

Report from the Science & Wireless 2015

prepared for the [Pandora Foundation](#) and for the [Kompetenzinitiative](#)

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Science and Wireless 2015 was hosted at the RMIT University in Melbourne, Victoria, Australia, on December 8, 2015. [Program of the event and link to all presentations are available here.](#)

The event consisted of two parts. The progress reports of the ongoing research projects conducted under the ‘umbrella’ of the Australian Centre for Electromagnetic Bioeffects Research (ACEBR) were presented in the first part:

Andrew Wood,
Swinburne University of Technology

Are RF exposure limits appropriate for adverse environmental conditions and the wearing of protective clothing?

Sarah Loughran,
University of Wollongong

Mechanisms underlying the influence of radiofrequency electromagnetic fields on brain activity

Elena Ivanova,
Swinburne University of Technology

Cell permeability induced by 18 GHz electromagnetic field

Vuk Vojisavljevic,
RMIT University

Biological effects of low level electromagnetic radiation on proteins and cells: Modelling and experimental evaluation

John Finnie,
University of Adelaide

Does long-term exposure to mobile telephone-type radiofrequency fields constitute a non-pharmacological therapeutic intervention strategy for treatment/prevention of Alzheimer's disease?

Boris Martinac,
Victor Chang Cardiac Research Institute

Modulation of mechanosensitive channel activity by magnetic fields

Nevena Todorova,
RMIT University

Molecular responses of proteins and cell membranes to electromagnetic radiation

The second part of the event consisted of the brief presentation by **Rodney Croft**, Director of the ACEBR followed by the keynote presentation by **Bernard Veyret**:

Rodney Croft, ACEBR Director

Key developments in international RF safety programs

Bernard Veyret, iMS France

Keynote: New international developments in RF bioeffect mechanism research

Following all the presentations, there was a general discussion conveyed by **Michael Repacholi**, retired Head of the WHO EMF Project and Chairman Emeritus of ICNIRP.

Presentations, part #1

[Andrew Wood](#) presented a study examining the heating impact of RF exposures on workers in extreme conditions. The extreme conditions were defined as outdoor temperature of 50 °C with relative humidity of 70 % and worker wearing two-layer impermeable outfit. It appears that the extreme conditions caused increases of body temperature by up to 2 °C and that the RF exposure added some 0.2-0.3 °C to the thermal load experienced by the worker. The conclusions of the study were:

- *“Implies no immediate change to the RF-EMF safety standards and guidelines for RF-EMF workers needed”*
- *“Safety margins may need to be re-evaluated, especially when core temperature already elevated”*

[DL/KL comment: This sounds as very common conclusion in many studies. On the one hand authors say that things are OK and there is no need for changes but, at the same time, the authors indicate that there is a need to re-evaluate situation. What, in fact, means that things are not as OK as they should be according to the promise of safety provided by the 'large safety margins built in to the current safety limits']

[Sarah Loughran](#) presented a mechanism (still hypothetical) to explain the effect of RF exposures on the EEG, which has consistently been observed in several studies. The functional significance of this effect is unknown. There is also no information that the effect on the EEG would be in any way detrimental to human health. The effect occurs at energy levels insufficient to induce any thermal effect. Thus, if it is a non-thermal effect then it is not taken into account in the current standards and guidelines. The EEG effect was proposed to be caused by the RF exposure's effect on thermoreceptors present in human skin and in brain, which in turn affects the EEG. In conclusion it was suggested that exposures to RF at the levels well below the current safety limits can affect temperature of the skin and activate thermoreceptors and that the effect is only thermal in nature. This implied, according to Sarah Loughran, that the current safety limits take EEG effect into account as the other thermally induced effects.

[DL/KL comment: this might be a false assumption that the current standards cover the safety for the thermal EEG effect. The effect occurs at the levels of RF exposure that according to the current

safety limits should not cause any significant biological effect, neither thermal nor non-thermal. Repeated confirmation of the existence of the EEG effect should be considered as a proof of potentially inadequate protection provided by the current safety limits.]

Several presentations, by [Elena Ivanova](#), [Vuk Vojisavljevic](#), [Boris Martinac](#), and [Nevena Todorova](#), addressed the issue of the possible effects of the various types of EMF exposures on molecular and cellular level:

- **Ivanova's** study examined the effect of 18 GHz exposure on the permeability of cell membrane. Such effect might be useful in developing therapeutic applications, e.g. for the locally targeted drug delivery.
- **Vojisajevic's** study examined the effects of various LTE frequencies (2100 MHz, 2300 MHz, 2600 MHz), currently used by the Australian mobile operators on the functional activity of biological molecules. The study combined theoretical modelling and experimental validation attempts. The preliminary results obtained with catalase and lactate dehydrogenase have shown effects on the enzyme-substrate interaction at very low levels of the network (not the mobile phone) exposure.
- **Martinac's** project examined the effect of magnetic field exposure on the activity of a mechanosensitive channels. Effects were found on the reconstituted mechano-channels. The authors stated that in spite of the lack of proven harmful effects of similar exposures, future research should examine effects of magnetic fields on the channels and receptors in human brain; these potentially vulnerable targets of exposure have not been studied yet.
- **Todorova's** project examined "Molecular responses of proteins and cell membranes to electromagnetic radiation". The work was completely based on theoretical modelling without any experimental confirmation of the effects or lack of them. Interesting part that will be examined in the future modelling is the effects of EMFs on amyloid protein aggregation that is one of the hallmarks of neurodegenerative Alzheimer's disease.

[John Finnie](#) presented research project examining effect of RF on the development of the Alzheimer's disease. His group attempts to replicate the study by Arendash and co-workers (J. Alzheimer's Disease, 19, 2010, 191-210) suggesting that exposures to mobile phone radiation might decrease amyloid deposition in the brain and improve cognitive processes. This, in turn, would suggest that using cell phone might help to mitigate cause for Alzheimer's. The study is in progress and no results were available yet.

Presentations, part #2

[Rodney Croft](#) spoke briefly about the ongoing evaluations of the RF effects on health by the WHO EMF Project (Environmental Health Criteria; EHC) and ICNIRP (High-Frequency EMF Guidelines):

- WHO's EHC is yet again delayed and the new timetable suggests that the publication of the document might happen by the end of 2016.
- ICNIRP's Guidelines should be ready and published by the end of 2016

[DL/KL comment: one cannot escape a thought that both, the EHC and the Guidelines, are one and the same story, prepared by the overlapping teams of scientists, with exactly the same opinions on scientific evidence. Why "bother" to prepare two documents of "the same kind"? Answer might be that it is the way to "demonstrate" that the WHO EMF Project is different from the ICNIRP. But in reality it is not. ICNIRP provides all scientific expertise and exposure guidelines for WHO EMF Project so that the creating of two documents is just a gimmick on behalf of two organizations. In practice, the WHO EMF Project is just a front for dissemination and implementation of the ICNIRP scientific opinions and guidelines. WHO EMF Project is a one-person-team where the only scientist is Emilie van Deventer, an engineer without expertise in biomedical research.]

[Bernard Veyret](#) delivered the key note presentation and the most notable parts of it were:

1. Complete omission of the IARC 2011 Monograph as a source of information and a replacement of it by IARC 2015 'European Code against Cancer 2015 4th Edition: Ionising and non-ionizing radiation and cancer'. To support his opinion that RF EMF is not a human carcinogen as classified by the IARC 2011, he provided a quote from the IARC 2015:

“Non-ionizing types of radiation, including ELF EMF as well as RF EMF – are not an established cause of cancer and are therefore not addressed in the recommendations to reduce cancer risk.” (Emphasis added by Bernard Veyret.)

As the database of the bioeffects were listed by name only:

- ICNIRP blue books
- National reports from France, Sweden and Australia
- IARC 2015
- SCENIHR 2015
- EHC of WHO 2016

[DL/KL comment: this is yet another attempt to reverse or to disregard the outcome of the classification of RF EMFs as a possible human carcinogen by the IARC Working Group in 2011. Bernard Veyret omitted the IARC Monograph 102, on carcinogenicity of the RF EMF, and replaced it with the so-called IARC 2015 document (Cancer Epidemiology, 39S, 2015, S93-S100). The sentence is in the abstract of the document and it was presented with misleadingly placed emphasis. Not established¹ doesn't mean non-existent. The IARC 2015 is not a thorough re-evaluation of the evidence on RF-EMF and cancer. IARC 2015 is an attempt to dismiss the outcome of IARC 2011. IARC 2015 quotes only epidemiological studies and uses low quality cohort studies (e.g. [Danish Cohort](#)) to support lack of causality between RF and cancer. Also, the trend-studies quoted in IARC 2015 are useless for proving that a single factor is not involved in causality. As [Chris Portier](#) presented in the BioEM2015 conference "Ecological studies following trends of appearance of cancer are useless because there can be simultaneously "at work" different factors - some increasing cancer, some preventing cancer - this

¹Established: "Having existed for a long time and therefore recognized and generally accepted."

can make trend data to look like no change is happening in response to studied factor. Reality might be the opposite because of the uncontrolled factors that might be simultaneously preventing the development of cancer". The sentence, concluding the brief paragraph on RF-EMF and cancer in the IARC 2015 is as follows: "Overall, currently available information does not provide unequivocal evidence that non-ionising radiation at low and high frequencies is a cause of cancer." By using word "unequivocal" the authors of IARC 2015 can mislead and claim that there is no valid scientific evidence to link EMF exposures with cancer. However, in biomedical science, rare are the cases where evidence is "unequivocal". **The IARC 2011 classification of RF-EMF as possibly carcinogenic to humans still stands and remains valid.**]

- Opinion on the possible mechanisms of RF effect on EEG was similar to what Sarah Loughran hypothesized and was presented as potentially plausible:

"Conclusion: may indicate an underlying thermal mechanism of RF-EMF on human REM sleep based on heating of the skin"

- When speaking about the amplitude of the bioeffects, Bernard Veyret mentioned that pulsed signals seem to elicit stronger bioeffects than the continuous-wave irradiation. This was illustrated on an example of GSM and CW signals and graph of the increased amplitude of the effects included the effects on EEG.

- For addressing the topic of the possible mechanisms of RF effects, Bernard Veyret relied solely on the opinion of the SCENIHR 2015 report:

*"A number of studies proposed other candidate mechanisms. However, **none that operates in humans at levels of exposure found in the everyday environment has been firmly identified and experimentally validated** nor do they enable concluding on potential health risks at other exposure conditions both with regard to amplitude and/or frequency."* (Emphasis added by Bernard Veyret.)

- While another important and continuously contested topic is whether the cause behind the RF bioeffects is thermal or non-thermal; and altogether the question of the role of the temperature increase. Bernard Veyret presented two contradicting opinions on the most important parameter in the induction of bioeffects by RF-EMF.

According to his first opinion, i.e. the outcome of the ICNIRP meeting in Istanbul, the absolute temperature is the most important parameter while the increase of the temperature over time (ΔT) is unimportant:

"What matters most is the absolute temperature T , and not the temperature elevation ΔT "

His second opinion Bernard Veyret presented while concluding his keynote presentation. Now the most important parameter was ΔT :

" ΔT is the main direct and/or indirect cause of bioeffects"

In addition, the following statements were included in Bernard Veyret's presentation:

"thermal effect is caused by temperature elevation"

"Heating is the main cause for bioeffects in the GHz range used in wireless communication".

[DL/KL comment: after the presentation we asked Bernard Veyret about his contradictory statements about the importance of T and/or ΔT for the induction of bioeffects. In his opinion there is no contradiction. Here is copy/pasted Bernard Veyret's response:

"No there is no contradiction:

- *"What matters most is the absolute temperature T , and not the temperature elevation ΔT ." is a scientific statement as a conclusion of the Istanbul meeting.*
- *"One conclusion is that ΔT is the main direct and/or indirect cause of bioeffects." is a simple statement equivalent to saying heating is the cause of the effects!"*

To us, Bernard Veyret speaks about T and ΔT as these would be one and the same. I disagree with his opinion - the contradiction is there. If nothing else - Bernard Veyret disagrees with the conclusions if ICNIRP meeting in Istanbul.]

6. Potentially beneficial effect of RF-EMF exposures on the development of Alzheimer's disease was briefly mentioned with pointing out to several technical differences between the four published studies, three of which showed beneficial effect and one negative. Ongoing study by Finnie will, in due time, add to one side of this evidence.
7. TRP receptors (channels) were presented as a new area of research that might, in due time, explain mechanisms of some of the observed biological effects of RF-EMF – especially the effects possibly caused by small temperature changes.

Brief definition of the TRP receptors (channels) from the article: Venkatachalam K, Montell C. TRP channels. *Annu Rev Biochem.* 2007; 76: 387-417: *"The TRP (Transient Receptor Potential) superfamily of cation channels is remarkable in that it displays greater diversity in activation mechanisms and selectivities than any other group of ion channels. The domain organizations of some TRP proteins are also unusual, as they consist of linked channel and enzyme domains. A unifying theme in this group is that TRP proteins play critical roles in sensory physiology, which include contributions to vision, taste, olfaction, hearing, touch, and thermo- and osmosensation. In addition, TRP channels enable individual cells to sense changes in their local environment. Many TRP channels are activated by a variety of different stimuli and function as signal integrators. The TRP superfamily is divided into seven subfamilies: the five group 1 TRPs (TRPC, TRPV, TRPM, TRPN, and TRPA) and two group 2 subfamilies (TRPP and TRPML). TRP channels are important for human health as mutations in at least four TRP channels underlie disease."*

8. In one of the slides and in conclusions, there was mentioned the ongoing animal study by the National Toxicology Program in USA, which is severely delayed and over the budget. Bernard Veyret stated that *"if the outcome of the NTP study will be negative (no effect) this will mean an end to the research on RF and cancer"*.

[DL/KL comment: this is an absolutely false statement by Bernard Veyret. If animal study, executed at low exposure levels, similar to the levels that people are exposed in every-day life (not the overdose of the agent/radiation), shows lack of effect, this **does not mean that people are safe**. It only means

that animals do not respond. This does not mean that people will not respond. Such **false statement** is often presented when discussing results of the animal studies.]

DL & KL - general comments concerning the Science & Wireless 2015

We participated in Science & Wireless events in 2010 and 2014 and in the 2012 DL was one of the invited speakers; interview as well as lecture are still [available from this link](#).

After the Science & Wireless 2010 event DL [wrote in BRHP blog](#):

"During my stay in Melbourne, on November 22, the Australian Centre for RF Bioeffects Research (ACRBR) has organized the Science & Wireless 2010 event (SW2010). This yearly Community Interaction event, which ACRBR organizes since 2007 (<http://acebr.uow.edu.au/events/index.html>), is the great discussion forum where scientists, as well as the representatives of the industry and of the mobile phone users, can present their views and discuss the current issues related to mobile phone health safety. This event is a very good example of how the discussions between various groups of stakeholders can, and should be, facilitated."

Unfortunately, enthusiastic opinion of the Science & Wireless event has vanished. The S&W events organized in 2014 at the Wollongong University and in 2015 at the RMIT have not much to do with the community interaction between scientists, industry and users. S&W events in 2014 and 2015 were just presentations of science by scientists for the benefit of the industry. The real users of wireless technology, some of whom are concerned with possible/probable health risks, were clearly marginalized in 2014 and 2015. The community participants had no presentations to express their views and opinions and the opportunity to voice opinions in the discussion was severely limited by the time constraints. As of now, the Science & Wireless event cannot be called anymore a 'Community Interaction' event.

An interesting exchange of opinions happened during the general discussion when someone from the audience asked Rodney Croft whether it would be advisable to inform general public about the impact of RF-EMF on the sleep EEG. This would not be a warning but just informing people that there are some bioeffects induced by the RF-EMF exposures at levels permitted by the current safety standards. Rodney Croft flatly rejected need for any such action because the effect on EEG was, so far, not shown to have any impact on human health. Therefore, Rodney Croft's opinion was to follow inaction, instead of being pro-active and open in communication with the users.

There is a potential problem with inaction advocated by Rodney Croft. The effect of RF-EMF on EEG has been consistently replicated in different laboratories over the last few years. In accordance with hypothesis, presented by Sarah Loughran and the data from Heidi Danker-Hopfe presented by Bernard Veyret, the EEG-effect is caused by a small (0.1 °C) temperature change of the skin, sensed by the thermal receptors and, which down the line, affects the sleep EEG. According to Rodney Croft such thermal effects are being taken care of in the current safety guidelines of ICNIRP. It is not so!

Current safety limits were set so that the exposures to RF-EMF would not cause increase of temperature by more than 1 °C. ICNIRP considers that any temperature changes less than 1 °C are insignificant for health. However, and maybe unexpectedly, the very small increase in temperature of the skin (0.1 °C) seems to be physiologically significant because it affects the sleep EEG. This means

that exposures to RF-EMF levels permitted by the current safety guidelines are not inconsequential physiologically. Such information should be clearly and understandably conveyed to the users, instead of the inaction approach advocated by the ACEBR.

Furthermore, the EEG effects were discovered and established by several replications in different laboratories. What other RF effects are being induced by the same small rise of temperature in the skin or brain or other tissues and organs of human body? We do not know because we did not do studies to discover them. Human volunteer studies examining the physiological and biochemical parameters would be of the greatest importance.

The "advocacy of inaction" clearly perspired from the opinions, conveyed in the discussion time by predominantly Rodney Croft, Bernard Veyret and Michael Repacholi. Besides the complete ignoring and omitting the IARC 2011 classification of RF as possible carcinogen (2B), the message to the audience included the following:

1. No evidence of harmful health effects
2. Enough research done, would it be time to stop it
3. ICNIRP guidelines take into account children because, besides limits for occupational exposures, the limits for general population exposure include children and sensitive persons
4. Nobody is suffering of the sleep EEG effect; no need for further research; changes in the REM sleep are not reason to study
5. No need for implementation of the Precautionary Principle (Note: The Precautionary Principle is included in the Australian standard that advises to turn off not needed exposures.)
6. Science has not shown any evidence of harmful effects on children

Each of these messages is wrong because, instead of considering indications of health effects found in numerous scientific studies, these messages arbitrarily and without scientific justification jump into a false conclusion that all issues are resolved and there is no problem whatsoever, for now and for the foreseeable future.

There is only a small handful of studies in human volunteers, insufficient for comprehensively determining what kind of physiological effects can be triggered by the RF-EMF exposures at levels permitted by the current safety guidelines. One set of studies shows the effect on the sleep EEG, and it appears to be scientifically proven. The other two, yet insufficiently examined to be considered as proven, are physiological effects of RF-EMF that alter glucose metabolism in the brain ([Volkow et al.](#); [Kwon et al.](#)) and protein expression in the skin ([Karinen et al.](#)) of human volunteers.

Clearly, RF-EMFs at the levels permitted by the current safety guidelines are able to induce physiological effects. We urgently need more studies in exposed volunteers to find out which physiological effects are caused by the RF-EMF to determine the potential health impact of the exposures. Unfortunately, the further research is being actively hampered by the "advocacy of inaction" strongly propagated by some of the speakers at the Science & Wireless 2015.