

Report on
“ISN symposium “The neurochemical mechanisms of EMF effect on the nervous system and interaction with other forms of environmental pollution”
Garni, Armenia, 6-9 September, 2016

Name: **Prof. Sinerik Ayrapetyan**

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The report is submitted in fulfillment of the requirements for the support provided by International Society for Neurochemistry on organization of ISN symposium “The neurochemical mechanisms of EMF effect on the nervous system and interaction with other forms of environmental pollution” within the 9th International EMF Workshop “Bioelectromagnetics and Water Science to Aid Environmental Health Defence”.

This report is written in regard to ISN symposium “The neurochemical mechanisms of EMF effect on the nervous system and interaction with other forms of environmental pollution” which was held on Wednesday, September 7, 2016, as part of the 9th International EMF Workshop “Bioelectromagnetics and Water Science to Aid Environmental Health Defence” organized by UNESCO Chair in Life Sciences at Life Sciences International Postgraduate Educational Center during September 6-9, 2016. The 9th International EMF Workshop “Bioelectromagnetics and Water Science to Aid Environmental Health Defence” has invited specialists who are involved in the studies of EMF dosimetry, physicochemical properties of water, biological effect of EMF treated water, cellular-molecular mechanism of EMF, biomarker of the EMF effect. Scientists studying biological and adverse health effects of EMF, developing exposure limits and legislation, epidemiologists and specialists in social sciences promoting communication strategies in the field of EMF prevention of workers and general population have also been invited to present their research. The main focus of the meeting was occupational exposure, exposure, risk assessment in the working and living environment as well as the cellular molecular mechanism (including neurochemical) of biological effect of EMF on organism.

Subsequent EMF meetings have been held throughout the world every second year since 1998. During the previous EMF Workshop held in Bulgaria, Varna in 2014 the Organizing Committee of the Workshop decided to organize the meeting in Armenia in 2016. This year the 9th EMF meeting was one of the successful meetings in these series with participants from 13 countries. The attendees were composed of leading scientists, students, stakeholders as well as governmental officials. During the meeting all the aspects of EMF radiation exposure in different occupations were discussed including legislation and restrictions for sources of radiation from the point of public health.

The Organizers of the Workshop:

Sinerik Ayrapetyan (Armenia)

Marko Markov (USA)

Henri Lai (USA)

International Organizing Committee:

David Carpenter (USA)

Fadel Mohammed Ali (Egypt)

Shoogo Ueno (Japan)
Alberto Foletti (Italy)
Oleg Krishtal (Ukraine)
Yuri Grigoriev (Russia)
Gayane Ayrapetyan (Armenia)

The ISN symposium “The neurochemical mechanisms of EMF effect on the nervous system and interaction with other forms of environmental pollution” was organized by Prof. Sinerik Ayrapetyan (Armenia) and chaired by Prof. Shoogo Ueno (Japan) and Prof. Soile Tapio (Germany). The Symposium began with a short introduction by Prof. Ayrapetyan who emphasized the ISN support, the importance of studying neurochemical mechanisms of EMF effect and thanked the speakers for their contribution in the symposium.

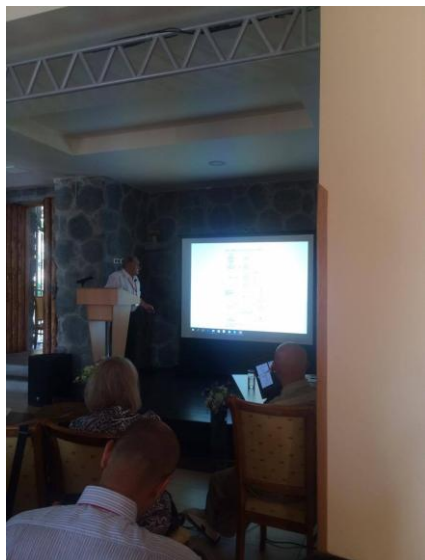
The first speaker was Prof. Oleg Krishtal and then Prof. Soile Tapio presented her research. After the coffee break Prof. Ersan Odaci and Shoogo Ueno presented their talks which were followed with discussion on the symposium. The session was well attended, with approximately 60 people. Each talk was followed by a vivid discussion involving the speaker and audience.

Symposium Chairs and Speakers:

O. A. Krishtal

Sensitivity of Ionotropic Brain Receptors to Environmental Pollution: Examples of Redox Metals and Other Redox Agents

Bogomoletz Institute of Physiology, Kyiv, Ukraine



Redox-active metals are among the most important factors of global pollution. Even the levels of so dangerous pollutant as mercury have a tendency to increase on a global scale. The roles of redox-active metals is usually subdivided into two major groups: 1) modification of specific processes of cellular signaling and 2) damage to the mitochondrial metabolism of oxygen. However, in the case of ionotropic receptors responsible for informational neuronal function we encounter rapid acute reactions connected

with crucial role(s) of sulfhydryl groups in the receptors gating. Here we demonstrate the role of mercury in the gating of glutamate receptors in the brain. We also demonstrate the role of redox agents in the activity of acid-sensing ionic channels (ASICs).

Prof. Soile Tapio

Long-Term Changes in the Brain Induced by Ionising Radiation

Helmholtz Zentrum München, German Research Center for Environmental Health GmbH, Institute of Radiation Biology, Neuherberg, Germany



The number of computed tomography (CT) scans, especially those involving the head region, is sharply rising in the western world. Children may be a target group for possible adverse effects due to the susceptibility of the growing brain. Epidemiological data strongly suggest that intellectual development is adversely affected when the infant brain is exposed to radiation doses equivalent to those from CT of the head. However, the biological mechanism behind the low-dose damage is unknown. The aim of this study was to investigate (i) whether and how low and moderate radiation doses influence cognition and (ii) to perform a detailed molecular analysis of the brain regions important in memory formation and behaviour – hippocampus and cortex (iii) study the effect of age at exposure by irradiating mice either at the age of 10 days or 10 weeks.

Changes in the cellular composition of the dentate gyrus, mitochondrial functionality, proteomic profile in the hippocampus, as well as cognitive performance were evaluated by a multidisciplinary approach.

Our data imply that moderate doses of ionising radiation result in abnormal cognitive behaviour associated with alterations in synaptic plasticity via the Rac1-Cofilin pathway determining correct spine / synapse morphology. In addition, the induction of specific alterations was observed in hippocampal neurogenesis, microvascular density and mitochondrial functions, depending on age at exposure.

Understanding the basic mechanisms of radiation-induced brain damage is essential in developing preventive measures to minimise radiation-associated health risks. These data suggest that neurocognitive disorders may be induced in adults when exposed at a young age to low and moderate cranial doses of radiation. This study raises concerns about radiation safety standards and regulatory practices.

Prof. Ersan Odaci

The Effect of 900-Megahertz Electromagnetic Field on Hippocampus Morphology, Biochemistry and Learning Behavior in Early and Mid-Adolescent Male Rats

Department of Histology and Embryology, Faculty of Medicine, Karadeniz Technical University, Trabzon, Turkey. Tel: +90 462 3777729. Fax: +90 462 325 2270.



The aim of this study was to investigate hippocampus morphology and changes in learning behavior in early and mid-adolescent male rats exposed to the effect of a 900-megahertz electromagnetic field (EMF). Twenty-four male Sprague Dawley rats aged 3-weeks were divided equally into control, sham and EMF groups. EMF group rats were exposed to a 900-megahertz EMF in an EMF cage, while the sham group rats were placed in the same cage but exposed to no effect. No procedure was performed in the control group. Following 25-day application of EMF, passive avoidance, the 8-arm radial maze and Y-maze tests were performed to determine rats' learning and memory performances. Open field and rotarod tests were performed to assess locomotor activity. At the end of the tests, the animals were sacrificed and their brains removed. Following histological tissue procedures, sections were taken from tissues and stained with toluidine blue. The optical dissector technique, a stereological method, was used to investigate pyramidal cell numbers in the CA1, CA2, CA3 and hilus regions of the hippocampus and granular cell numbers in the dentate gyrus region. Histopathological evaluation was performed in the same areas. The tissue oxidative stress parameters malondialdehyde, superoxide dismutase, glutathione and catalase values were investigated at biochemical examination. At histopathological examination,

vacuolization and impairment of pyramidal and granular cell structures were observed in the EMF group hippocampus. Stereological analysis revealed a significant increase in EMF group granular and pyramidal cell numbers. A significant increase in EMF group superoxide dismutase activity was observed at biochemical analyses. No significant change was observed in learning, memory or locomotor behavior in any group. In conclusion, 900-megahertz EMF applied in early and mid-adolescence causes an increase in neurons, changes in morphological structure in the male rat hippocampus, but no changes in learning, memory or locomotor behavior.

Prof. Shoogo Ueno

Magnetic Brain Stimulation for Medical Treatments and Brain Research

Professor Emeritus, the University of Tokyo, Tokyo, 113-0033 Japan



Transcranial magnetic stimulation (TMS) is a technique to stimulate the human brain transcranially by a coil positioned outside of the head. The pulsed magnetic fields of 1T with a pulse-duration of 0.1 ms generated by a coil can induce sufficient electric fields or eddy currents that stimulate neurons in the brain. We proposed a method to stimulate a localized area of the brain by TMS with a figure-eight coil, and succeeded in stimulating the human motor cortex within a 5-mm resolution [1, 2]. The basic idea for localized brain stimulation is to concentrate induced eddy currents locally by a figure-eight coil. TMS with a figure-eight coil is now used worldwide in cognitive brain research and clinical medicine [3, 4].

In this presentation, the history and principles of magnetic nerve stimulation and TMS of the human brain are introduced. Computational biomagnetic design for magnetic brain stimulation is discussed. The studies toward deep brain stimulation are also introduced.

In the second part of presentation, potential medical applications of TMS and repetitive TMS, called rTMS, are introduced. The medical applications include reduction of pain sensation and treatments of

depression by rTMS. For the medical usages of rTMS, experimental studies using rat hippocampus neurons are introduced. Both classical and recent studies of cognitive functions using TMS are also discussed.

Financial report:

Travelling expenses: 2180\$

Prof. Shoogo Ueno (Japan) 602\$

Prof. Ersan Odaci (Turkey) 500\$

Prof. Soile Tapio (Germany) 698\$

Prof. Oleg Krishtal (Ukraine) 380\$

Accommodation: (for 2 days) (150 per day x 4 speakers x 2 nights) =1200\$

Prof. Shoogo Ueno (Japan)

Prof. Ersan Odaci (Turkey)

Prof. Soile Tapio (Germany)

Prof. Oleg Krishtal (Ukraine)

Registration fee for the invited speakers:240\$ (80\$ x 4 speakers)

Registration fee for the whole workshop is 450 \$. This includes conference materials, conference hall rent, social program, transportation, meals, coffee breaks.

Registration fee for the day of the symposium is calculated 150\$ for 20 participants (16 attendees and 4 speakers).

Registration fee for the day of symposium includes:

Conference materials – 900\$ (for 16 attendees and 4 speakers of the ISN symposium)

Conference hall rent – 500\$ (for the day of symposium)

Social program – 300\$

Transportation – 200\$

Meals – 1000\$ (50\$ for each attendee and speaker of the symposium)

Coffee break - 100\$ (5\$ for each attendee and speaker of the symposium)

Registration fee for the day of the symposium for the invited speaker requested from

ISN-CC is 80\$ as the expenses for social program, meals and coffee breaks are excluded from the registration fee for the invited speakers.

Total: 3620\$