology that he used was to inject the fluorescent dye fluorescein into the blood (IV) and then use its fluorescence to detect whether and to what extent it penetrates into the brain tissue from the blood. A subsequent paper was published in 1978 [123], using similar methodology *except* that the fluorescein instead of being injected into the blood, was injected by intraperitoneal (IP) injection. When a compound is injected IP, it enters the blood only slowly over a substantial period of time, so that when one does a short term experiment looking at penetration through the blood-brain barrier, essentially nothing is seen. This was a transparent attempt to claim that the studies of Dr. Frey had been repeated with negative results, but the Frey studies had not be replicated.

I am aware of many papers that were flawed like the seven studies of simulated Wi-Fi, discussed near the end of Chapter 5 that were each touted by Foster and Moulder [110]. Let me remind you of what the flaws were in those seven studies. Firstly, each of them used EMFs that were the correct frequency for Wi-Fi but differed in pulsation from genuine Wi-Fi. Each of these studies used a reverberation exposure chamber which is predicted to decrease effects by both decreasing the polarization of the EMFs and increasing the destructive interference of the EMFs. They also used tiny numbers of animals for each study group, such that any statistics would have very low power. Finally, Foster and Moulder claimed each of them showed "no effect" when one can only at best claim there was no statistically significant evidence of an effect. Given the tiny numbers, the lack of statistical significance is of very little importance. I find that this pattern has been followed in a substantial number of additional studies.

What I want to discuss here is a paper that had each of those four properties but had several additional flaws, as well. I am aware of three legal proceedings in the U.S., where the industry side of that case touted the paper to be discussed, as being a particularly strong one. This paper by Ziemann et al [124] is entitled "Absence of genotoxic potential of 902 MHz (GSM) and 1747 MHz (DCS) wireless communication signals: In vivo two-year bioassay in B6C3F1 mice. In other words, the title claims that the 902 MHz frequency, studied and the 1747 MHz frequency also studied in the paper cannot cause DNA damage or other types of genotoxicity."

On p. 456 of Ziemann et al [124], the authors make clear that they are studying the effects of simulated cell phone radiation, not actual cell phone radiation. You will recall that Panagopoulos et al [110] found that almost all studies of genuine cell phone radiation found effects whereas less than half of simulated cell phone studies showed effects. This raises an important question about why Ziemann et al [124] opted to study simulated cell phone radiation. Much of the funding of the Ziemann et al paper (see pp. 462-463) came from industry sources. Funding source is not a flaw but it is a reason to look at the paper particularly closely. 2. The Ziemann et al [124] study used a stainless steel exposure chamber similar to the reverberation chambers discussed in Chapter 5 of this document. The chamber is predicted, to produce lower effects because of lowered polarization and increased destructive interference 3. The study is described as being a two year study of radiation effects. However the cells examined for micronuclei (their marker for genotoxicity (cellular DNA damage)), were mouse erythrocytes (red blood cells), and such

erythrocytes have a lifespan of only about 30 days; because of the inherent instability of micronuclei in replicating cells, such micronuclei in erythrocytes may possibly be generated over at most a 30 day period. It is misleading to describe this as a two year study when only the last 30 days are relevant to generating the marker being studied. 4. In rats and humans, erythrocytes containing micronuclei are selectively removed from circulation very quickly (see p. 459 of Ziemann et al [124]). While Ziemann et al claim that mice do not have a similar mechanism for selective rapid removal, the only citation that they provide is a study published by Chaubey et al (1993) showing that this was apparently true with Swiss mice; Ziemann et al [124] chose to use B6C3F1/CrlBR mice, a different inbred mouse strain which may well behave quite differently from Swiss mice. It follows from this that we have no idea whether the strain studied is similar to Swiss mice with regard to selective removal of erythrocytes containing micronuclei.

5. Ziemann et al [124] show that male and female mice behave quite differently with regard to levels of micronuclei (Tables I and III in [124]); however in their experimental study (Figure 2), males and females were combined in doing the statistics. What that inevitably does is to produce greater variations in micronuclei levels within different animal groups, making it substantially more difficult to detect any statistical significance among different animal groups in the study. It also means that it is important to use similar ratios of males and females in the experimental groups and we have no idea whether this was done or not. 6. In section A of Figure 2, there were only 8 animals in each group studied. In section B of Figure 2, there are only 5 to 9 animals in each animal group studied. These tiny numbers mean that there is only extremely low statistical power to detect any effects of EMF exposure and therefore these tiny studies make it almost impossible to say anything at all about the results. 7. The Ziemann et al study [124] provide none of their raw data; consequently we are in a situation where we have no way of judging whether their statistical analysis was done properly. We also have no way to use any such data as part of a meta-analysis of multiple studies, which may have much more power than do any single study (particularly such a tiny one). Consequently, the lack of statistical significance they report, cannot be properly assessed by the reader. 8. When one does a study looking at the possible effects of some variables, in this case a couple of simulated cell phone radiation studies, the most you can say about an apparent negative result is that "we did not see any statistically significant effects." When you have tiny studies such a described under 7 above, then the lack of statistical significance tells you almost nothing. But even with a very large study such as with thousands of mice including hundreds in each experimental group, all you can say is that "we did not see any statistically significant effects." 9. What do Ziemann et al conclude? They state in their title that there is an "Absence of genotoxic potential of 902 MHz (GSM) and 1747 (DCS) wireless communication signals." Did they study these EMFs in all organisms and all cell types? No of course not. Did they study all possible pulsation patterns of these two frequency EMFs? No of course not. Did they study all types of genotoxicity found following low-intensity EMF exposures? No, just one, micronuclei in erythrocytes in an inbred strain of mice. This title alone should tell any competent scientist that the paper is deeply flawed, completely apart from the preceding 8 flaws, with each of the 8 adding substantially to the flaws in this paper.

<u>George Carlo Letter</u>

Dr. George Carlo is an interesting and controversial figure who has both a law degree (JD) and a PhD in, I believe, epidemiology. He had worked in the telecommunications industry for years as head of the SAG and then WTR research arms. Dr. Carlo wrote an important letter to the heads of the telecommunications companies on October 7, 1999. The letter he sent to the head of AT&T is available on the internet [125]. In his book [126] Carlo lists all of the people sent the letter and also provides the text of the letter.

Carlo was, at that time the soon to be retiring head of the WTR, which was the CTIA/telecommunications industry research arm. In the letters to the heads of the telecommunications industry companies, Carlo discusses the types of evidence arguing that cell phones do apparently cause cancer and that they do cause DNA damage to our cellular DNA. The DNA damage, suggested that the apparent cancer causation was real. Carlo continues the letter as follows [125]:

"Today, I sit here extremely frustrated and concerned that appropriate steps have not been taken by the wireless industry to protect consumers during this time of uncertainty about safety." Continuing further down, Carlo adds:

"Alarmingly, indications are that some segments of the industry have ignored the scientific findings suggesting potential health effects, have repeatedly and falsely claimed that wireless phones are safe for all consumers including children, and have created an illusion of responsible follow up by calling for and supporting more research. The most important measures of consumer protection are missing: complete and honest factual information to allow informed judgment by consumers about assumption of risk; the direct tracking and monitoring of what happens to consumers who use wireless phones; and, the monitoring of changes in the technology that could impact health.

I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO with them in following a non-effectual course that will likely result in a regulatory and consumer backlash."

This is an important letter for several reasons. After October 7, 1999 the heads of the telecommunications companies or, for that matter anyone else at those companies, could no longer legitimately claim that they did not know there were serious health concerns with cell phones, with targeting cell phones to young children, or with increasing allowable cell phone exposure radiation. The last of these was done a few years later, as you have already seen.

The concerns Carlo expresses about the FCC (Federal Communications Commission) and the FDA (U.S. Food and Drug Adminstration) are particularly important in the U.S., because both the FCC and the FDA had already been given important regulatory roles when the Carlo letter was written. The FCC had been given the power of regulating the location of cell phone towers by the 1996 telecommunications act, which also *prohibited, as I understand it, any state or local government from protecting their people's health by regulating cell phone tower positioning*. In other words, the 1996 telecommunications act *de facto* stated that the U.S. Federal government valued telecommunication industry profits over every single health impact of microwave frequency radiation, *no matter how serious* it is, to the American people. There have been several subsequent pieces of legislation that have made the situation still worse. The FDA had been given the power to regulate radiation emissions from cell phones and other devices that emit microwave/radiofrequency radiation, with cell phone regulation apparently being shared with the FCC.

<u>What Can We Say About the FCC?</u>

There was a very informative document about the FCC published by the Safra Institute for Ethics at Harvard University [127] entititled "Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates." One of the sections in that document shows why both the FCC role and the telecommunications industry role were so important with regard to the 1996 telecommunications act:

Section 332(c)(7)(B)(iv) of the Act remarkably, and that adverb seems inescapably best here, wrests zoning authority from local governments. Specifically, they cannot cite health concerns about the effects of tower radiation to deny tower licenses so long as the towers comply with FCC regulations.

Congress Silences Public

Section 322(c)(7)(B0(iv) of the Communications Act Provides:
No State or local government or instrumentality thereof may regulate the placement, construction of personal wireless service facilities on the basis of environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

In preempting local zoning authority – along with the public's right to guard its own safety and health, Congress unleashed an orgy of infrastructure build-out. Emboldened by the government green light and the vast consumer appetite for wireless technology, industry has had a free hand in installing more than 300,000 sites. Church steeples, schoolyards, school rooftops, even trees can house these facilities.

What, then are the consequences of all of this? The 17 studies that have been done on people living near cell phone towers show that many people within 300 meters (about 1000 feet) of a cell phone tower are afflicted by six of the health effects found in those many reviews listed in Chapter 1. Two of those effects have not been looked at. According to this literature, people living within 300 meters of cell phone towers suffer from widespread neuropsychiatric effects, cellular DNA damage, cancer, oxidative stress, elevated apoptosis (cell death), and hormonal effects. They also suffer from cardiac effects like those discussed in Chapter 3 and from hypertension and also anemia. The two extremely well documented EMF health effects that have not been looked at are the reproductive effects and the high levels of intracellular calcium. That does not tell us these are not also caused in people living near cell phone towers, just that no one has looked. Roughly 30% of the people in this country live within 300 meters of a cell phone tower so the impact on health is major. But few know about this and the media and our government, including especially the FCC and FDA are keeping it all a deep dark secret. Not a single one of these 17 studies have been done in the U.S. Consequently, when the U.S. has ensured that we are irradiated by well over 300,000 of these cell phone towers, it has done absolutely nothing to determine what the consequences of exposure are. Of course we are impacted not only by cell phone towers near where we live but also near where we work or go to school and to some extent, when we are driving around town. These high levels of exposure are not necessary. Switzerland has safety guidelines that are 100 times more stringent than ours, Russia has safety guidelines that are 1000 times more stringent than ours. The health effects we see now will no doubt rise much further in the future without any increasing exposure, because many of these effects are cumulative, eventually becoming irreversible.

I would encourage you to look at the whole FCC as a captured agency document [127] – it can be downloaded at no cost from the internet [127]. It is very interesting and adds considerably to my short comments here regarding corruption.

So what does the FCC have to say about EMF effects on its web site [128]? I have copied some relevant sections as follows:

At relatively low levels of exposure to RF radiation, i.e., levels lower than those that would produce significant heating, the evidence for production of harmful biological effects is ambiguous and unproven. Such effects, if they exist, have been referred to as "non-thermal" effects. A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard. It is generally agreed that further research is needed to determine the generality of such effects and their possible relevance, if any, to human health. In the meantime, standards-setting organizations and government agencies continue to monitor the latest experimental findings to confirm their validity and determine whether changes in safety limits are needed to protect human health. (Back to Index)

CAN PEOPLE BE EXPOSED TO LEVELS OF RADIOFREQUENCY RADIATION THAT COULD BE HARMFUL?

Studies have shown that environmental levels of RF energy routinely encountered by the general public are typically far below levels necessary to produce significant heating and increased body temperature. However, there may be situations, particularly in workplace environments near high-powered RF sources, where the recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or mitigation actions may be necessary to ensure the safe use of RF energy. (Back to Index)

CAN RADIOFREQUENCY RADIATION CAUSE CANCER?

Some studies have also examined the possibility of a link between RF exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. Many other studies have failed to find evidence for a link to cancer or any related condition. The Food and Drug Administration has further information on this topic with respect to RF exposure from mobile phones at the following Web site: FDA Radiation-Emitting Products Page . (Back to Index)

Let's look at the first paragraph. In the third and fourth sentence, they state that there have been non-thermal effects reported but then say that "in most cases they have not been reproduced." Is that true? No. The 79 reviews listed in Chapter 1 have each found repeated studies documenting one or more of the EMF effects. You can't get a review published without multiple studies. And the fact that so many of these effects have been repeatedly reviewed, over many years shows that similar patterns of evidence have been found over long periods of time. *The FCC provides not one iota of evidence on its claims, despite the fact that such a claim of inability to reproduce findings absolutely requires extensive documentation to be scientifically valid. This difference in documentation, means that any one of those 79 reviews listed in Chapter 1 is vastly more scientific in showing the falsity of the FCC statement than is the FCC statement itself, which is completely undocumented.*

Let's go on to the cancer claim at the bottom of the copied section. The FCC states that "A number of reports have appeared in the scientific literature describing the observation of a range of biological effects resulting from exposure to low levels of RF energy. However, in most cases, further experimental research has been unable to reproduce these effects. Furthermore, since much of the research is not done on whole bodies (in vivo), there has been no determination that such effects constitute a human health hazard." You will note here that there are no specifics, nor were there any specifics on the section discussed in the previous paragraph. What we have here are completely undocumented FCC claims, with no specifics whatsoever and claims that are clearly contradicted by each of the 35 reviews on cancer causation by EMF exposure. They are also clearly contradicted by the 21 reviews on cellular DNA damage following EMF exposures, something that the FCC says nothing about. It has been known for decades, that the process of carcinogenesis (cancer causation) usually starts with one or more mutations in the cellular DNA, mutations that can be caused by each of the three types of cellular DNA damage known to be caused by EMF exposure.

The sort of pattern seen here, where we have gross generalizations followed by no or completely inadequate documentation goes on with the industry propaganda [119,120] as discussed earlier, as well as in the Speit/Schwarz discussion from early in Chapter 5. What you see in each of those cases is everything falls apart when you look carefully at the facts. The situation with the FCC statements is very similar. There can be little doubt that the FCC is acting as a propaganda organization here, as strongly suggested by the George Carlo letter [125,126] and the FCC as a captured agency [127] document.

Three questions: Does the FCC know that these statements that it has made are not factual? Does it know how non-thermal EMF effects actually are produced? Does it know that its safety guidelines do not protect our health? That answer to all three of these questions is yes. How do I know? I know because I did a PowerPoint presentation to the FCC in September 2016 which presented findings in each of these important areas. My account of that presentation, written two days after it occurred, follows:

Professor Emeritus Martin L. Pall presented Powerpoint presentation on the main mechanism of action of non-thermal microwave frequency EMFs to the FCC

I met with Julius Knapp, Chief of OET, Martin Doczkat, Branch Chief, OET/Technical Analysis Branch, and Ed Mantiply Engineer OET/Associate Chief at the Federal Communications Commission on September 21, 2016 to present a Powerpoint presentation and answer questions. The presentation showed that non-thermal microwave and lower frequency EMFs act via voltage-gated calcium channel (VGCC) activation. The most important findings demonstrating this mechanism are that various effects produced by such non-thermal exposures can be blocked or greatly lowered by calcium channel blockers, drugs that are highly specific for blocking VGCCs. The reason why such low intensity non-thermal exposures activate the VGCCs is because the voltage sensor of the VGCCs is exquisitely sensitive to the electrical forces produced by these EMFs. The forces on the voltage sensor are calculated to be about 7.2 million times higher than are the forces on singly charged chemical groups in the aqueous phases of the cell. This very high level sensitivity also predicts that the safety guidelines allow us to be exposed to EMF intensities that are approximately 7.2 million times too high.

The actions produced by such VGCC activation go mainly through the excessive intracellular calcium levels produced by such activation. Excessive calcium acts via three main pathways to produce effects in the body. Therapeutic effects are produced through the nitric oxide signaling pathway whereas many pathophysiological effects are produced by the peroxynitrite/oxidative stress pathway. Excessive calcium signaling also produces pathophysiological effects. Numerous effects produced following non-thermal EMF exposures can be produced by these pathways including oxidative stress, cellular DNA damage, cancer, widespread neuropsychiatric effects, breakdown of the blood brain barrier, lowered male and female fertility and various endocrine (that is hormonal) changes.

It has long been known that pulsed EMFs are usually much more biologically active than are non-pulsed (or continuous wave) EMFs and this difference appears to be consistent with the VGCC mechanism. Because all wireless communication devices communicate via pulsations, such devices may be of special concern.

Three concerns were expressed with regard to 5G: 1. The stronger absorption of the very high frequencies involved require the setting up of vast numbers of antennae, making it essentially impossible to avoid damaging exposures. 2. The stronger absorption suggests that these EMFs may be particularly active in activating the VGCC voltage sensor. 3. The very high level and complexity of pulsations also may make for much more biological damage via VGCC activation.

There was substantial discussion of the need for biological safety testing. That discussion focused on the using cells in culture that have high densities and different types of VGCCs. Responses can be monitored by either monitoring intracellular calcium levels or by measuring nitric oxide production using a nitric oxide electrode.

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We had what would be considered in diplomatic circles a good and productive meeting, but since that time the FCC has doubled down on their positions, pushed much further on 5G, leading us to the mega-crisis situation which we are faced with now. Instead of actually testing 5G radiation biologically for safety, using the methods that were discussed in that meeting, the FCC has instead opted to put out tens of millions of 5G antennae without any biological safety testing of genuine 5G radiation. That is the insanity that we are in.

What About the FDA?

The Food and Drug Administration (FDA) was given the power to regulate devices that emit microwave frequency EMFs. This was not an unreasonable decision, given that the FDA was already regulating the safety of medical devices, where one can argue that there are similar challenges involved. The FDA was given this responsibility without any additional funding. So obviously, it was and is distinctly limited in what it can do.

What the FDA did was to issue a Letter of Intent for Proposed Collaboration in Mobile Phone Research between the Food and Drug Administration and the Cellular Telecommunications

Industry Association (CTIA), [129] Dated October 20, 1999. This would involve a Cooperative Research and Development Agreement (CRADA). Later in their Letter of Intent, it states under Initial Research Under the CRADA [129]: "The first study to be conducted would follow up on the findings of studies previously conducted by WTR but not yet published using the micronucleus assay, a test which detects structural effects on genetic material. Research data in the literature from RF exposure studies using the micronucleus assay are conflicting, and warrant follow-up study." You will see here that the FDA is accepting the industry claim that these studies are conflicting even though, having been done under different circumstances, they are not.

The basic approach of the CRADA was that the industry would fund any research to be done and decide what research should be done by whom and how and what information would be published subsequently.

You may recall that Dr. George Carlo wrote a very important letter to the heads of the telecommunications companies, described earlier. That letter was dated two weeks before the date of the letter or intent. Carlo's letter stated: "I am especially concerned about what appear to be actions by a segment of the industry to conscript the FCC, the FDA and WHO… ." Carlo who had been up to that point, an industry insider, and apparently had reason to think that the FDA had been corrupted, or what he called conscripted by parts of the telecommunications industry two weeks before the letter of intent was written. I don't think this is definitive evidence that the FDA has been corrupted, and it can even be argued that it is not evidence at all. But it does suggest, however, that we need to look further into this issue.

Let's go on to the results of this CRADA [130]. The FDA reports the following findings from the CRADA: "FDA's cooperative research and development agreement (CRADA) with the Cellular Communication & Internet Association (CTIA) has resulted in research projects focused on two topics - mechanistic studies related to genotoxicity and exposure assessment studies. All studies funded through the CRADA have been completed, and no association was found between exposure to radiofrequency (RF) radiation from cell phones and adverse health effects." I have been unable to get copies of these studies and therefore cannot comment on them.

The CRADA also lead to a National Academy of Sciences (NAS) workshop on EMFs that lead, in turn, to a 2008 NAS report. That 2008 NAS report can be accessed from [130]. It is a useful report, in my view, albeit one that leaves out much of what was already known in 2008. It does ***not*** say that there are no clear non-thermal effects and specifically calls for study of the neurological effects, suggesting that "that neural networks are a sensitive biological target." It also calls for much research on biophysical or biochemical molecular mechanism(s) that may lead to the non-thermal effects. It also calls for much more study on cancer. There has been a large amount of progress in each of these three areas since 2008, including of course the identification of VGCC activation as the most important but not necessarily the only biophysical mechanism. The problem with regard to the FDA is that as far as one can tell, the FDA has paid no attention to either the 2008 report or to the subsequent progress we have had in these several areas.

Let's shift our attention to what the FDA currently says about the impacts of these EMFs? On their web site [131], the FDA states the following:

Is there a connection between certain health problems and exposure to radiofrequency fields via cell phone use?

The results of most studies conducted to date indicate that there is not. In addition, attempts to replicate and confirm the few studies that did show a connection have failed.

According to current data, the FDA believes that the weight of scientific evidence does not show an association between exposure to radiofrequency from cell phones and adverse health outcomes. Still, there is a consensus that additional research is warranted to address gaps in knowledge, such as the effects of cell phone use over the long-term and on pediatric populations.

There was a similar statement made by the FCC, in previous section, and also similar statement was made by Samsung, one of world's largest producers of cell phones which reads a follows [132]:

Over the past 15 years, scientists have conducted hundreds of studies looking at the biological effects of radio frequency energy emitted by cell phones. While some researchers have reported biological changes associated with RF energy, these studies have failed to be replicated. The majority of studies published have failed to show an association between between exposure to radio frequency from a cell phone and health problems.

Neither the FDA statement nor the Samsung statement give us any idea what possible effects are being considered here, what literature was used for such a consideration. These statements are completely undocumented and therefore must be viewed as being unscientific. In Chapter 1, 79 reviews were given that each showed the existence of one or more effects. Eignt different of effects were each documented in from 12 to 35 reviews. Such reviews must be extensively documented or one cannot get them published. Any one of those reviews provides, therefore, a much stronger argument for presence of one or more effects than do the FDA, FCC and Samsung statements put together arguing for the opposite. One thing that is strange about the FDA statement is that they are talking specifically about cell phones even though they are tasked with regulating safety on all such microwave/radiofrequency devices. What I have done below is to put together the 16 reviews which are completely or largely focused on cell phone radiation effects so that we can see what specific effects have been found to be caused by cell phone radiation. I will summarize those effects below.

Table 5: Reviews on Cell Phone Effects and the Effects Found in Each

Review on Cell Phone Effects	Effects Found
La Vignera S, Condorelli RA, Vicari E, D'Agata R, Calogero AE. 2012 Effects of the exposure to mobile phones on male reproduction: a review of the literature. J Androl 33:350-356.	Multiple effects on male reproduction
Makker K, Varghese A, Desai NR, Mouradi R, Agarwal A. 2009 Cell phones: modern man's nemesis? Reprod Biomed Online 18:148-157.	Cellular DNA damage, neurological/neuropsychiatric effects, apoptosis
Yakymenko IL, Sidorik EP, Tsybulin AS. 1999 [Metabolic changes in cells under electromagnetic radiation of mobile communication systems]. Ukr Biokhim Zh (1999), 2011 Mar-Apr:20-28.	Apoptosis, increased oxidative stress, increased intracellular calcium
K Sri N. 2015 Mobile phone radiation: physiological & pathophysiological considerations. Indian J Physiol Pharmacol 59:125-135.	Male infertility, cellular DNA damage, lowered melatonin, increased stress protein expression
Nazıroğlu M, Yüksel M, Köse SA, Özkaya MO. 2013 Recent reports of Wi-Fi and mobile phone-induced	Oxidative stress, male and female reproductive signaling dysfunction

radiation on oxidative stress and reproductive signaling pathways in females and males. J Membr Biol 246:869-875.	
Yakymenko I, Sidorik E. 2010 Risks of carcinogenesis from electromagnetic radiation and mobile telephony devices. Exp Oncol 32:729-736.	Cancer, cellular DNA damage, apoptosis; higher cancer incidence on ipsilateral side of the head, not contralateral
Zhang J, Sumich A, Wang GY. 2017 Acute effects of radiofrequency electromagnetic field emitted by mobile phone on brain function. Bioelectromagnetics 38:329-338. doi: 10.1002/bem.22052.	Neurological dysfunction
Kundi M, Mild K, Hardell L, Mattsson M. 2004 Mobile telephones and cancer – a review of the epidemiological evidence. J Toxicol Env Health, Part B 7:351-384.	Cancer – epidemiological review
Hardell L, Carlberg M, Soderqvist F, Hansson Mild K. 2008 Meta-analysis of long-term mobile phone use and the association with brain tumors. Int J Oncol 32:1097-1103.	Cancer – meta-analysis on long-term cell phone use and brain tumors
Hardell L, Carlberg M. 2013 Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. Rev Environ Health 28:97-106. doi: 10.1515/reveh-2013-0006.	Mobile and cordless phone radiation caused brain cancer based on the Hill criteria for causation (most important criteria for causation in epidemiology)
Hardell L, Carlberg M, Hansson Mild K. 2013 Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Pathophysiology 2013;20(2):85-110.	Mobile and cordless phone exposures associated with increased risk of glioma and acoustic neuroma; higher cancer increase on ipsilateral side of the head
Davis DL, Kesari S, Soskolne CL, Miller AB, Stein Y. 2013 Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen. Pathophysiology 20:123-129.	Cell phone and cordless phone radiation are a probable carcinogens; cancer increase on ipsilateral side of the head, not contralateral side
Morgan LL, Miller AB, Sasco A, Davis DL. 2015 Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A). Int J Oncol 46(5): 1865-1871.	Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen
Bielsa-Fernández P, Rodríguez-Martín B. 2017 [Association between radiation from mobile phones and tumour risk in adults]. Gac Sanit. 2017 Apr 12. pii: S0213-9111(17)30083-3. doi: 10.1016/j.gaceta.2016.10.014.	Association between mobile phone risk and tumor risk
Prasad M, Kathuria P, Nair P, Kumar A, Prasad K. 2017 Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes. Neurol Sci. 2017 Feb 17. doi: 10.1007/s10072-017-2850-8.	The association between mobile phone use and brain cancer is higher in independently funded studies than in industry funded studies
Miller A. 2017 References on cell phone radiation and cancer. https://ehtrust.org/references-cell-phone-radio-	This is a bibliography of studies on cell phone radiation and cancer – most

frequency-radiation-cancer/ (Accessed Sept. 9, 2017)	support the view that cell phones do cause cancer

The effects of specifically cell phone radiation that have been found in these reviews (Table 5) include: lowered male reproductive function, lowered female reproductive function, increased cellular DNA damage, neurological/neuropsychiatric effects, increased stress protein synthesis, increased intracellular calcium, apoptosis, lowered melatonin, oxidative stress, cancer (10 reviews) and specifically increased ipsilateral cancer (3 reviews). So there are 11 different cell phone effects where there is substantial enough evidence to warrant publication in one or more review articles. Each of these effects has been shown to occur in response to other microwave frequency EMFs and therefore should be considered to be caused by EMFs more broadly.

The summary of Table 4, Chapter 5, the genuine cell phone primary literature studies that fell into the 2009-2013 time frame, started as follows: "If you look through the studies described in Table 4, you will see multiple studies in oxidative stress/free radical damage, on changes in tissue structure (sometimes called remodeling), on cellular DNA damage, on male fertility (and also one on female fertility), on behavioral changes and on neurological changes. There is also one study on insulin/type 2 diabetes (hormonal effect). It follows from this that five of the effects that were extensively documented in large numbers of reviews (Chapter 1) are further demonstrated to be produced by cell phone radiation in these studies. In addition the tissue remodeling and proteomic changes discussed in Chapter 3 are also further demonstrated here."

It can be seen from Tables 4 & 5 and the preceding two paragraphs, that there is a vast amount of literature on repeatedly found effects of cell phone radiation, effects which make a mockery of the *completely undocumented and non-specific* FDA claims to the contrary.

Let's look at another part of the FDA statement which also shows similarities to statements made elsewhere [131]:

The biological effects of radiofrequency energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radiofrequency energy, including both radio waves and microwaves, are not great enough to cause the ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat) and other forms of electromagnetic radiation with relatively low frequencies.

This is almost identical to another Samsung statement and also to an FCC statement that I have not copied. Here is the Samsung statement [133]:

The biological effects of RF energy should not be confused with the effects from other types of electromagnetic energy.

Very high levels of electromagnetic energy, such as is found in X-rays and gamma rays, can ionize biological tissues. Ionization is a process where electrons are stripped away from their normal locations in atoms and molecules. It can permanently damage biological tissues including DNA, the genetic material.

The energy levels associated with radio frequency energy, including both radio waves and microwaves, are not great enough to cause ionization of atoms and molecules. Therefore, RF energy is a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation (heat), and other forms of electromagnetic radiation with relatively low frequencies.

While RF energy does not ionize particles, large amounts can increase body temperatures and cause tissue damage. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because there is relatively little blood flow in them to carry away excess heat.

The three paragraphs from the FDA statement are word for word identical to the first three paragraphs of the Samsung statement. The last paragraph in the Samsung statement was deleted from the FDA statement. It is clear from this that either the FDA statement is derived from the earlier industry statement rather than the other way around or both are derived from a previous statement similar to the Samsung statement.

These types of statements have given rise to shorter statements that are all something like the following:

Non-ionizing radiation consists of photons that do not have enough energy to break chemical bonds including the chemical bonds of DNA.

All of these statements are technically correct. They are also highly misleading. They are often falsely interpreted as meaning that there cannot be any effects of non-ionizing, non-thermal EMF exposures ***including indirect effects***. There are many possible indirect effects that may occur, given the complexity of biology. But our situation goes way beyond that, because we know that most of the effects are produced via VGCC activation which produces, as downstream effects, the free radical breakdown products of peroxynitrite (Fig. 1, Chapter 2). Those free radical breakdown products attack DNA, proteins and other biological constituents in ways that are very similar to the ways in which ionizing radiation attack these same molecules. Ionizing radiation was shown by Arthur Compton, who won the Nobel prize in physics in 1927, for showing that ionizing radiation produces large numbers of free radicals through what has become known as Compton scattering, with those free radicals being responsible for most of the biological effects of ionizing radiation. So the often repeated industry claim that ionizing radiation is dangerous but non-ionizing radiation is not, <u>is wrong</u> – both of them produce similar effects mediated through free radical generation. However the dangers of non-ionizing radiation may eclipse the dangers of ionizing radiation under some conditions because of something that is discussed early in Chapter 5, at the end of the Speit/Schwarz discussion. There are three processes which occur in the sequence by which EMF activation leads to peroxynitrite breakdown product radicals, each of which have high levels of amplification (each discussed on p. 29 in Chapter 5). Thus potentially and I believe actually microwave frequency EMFs can produce under suitable conditions, much more efficient free radical production than occurs from a similar energy level of ionizing radiation.

The FDA may have had a long history of playing fast and loose with the truth. For example, Microwave News article published in 2003, provides this account of what occurred at the FDA in 1993 [134]:

1993 FDA Memo Data "Strongly Suggest" Microwaves Can Promote Cancer.

In the spring of 1993 at the height of the public concern over cell phone brain tumor risks, the Food and Drug Adminstration (FDA) biologists concluded [134] that the available data "strongly suggest" that microwaves can "accelerate the development of cancer." This assessment is from an internal agency memo recently obtained by Microwave News under the Freedom of Information Act.

"Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both" wrote Drs. Mays Swicord and Larry Cress of FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. They also pointed to other evidence from laboratory (in vitro) studies which supported cancer risk.

Yet in its public statements at that time, the agency played down these findings [134]. For instance in a Talk Paper issued in early February, the FDA stated that there was "limited evidence that suggests that lower levels (of microwaves) might cause adverse effects."

"A few studies suggest that (microwave) levels (from cellular phones) can accelerate the development of cancer in laboratory animals," the FDA added [134], "but there is much uncertainty among scientists about whether these results apply to the use of cellular phones."

I have three comments. Firstly, if you look at the 35 citations in the list on cancer causation in Chapter 1, you will see that there are 8 citations (#s 2-7 & 15 & 19) which provide similar evidence of stimulation of tumor promotion, four of which (#s 3-6) were published around 1993, the time of the FDA memo and public statement described above. Therefore, there was a substantial literature including peer-reviewed primary literature and review articles which produced similar conclusions to those of the FDA internal memo. The importance of the memo is that the FDA knew about these findings and opted to cover them up.

Secondly if you compare the rhetoric in the 1993 memo with the first quote from the current FDA web site quoted in this section, you will see some striking similarities. They both first refer to "a few studies" which are not identified, followed by raising uncertainties and then finally raising doubt as to whether these findings apply to cell phone radiation. The pattern of the FDA rhetoric has not changed much in 25 years.

If one includes the middle statement also quoted from the FDA web site, we have three FDA statements each of which downplays any biological effects and each of which are strongly rebutted by extensive peer-reviewed independent scientific literature. I'm not sure we can say the FDA has been corrupted by the industry, but what we can say is that it has been functioning as if it has been corrupted for 25 years.

In mid-2009 Margaret A. Hamburg, the new commissioner of the FDA, and Joshua M. Sharfstein, her principal deputy commissioner, published a commentary article in the New England Journal of Medicine [135] which included the following:

"One of the greatest challenges facing any public health agency is that of risk communication. … The FDA's job is to minimize risks through education, regulation, and enforcement. To be credible in all these tasks, the agency must communicate frequently and clearly about risks and benefits—and about what organizations and individuals can do to minimize risk. When, like the FDA, Americans must make choices about medication, devices, foods, or nutrition in the absence of perfect information, the FDA cannot delay in providing reasonable guidance —guidance that informs rather than causes unnecessary anxiety. For these communications to have credibility, the public must trust the agency to base its decisions on science."

These were and are laudable goals. As far as I can tell, with regard to EMF effects, the FDA has failed to base either its communications or its decisions on science.

Summary of Chapter 6

In the areas discussed in Chapter 6 what used to be the primacy of U.S. science has completely disintegrated. It has disintegrated because of the cessation of U.S. government funding for either experimental studies or epidemiological studies. It has disintegrated due to attacks on U.S. and International scientists, attacks that started in the U.S. with the attacks on Dr. Henry Lai. It has disintegrated because of aggressive industry propaganda, propaganda that has no connection with the real science. It has disintegrated because of the outright corruption of the committee to set standards for radio-frequency exposures and the FCC and the possible and *de facto* corruption of the FDA. The telecommunications industry has been aware of much of the problems with their approach since the 1999 letter to them from George Carlo. The FCC has been aware of much more of the science since my presentation to them in September 2016. The FDA has been aware of contrary findings since 1993. Each of them has, if anything, doubled down on their fictions since those respective times.

Many of these things are going on internationally; however the U.S. has often been leading the world in these processes. All of the actions we have seen to corrupt the science and public understanding of the science have the effect of making it vastly more difficult for individuals impacted by the EMFs to protect themselves from further harm. We have many effects that are cumulative and become irreversible as they become more severe, effects that impact at a minimum, tens of millions of Americans and hundreds of millions of people elsewhere in the world. *Industrial and regulatory organizations make it difficult or impossible for people to have scientifically valid information also make it difficult or impossible for people to protect themselves from the accumulation of these effects, leading to severe irreversible effects. Each of the organizations involved, both U.S. and international that collaborate in this process, have important responsibility for the consequences.* I think damage goes way beyond tens and hundreds of millions of people, because I think we are looking at cumulative severe impact on our brain function, on our reproductive function and on our DNA, and that these, in turn will lead to the crash of every single technologically advanced country on earth, barring a major change in course. That will happen fairly quickly, in my opinion, even without 5G but 5G will greatly speed up the process and perhaps even add new egregious effects

Chapter 7: The Great Risks of 5G: What We Know and What We Don't Know

We have already discussed two issues that are essential to understanding 5G. One is that pulsed EMFs are, in most cases, much more biologically active than are non-pulsed (often called

continuous wave) EMFs. A second is that the EMFs act by putting forces on the voltage sensor of the VGCCs, opening these calcium channels and allowing excessive calcium ions to flow into the cell. The voltage sensor is extraordinarily sensitive to those electrical forces, such that the safety guidelines are allowing us to be exposed to EMFs that are something like 7.2 million times too high.

The reason that the industry has decided to go to the extremely high frequencies of 5G is that with such extremely high frequencies, it is possible to carry much more information via much more pulsation than it is possible to carry with lower frequencies even in the microwave range. We can be assured, therefore, that 5G will involve vastly more pulsation than do EMFs that we are currently exposed to. It follows from that, that any biological safety test of 5G must use the very rapid pulsations including whatever very short term spikes may be present, that are to be present in genuine 5G. There is an additional process that is planned to be used in 5G: phased arrays (https://en.wikipedia.org/wiki/Phased_array). Here multiple antenna elements act together to produce highly pulsed fields which are designed for 5G, to produce increased penetration. 5G will entail particularly powerful pulsations to be used, which may, therefore, be particularly hazardous.

The only data we have, to my knowledge, on millimeter wave frequencies of 5G used *non-pulsed EMFs in the millimeter frequency range of 5G, not genuine 5G*. Such millimeter waves have been shown to produce a number of downstream effects of VGCC activation. One millimeter wave study showed that it activated both the VGCCs and also the voltage-gated potassium channels, suggesting that it worked via the voltage sensor, as do other EMFs [136]. Any such data tells us almost nothing about how biologically active genuine very highly pulsed 5G will be. I take it that from their statements, that both Mr. Ryan and Dr. Vinciūnas are ready to put out 10s of millions of 5G antennae to afflict every single person in the EU with 5G radiation without even a single biological test of safety of genuine 5G. In the U.S., the FCC has taken a much worse position. The FCC is not only willing to allow such completely untested exposures but has also been has been aggressively pushing to promote installation of 5G antennae, such that antennae are already being installed in parts of the U.S. In a world where shocking behavior has become less and less shocking, I consider EU and U.S. views and actions to be shocking. The U.S. situation is mass insanity. I would have hoped that the Europeans, who think of themselves as being much more thoughtful than Americans, would have been genuinely more thoughtful.

Why does 5G need such high numbers of antennae? It is because the 5G radiation is much more absorbed as it enters various materials. The approach is to use many more antennae with one found every few houses, such that 5G can sufficiently penetrate local walls. Such absorption usually involves the interaction with electrically charged groups, such that such high absorption is likely to involve placing forces on electrically charged groups. Because such forces are the way in which EMFs activate the VGCCs, it seems highly likely, therefore, that 5G radiation will be particularly active in VGCC activation.

In summary, then, 5G is predicted to be particularly dangerous for each of four different reasons: 1. The extraordinarily high numbers of antennae that are planned. 2. The very high energy outputs which will be used to ensure penetration. 3. The extraordinarily high pulsation levels. 4. The apparent high level interactions of the 5G frequency on charged groups presumably including the voltage sensor charged groups.

Now what the telecommunications industry argues is that 5G radiation will be mostly absorbed in the outer 1 or 2 mm of the body, such that they claim that we don't have to worry about the effects. There is some truth to that, but there are also some caveats that make any conclusions

made from that, much more suspect. In any case, these surface effects of 5G will have especially strong impact on organisms with much higher surface to volume ratios. Consequently, I predict that many organisms will be much more impacted than we will. This includes insects and other arthropods, birds and small mammals and amphibia. It includes plants including even large trees, because trees have leaves and reproductive organs that are highly exposed. I predict there will be major ecological disasters as a consequence of 5G. This will include vast conflagrations because EMF exposures make plants much more flammable.

But let's get back to humans. The industry has also made claims that more conventional microwave frequency EMFs are limited in effect to the outer 1 cm of the body. We know that is not true, however because of the effects deep in the human brain, on the heart and on hormone systems. Perhaps the most important two studies demonstrating effects deep within the body are the studies of Professor Hässig and his colleagues in Switzerland on cataract formation in newborn calves [137,138]. These two studies clearly show that when pregnant cows are grazing near mobile phone base stations (also called cell phone towers), the calves are born with very greatly increased incidences of cataracts. It follows from these findings that even though the developing fetuses are very deep in the body of the mother and should be highly protected from the EMF exposures, they are not so protected. And because the EMF safety guidelines in Switzerland are 100 times more stringent than are the safety guidelines in most of the rest of Europe, in the U.S., Canada and most of the rest of the world, the more general safety guidelines allow greatly excessive exposures and penetration of effects. The claims of industry that microwave frequency EMFs only act in the outer centimeter of the body are clearly false.

How then can both conventional microwave frequency EMFs and 5G radiation act deeply within the body? You may correctly observe that the electrical effects of the EMFs activate the voltage sensor and that the direct electrical forces are rapidly attenuated in the body. So how can we get deep effects? I think the answer is that the magnetic parts of the EMFs have been known for decades to penetrate much more deeply than do the electrical parts. The magnetic fields put forces on mobile electrically charged groups dissolved in the aqueous phases of the body and small individual movements of the charged groups can regenerate electric fields that are essentially identical to the electric fields of the original EMFs, carrying the same frequency and same pulsation pattern, although with lower intensity. An example of this is given in the Lu and Ueno [139] study. Because the voltage sensor is so stunningly sensitive to electrical forces and part of the reason for that is the very high level of amplification of the electrical field across the plasma membrane, we have an almost perfect way in which to produce EMF effects deeply within our bodies.

I am very concerned that 5G may produce effects like those we already see produced from lower frequency EMFs but are much more severe. I am also concerned that we will also see responses that are qualitatively different. Let me give you three possible examples of the latter type and one quantitative example. Each of the four types of blindness, have downstream effects of VGCC activation as causal factors: cataracts, detached retinas, glaucoma and macular degeneration. The aqueous and vitreous humors in the eye may be an ideal environment for the regeneration of the electrical fields within the eye. We may, therefore have a gigantic epidemic of each of the four types of blindness. Another concern focuses on kidney dysfunction, which was shown in Chapter 5 to be impacted by EMFs. The kidneys have much fluid, both blood and also what will become urine, which may allow efficient the regeneration of electrical fields. Such regeneration may be expected to impact both the glomerular filtration and also the reabsorption, both essential to kidney function. Does this mean that 5G will produce very large increases in kidney failure? The only way to find out is to do biological safety testing of genuine 5G radiation. Let me give you a third example. Fetuses and very young babies have much more water in their bodies than do

adults. Therefore, they may be a special risk for impacts of 5G, because of great increases in the regeneration of the electrical fields. Here one can think of all kinds of possibilities. Let me suggest two. We may have a gigantic (sorry about using that word again) epidemic of spontaneous abortion due the teratogenic effects. Another possibility is that instead of autism being one birth in 38, however horrendous that is, it could be one out of two, or even a majority of births. I don't know that these will happen, but these are the kinds of risks we are taking and there are many others one can think of. Putting in tens of millions of 5G antennae without a single biological test of safety has got to be about the stupidest idea anyone has had in the history of the world.

This brings us back to the earlier point. The only way to do 5G safety testing is to do genuine 5G biological safety testing. I have published on how this can be done relatively easily at relatively low cost and have, as you saw in the Chapter 6, told the FCC how this can be done. Those tests must be done by organizations completely independent of industry and that leaves out both ICNIRP and SCENIHR and a lot of other organizations.

Now we will get into the precautionary principle which is specially relevant to the EU but may have lessons for all of us.

Dr. Vinciūnas' last full paragraph reads as follows: "The recourse to the EU's precautionary principle to stop distribution of 5G products appears too drastic a measure. We need first to see how this technology will be applied and how the scientific evidence will evolve. Please be assured that the Commission will keep abreast of the scientific evidence in view of safeguarding the health of European citizens at the highest level possible and in line with its mandate."

Article 191 defines the **Precautionary Principle** as follows:

"According to the European Commission the precautionary principle may be invoked when **a phenomenon, product or process may have a dangerous effect**, identified by a **scientific and objective evaluation**, **if this evaluation does not allow the risk to be determined with sufficient certainty**.

Recourse to the principle belongs in the general framework of **risk analysis** (which, besides risk evaluation, includes risk management and risk communication), and more particularly in the context of **risk management** which corresponds to the decision-making phase.

The Commission stresses that the precautionary principle may only be invoked in the event of a potential risk and that it can never justify arbitrary decisions.
The precautionary principle may only be invoked when the **three preliminary conditions** are met:

identification of potentially adverse effects;
evaluation of the scientific data available;
the extent of scientific uncertainty."

The question now is what about 5G? We have with 5G strong suspicions of similar or much more severe risk of effects documented elsewhere in this document. We have no biological safety testing of genuine 5G radiation. Therefore, we have no risk analysis or risk management because we have no risk assessment whatsoever on 5G. So here we have Dr. Vinciūnas arguing that the request for precautionary principle application is premature. But it is not the request for

the use of the precautionary principle that is premature, it is the Commission's claim that it has done the required risk analysis and risk assessment. This is the bizarre world that we live in.

The European Commission has done nothing to protect European citizens from the very serious health hazards and the U.S. FDA, EPA and National Cancer Institute have done nothing to protect U.S. citizens. The U.S. FCC has been worse than that, acting in wanton disregard for our health.

Let me close, as follows. There have been certain points in our history where people have stood up to strong destructive forces against what often appeared to be insurmountable odds. Those people are THE most honored people in our history. The people who failed to do so are among the most despised people in our history. I am not at all sure we will have historians to record us 100 years from now or even 30 years from now, given the direction in which we are heading. But if we do, rest assured that these are the standards by which we will all be judged.

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From:	Pall, Martin L
To:	Council Clerk – Testimony; Dennis, Kristin; Commissioner Fish; Commissioner Fritz; Commissioner Hardesty; Commissioner Eudaly
Cc:	Robyn Gottlieb; rodrigue@emfradiationspecialist.com; D M; Deb Mayer
Subject:	5G
Date:	Tuesday, February 12, 2019 9:53:44 PM
Attachments:	EMF-appealList.pdf FCCcapturedagency.pdf Finland4-2019Overview.docx EU-EMF2018-6-11US3.pdf

Dear Mayor Wheeler, Commissioners Fish, Fritz, Hardesty and Eudaly:

I understand that you have been getting a lot of propaganda from the telecom industry but it has no relationship to the actual scientific information. The situation from the electromagnetic fields is dire and the situation from 5G will be vastly worse. If you put these 5G proposals through with no thought of the consequences, it will be the worst thing that has ever been done in the city of Portland by far.

I am attaching four documents for your information. The first is a list of 41 statements from scientists and/or physicians, each expressing great concern about the so-called safety guidelines, statements that are based on the strongest science, but get no attention whatsoever from the telecom industry or the FCC. Two of the most recent of these are on 5G and there is a third which will be finalized within days.

The second document I am attaching is a 6 chapter document from the Safra Institute for Ethics at Harvard University showing that the FCC is a "captured agency", captured by the telecom industry that it is supposed to be regulating.

The third document that I am attaching is a document that describes my own role as a scientist working on electromagnetic field (EMF) health impacts. This document was recently prepared with regard to some talks to be given in Europe in this coming Spring. As you can see, there are already many major effects produced by the EMFs we are already exposed to and that 5G will make the situation vastly worse. We are already causing large numbers of neurological/neuropsychiatric effects, due to the impacts of EMFs on our brains and that these effects are cumulative, getting worse and worse with longer times of exposure and because these effects are cumulative and as they become more severe, become irreversible, our collective brain function is already under severe attack. In animals, it was already known 40 over years ago, that the structure of animal brains become more a more severely impacted by exposures well within our current safety guidelines, to the point that they have no resemblance to a normal animal brain. There are also reproductive effects in humans and on animals, producing much lowered male reproduction, female reproduction, increased spontaneous abortion, lowered levels of the three sex hormones and lowered libido. In mice, EMF exposure well within out safety guidelines within 90 to 150 days, produced a crash in reproduction to zero, a crash that was essentially irreversible. It is already the case that sperm counts have dropped to below 50% of normal in every single technologically advanced country on earth. Reproduction has already dropped well below replacement levels in every single technologically advanced country on earth with a single exception. Now three east Asian countries appear to have started their crash in reproduction and it seems likely that all of the rest of us will be following along shortly. 5G will probably greatly speed this whole thing so we can crash in months instead of taking years.

There are many other things that we know are also caused by EMFs: Oxidative stress, free radical damage which have roles in causing essentially all chronic disease; attacks on the DNA of our cells, causing mutations that cause cancer and when they occur in human sperm, which they do, they cause the most important types of human mutations; there are effects on all or almost all of the hormone systems in the body; there is increased apoptosis (programmed cell death) which has roles in producing the reproductive effects and in causing neurodegenerative diseases; there are also life threatening cardiac effects on the electrical control of the heart including tachycardia, arrhythmia, bradycardia (with longer exposure) and heart palpitations; and then there is cancer which has been clearly been shown to be caused by cell phone radiation and cell phone tower radiation. A recent review on people living near cell phone towers reported "remarkable increases in cancer" in people living within 400 meters of a cell phone tower; about half of us live within 400 meters of a cell phone tower.

There are lots of other things where the linkage to EMFs is probable, but not yet certain, more things to look forward to. Things like very early onset Alzheimer's and other dementias, people age 30 coming down the Alzheimers disease; autism and ADHD where late prenatal and early post-natal exposures are thought to have by far the most important roles; then we have impacts of EMFs on the immune system, clearly causing autoimmune diseases in animals but where we have only limited data in humans at this writing.

We know how the EMFs can produce all of these effects or apparent effects, through the mechanism of action of the EMF action that I have discovered. There is no mystery any more, because this mechanism is shown to be produced by EMFs from both the biological studies and the physics! Look over the last four paragraphs and answer one question for me – are you willing to greatly speed all of this up with 5G?? The plan that is being pushed by the FCC and the telecom industry is to put out tens of millions of 5G antennae communicating with billions of devices ***without doing one single biological safety test of genuine 5G radiation with all of its pulsations and therefore biological activity***. Is that what you want for this city?

And let me say, that this says nothing about the ecological impacts that will be massive, almost more massive than I can imagine. I predict that there will be fires that will make the California fires look tame, because EMFs make plants much more flammable by causing them to make very large amounts of highly volatile, highly flammable terpenes.

The fourth document is a 90 page, 7 chapter document which I wrote which documents how each of these effects are produced. The 7th chapter is all about the dangers of 5G. Chapters 5 and 6, over 60% of the text, show how the science has been corrupted. This document has been translated into French and will be translated shortly into German and Norwegian. A somewhat related document has been translated into Italian.

Thank you for your attention,
Martin L. Pall, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University

McClymont, Keelan

From: Pall, Martin L <martin_pall@wsu.edu>
Sent: Friday, March 1, 2019 10:54 AM
To: Council Clerk – Testimony; Dennis, Kristin; Commissioner Fish; Commissioner Fritz; Commissioner Hardesty; Commissioner Eudaly
Cc: Robyn Gottlieb; rodrigue@emfradiationspecialist.com; D M; Deb Mayer; Andrew Markell
Subject: More information on millimeter waves and 5G
Attachments: CIAmmHuman.pdf; mmWaveCIATranslat.pdf; 5GRonKostoff.docx; FCC-BlumenthalResp.pdf; DrShurenFDAstatement11-2019.docx

Dear All:

The first two attachments are CIA translated documents of Russian language studies showing that millimeter wave EMFs of frequencies to be used with 5G produce effects deeply within the bodies of animals and inside brains of humans, effects that are circa 20 times deeper than the industry claims is possible. I predicted this in Chapter 7 of my 90 page document based on the physics and also based on the findings that microwave frequency EMFs act circa 40 times more deeply than the industry claims is possible. It is important to see empirical verification regarding millimeter wave effects in these CIA translated studies.

This means of course, that 5G can be confirmed to be much more dangerous than the industry claims is possible, but it greatly underestimates the effects of genuine 5G radiation. That is because 5G is designed to be extremely highly pulsed and we have 13 review articles showing that pulsed EMFs are, in most cases, much more biologically active and therefore much more dangerous than are non-pulsed EMFs the extraordinarily high level of pulsation of genuine 5G radiation makes it potentially and I believe actually extremely dangerous. The only way to test this is to do biological safety testing, something the industry and the FCC have systematically avoid doing.

I am also attaching a document from Ronald Kostoff which includes information regarding the Sacramento CA 5G system. What it shows is that the Sacramento system while producing radiation well below the safety guidelines, produce radiation that is orders of magnitude above the levels known to produce health impacts. That just repeats what you already know, namely that the safety guidelines have nothing to do with the actual health threats. We know that EMFs that are 5 orders of magnitude (100,000 times) lower than those allowed by the safety guidelines produce substantial health effects. And these figures do not take into consideration the fact that 5G may well be vastly worse because of the millimeter wave frequencies and high level pulsations to be used. The only good news here is that because of the complex dose-response curves, effects do not always increase with increasing exposures - sometimes they decrease - if it hadn't been for that we would have all been dead long ago.

Senator Blumenthal (Connecticut) and Congesswoman Eshoo (Silicon Valley CA) wrote a letter to the head of the FCC demanding all studies on safety, or lack thereof of 5G radiation. The response they received was that the FCC has no such evidence, rather referring Senator Blumenthal to the FDA (see attached). So the FCC is claiming that 5G is safe while having no evidence of safety.

What then does the FDA have to say? Their position can be seen from the statement of Dr. Shuren of the FDA (see attached). Dr. Shuren states that "We have relied on decades of research and hundreds of studies to

have the most complete evaluation of radiofrequency energy exposure. This information has informed the FDA's assessment of this important public health issue, and given us the confidence that the current safety limits for cell phone radiofrequency energy exposure remain acceptable for protecting the public health." He also states that "Based on our ongoing evaluation of this issue, the totality of the available scientific evidence continues to not support adverse health effects in humans caused by exposures at or under the current radiofrequency energy exposure limits. We believe the existing safety limits for cell phones remain acceptable for protecting the public health." Dr. Shuren makes these statements while providing no evidence in support of them. These statements are among the most difficult statements to document, because of the complexity of the topic and because there are circa 10,000 primary literature citations which each argue that these statements are false, that is that the FDA position has been falsified. You have already seen in Chapter 1 of my 90 page document that there are 167 bodies of evidence in published review articles each arguing for the existence of an important effect at levels well below FCC safety guidelines and each of these 167 is vastly better documented than all of the claims of the FCC or the FDA that nothing is going on. Many of these are peer-reviewed, unlike the FCC or FDA statements, and are considered, therefore, to be more scientific.

We have, in summary, a situation where we are already in a megacrisis based on the EMF exposures we already have and where we have every expectation that 5G will make things vastly worse. When I first got involved in EMF research including the main mechanism of action of EMFs, 6 1/2 years ago, I rapidly became convinced that this was an unparalleled environmental health crisis and every month that passes brings new important understandings which make the situation much worse. I have over the 6 1/2 year period, donated approximately 10,000 hours of my time to studying EMF health effects with no remuneration whatsoever because the almost unimaginable severity of the situation. I would like to meet individually with the Mayor and each Commissioner over the next two weeks to share my expertise with each of you. I am going to request a one hour meeting, but if I can't get that, I will take what I can get. I will call early next week to try to set up meetings.

Martin L. Pall, Professor Emeritus and Portland resident

On Feb 27 Kostoff, Ronald N <ronald.kostoff@pubpolicy.gatech.edu> wrote

Following are some excerpts from Verizon's consulting engineer on radiation from a proposed small cell antenna in Sacramento.

p.247

"Based on worst-case predictive modeling, the worst-case emitted power density may exceed the FCC's general public limit within approximately 3 feet of the antenna at the antenna face level.

At the nearest walking/working surfaces to the Verizon antennas, the maximum power density generated by the Verizon antennas is approximately 6.50 percent of the FCC's general public limit (1.30 percent of the FCC's occupational limit)."

Two issues from this statement. First, if we assume the general public limit is 10,000,000 microwatts/square meter, then that power flux is achieved at about one meter from the antenna roughly in the plane of the antenna. This means e.g. that a second-floor window perhaps five meters from the antenna would receive a power flux of approximately 1/25 * 10,000,000 or ~400,000 microwatts/square meter. If that is the window to someone's bedroom, they would be subjected to substantial levels of radiation throughout the night.

Second, pedestrians/workers/outdoor café diners in the nearest allowable location to the antenna would be subjected to as much as 650,000 microwatts/square meter. These radiation levels are massive, and are orders of magnitude above those shown in the medical literature to cause harm.

RNK

Example of the Effects on Humans (mm Waves)

Science Applications International Corporation
Cognitive Sciences Laboratory

Approved For Release 2000/08/10 : CIA-RDP96-00792R000100070001-9

Reactions of the Central Nervous System to Peripheral Effects of Low-Intensity EHF Emission

Natalia N. Levedeva
(Translation from Russian)

Abstract

The study of reactions of the human central nervous system (CNS) to peripheral effects of EHF emission, created by therapeutic apparatus Yav-I (7.1 mm wavelength) revealed restructuring of the space-time organization of biopotentials of the brain cortex of a healthy individual which indicate development of a non-specific activation reaction in the cortex. The study of sensory indication of EHF field with these parameters showed that it is can be reliably detected at the sensory level by 80% of the subjects.

Introduction

In the process of study of reactions of living systems with a different level of organization to millimeter waves, non-thermal (informational) effects were discovered.[1-3] The distance from the place affected by the emission to the location of appearance of the biological reaction may be hundreds and thousands times larger than the distance at which the emission decreases one order of magnitude. This fact demonstrates participation of the nervous system in perception of millimeter-range emission by living organisms.

There is a wide-spread opinion that biological effects of EMF are realized in humans at a subsensory level. However, in the recent years there is interest to their sensory detection in the form of radiosound, magnetophosphenes, or skin sensations.[4-9]

Changes in EEG to EMF effects were most often observed in the form of an increase in the slow waves and spindle-shape oscillations in reptiles, pigeons, rats, rabbits, monkeys, and humans.[10-12]

We have not found studies devoted specifically to the effects of millimeter waves on the central nervous system in the available literature; thus, the current study has been undertaken. This study employed electrophysiological and psychophysiological methods for the evaluation of the state of the central nervous system while affected by EMF.

Methodology

Twenty healthy subjects aged 17 to 40 years participated in the experiments. Apparatus Yav-I with the wave length of 7.1 mm was used as the EMF source. A flexible waveguide with the power of 5 mW/cm^2 at its end was directed at He-Gu [4 Gi] acupuncture point in the right or left hand of the subject.

Two experimental series have been conducted. In the first one (10 subjects, 10 tests with each subject, 20 instances of field action in each test), sensory detection of the field was studied. The length of the EMF signal or control trial without the signal was 1 minute. To evaluate the subject's EMF sensitivity, the indicator of response strength (RS) was used, i.e., the ratio between the number of correctly identified

trials and the total number of EMF signals. Another indicator used was the level of false alarms (FA), i.e., the ratio between the number of false positives to the total number of control trials. The significance of the difference between RS and FA was evaluated by using the Mann-Whitney test. The analysis of latent time T_{lat} included total histograms of true responses and false alarms.

In the second series (10 subjects, 11 tests with each, including placebo tests) the exposure to the field was 60 minutes.

EEG recording was conducted before and after the EMF influence by using EEG-16S (Hungary), with 4 paired leads, located according to 10-20% system (in the frontal F-F, central C-C, parietal P-P and occipital O-O areas). As the reference electrode, a joint ear electrode was used.

Together with EEG recording on paper, the data were fed for on−line processing into an IBM-PC Amstrad computer using spectrum coherent analysis by means of rapid Fourier transformations with plotting power spectra and computing mean coherence levels. Selected for the study were frequencies from 2 to 30 Hz in major physiological ranges of the EEG spectrum.

Results and Discussion

In the first experimental series, the subjects showed a division into two unequal subgroups according to their RS and FA indicators. The first subgroup (8 individuals) could detect at a statistically significant level: the differences between RS and FA were significant according to Mann-Whitney test, the means for RS and FA being 64.3±10.5% and 20.6±11.2%, respectively. The second subgroup (2 individuals) could not reliably distinguish between EMF effects and control trials, the means for RS and FA being 59.0±14.25% and 43.53±16.5%, respectively.

From the eight individuals who could detect the EMF well, two could reliably distinguish it from control trials with both hands, one could do this only with the left hand and the others only with the right hand. An analysis of distribution of Tlat of true responses and false alarms showed single mode distribution in both instances. The mean of latent time for eight subjects was 46.1±5.8 sec.

The prevalent sensations were pressure (46.7%), tingling (36.3%), itching (8.9%), warmth-coolness (5.3%), and other sensations (2.8%). All the sensations were experienced either in the palm of the hand or in the fingers, each subject having his own set of sensations.

An analysis of the data obtained experimentally justifies the assumption that humans are capable to perceive sensorially the EMF in the millimeter range, similarly to their capacity of perceiving the ELF fields,[4-6] which is in accordance with the results obtained elsewhere.[9]

Interaction of any physical factor with biological systems of complex organization begins on their surface, and the skin is the first receptor. Unlike other analyzers, the skin does not have absolutely specific receptors. This was confirmed in experiments conducted by A. N. Leontiev and his associates,[13] who conducted similar studies with non-thermal emission in the visible range of spectrum and found that their subjects were capable of reliably distinguishing the emission effects from control trials. The modes of perception were similar to those observed in our tests. Thus, our results as well as data of other authors indicate the importance of the skin analyzer in EMF perception.

Study of the modes of perception which occur in the process of EHF field reception makes it possible to assume that EMF stimuli are perceived either by mechanical receptors (sensations of touch or pres-

sure), or by pain receptors, i.e., nociceptors (tingling and burning sensations). From mechanical receptors, only Ruffini's and Merkel's endings and tactile disks may be involved in the process, according to the depth of their location in the epidermis, their adaptation speed and their capacity to spontaneous activity. The assumption that nociceptors may be responsible for the reception of EMF signal is based on the following: their polyspecificity in relation to stimuli; the kind of sensations (e.g., tingling and burning), which are considered precursors of pain; experiments which showed complete disappearance of EMF sensitivity in individuals whose skin at the place of influence was treated by ethyl chloride that turns off pain receptors; facts from medical practice that the EHF influence on the respective dermatome causes sensory response in the afflicted organ of the body which may be the result of convergence of nociceptive afferents from the dermatomes and the internal organs on the same neurons of pain pathways. With this, skin hypersensitivity occurs because visceral impulses increase the excitability of inter-stitual neurons and facilitation takes place.

The latent time of EMF responses (to both ELF range and millimeter range EMF) is unusually large. While the reaction time of visual and auditory sensory systems is from dozens to hundreds of milliseconds, the perception of EMF takes dozens of seconds. This is in a good agreement with theoretical calculations by I. V. Rodshtat[14] who made an assumption that a single time cycle of microwave sensory reception, including detection of sensory sensation, is within 40 to 60 seconds. This is explained by a complex structure of the reflex arc which includes both nervous and humoral links.[14]

An analysis of inter-central EEG ratios is one of the approaches to the study of regulation mechanisms of functional states of the human brain.

As known from the literature,[15] the indicator of coherence level (COHm) is the most significant of EEG correlates which characterizes the peculiarities of the human brain functioning.

Major changes of the cortical EEG with regard to both inter-central and intra-hemispheric connections in placebo tests can be characterized either by a decrease in COHm, especially in the range of delta and theta, or by maintaining the background level. A power spectrum analysis shows a decrease in the brain waves magnitude, especially in the alpha range (Fig. 1).

Thus, as a result of placebo (control) tests, a kind of "expectancy reaction" with specific space-time organization of the cortex biopotentials takes place.

A different EEG pattern is observed after the individual is exposed to EMF. There is a significant power increase in the alpha range, especially in occipital and parietal areas in both hemispheres; in other parts of the spectrum the power remains close to the background level (arrows 2 and 3 in Fig. 1). Unlike in placebo tests, an increase in the mean of the coherence level COHm takes place practically in all the subjects resulting from exposure to EHF. It mainly occurs in the frontal and central areas of the cortex and is mostly expressed in slow wave spectrum range (delta and theta). A similar pattern of brain waves is characteristic of the state of an increased brain tone (i.e., it occurs in non-specific activation reaction).[16] This kind of response is characteristic because it is known that frontal areas of the cortex are sensitive to various external factors. These zones have broad bilateral connections with other cortical and subcortical structures which determine the involvement of frontal areas in many functional response systems.

Conclusions

(1) Peripheral effects of EHF (7.1 mm wave length, 5 mW/cm^2) with a 60 minute exposure causes restructuring of the cortical brain waves in a healthy individual; this points to the developments of a non-specific activation reaction (i.e., to an increase in the tone of the cortex).

(2) The study of sensory detection of EMF in EHF range showed that the field with the above parameters is detected at a statistically significant level by 80% of the subjects.

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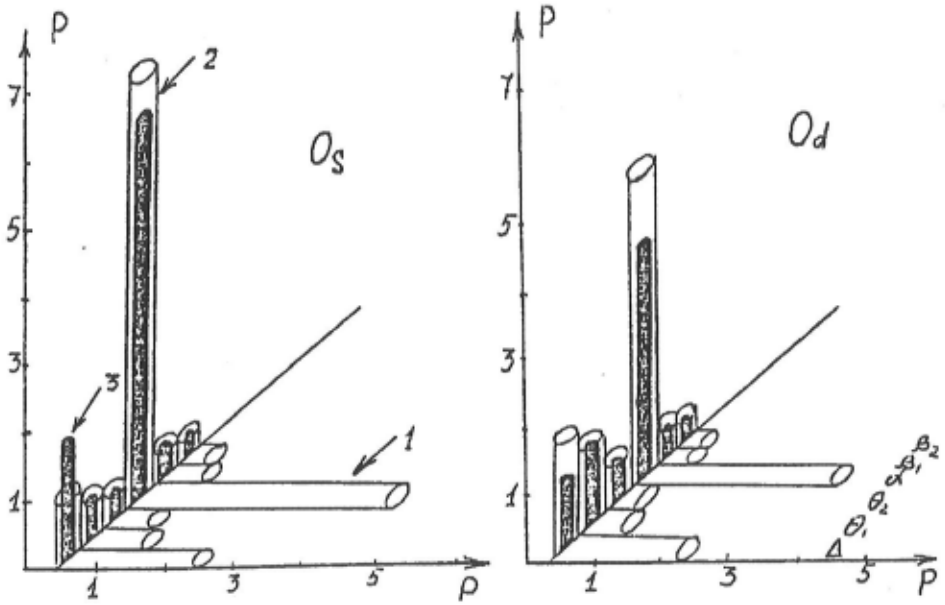

Fig. 1.

https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm624809.htm

FDA Statement

Statement from Jeffrey Shuren, M.D., J.D., Director of the FDA's Center for Devices and Radiological Health on the National Toxicology Program's report on radiofrequency energy exposure

- For Immediate Release

November 1, 2018

Statement

We know that cell phones are an important, everyday tool to most Americans. We use them now for much more than just talking—from booking travel on an app to using mobile wallets to pay for groceries. Our ubitquitious use of cell phones inevitably means that we must continue to review and ensure their safety.

The Food and Drug Administration is charged with ensuring cell phones— and any radiation-emitting electronic product—are safe for the public to use. Our scientific expertise and input, along with other health agencies, are used by the Federal Communications Commission (FCC) to set the standards for exposure limits of radiation from cell phones, called radiofrequency energy.

We have relied on decades of research and hundreds of studies to have the most complete evaluation of radiofrequency energy exposure. This information has informed the FDA's assessment of this important public health issue, and given us the confidence that the current safety limits for cell phone radiofrequency energy exposure remain acceptable for protecting the public health.

When new studies or information becomes available, the FDA conducts thorough evaluations of the data to continually inform our thinking. We reviewed the recently finalized research conducted by our colleagues at the National Toxicology Program (NTP), part of the National Institute of Environmental Health Sciences within the National Institutes of Health, on radiofrequency energy exposure. After reviewing the study, we disagree, however, with the conclusions of their final report regarding "clear evidence" of carcinogenic activity in rodents exposed to radiofrequency energy.

In the NTP study, researchers looked at the effects of exposing rodents to extremely high levels of radiofrequency throughout the entire body. This is commonly done in these types of hazard identification studies and means that the study tested levels of radiofrequency energy exposures considerably above the current whole body safety limits for cell phones. Doing this was intended

to help contribute to what we already understand about the effects of radiofrequency energy on animal tissue. In fact, we only begin to observe effects to animal tissue at exposures that are 50 times higher than the current whole body safety limits set by the FCC for radiofrequency energy exposure.

Our colleagues at NTP echoed this point in a statement earlier this year about their draft final report, including the important note that "these findings should not be directly extrapolated to human cell phone usage."

We agree that these findings should not be applied to human cell phone usage.

NTP hosted a three-day peer review of this study in March, as part of their normal process for issuing scientific reports. The FDA was not a participant in that process, but was invited to observe the panel discussions, which included an assessment of the study methods and data by a panel of 15 peer reviewers to determine the basis of evidence for the final report. Based on their assessment, the panel voted to upgrade the conclusions from some evidence to clear evidence for malignant heart schwannomas in male rats, and from equivocal (ambigious) to some evidence for malignant gliomas of the brain and benign tumors of the adrenal gland in male rats. It's important to note that the vote does not mean new data or findings were reported in the final assessment.

In addition, as we've noted previously, there were unusual findings in the study, such as: the rats exposed to whole body radiofrequency energy lived longer than rats that were not exposed to any radiation (control group); only male rats exposed to the highest radiofrequency energy dosage developed a statistically significant number of heart schwannomas, which are very rare in humans, when compared to the control group in this experiment. There was also no true dose response, or a lack of a clear relationship between the doses of radiation administered to the animals and their subsequent tumor rate. Researchers will need to consider all of the findings when exploring future human epidemiological studies.

As scientists, we welcome new studies. Animal studies like this one contribute to our discussions on this topic, but we must remember the study was not designed to test the safety of cell phone use in humans, so we cannot draw conclusions about the risks of cell phone use from it. We also must thoroughly evaluate and take into consideration the totality of the data, and do so within the context of the complete body of evidence rather than drawing conclusions from the results of a single study.

As part of our commitment to protecting the public health, the FDA has reviewed, and will continue to review, many sources of scientific and medical evidence related to the possibility of adverse health effects from radiofrequency energy exposure in both humans and animals and will continue to do so as new scientific data are published.

Based on our ongoing evaluation of this issue, the totality of the available scientific evidence continues to not support adverse health effects in humans caused by exposures at or under the current radiofrequency energy exposure limits. We believe the existing safety limits for cell phones remain acceptable for protecting the public health.

The FDA, an agency within the U.S. Department of Health and Human Services, protects the public health by assuring the safety, effectiveness, and security of human and veterinary drugs, vaccines and other biological products for human use, and medical devices. The agency also is responsible for the safety and security of our nation's food supply, cosmetics, dietary supplements, products that give off electronic radiation, and for regulating tobacco products.

Federal Communications Commission
Washington, D.C. 20554

Brendan Carr
Commissioner

December 17, 2018

Dear Senator Blumenthal and Congresswoman Eshoo,

Thank you for your December 3, 2018, letter regarding the Senate Commerce Committee field hearing in Sioux Falls, South Dakota. I appreciated the chance to spend time outside of Washington, D.C., and hear directly from community leaders who are eager to see next-generation broadband deployed across the country. I welcome the chance to respond to your letter, which touches on topics discussed at the hearing.

Local governments are critical partners in building wireless infrastructure. As an order the Commission adopted in September affirms, localities play an important role in reviewing the placement of wireless facilities, applying reasonable aesthetic requirements that reflect the surroundings, and charging fees that allow localities to recover their costs. At the same time, Congress has prohibited localities from regulating wireless infrastructure based on radio frequency emissions, stating that, "No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions." 47 U.S.C. § 332(c)(7)(B)(iv).

As indicated in my remarks, federal agencies that are experts in these health and safety issues monitor and evaluate the relevant science and stay up-to-date on scientific and medical studies. I also indicated that these experts consistently take new information into account.

The FCC sets the radiofrequency emissions limits for cell phones and other electronic equipment, relying on the scientific and medical expertise of our sister federal agencies. As Dr. Jeffrey Shuren, Director of the FDA's Center for Devices and Radiological Health, recently explained, "The Food and Drug Administration is charged with ensuring cell phones—and any radiation-emitting electronic product—are safe for the public to use. Our scientific expertise and input, along with other health agencies, are used by the [FCC] to set the standards for exposure limits of radiation from cell phones . . . ."[1]

[1] Statement from Jeffrey Shuren, M.D., J.D., Director of the FDA's Center for Devices and Radiological Health, on the National Toxicology Program's report on radiofrequency energy exposure (November 1, 2018), https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm624809.htm.

The FCC indeed has set RF exposure limits. And those limits do not stop at 6 GHz. Rather, the FCC's rules apply up to 100 GHz.[2]

Your letter references a recent report from the National Toxicology Program (NTP). On February 2, prior to my remarks in Sioux Falls, the NTP released a draft report on radiofrequency energy exposure. After reviewing the draft report, Dr. Shuren of the FDA confirmed his agency's determination that, "the current safety limits for cell phone radiation remain acceptable for protecting the public health." That determination was based on, "hundreds of studies from which to draw a wealth of information about these technologies," and the FDA pledged to continue to review, "many sources of scientific and medical evidence . . . as new scientific data are published," including the NTP's report.[3]

The NTP released the final version of its report on November 1, subsequent to my remarks in Sioux Falls. Dr. Shuren of the FDA again reviewed the report and again affirmed the current RF limits. "We have relied on decades of research and hundreds of studies to have the most complete evaluation of radiofrequency energy exposure. This information has informed the FDA's assessment of this important public health issue, and given us the confidence that the current safety limits for cell phone radiofrequency energy exposure remain acceptable for protecting the public health," wrote Dr. Shuren. He stated again that, "the FDA has reviewed, and will continue to review, many sources of scientific and medical evidence . . . and will continue to do so as new scientific data are published."[4]

Thank you again for contacting me about small cell deployment and 5G. I look forward to continuing to engage with you on these issues.

Sincerely,

Brendan Carr

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[2] *See, e.g.*, 47 C.F.R. § 1.1310(e).

[3] Statement from Jeffrey Shuren, M.D., J.D., Director of the FDA's Center for Devices and Radiological Health, on the recent National Toxicology Program draft report on radiofrequency energy exposure (February 2, 2018), https://www.fda.gov/newsevents/newsroom/pressannouncements/ucm595144.htm.

[4] Shuren, *supra* note 1.

UDC 612.014.424.5

BIOLOGICAL EFFECT OF MILLIMETER RADIOWAVES

Kiev VRACHEBNOYE DELO in Russian No 3, 1977 pp 116-119

[Article by N. P. Zalyubovskaya, Khar'kov Scientific Research Institute of Microbiology, Vaccines and Sera imeni Mechnikov]

[Text] Morphological, functional and biochemical studies conducted in humans and animals revealed that millimeter waves caused changes in the body manifested in structural alterations in the skin and internal organs, qualitative and quantitative changes of the blood and bone marrow composition and changes of the conditioned reflex activity, tissue respiration, activity of enzymes participating in the processes of tissue respiration and nucleic metabolism. The degree of unfavorable effect of millimeter waves depended on the duration of the radiation and individual characteristics of the organism.

The ubiquitous propagation of radiowaves, radio broadcasting and television is contributing to the appearance of a new physical factor -- electromagnetic waves of the radio-frequency range. In recent years it has been established that radiowaves of different ranges have an unfavorable influence on the organism. The literature data (A. G. Subbota, 1970; N. V. Tyagin, 1971; B. A. Chukhlovin, 1973; M. I. Yakovleva, 1973; Yu. D. Dumanskiy et al, 1975) testify that long stay in conditions of the effect of radiowaves (the dm and cm ranges) leads to change of the functions of the nervous, cardiovascular and other systems of the organism, with the development of a characteristic complex of symptoms which permit speaking of a special nosological form of disease -- radiowave disease (M. N. Sadchikova, 1973). However, in the literature there is almost no information about the biological effect of radio frequencies of the millimeter range, although that range is widely used in technology and the question of its biological activity has acquired special urgency.

The goal of the present investigations consisted in study of the physiological and biochemical processes lying at the basis of the changes which occur in animals as a result of the effect of radiowaves in the range of 5-8 mm, at a density of the flow of power of 1 milliwatt/cm^2. The investigations were conducted on rats of the Wistar line and mice of the CBA line, irradiated for 15 minutes daily in the course of 60 days in the volume resonator of an experimental installation working on the basis of a type OV-12 generator.

Study of the morphological, functional and biochemical indicators, which play an essential role in the formation of reactions of the organism, disclosed various disorders in the experimental animals.

As is known, the energy of millimeter waves, because of its weak penetrating ability, is absorbed primarily and mainly by the skin. Our investigations have shown that in the skin of irradiated animals deformation of the receptor apparatus and well-expressed changes of a reactive character were observed. In the skin layer properly speaking appeared bunches of nerve fibers with hypertrophy of a portion of the fiber and sections with demyelinization. In the dermis, among the collagen fibers were small trunks of various thickness, the neural conductors of which were fragmented in separate cases, and phenomena of demyelinization were observed in the surface layers.

As the results of histomorphological analysis showed, in the functionally active structures of tissue of the myocardium, liver, kidneys and spleen disorders of the hemodynamics were established, with disruption of the permeability of the vesicular membranes, the appearance of micronecroses and subsequent tissue dystrophy. Moreover, qualitative and quantitative shifts were revealed in the erythrocytic and leukocytic composition of the blood of irradiated animals, indicating suppression of the hemopoietic function of the bone marrow and ymphatic system. Noted in the composition of the red blood was eosinophilia, neutrophilia and lymphopenia, and lowering of the hemoglobin level and reduction of the number of erythrocytes were observed, which was determined to a considerable degree by the retention of erythrocytes in the bone marrow. In the latter occurred an increase of the number of erythroblastic cells and decrease of cells of the leukoblastic series.

Under the effect of millimeter waves of low intensity the degree of affection depends on the general condition of the organism and evidently is not so great, as the observed disorders are in the main reversible.

A characteristic feature of the biological effect of radiowaves was changes of the state of various sections of the central and vegetative nervous systems which involve directly or indirectly disorders of the principal functions of the organisms (M. I. Yakovlev, 1973).

As a result of investigations conducted by us on animals irradiated with millimeter waves, disorders of conditioned reflex activity have been established: weakening of the stimulatory process, reduction of the size of the latent period in response to different conditioned stimuli (light, noise or pain) and disinhibition of differentiation reactions. Disorders of the stimulatory and inhibitory processes displayed in animals during the repeated effects of millimeter radiowaves can be considered suppression of the function of the central nervous system, although the developed inhibition can be linked with protective-compensatory reaction of the organism in response to irradiation.

In the blood plasma of irradiated animals the content of 17-oxycorticosteroids increased (22.64 ± 2.18 mkg per 100 ml of plasma of the irradiated and 14.98 ± 2.01 mkg of the unirradiated. Along with that, in the adrenal cortex of

rats irradiated by millimeter waves the ascorbic acid level dropped 5%. The functional changes established in the content of 17-ocs in the blood plasma and of ascorbic acid in the adrenal cortex of irradiated animals indicate the influence of millimeter radiowaves on the central components of the hypothalamus-hypophysis system -- the adrenal glands with involvement of a number of humoral components.

The conducted investigations showed that in animals subjected to the effect of millimeter radiowaves there was a variation of the content and ratio of catecholamines: in the blood the concentration increased, in the hypothalamus the adrenaline content increased and the noradrenaline level dropped, in the cerebral cortex there was a slight redistribution of catecholamines, in the adrenal glands the adrenaline content doubled and the noradrenaline level dropped by 11% in comparison with that in unirradiated animals. The adrenaline concentration in the adrenal glands remained elevated by 60% 10 days after the irradiation ceased. The obtained results indicate well-expressed changes of metabolism of catecholamines under the influence of millimeter waves both in the hormonal and in the sympathetic components of the sympathetic-adrenal system and also reflect changes of the functional activity of its hormonal and mediator components.

The main mass of the energy in tissues and organs of animal organisms, as is known, is released during the biological oxidation of organic substances, in which case the greater part of it is accumulated in the form of macroergs. The processes of bioenergetics, occurring mainly in the mitochondria with the direct participation of respiratory enzymes which accomplish the terminal stage of biological oxidation, are of universal importance and assure the functional activity of organs and tissues, the synthesis of proteins and nucleic acids, the formation of some intermediate products of exchange, etc.

The conducted investigations showed that the irradiation of animals by millimeter waves caused changes of the processes of oxidative phosphorylation in the liver, kidneys, heart and brain of the animals. The irradiation inhibited the oxygen consumption rate by the mitochondria of those organs in the active phosphorylating state and slowed down the rate of respiration upon exhaustion of the ATP. In the liver and kidneys of irradiated animals the intensity of phosphorylation decreased by 64%, the values of the respiratory controls decreased by 26 and 28% respectively and the changes were less expressed in the heart and brain.

The established disorders of the process of conjugate oxidative phosphorylation in the mitochondria of irradiated animals testify to suppression of energy exchange and can be a result of changes occurring in the electron transport chain. The expressed hypothesis was confirmed by the results of investigations of the activity of enzymes participating in the processes of tissue respiration. In the mitochondria of the livers of irradiated animals the succinate dehydrogenase activity increased by 34% and the cytochromoxidase activity decreased by 37%. Those data testify to destruction of the cytochrome chain.

Very essential in the system of enzymes of cell energy supply is the role of the ATPases regulating the processes of formation and use of the energy of macroergs (V. P. Skulachev, 1969). The conducted investigations revealed in the mitochondria of the livers of irradiated animals an increase of ATPase activity by 63% as compared with similar indicators for the unirradiated. In that case in the liver and spleen of animals irradiated many times by millimeter waves there was a decrease of the content of adenylnucleotides by 61 and 68% respectively.

Investigation of the influence of millimeter waves on the state of nucleic exchange showed that in the liver, spleen, kidneys, lungs and heart there was a reduction of the content of nucleic acids and suppression of the rate of ^{14}C-thymidine in DNA and ^{14}C-uridine in RNA. In a comparison of the results of quantitative determination of nucleic acids it was established that the rate of inclusion of the predecessor in RNA and its content in the organs changes less than the DNA. The change of the nucleic acids concentration was more expressed in the liver, spleen and kidneys than in the heart and lungs. Together with reduction of the nucleic acids content, the quantity of acid-soluble products in the liver and spleen of irradiated animals increased by 35 and 43% and the activity of ribonuclease and DNAase increased 50%.

Under the influence of radiowaves the protein spectrum of the blood serum changed (the albumin content decreased and the number of globulins increased, which led to decrease of the value of the albumin-globulin coefficient) and the number of free amino acids decreased by 22%. An indicator of the reduced level of protein synthesis in the irradiated animals also was the established reduction of the rate of inclusion of ^{14}C-methionine in proteins of the liver, spleen, lymph nodes and thymus. The presented data testify to substantial changes in the protein metabolism which occur under the influence of multiple irradiation of animals by millimeter radiowaves. Evidently the reduction of of the general energy level occurring in the organism under the influence of millimeter radiowaves had an effect on the formation of macroergs and caused a suppression of all functions of the organism, including suppression of synthetic processes but especially of nucleoprotein metabolism, which is very energy-consuming.

The conducted experimental investigations were compared with observations of the state of health of 97 persons working with generators of the millimeter range on the basis of systematic conducting of biochemical analyses. The obtained data confirmed the existence of an influence of radiowaves on the state of metabolic processes in the organism, in particular, changes of the indicators of protein and carbohydrate metabolism were revealed and disturbances of the indicators of immuno-biological reactivity and of the blood system were established.

Thus the conducted investigations indicate high biological activity and an unfavorable influence of millimeter radiowaves on the organism. The expressness of the biological reactions increased with increase of the period of irradiation and depended on individual characteristics of the organism.

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5G – A Toxic Assault on the Planetary Web of Life

01/31/2019

"The 5G rollout is absolutely insane." ~ Dr. Martin Pall addressing the NIH

"Allowing this technology to be used without proving its safety is reckless in the extreme, as the millimeter waves are known to have a profound effect on all parts of the human body."
~ Prof. Trevor Marshall, Director Autoimmunity Research Foundation, California

"The plans to beam highly penetrative 5G milliwave radiation at us from space must surely be one of the greatest follies ever conceived of by mankind. There will be nowhere safe to live."
~ Olga Sheean former WHO employee and author of No Safe Place

It is already clear from over 10,000 studies on 2G, 3G, and 4G that these wireless network radio frequency (RF) radiation network systems are causing significant acute and chronic health problems, including life-threatening diseases such as cancer, heart disease, type-2 diabetes, and mental disturbances, such as depression, anxiety, and increased suicidal tendencies.

Beyond the statements of informed individuals decrying the 5G "rollover", there are also major organizations warning of its dangers. The International Appeal to Stop 5G on Earth and in Space currently boasts approximately 31,300 signatories as of January 11th, 2019. They write,

"We the undersigned scientists, doctors, environmental organizations and citizens from (__) countries, urgently call for a halt to the deployment of the 5G (fifth generation) wireless network, including 5G from space satellites. 5G will massively increase exposure to radio frequency (RF) radiation on top of the 2G, 3G and 4G networks for telecommunications already in place. RF radiation has been proven harmful for humans and the environment. The deployment of 5G constitutes an experiment on humanity and the environment that is defined as a crime under international law."

Even before 5G was proposed, dozens of petitions and appeals[i] by international scientists, including the Freiburger Appeal signed by over 3,000 physicians, called for a halt to the expansion of wireless technology and a moratorium on new base stations.[ii] In 2015, 215 scientists from 41 countries communicated their alarm to the United Nations (UN) and World Health Organization (WHO).[iii] They stated that "numerous recent scientific publications have shown that EMF [electromagnetic fields] affects living organisms at levels well below most international and national guidelines". These concerns have a strong scientific foundation. More than 10,000 peer-reviewed scientific studies demonstrate harm to human health from RF radiation.[iv] [v]

These wise statements, while accurate on one level, are missing the larger point. There is a plan, within the next two years, to launch 20,000 satellites to beam 5G onto the planet. This new attack on life on Earth would cause a disruption of the earth's primary harmonic frequency called the Schumann Resonance. When this harmonic resonance is disrupted, it is likely to cause and activate more physical and biological mechanisms for creating even more human health problems.

Since there's not a lot of understanding about the Schumann Resonance, a little bit of background will help the discussion. The Schumann Resonance is a frequency generated from the wave resonance of the lower part of the ionosphere and the earth. The ionosphere has several different layers and is a shell of electrons and electrically charged atoms and molecules that surrounds the earth. It stretches from a height of about 50 km (31 miles) to 1,000 km (620 miles). The most relevant layer is the D-layer, which is the innermost layer at about 37-56 miles above Earth's surface. It's between the earth and the D-layer where there's a resonance that is set up that creates the Schumann Resonance. There is a significant amount of research on the topic. In a paper by Neil Cherry published in July of 2002, he writes, "A large number of studies have identified significant physical, biological, and health effects associated with changes in solar and geomagnetic activity (S-GMA)."

The Schumann Resonance is a geomagnetic electric resonance between the surface of the earth and the lower levels of the ionosphere, which has a natural ultra-low frequency and extreme low-frequency signal. They are discovering that the Schumann Resonance signal is correlative with sunspot numbers and has a real physical mechanism located in the D-layer of the ionosphere with an ion and electron density that varies with the S-GMA. The Schumann Resonance would be potentially disrupted by 20,000 5G satellites put into orbit in the D-region of the ionosphere, as this D-region forms the upper boundary of the resonant cavity in which the Schumann Resonance is formed in relation to the earth. Research suggests that the Schumann Resonance signals are the mechanism through which melatonin production is activated. When the Schumann Resonance goes above 7.87 Hz, there is a decrease in melatonin secretion.

Many feel that the Schumann Resonance is already being altered by all the radiofrequency/microwave (RF/MW) radiation humans are presently creating, and 5G will alter it significantly more. In the process, the 5G may also be creating enough electropollution noise, whether or not it is raising the Schumann Resonance frequency, and therefore disconnecting humanity from accessing the Schumann Resonance itself, and, thus, creating and/or amplifying a variety of acute and chronic disease problems documented in over 10,000 scientific papers that come from these 2G, 3G, and 4G frequencies.

The Schumann Resonance is essentially the pulse of the heart of the earth, to which our hearts and brains are specifically attuned with.

It is highly likely it will be disrupted by 5G satellites, and thus would disrupt the basic harmonic of all life on the planet. The Schumann Resonance particularly resonates with our brains and hearts. This fact takes us to the heart of the matter. Basically, the electromagnetic field generated by the heart is *evolutionarily* tuned to 7.83 Hz. As this frequency potentially changes due to the increase in RF/MW radiation, it would most likely create problems in human health. This research needs to be done before 5G, and, particularly, 5G beamed from satellites is installed. This is basic health safety research. The Schumann Resonance is a planetary tuning fork to which all lifeforms on the surface of our planet are tuned. In essence, the physical, emotional, mental, and spiritual bodies and minds would be highly likely to be affected as the Schumann Resonance is disrupted.[vi], [vii] If it continues to rise in frequency due to the 5G (100 times more intense than current microwave), these human-made electromagnetic fields will create electromagnetic chaos. The increase of the Schumann Resonance above 7.83 Hz would increase the chaos within all biological organisms on the planet.

Researchers have shown that there is a key connection between the Schumann Resonance and the brain's alpha states (frequencies between 8 Hz – 12 Hz). Many researchers, such as Dr. Konig, from Munich University, have shown a correlation between Schumann Resonance and brain rhythms. Alpha states are the brainwave frequency at which thinking and creativity are associated. Alpha brainwaves are associated with overall mental and body/mind coordination, alertness, and learning. These are core human functions, which may eventually express problematically as discordant psychological states.

The good news is that as long as the properties of the earth's electromagnetic cavity, which holds the Schumann Resonance remain the same, we will remain in harmony with the Schumann Resonance and with the earth. The Schumann Resonance also helps the human biological system to become synchronized with the daily rhythmic cycles of the earth and melatonin production. According to Dr. Cherry's research, as we disrupt the Schumann Resonance, including raising the potential frequency above 7.83 Hz through a variety of ways, we decrease melatonin secretion, which decreases our ability to be in harmony with the earth's daily rhythmic cycles. Specifically, when there is an alteration, such as changes in S-GMA activity, ill effects follow such as altered blood pressure; reproductive, immune system, cardiac and neurological problems; mental disorders, depression, and suicide; increase hospital admissions, accidents, and sudden death; as well as other stress-related conditions. These electromagnetic disruptions and their negative health effects are not new, but 5G is one hundred times more potent in moving in that direction and will likely result in an increase in cancer, heart disease, depression, and other diseases. We already see epidemics in all these areas, as well as in type-2 diabetes. In *There Is a Cure for Diabetes*, this form of electromagnetic RF/MW radiation caused type-2 diabetes is well documented.

The awareness of the Schumann Resonance helps us to see the real cosmic interconnectedness of all of us humans, animals, plants, the planet earth, and the sun and moon. EMF and EMFR reduce melatonin secretion in animals and people. Once we understand that, it helps us examine at least one mechanism for why, indeed, we are seeing so many health problems. Melatonin is a vital natural neuro-hormone that regulates the daily circadian rhythm in mammals. Melatonin is the most potent known antioxidant; it has also been shown to protect against various forms of cancer. The pineal gland's production of melatonin rises at night, and the melatonin is carried by the circulation system throughout the body, passing through the cell membrane and scavenging free radicals in the cell in order to protect the DNA. Melatonin also has many other vital functions involving the assistance of the immune system to maintain its immunocompetence, and it regulates sleep activity including aspects of REM sleep and sleep efficiency. Reduced melatonin production causes many serious biological effects in humans and other mammals, including chronic fatigue, sleep disturbance, DNA damage leading to cancer, cardiac, reproductive and neurological diseases, and mortality. Melatonin reduction is also associated with arthritis, depression, and suicide, seasonally affective disorder (SAD), miscarriage, sudden infant death syndrome (SIDS), schizophrenia, Alzheimer's disease, and Parkinson's disease. Multiple independent studies have found that electromagnetic fields reduced melatonin in animals and human beings. The scientific evidence includes correlations with altered geomagnetic activity reducing human melatonin, through the Schumann Resonance signal effect. The level of evidence exceeds requirements for a causal link, strongly suggesting that melatonin production caused by electromagnetic fields and radiation exposure contributes significantly to the allocation of many adverse health effect rates.[viii]

All life has adapted over time to live in the electromagnetic frequencies of the Schumann Resonance, somewhere between 7.83 and 8 Hz. When we move away from this biologically attuned resonance field, it is highly likely to result in disorganization of our electrophysiology. This means that if you are susceptible to some of these frequencies, you may begin feeling "unusual stress, mental confusion, forgetfulness, unusual or repetitive thoughts and mood swings, periods of diminished hearing and eyesight, sudden onset of unexplained neurological problems and sharp pains shooting into head, as well as symptoms that mimic mental illness; depression, split personality disorder, and paranoid schizophrenia.[ix] The 5G frequencies have already been shown potentially to literally have a mass effect on mental functions in the populace. This has obvious serious negative spiritual implications because if you don't have a functioning brain it is very hard to access our soul connection and evolve spiritually on the planet from a spiritual point of view. An additional worry held by many anti-globalists is that the globalist elites will use 5G, in a high percentage of cases, to keep everyone's brainwaves in a range that prevents critical thought processing, and thus keeping people in the brainwave range that favors their agenda, for example, an emotional, slow, or hysteric state of thought — all depending on what they want the population to think. We need to understand that 5G will greatly amplify these mind control mechanisms that have already been proven to exist and be effective scientifically.

Research in the last 20 years shows that ELF electromagnetic fields affected the way calcium ions move in brain tissue and the way this affects the cells' inner workings. The more permeable blood/brain barrier, which will happen with the 5G, a greater amount of toxins can enter the brain. The opening of the blood/brain barrier and calcium leakage is also associated with oxidative damage to the neurons; and it also breaks up the DNA structure. All of this is already associated with electro-smog, dirty electricity, electrical pollution, and electrical hypersensitivity, which is seen in many patients.

In addition to this, the 5G frequency is connected to the 60 GHz millimeter-wave band — 5G applications will require unlocking of new spectrum bands in higher frequency ranges above 6 GHz to 100 GHz and beyond (5G is to start initially with sub-6GHz moving as quickly into 6GHz and above as the network advancement allows). This will allow the utilization of sub-millimeter and millimeter

as quickly into 6GHz and above as the network advancement allows). This will allow the utilization of sub-millimeter and millimeter waves to allow ultra-high rates of data to be transmitted in the same amount of time as compared with previous deployments of RF/MW radiation. 5G represents a massive step up from 3G at 1.8-2.5 GHz, and 4G at 2-8 GHz, placing it well within the microwave category. This frequency is miles away from the natural resonance of 8Hz that our bodies are accustomed to, and far, far above current EMF levels (which are already damaging enough). High-frequency 60GHz 5G has already been shown to interfere with the oxygen molecules we breathe. Joe Imbriano has studied the molecular level of impact 5G will have and made an alarming discovery – 5G's 60GHz bandwidth was selected for a specific reason. Imbriano thinks this reason may be to negatively affect the oxygen we breathe as part of a population control mechanism: "60GHz is the frequency of oxygen molecule absorption. Oxygen molecules have electrons that they share with each other, oxygen is a diatomic molecule. What we breathe are two oxygen molecules bonded together with the electrons that they share." When the oxygen molecule is hit with 60GHz 5G waves, these waves affect the orbital resonance properties of those shared electrons. It is those shared electrons that bind to the hemoglobin in our blood. In addition to disrupting oxygen absorption, 5G will alter the iron and magnetite function respectively of the hemoglobin and pineal gland. Hemoglobin and the pineal gland have a magnetic compound within them. The magnetic field disruption is already happening, but, with 5G, this disruption will be more seriously amplified. Hemoglobin is a very complex ferromagnetic compound. If we interfere with the orbital spin properties of diatomic oxygen's (O2) electrons via 5G, our ability to absorb oxygen will be significantly hampered, creating slow suffocation. Because of this additional factor, with or without 5G, people should avoid 60 GHz WiFi systems in any case. At 60GHz the frequencies also impair the body's ability to produce vitamin D and melanin. In this context, 5G and the 60 GHz delivery system is an overt attack on the human body.

Most living organisms are naturally equipped to deal with low-level environmental frequency exposure. For example, a ferromagnetic compound called magnetite is naturally present in the brain that absorbs frequencies up to 12GHz, which shields the brain from such radiation. However, beyond 12GHz this natural defense is rendered ineffective; our biology hasn't made provisions for a frequency exposure so abnormal as 5G at 60 GHz will be, which is well above 12 GHz and beyond.

In summary, we've been given a story of how good it is that we can have "smart" homes, "smart" businesses, "smart" highways, "smart" cities and self-driving cars. Virtually everything we own and buy, from refrigerators and washing machines to milk cartons, hairbrushes, and infants' diapers, will contain antennas and microchips and will be connected wirelessly to the Internet. We're being told that this is a good thing, but it's not if we value our physical, mental, moral, and spiritual health. In other words, no matter how "ultra-convenient" these ultra "smart" devices, agreeing to be seduced by the promises of convenience is potentially not too smart. What isn't acknowledged in all this media hype is that this technology may present as an unprecedented negative environmental effect. The planet, plants, animals, humans, and all life on Earth is in jeopardy. With millions of new 5G base stations, also known as cell towers or small cells, from Earth, and 20,000 new satellites from space simultaneously beaming hundreds of times more powerfully focused RF/MW radiation of pulse modulated *millimeter* waves, with a much higher absorption rate than 4G/3G/2G *centimeter* waves, through walls, trees, and human bodies day and night, we're talking about an estimated of 200 billion transmitting objects, which will be part of the Internet of Things (IoT) by 2020. This could be a large-scale and complete disaster for the human race. Part of what the globalists are trying to do is deny that there's a problem with non-ionizing frequencies, even though, as already stated, more than 10,000 papers are saying there are indeed multiple levels of health problems. According to the actual scientific research, there's clear evidence of damage of DNA, cells, and organs in a wide variety of ways and increased disease processes, including cancer, heart disease, diabetes, and a host of electromagnetic diseases. If 5G comes to fruition, no person, no animal, and no plant will be able to avoid the 24/7 exposure to levels of RF/MW radiation that are at least 100 times greater than current levels. 5G will threaten to provoke severe and irreversible effects in humans and also damage to all of Earth's ecosystems.

The potential or actual disruption of the Schumann Resonance effect on all life on the earth and also our atmosphere is an important additional insight into the whole picture of how we'll be susceptible to a variety of illnesses from 5G. In order to transmit the enormous amounts of data required for the Internet of Things (IoT), 5G technology, when fully deployed, will use millimeter waves, which are poorly transmitted through solid material. This will require every carrier to install base stations every 100 meters[x] in every urban area in the world. Unlike previous generations of wireless technology, in which a single antenna broadcasts over a wide area, 5G base stations and 5G devices will have multiple antennas arranged in "phased arrays"[xi] [xii] that work together to emit focused, steerable, laser-like beams that track each other. Each 5G phone will contain up to dozens of tiny antennas, all working together, to track and aim a narrowly focused beam at the nearest cell tower, which may be less than 25 feet from your home; and those beams will be sent back and forth between the 5G device and the cell tower in order to be able to handle important things like Ultra HD video downloaded in seconds versus minutes for 1,000 people per meter. Unfortunately, the US Federal Communications Commission (FCC) has adopted rules[xiii] permitting the effective power of those beams from a 5G cell phone is to be as much as *20 watts*, ten times more powerful than the levels permitted for current phones. Each 5G base station will contain hundreds or thousands of antennas aiming multiple laser-like beams simultaneously at all cell phones and user devices in its service area. This technology is called "multiple input multiple output" or MIMO. FCC rules permit the effective radiated power of a 5G base station's beams to be as much as *30,000 watts* per 100 MHz of spectrum, or equivalently 300,000 watts per GHz of spectrum, an estimated hundreds of times more powerful than the levels permitted for current base stations.

Making potential health problems significantly worse, at least five companies[xiv] are proposing to provide 5G from space from a combined 20,000 satellites in low- and medium-Earth orbit that will blanket the Earth with powerful, focused, steerable beams. Each satellite will emit millimeter waves with an effective radiated power of up to *5 million watts*[xv] from thousands of antennas arranged in a phased array. Although the energy reaching the ground from satellites will be less than that from ground-based antennas, it will irradiate areas of the Earth not reached by other transmitters and will be additional to ground-based 5G transmissions from billions of IoT objects. Even more importantly, the satellites will be located in the Earth's magnetosphere, which exerts a significant influence over the electrical properties of the atmosphere including the Schumann Resonance. As previously explained, the alteration of Earth's electromagnetic environment, especially where Schumann Resonance resides, may be an even greater threat to life than the radiation from ground-based antennas.

In conclusion, in 2015, 215 scientists from 41 countries communicated their alarm (about the potential of 5G) to the United Nations (UN) and World Health Organization (WHO).[xvi] They stated that "numerous recent scientific publications have shown that EMF [electromagnetic fields] affects living organisms at levels well below most international and national guidelines". As already stated, more than 10,000 peer-reviewed scientific studies demonstrate harm to human health from RF/MW radiation.[xvii] [xviii] Effects include:

- Alteration of heart rhythm[xix]
- Altered gene expression[xx]
- Altered metabolism[xxi]
- Altered stem cell development[xxii]
- Cancers[xxiii]
- Cardiovascular disease[xxiv]
- Cognitive impairment[xxv]
- DNA damage[xxvi]
- Impacts on general well-being[xxvii]
- Increased free radicals[xxviii]
- Learning and memory deficits[xxix]
- Impaired sperm function and quality[xxx]
- Miscarriage[xxxi]
- Neurological damage[xxxii]
- Obesity and diabetes[xxxiii]
- Oxidative stress[xxxiv]
- Autism[xxxv]
- ADHD[xxxvi] [xxxvii]
- Asthma[xxxviii]
- Negative altered mental states, including increased depression, anxiety, and suicidal tendencies[xxxix]

Damage goes well beyond the human race, as there is abundant evidence of harm to diverse plant- and wildlife[xl] [xli] and laboratory animals, including ants,[xlii] birds,[xliii] [xliv] forests,[xlv] frogs,[xlvi] fruit flies,[xlvii] honey bees,[xlviii] insects,[xlix] mammals,[l] mice,[li] [lii] plants,[liii] rats,[liv] trees,[lv] and microbes.[lvi]

The Earth and the ionosphere and the lower atmosphere form the Global Electric Circuit in which we live. It is well established that biological rhythms are controlled by Earth's natural electromagnetic environment, which is this global electric circuit. In essence, adding 20,000 5G satellites will further pollute and potentially disrupt the global electric circuit[lvii] [lviii] and could alter the Schumann Resonance,[lix] around which all life on Earth has evolved. By going global with 5G, we are not just talking about human evolution, but all life on planet earth.

It is concerning that at least eleven in international agreements have been violated by 5G implementation. The international agreements for the protection of humanity are being explicitly violated, including:

- The United Nations Convention on the Rights of the Child states that States shall "undertake to ensure the child such protection and care as is necessary for his or her well-being" (art. 3), "ensure… the survival and development of the child" (art. 6) and "take appropriate measures to combat disease… taking into consideration the dangers and risks of environmental pollution" (art. 24(c)).
- The Nuremberg Code (1949) applies to all experiments on humans, thus including the deployment of 5G with new, higher RF/MW radiation exposure that has not been pre-market tested for safety. "The voluntary consent of the human subject is absolutely essential" (art. 1). It is obvious that the majority of the humans exposed to 5G will be involuntary. "No experiment should be conducted, where there is an a priori reason to believe that death or disabling injury will occur" (art. 5). The findings of over 10,000 scientific studies and the voices of hundreds of international organizations representing hundreds of thousands of members who have suffered disabling injury and been displaced from their homes by already-existing wireless telecommunications facilities, are "a priori reasons to believe that death or disabling injury will occur" (see attached Press Release requesting WHO to recognize the already EMF injured globally).
- The Declaration of the United Nations Conference on the Human Environment (1972) has also been violated: "The discharge of toxic substances… in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems" (principle 6).
- The World Charter for Nature (1982) has also been violated: "Activities which are likely to cause irreversible damage to nature shall be avoided. [W]here potential adverse effects are not fully understood, the activities should not proceed" (art. 11).

shall be avoided… [if future potential adverse effects are not fully understood, the activities should not proceed" (art. 11).

- The Rio Declaration on Environment and Development (1992) has also been violated: "States have… the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction" (principle 2).
- The United Nations World Summit on Sustainable Development (2002) has also been violated: "There is an urgent need to… create more effective national and regional policy responses to environmental threats to human health" (para. 54(k)).
- The African Convention on the Conservation of Nature and Natural Resources (2017) has also been violated: "The Parties shall… take all appropriate measures to prevent, mitigate and eliminate to the maximum extent possible, detrimental effects on the environment, in particular from radioactive, toxic, and other hazardous substances and wastes" (art. 13).
- The Universal Declaration of Human Rights: "Everyone has the right to life, liberty and security of person" (art. 3).
- The United Nations Global Strategy for Women's, Children's and Adolescents' Health (2016-2030) has as objectives and targets to "transform", by expanding enabling environments; to "survive", by reducing maternal and newborn mortality; and to "thrive" by ensuring health and well-being and reducing pollution-related deaths and illnesses.
- The Outer Space Treaty (1967) requires that the use of outer space be conducted "so as to avoid [its] harmful contamination and also adverse changes in the environment of the Earth"(art. IX).
- The United Nations Guidelines for The Long-Term Sustainability of Outer Space Activities (2018): "States and international intergovernmental organizations should address… risks to people, property, public health and the environment associated with the launch, in-orbit operation and re-entry of space objects" (guideline 2.2(c)).

The violation of all those international agreements, given the knowledge of the seriously detrimental physical, emotional, mental, and spiritual effects of 5G, is a serious planetary violation. With the slightest imagination, one can see how the implementation of 5G, going a step further, may actually limit and block spiritual evolution on the planet as it is explicitly detrimental to the higher brain and spiritual function. From an evolutionary spiritual point of view, we are put here on the planet, not to have more electronic convenience play toys, but to evolve spiritually. As is the overall purpose in all the great spiritual teachings. 5G represents a knowledgeable effort by the forces of darkness to limit and to harm the physical, mental, emotional, and spiritual health and evolution of humanity. This knowing rejection of 5G, with 10,000 papers behind it, and several scientific groups and thousands of scientists protesting against 5G needs to be seen in a broader context, beyond harm to physical health. In the bigger picture, many feel 5G is an effort to dominate and limit consciousness and to ultimately decimate human civilization. It would be very difficult in discussing 5G at this spiritual evolutionary level not to see this as a demonic effort, by people who have knowingly chosen to participate in these blatantly destructive efforts, given the knowledge of 5G that we have today.

What to do? If we care about our families, our children, our grandchildren, and the living planet, then there are a few things we can do.

- Time is of the essence. Since local, state, federal and international action can take time, especially through a *judicial* process, we must make haste given the urgency and imminent threat of 5G. Therefore, the most powerful thing we can do is from a grassroots, individual level. With key knowledge, the pen is mightier than the sword and paves the way for peaceful solutions. There is an empowering, extremely effective, lawful, *extrajudicial* process that does not involve the courts that each man and woman can implement now. This process holds accountable the men and women, attempting to hide behind the veils of corporations, US and international governing agencies, responsible for their actions that cause harm, whether 5G, smart meters, mandatory vaccinations, etc.—with quick results. It is called [Uniform Commercial Code [UCC]], or contract law. According to the Federal Tax Lien Act of 1966, all law has been under [UCC] since 1966. All fifty states and all countries in the world operate under [UCC]. When the liability of a [UCC] self-executing *extrajudicial* judgment outweighs the profits that the CEO's or government officials gain, they are vulnerable to multi-million or multi-billion-dollar liability claims, which can be used to place a lien on them or even shut the company down, no matter how big the company is. A lawful humanitarian activist group called InPowerMovement.com has a proven successful track record in removing toxic Smart Meters worldwide and will have boilerplate documents available in the near future to facilitate a similar halt of 5G. Inhabitants of the United States of America will be the first to use these boilerplate documents. Other countries will follow shortly thereafter. Questions can also be sent via the In Power Movement help desk. If anyone wants to be a group leader, who wants to activate and support these actions locally, they can specify such when they subscribe. Please create your own local 5G awareness groups to spread this information as this lawful educational process is the Achilles Heel of 5G.
- Some 5G base stations have already been installed residentially without consent or knowledge based on "perceived demand". If people refuse to purchase 5G devices, it will disrupt the 5G rollout from the grassroots level.
- We must urge all regulatory agencies, at local, national, and international levels, to halt the 5G RF/MW radiation expansion until independent scientists can ensure that 5G and the total radiation levels caused by current RF/MW radiation, EMF, and 5G, together with 2G, 3G, 4G, WiFi, and Smart Meters are not harmful to all world citizens.
- Recommend that all countries, especially their so-called radiation safety agencies, inform citizens, including teachers and physicians, about the health risks of RF/MW radiation and how and why to avoid, or at least minimize wireless communications.
- Recommend that all countries prohibit the wireless/telecommunications industry through its lobbying organizations from persuading officials to make decisions permitting further expansion of RF/MW radiation, including ground- and space-based 5G.
- Recommend the immediate appointment of international groups of independent impartial EMF and health scientists without conflicts of interest, to establish new international safety standards for RF/MW radiation. This should be done without industry

influence. These international standards should not be based solely on thermal effects or power levels, but should also consider non-thermal effects, modulation effects (information riding on a pulsed wave as a form of data communication) that disrupts intra– and inter-cellular data communication with its concomitant negative health effects. There is a growing number of EMF-injured people who are now classified as suffering from electro-hypersensitivity. One decade ago, it was 3%. Now it's close to over 10% of the total global population. 5G, which is exponentially higher than 4G, will undoubtedly, disastrously increase the percentage of the world population of electro-hypersensitivity disability.

- Recommend the appointment, immediately—without industry influence—international groups of scientists with expertise in EMFs, health, biology and atmospheric physics, for the purpose of developing a comprehensive regulatory framework that will ensure that the uses of outer space are safe for humans and the environment, taking into account RF/MW radiation, rocket exhaust gases, black soot, and space debris and their impacts on ozone, the atmosphere and the preservation of life on Earth. Not only ground-based but also space-based technology must be sustainable for adults and children, animals and plants based on scientific, moral, and ethical considerations for the evolution of humanity.

May everyone be blessed with renewed empowered hope to prevent 5G from happening, even though the global powers have made a tremendous effort to make this happen with its horrible undermining influences. Peace, strength, love, and hope to all.

Rabbi Gabriel Cousens, MD, MD(H), ND

What can you do? Read "5G Solution Explained"

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