REPORT from the SCIENCE & WIRELESS 2016

prepared for the Pandora Foundation and for the Kompetenzinitiative

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‘Science & Wireless 2016’ was hosted at the Royal Melbourne Institute of Technology (RMIT) in Melbourne, Victoria, Australia, on November 22, 2016. Program of the event and links to all presentations are available here.

The event consisted of two parts. The first part, the ‘RF & Alzheimer's Disease’, focused on the possibility of developing novel medical treatment of Alzheimer’s disease by exposing patients’ brains to RF-EMF. In the second part, the ‘Radiofrequency Guidelines’, were presented a progress report on the development of ICNIRP guidelines for the exposures to RF-EMF and the time-table for the development and implementation of the 5G technology.

My comments are bulleted with ‘D’ and marked in blue italics throughout the text.

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ALZHEIMER’S DISEASE

The main presentation of the Science & Wireless 2016 event was given by Gary W. Arendash on the development of a novel clinical treatment for the Alzheimer’s disease (AD): ‘TRANSCRANIAL ELECTROMAGNETIC TREATMENT (TEMt) AGAINST ALZHEIMER’S DISEASE: PRE-ClinICAL EFFICACY AND CLINICAL TRIAL IN PROGRESS’.

The protocol of the ongoing human trial: https://clinicaltrials.gov/ct2/show/NCT02958930?id=02958930&rank=1

D When looking at the slides of Gary W. Arendash readers should remember his conflict of interest. It is not a presentation by a solely academic researcher but it is a presentation by a businessman presenting, advertising and lobbying for his product.

In his presentation, Dr. Arendash made several claims worth to be pointed out:

➢ “SWEET SPOT”

Throughout the presentation Dr. Arendash repeatedly referred to the “sweet spot” of the RF-EMF exposure that he and his team have found and that this “sweet spot” of radiation works as a treatment for the AD.
The observation of the possible impact of RF-EMF on AD is indeed very interesting. However, the “sweet spot” of RF-EMF as referenced by Arendash is nothing else but the exposure to regular RF-EMF emitted by a cell phone. Dr. Arendash and his team did not test, or at least did not present any data of such, various RF-EMF frequencies and/or modulations to find the one that works specifically on AD. The team simply used the cell phone radiation and observed that it had biological effect on normal and transgenic mice.

EXPOSURE OF ANIMALS

The set up used to expose the animals in the AD study was extremely crude. Already at the time of first publication by Arendash et al., the exposure set-up was strongly criticized within the bioelectromagnetics community. The set-up was especially criticized by those who believed there cannot ever be any biological effects caused by the cell phone radiation were very critical and dismissive of the Arendash’s result.

The crudeness of the exposure set-up makes it indeed impossible to determine how much radiation each animal received. This might be problematic for the replication studies because it will be difficult to exactly replicate the exposure conditions when the level of radiation exposure of animals is practically unknown. While it is easy to set cages around the antenna, it is very difficult to determine radiation exposure of each animal.

The set-up was depicted in one of the slides. At the time of publication of the first of Arendash’s studies on AD, there was simply an uproar within the bioelectromagnetics research community that the exposure set-up is too crude and there is no knowledge on the actual radiation exposure of the mice. At the Science & Wireless 2016 nobody complained about the exposure set-up. Neither the representatives of the ICNIRP nor industry.

The crude exposure set-up doesn’t automatically invalidate results. Already in 2011, during the discussions at the IARC meeting for the classification of the carcinogenicity of cell phone radiation, Niels Kuster pointed out that if there is a clear difference between unexposed controls and exposed models, the result should be considered as valid, even though it might be very difficult to exactly replicate.

NON-THERMAL EFFECT

In the context of the complete lack of scientific recognition of the existence of non-thermal effects of RF-EMF exposure, by ICNIRP and by the co-organizer of the Science & Wireless 2016, Rodney Croft, the most controversial statement by Arendash was that the beneficial effect of RF-EMF exposure on mice with AD was of non-thermal nature.
Indeed, looking at the very low level of the estimated exposure (1.05 W/kg at the highest) and the distance between the antenna and the animals in cages, it is pretty obvious that the exposure could not cause any thermal effects.

However, ICNIRP’s member, Rodney Croft, did not recognize this possibility. To the question from the audience, asking what ICNIRP thinks of the non-thermal claim by Arendash, Croft did not respond directly but addressed Arendash in the form of a question/statement: “this is only a hypothesis?” Somewhat “surprised” Arendash sort of confirmed the correctness of Croft’s statement that the non-thermal effect is just a hypothesis at this point.

Once again it was clearly demonstrated that ICNIRP has no intention whatsoever to acknowledge the existence of non-thermal effects. Even in situation where biological responses are caused by exposures unable to rise temperature of the biological model... but there is a reason for this stubbornness of ICNIRP...

If ICNIRP acknowledged that non-thermal effects exist, it would mean that all the current safety limits and safety standards should be thoroughly re-evaluated for their validity. In simple terms, acknowledging the existence of non-thermal effects would invalidate the current safety limits recommended by the WHO, ICNIRP and ICES/IEEE.

MECHANISM OF THE EFFECT

Two potential biological mechanisms were suggested to explain the therapeutic effect of RF-EMF exposure on AD. The first one was a direct effect of radiation causing vibration of H-bonds in beta-sheet proteins, weakening the bonds in amyloid-oligomers leading to their disaggregation (the oligomers are toxic to neurons, not the plaques...). The second mechanism was indirect (radiation affects unknown yet target inside cells that, in turn, causes increased expression of Hsps), where therapeutic effect was elicited through increased expression of Hsp70 and Hsp90.

While changes in the expression of Hsps were shown in several studies, including research on the endothelial expression of Hsp27 in my own laboratory, the impact on RF-EMF on vibration of H-bonds is controversial and, in one of the subsequent slides, Arendash contradicted himself...

SAFETY OF THE ALZHEIMER’S DISEASE THERAPY

There are numerous studies suggesting that RF-EMF exposures might have negative impact on human health. Therefore, when planning a long-term treatment of AD patients’ this aspect needs to be taken into consideration. Arendash, however, in spite of the existing evidence, has completely dismissed any possibility of causal link between RF-EMF exposure and ill health.

Shown in the first part of the Arendash’s slide, his claims that there are no effects of RF-EMF exposure on cognition, immune function, oxidative stress, blood-brain barrier and DNA damage are outright misleading and false.
In the second part of the slide Arendash repeats claim that cancer cannot be caused by RF-EMF exposures because the energy is too low to break chemical bonds. The “chemical bonds” story, however, appears to contradict the Arendash’s own hypothetical mechanism how the AD therapy works. He claims that RF-EMF exposure causes vibration of H-bonds in beta-sheet proteins, weakening the bonds in amyloid-oligomers leading to their disaggregation. Question is why similar mechanism could not be considered for the abundant and functionally essential H-bonds in DNA double-helix. It seems that in zest to defend safety of his therapy for AD, Arendash dismissed the mechanism for this therapy as proposed by himself.

The safety issue should be looked at differently. AD is a disease of old age. Even if long-term exposure to RF-EMF increases the risk of cancer, these old AD patients will have choice between “here and now” debilitating AD or a potentially increased risk of a very rare disease - glioma (10-20 cases/100.000 people that might increase to 20-40 cases/100.000 people if the worst case scenarios from epidemiological studies ever materialized).

PRAISE FOR THE BAD QUALITY EPIDEMIOLOGY

In the following slide, Arendash went still further in his zest to prove safety of his AD therapy. He praised the epidemiological studies of dubious quality. Studies that are strongly criticized, with the exception of e.g. ICNIRP and SCENIHR, for their poor quality that invalidates conclusions drawn by the authors. Especially praise for the Danish Cohort and the Million Women study is scientifically very “disturbing”. It also shows that the conflict of interest, of Arendash as a businessman, might be here “in action”.

SUMMA SUMMARUM

It is an interesting possibility that RF-EMF exposures could be therapeutic for the Alzheimer’s disease. The ongoing human trial (https://clinicaltrials.gov/ct2/show/NCT02958930?id=02958930&rank=1) will provide some much needed evidence to corroborate, or to dismiss, Arendash’s claims.

Transgenic mice model does not reflect exactly what happens in human AD. That is why the beneficial effects of RF-EMF exposure, observed by Arendash et al., might not apply directly to human situation. Expression of the Tau protein, and not the decline in beta-amyloid oligomers, was suggested to have larger significance in the impact of AD on human cognition (see also comments on Finnie lecture).

The second presentation on Alzheimer’s disease was by John Finnie: “DOES LONG-TERM EXPOSURE TO MOBILE PHONE-TYPE RADIOFREQUENCY FIELDS REDUCE BRAIN AMYLOID DEPOSITION?”.
Presentation was disappointing. Finnie described what is known about AD and only very briefly presented what his students are doing/going to do.

During the Science & Wireless 2015, John Finnie presented similarly a brief outline of the replication study of Arendash et al. ongoing in his laboratory. This year, during Science & Wireless 2016, I was awaiting some experimental results but... no luck... John Finnie did not present yet any experimental data except for a few histological images from the brains of AD mice.

What was interesting in Finnie’s presentation was that he questioned whether beta-amyloid oligomers are important for AD or whether another protein, called Tau, plays the more important role in the development of the disease. By this, Finnie put in question whether the decline in beta-amyloid plaques is an indicator of improvement in AD, observed by Arendash et al.: “…amyloid burden is a poor indicator of clinical disease severity…”.

Finally, unlike the dismissive comments from Arendash, Finnie left open the possibility that exposures to cell phone radiation might cause health problems (brain cancer but not the BBB-leakage) in humans.

Experimental studies to date suggest that there is little evidence for these potentially deleterious effects, except for a possible increase in certain brain tumours after long-term mobile phone exposure, although this is still actively debated.
ICNIRP

Rodney Croft, Chair of the ICNIRP High Frequency Project Group, presented an ‘UPDATE ON ICNIRP’S HIGH FREQUENCY GUIDELINES’.

ICNIRP is preparing guidelines for exposures to high frequency fields between 100 kHz and 300 GHz (previous guidelines are from 1998)

ICNIRP is awaiting the WHO Environmental Health Criteria (EHC) to be ready before it can/will continue development of the new guidelines.

D WHO EHC development is delayed. Draft of the EHC was presented for the public discussion and the comments received by the WHO are being incorporated into the revised EHC draft.

ICNIRP considers as evidence only scientifically substantiated data that were independently replicated, are of sufficient scientific quality and are scientifically explicable.

D This definition provides several easy ways to exclude scientific evidence. Anything what is too difficult to explain or to replicate can be arbitrarily excluded by ICNIRP.

ICNIRP intends to find ‘health effect threshold’ and use it to re-examine the WHO Health Definition that is very broad (physical, mental and social well-being).

D Under the WHO Definition of Health, anyone worrying about the potential health effect of wireless communication, could be considered as having ill health. By this WHO standard, the self-diagnosed EHS persons are suffering a health effect. The ‘health effect threshold’ will likely aim at re-assessing this possibility of recognizing EHS as health impairment based on WHO Health Definition.

ICNIRP considers to patch-up gaps in the knowledge as follows: “Where insufficient threshold data, use knowledge of mechanisms to set ‘operational threshold’… e.g. use knowledge of temperature in lieu of clear RF threshold…”

D ICNIRP continues to dismiss all evidence pointing to the existence of non-thermal effects, effects occurring at exposure levels permitted by the current safety limits. Accepting that non-thermal effects exists would invalidate all current safety limits and require thorough de novo evaluation.

ICNIRP divides our body into important and less important parts. The less important parts, called extremities, may be exposed to higher levels of radiation.

D Dividing body into more and less important parts is nothing new. For many users of cell phones it seems to be puzzling that the phone needs to be put to ear to be used but at the same time manufacturers warn that phones should be kept at certain distance from the body in order to comply with safety limits. Here is nothing puzzling. Earlobe was considered as extremity, less important part of the body that can be exposed to higher levels of radiation. Hence, it is OK to put hone to ear and remain compliant with safety limits.

D Dividing human body into more and less important parts was OK for the 1G, 2G, 3G and 4G technologies. It is not valid anymore for 5G technology where all radiation energy will be absorbed by skin alone.
According to the draft from ICNIRP, skin (dermis and epidermis) is listed within the group of limbs, the less important parts of body that may be more irradiated. The safety guidelines are being prepared for up to 300GHz, covering also 5G technology operating at 6GHz to 100GHz. For the 5G spectrum, it is known that all radiation energy will be deposited solely in the skin. Classifying skin within limbs means that ICNIRP considers allowing higher level of exposure for skin from the 5G devices. The 5G devices will be irradiating skin only.

ICNIRP should be reminded that skin is the largest organ of the human body and it is involved in regulating variety of processes, both local and systemic, including the immune response.

Currently there is no research whatsoever on how skin will react to 5G exposures.

For 5G technology, skin (dermis and epidermis) should be listed as the most important part of the body that should be irradiated as little as possible.

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5G TECHNOLOGY

Mike Wood of Telstra, Australia, spoke about ‘EME STANDARDS FOR 5G TECHNOLOGIES: HUMAN EXPOSURE COMPLIANCE ASSESSMENT PROCEDURES FOR MOBILE DEVICE AND NETWORK EQUIPMENT OPERATING FROM 6-100 GHz’.

The most telling was this slide in Wood’s presentation. It clearly informs that the industry is rapidly developing 5G technology.

The 5G technology will use the spectrum from 6GHz to 100GHz but the current compliance assessment standards do not cover this spectrum yet. New assessment standards need to be developed in Australia within next 2 years, by 2019, to be ready for the broad implementation of 5G technology in 2020. The time-table of implementation 5G technology may vary in different countries.

The requirement to ensure that human health is unaffected was pointed out by Wood but...
The standards will be developed by various international committees, but... there is no ongoing biological research to assess health effects for 5G technologies’ spectrum of 6GHz - 100GHz. There is no research on possible effects on skin where all energy emitted by 5G devices will be deposited.

For frequencies above 10GHz, SAR is not a valid compliance assessment as the RF energy is only deposited into the skin and near body surface resulting in surface heating.

Some important and troubling questions without any answers to provide:

- What biological data the international committees will use to determine if 5G technology is safe?
- What biological data scientists will be able to generate in next 2-3 years?

Yet again the situation repeats. New technology is rapidly developed. Biological and health research is lagging far behind. International committees are setting safety standards using an incomplete and outdated information.

What was learned for 2G, 3G, and 4G will be likely re-applied to 5G safety considerations even though it is well known that it does not apply, at least directly.

Final comments concerning the Science & Wireless 2016

I have participated in the Science & Wireless events in 2010, 2012, 2014, and 2015 and in the 2012 I was one of the invited speakers.

After my first encounter with the Science & Wireless, in 2010 I wrote a very enthusiastic post in my BRHP blog about this kinds of events, gathering scientists, regulators, industry and users of the technology.

Unfortunately, my enthusiastic opinion of the Science & Wireless event has vanished over the time. In recent years the Science & Wireless events cannot be called anymore a ‘Community Interaction’ events. They become events where science, this acceptable by the industry and by the ICNIRP, is presented for the benefit of industry and the ICNIRP. ‘Community representatives’, questioning validity of science evaluation by industry and by ICNIRP, have been entirely excluded.

The take-away message from the Science and Wireless 2016:

- RF-EMF exposures affect beta-amyloid proteins in brains of transgenic mice
- Effect on beta-amyloid protein is caused by non-thermal mechanism
- It is still unclear whether observed beneficial effects of RF-EMF in transgenic mice will apply to human AD
- ICNIRP stubbornly disregards all evidence concerning non-thermal effects of RF-EMF (ICNIRP’s acceptance of the existence of non-thermal effects would invalidate current safety limits)
ICNIRP, arbitrarily, without plausible scientific evidence, places skin among the least important parts of body that can be more exposed to RF-EMF.

Skin should not be allowed to be placed by ICNIRP in the ‘limbs’ group of organs because this will allow the 5G technology to market devices with higher radiation exposure, irrespective of the proximity of these devices to human body - all energy of 5G device will be absorbed solely by the skin.

Implementation of 5G technology goes fast ahead in spite of the complete lack of science on the 5G effects on skin biology.

The Precautionary Principle is completely disregarded by the ICNIRP and industry.