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Regarding: Health effects of 5G Telecommunication Infrastructure (CTIA)

I have read the letter to CTIA on this issue by E.S. Swanson, Professor of Physics, University of Pittsburgh dated May 29, 2019. It represents mostly a text book presentation on this issue without a sound scientific evaluation of health risks from radiofrequency (RF) radiation. Thus the Swanson letter needs to be rebutted.

I have worked since the 1970's as an oncologist and researcher mainly in cancer epidemiology. This has resulted in more than 350 published peer-reviewed articles in scientific journals with more than 12,000 citations. My research team was the first in the world to clearly show an increased risk for cancer among persons exposed to herbicides of the Agent Orange type. I was an expert in the hearings on Agent Orange in Washington D.C. in 1985 resulting in a settlement and giving compensation to Vietnam Veterans with certain types of cancer and exposure to Agent Orange and contaminating dioxins, mainly TCDD. Some 20 years later TCDD was classified as a human carcinogen Group 1, which is the strongest category, by the International Agency for Research on Cancer (IARC) at WHO. Our cancer studies were part in that evaluation. Examples of other research on cancer risks by our group included in IARC evaluations are PCBs, Group 1 (human carcinogen), and glyphosate (Roundup), Group 2A, (probable human carcinogen)

In 2011 radiofrequency (RF) radiation in the frequency range of 30 kHz–300 GHz was classified by IARC at WHO as a 'possible' human carcinogen, Group 2B (Baan 2011, IARC 2013). I was part of the evaluation group. This frequency range includes 5G. Since then the evidence has strengthened based on human epidemiology, for discussion see Belpomme et al (2018), Miller et al (2018), and animal studies (NTP 2018 a,b, Falcioni et al 2018). RF radiation may now be classified as a human carcinogen, Group 1 (Carlberg, Hardell 2017). That is the strongest classification similar as for e.g. TCDD, asbestos and smoking.

Up-dated meta-analysis of glioma risk associated with ipsilateral cumulative use of mobile phones $\geq 1,640$ hours yielded a statistically significant increased risk with odds ratio (OR) = 2.54, 95 % confidence interval (CI) = 1.83-3.52, see Table 1. Only the Hardell group assessed use also of cordless desktop phones (DECT). The results are similar by the different study groups with CIs overlapping the point estimates, see Belpomme et al (2018). Note that for Coureau et al (2014) highest exposure group was ≥ 896 h.

Similar up-dated results are shown for acoustic neuroma in Table 2. Meta-analysis of ipsilateral cumulative use $> 1,640$ hours gave OR = 2.71, 95 % CI = 1.72-4.28. These results are statistically significant and are more discussed in Belpomme et al (2018).

In spite of the IARC cancer classification little or mostly nothing has been done to reduce RF exposure worldwide. No doubt the exposure guidelines by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) based only on short-term thermal (heating)

effects from RF radiation have been contra-productive for public health. These guidelines were initially published in 1998 (ICNIRP 1998) and updated in 2009 (ICNIRP 2009), but not considering non-thermal health effects from RF radiation. Despite being outdated, considering only thermal effects, and not based on current knowledge, the ICNIRP guidelines are used in many countries. This is also the case for Professor Swanson's letter that does only discuss thermal effects from RF radiation.

Not only cancer risks but also other health effects such as fertility, cognitive and neurobehavioral effects, oxidative stress and electrohypersensitivity (EHS) have been associated with RF exposure, for more discussion see Yakymenko et al (2016), Belyaev et al (2016), Belpomme et al (2018). It is thus remarkable that the ICNIRP non-thermal paradigm still is used for evaluation of health risks from RF radiation as is the case for Professor Swanson. One issue for concern is that there seems to be conflicts of interest among persons in the evaluating groups and that the same persons may often be found in different bodies thereby citing in fact themselves. This has been outlined in peer-reviewed publications, see Starkey (2016) and Hardell (2017) and is illustrated in Figure 1.

The fifth generation (5G) for wireless communication will be different from the previous ones such as 2G, 3G and 4G. In April 2019 an 'In-Depth Analysis' on 5G deployment was published by EU

([https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA\(2019\)631060_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA(2019)631060_EN.pdf)). It was requested by the ITRE committee for 'State of Play in Europe, USA and Asia'. Some important statements in the document are:

Long-term technology research is essential. One key problem is the unusual propagation phenomena, especially controlling and measuring RF EMF exposure with MIMO [Multiple Input Multiple Output] at mmWave frequencies for the handset and the base station.

Rather than transmitting a wide area broadcast spread over a segment of the cell around a base station, an "active antenna" technique is used to form a set of steerable radio beams with power focused on a small area – the receiving handset

Significant concern is emerging over the possible impact on health and safety arising from potentially much higher exposure to radiofrequency electromagnetic radiation arising from 5G. Increased exposure may result not only from the use of much higher frequencies in 5G but also from the potential for the aggregation of different signals, their dynamic nature, and the complex interference effects that may result, especially in dense urban areas.

The 5G radio emission fields are quite different to those of previous generations because of their complex beamformed transmissions in both directions – from base station to handset and for the return. Although fields are highly focused by beams, they vary rapidly with time and movement and so are unpredictable, as the signal levels and patterns interact as a closed loop system. This has yet to be mapped reliably for real situations, outside the laboratory.

This document has got remarkably little attention in media or by organizations in different countries setting guidelines for deployment of 5G which seems to continue by its own track orchestrated by industry and their affiliated scientists. The majority of governments and politicians seem only consider thermal effects from RF radiation and furthermore seem to be uniformed about technical aspects on 5G, that differ from the previous generations, as well as risks to human health and the environment. The 5G appeal to EU (2017) (www.5Gappeal.eu)

signed by more than 240 scientists and medical doctors asking for a moratorium on 5G deployment until research on risks has been performed has had little impact on the progress of this technology.

No doubt there is increasing concern among people around the world about health risks from 5G. Millimeter waves (MMW) have low penetration depth into the body. Primarily skin and ocular effects have been seen. MMW may have effects on nerve endings and capillaries in the skin and through them influence deeper structures and functions in the body (Le Drean et al 2013, Russel 2018). Sweat ducts in the skin may act as helical antennas and respond to MMW for penetration (Feldman et al 2008, Betzalel et al 2018). MMW can also have effects on bacterial growth and augmented antibiotic resistance (Soghomoyan et al 2016), which can lead to difficulties to treat severe infections. One study showed increased risk for permanent tissue damage (Neufeld, Kuster 2018). However, the literature on 5G health risks is scanty and there is no research showing that 5G is safe.

The letter by Professor Swanson gives reference to some evaluations made by different organizations. However, the majority are published some years ago and do not include the most recent studies like the NTP (USA) and Ramazzini Institute (Italy) animal studies. In several committees the members overlap each other with conflicts of interest as published by Starkey (2016) and Hardell (2017).

The letter by Professor E.S. Swanson must be dismissed as scientific evidence of no risks to human health and the environment from RF radiation, especially 5G:

- He is a Professor of Physics
- He is no expert in medicine, oncology or cancer epidemiology
- He is not qualified to make a health evaluation
- He has ignored the vast majority on scientific research on health effects from RF radiation
- He does only discuss thermal effects from RF radiation
- He ignores the large body of scientific evidence on non-thermal effects from RF radiation
- He ignores the studies on oxidative stress and DNA damage from RF radiation
- He ignores the clearly shown cancer effects in humans supported by animal studies
- He ignores the IARC evaluation from 2011 showing that RF radiation is a possible human carcinogen, Group 2B

Conclusions

The letter by Professor Swanson must be dismissed as scientific evidence on health risks from 5G. It is based on wrong selective evaluation of the literature and is not supported by the majority of researchers in this field.

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Pro Bono Publico

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Attachments: 5G Appeal; 5G Deployment

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Table 1. Numbers of exposed cases (Ca) and controls (Co) and odds ratio (OR) with 95 % confidence interval (CI) for glioma in case-control studies in the highest category of cumulative use in hours for mobile phone use.

	All			Ipsilateral		
	Ca/Co	OR	95 % CI	Ca/Co	OR	95 % CI
Interphone 2010 Cumulative use $\geq 1,640$ h	210/154	1.40	1.03 – 1.89	100/62	1.96	1.22 – 3.16
Coureau et al 2014 Cumulative use ≥ 896 h	24/22	2.89	1.41 – 5.93	9/7	2.11	0.73 – 6.08
Hardell, Carlberg 2015 Cumulative use $\geq 1,640$ h	211/301	2.13	1.61 – 2.82	138/133	3.11	2.18 – 4.44
Meta-analysis Cumulative use $\geq 1,640$ h*	445/477	1.90	1.31 – 2.76	247/202	2.54	1.83 – 3.52

*Coureau et al ≥ 896 h

Table 2. Numbers of exposed cases (Ca) and controls (Co) and odds ratio (OR) with 95 % confidence interval (CI) for acoustic neuroma in case-control studies in the highest category of cumulative use in hours for mobile phone use..

	All			Ipsilateral		
	Ca/Co	OR	95 % CI	Ca/Co	OR	95 % CI
Interphone 2011 Cumulative use $\geq 1,640$ h	77/107	1.32	0.88 – 1.97	47/46	2.33	1.23 – 4.40
Hardell et al 2013 Cumulative use $\geq 1,640$ h	27/301	2.40	1.39 – 4.16	19/133	3.18	1.65 – 6.12
Meta-analysis Cumulative use $\geq 1,640$ h	104/408	1.73	0.96 – 3.09	66/179	2.71	1.72 – 4.28

Figure 1. The "ICNIRP Cartel" and "The 5G Mass Experiment"

<https://www.saferemr.com/2018/07/icnirps-exposure-guidelines-for-radio.html>

