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Technical Program

June 9, 2014

Session: OC
Opening Ceremony
June 9, 2014 • 08:30 - 09:00
The Ballroom, Table Bay Hotel

Session: DA
The d'Arsonval Lecture. Carl Blackman: A Scientific Career in EMF Research as influenced by Courses, Chiefs, Colleagues, Collaborators, Critics, Circumstances, Conundrums and Cash.
June 9, 2014 • 09:00 - 10:00
The Ballroom, Table Bay Hotel
Chair: Alexandre Legros

Session: 01
Mechanisms I
June 9, 2014 • 10:30 - 12:30
The Ballroom, Table Bay Hotel
Chairs: P. Thomas Vernier & Francesca Apollonio

Session: 02
Children
June 9, 2014 • 10:30 - 12:30
The Pavilion, Table Bay Hotel
Chairs: Joe Wiart & Wout Joseph

01-1 [10:30]

Calcium toxicity in cells exposed to nanosecond pulsed electric field (nsPEF)

Olga Pakhomova¹, Betsy Gregory¹, Iurii Semenov¹ & Andrei Pakhomov¹

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Keywords: Electroporation, Pulsed, Completed (unpublished)

We established that extracellular Ca²⁺ significantly facilitates cell death early after nsPEF exposure. The data indicate that cell swelling and Ca²⁺ toxicity are two separate mechanisms of cell killing by nsPEF, although both of them result in the early necrotic death. However, the block of both Ca²⁺- and swelling-mediated necrosis does not prevent the late apoptotic death of nsPEF-treated cells. Thus, the apoptotic cell death apparently was not a result of the extracellular Ca²⁺ uptake by nanoporated cells.

01-2 [10:50]

Extremely low frequency pulsed electromagnetic fields improve the maturation of primary human osteoblasts by activation of the ERK1/2 signaling and induction of osteogenic transcription factors

Andreas K Nussler¹, Sabrina Ehnert¹, Patrysa Lacorte¹, Christina Stacke², Anne-Kristin Fentz², Karsten Falldorf² & Jens Sachtleben²

02-1 [10:30]

International policy and advisory response regarding children's exposure to RF-EMF

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Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

The international response to the recent rapid increase of children's exposure to RF has been varied. Currently, many health advisory bodies and experts are recommending precaution, whereas the more traditional physics-centric expert committees are offering re-assurances of the robustness of the current ICNIRP- or IEEE-based standards (that is, the current Standards ensure there is no risk of thermal damage; non-thermal biological effects are not likely to affect health; and while no mechanism of non-thermal effect is agreed upon by these committees there is no mechanism upon which to base a non-thermal Standard). These assurances are sometimes guarded and one has said reference levels are wrong and must be lowered.

02-2 [10:50] - STUDENT PAPER

Mobile phone use during night and its impact on health and cognitive functions in adolescents

Anna Schoeni^{1,2}, Katharina Roser^{1,2} & Martin Roosli^{1,2}

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

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Keywords: In vitro, ELF/LF, Completed (unpublished)

A therapy improving osteoblast function could accelerate fracture healing for non-unions and/or delayed unions. In this study the influence of electromagnetic fields on primary human osteoblasts' and osteoclast function is investigated. Our data show that EMF treatment significantly improves viability and AP-activity in human osteoblasts early in the differentiation process. Furthermore, electromagnetic stimulation enhanced the formation of mineralized matrix.

01-3 [11:10]

Sub- μ T ELF Magnetic Fields Activate the ERK/MAPK Cascade in COS7 and HeLa Cells: Evidence for the Involvement of a Radical Pair Mechanism

Einat Kapri¹, Patricia L. Bounds², Niels Kuster^{2,3} & Rony Seger¹

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Keywords: Mechanistic/Theoretical, ELF/LF, Work in Progress

Extremely low frequency magnetic fields (ELF MF) are classified as possibly carcinogenic to humans, but the biophysical mechanism for a causal relationship remains unclear. A cryptochrome-based radical pair mechanism has been invoked to explain effects with MF strengths in the nT range in *in vivo* magnetoreception studies; typical exposures used *in vitro* are in the μ T range and above. We found little difference between exposure at 1 mT vs. sham at 7 μ T in extracellular signal-regulated kinase (ERK) response in COS7 and HeLa cells, while 0.3 and 0.15 μ T exhibited field strength dependence. ERK sensitivity to sub μ T strength fields in the cells may be evidence for involvement of a radical pair mechanism.

01-4 [11:30]

The Effects of Magnetic Fields on Free Radical Pairs

Frank Barnes¹ & Ben Greenebaum²

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Keywords: Mechanistic/Theoretical, ELF/LF, Completed (unpublished)

Free radical concentrations can be modified by weak magnetic fields by modifying the population distribution of the nuclear and electronic spin states. Coupling between the nuclear and electronic spin states depends on the states and their orientation with respect to the externally applied magnetic field, according to the hyperfine structure Hamiltonian. At frequencies corresponding to the energy separation between the spin orientation energies, magnetic fields at low intensities can lead to transitions that result in

A part of adolescents tends to leave their mobile phones turned on during night and accept being awakened by an incoming text message or call. A cross-sectional study of 439 adolescents indicates impaired health outcomes when mobile phones are turned on and used during night, whereas cognitive functions as concentration and learning capacity are not affected. These findings are confirmed by analysing objective mobile phone traffic data.

02-3 [11:10]

Environmental RF-EMF exposure at home and sleep quality in 7 year old children

Anke Huss¹, Manon van Eijsden², Mònica Guxens¹, Johan Beekhuizen¹, RobT. van Strien², Hans Kromhout¹, TanjaG.M. Vrijkotte³ & Roel Vermeulen¹

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

We assessed the association between sleep quality of 2710 Dutch children aged 7 years and environmental exposure to RF-EMF from base stations and indoor sources in a cross-sectional study. Overall, sleep quality was not associated to RF-EMF exposure in our study.

02-4 [11:30]

RF and ELF electromagnetic field exposure of children in the French ELFE birth cohort

Bouvier Ghislaine¹, Rene De Seze², Gaëlle Coureau¹, Blandine Vacquier³ & Isabelle Baldi¹

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

A French birth cohort of about 18000 children called ELFE started in 2011. It is planned to assess RF and ELF exposure in the cohort by questionnaires, and to validate this exposure assessment by actual measurements by 400 children at the age of 3.5. A job-exposure matrix will be

changes in the populations of both electron and the nuclear states, which in turn can change the electrons in radical pairs between S and T and hence their recombination rate and radical concentrations.

01-5 [11:50]

The Increase in Migration Speeds of Amoeba Under 1.6 Hz AC Electric Fields is Consistent with an Electromechanical Transduction Model

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Keywords: Mechanistic/Theoretical, ELF/LF, Completed (unpublished)

Time-lapse movies of amoeba in which each amoeba serves as its own control indicate that in 1.6 Hz AC fields above 40 V/m (peak), amoeba significantly increase their migration speed, which is consistent with the hypothesis that cells detect electric fields through an electromechanical transduction mechanism.

01-6 [12:10]

Interdisciplinary research on the causes of childhood leukemia

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Keywords: Human, ELF/LF, Work in Progress

Unexplained findings from epidemiological studies in two different areas of radiation protection prompted the BfS to intensify the research on the aetiology of childhood leukaemia: (i) the increased incidence of childhood leukaemia near nuclear power plants and (ii) the consistently observed association of the risk for childhood leukaemia with exposure to low-level low-frequency magnetic fields. Based on a strategic research agenda towards a better understanding of the main causes of childhood leukaemia, BfS initiated five pilot projects in 2012. The results of these projects were discussed in a meeting in December 2013 and will be presented.

applied to assess maternal occupational exposure during pregnancy, domestic uses will be collected, and residential exposure will be assessed by using geocoded residential addresses and mapping of EMF sources. A time-activity diary will be used to improve measurements analysis.

02-5 [11:50]

Use of mobile phones and cognitive effects in Australian primary school children

Mary Redmayne^{1,2}, Catherine Smith¹, Geza Benke¹, Rodney Croft^{1,3}, Anna Dalecki³, David Darby¹, Christina Dimitriadis¹, Skye Macleod¹, Jordy Kaufman¹, Malcolm Sim¹, Rory Wolfe¹ & Michael Abramson¹

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Keywords: Epidemiology, RF/Microwaves, Completed (unpublished)

This study explored cognitive effects of wireless phone use by young children (N=619, mean age 9.9 years). Parents estimated their child's mobile (MP) and cordless (CP) phone use. Children did neurocognitive and Stroop tasks. Data were categorised as 'no', 'low', 'higher' use for analysis using multiple linear regression. The median [range] number of weekly MP calls was 2.5 [0-200], weekly CP calls was 2.0 [0-27.5]. Response inhibition was longer in higher vs some (p=0.01) and no MP use (p=0.03). There were also a few other significant results, but no consistent patterns in the relationships between cognition and use of a MP or CP. The current results are not in agreement with our previous findings for adolescent cognition and MP use.

02-6 [12:10] - STUDENT PAPER

Children's Exposure to Extremely Low Frequency Magnetic Fields: A Personal Exposure Measurement Study

Benjamin Struchen¹, Ilaria Liorni^{2,3}, Marta Parazzini², Stephanie Gängler¹, Paolo Ravazzani² & Martin Roosli¹

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²Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni (IEIIT), Consiglio Nazionale delle Ricerche (CNR), Milan, Italy, 20133

³Dipartimento di Elettronica, Informazione e Bioingegneria (DEIB), Politecnico di Milano, Milan, Italy, 20133

Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)

This study measured exposure to extremely low frequency magnetic fields (ELF-MF) of 172 children in Switzerland and Italy by means of portable exposimeter devices, twice, in summer and winter season. The data is supplemented by information from a time-activity diary, GPS data, a questionnaire about possibly exposure relevant factors and bedroom measurements, in order to learn more about the levels and temporal patterns of ELF-MF exposure of children in their daily lives. The aim of this paper is to assess reproducibility of personal and bedroom measurements,

Session: 03
Neurological effects I
June 9, 2014 • 14:00 - 16:00
The Ballroom, Table Bay Hotel
Chairs: Heidi Danker-Hopfe & Rene De Seze

03-1 [14:00]

Threshold for magnetophosphene perception and EEG response in humans exposed to 50 and 60 Hz MF up to 50,000 μ T

Alexandre Legros^{1, 2, 3, 4}, Julien Modolo^{1, 2, 3}, Daniel Goulet⁵, Michel Plante⁵, Martine Souques⁶, François Deshamps⁷, Genevieve Ostiguy⁵, Jacques Lambrozo⁶ & Alex Thomas^{1, 2, 3}

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⁷Service Environnement Réseaux, Paris, France

Keywords: Human, ELF/LF, Work in Progress

OBJECTIVE: Quantify human EEG response and magnetophosphene perception in 50 and 60 Hz MFs up to 50 mT. **METHODS:** Magnetophosphene perception and EEG collected during 55 MF conditions at 50 and 60 Hz. **RESULTS:** Magnetophosphene perception threshold between 10 and 30 mT depending on the exposure conditions. **CONCLUSIONS:** Pilot results provide a preliminary estimate of magnetophosphene perception threshold at 50 and 60 Hz. Associated EEG changes will be presented at the conference.

03-2 [14:20]

Assessment of 60 Hz MF exposure up to 7.6 mT on human brain activity: a simultaneous EEG/fMRI study

Julien Modolo^{1, 2, 3}, Daniel Goulet⁵, Michel Plante⁵, Martine Souques⁶, François Deshamps⁷, Genevieve Ostiguy⁵, Raphaël Paquin⁸, Jacques Lambrozo⁶, Alex Thomas^{1, 2, 3} & Alexandre Legros^{1, 2, 3, 4}

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investigate exposure relevant factors for personal exposure and to compare summary measures of personal and bedroom measurements.

Session: 04
Calculations of Human Exposure
June 9, 2014 • 14:00 - 16:00
The Pavilion, Table Bay Hotel
Chairs: Marthinus Van Wyk & Andrew Wood

04-1 [14:00]

Dosimetry Work in South Africa over the past Two Decades

Frans Meyer¹, Marthinus Van Wyk¹ & Francois du Plessis¹

¹EMSS Consulting, Stellenbosch, South Africa, 7600

Keywords: Dosimetry (computational), RF/Microwaves, Completed (published)

Details of the dosimetry work conducted in South Africa are given, from the 1990's to date. The work included advances in Computational ElectroMagnetics, Dosimetry measurements of cellular base station antennas as well as measurement programs to determine the level of electromagnetic exposure of the public around cellular base stations.

04-2 [14:20] - STUDENT PAPER

Correlation Assessment for In-vivo and Human Dosimetry of ELF Magnetic Field Exposure

Yijian Gong^{1, 2}, Myles Capstick¹, Niels Kuster^{1, 2}, Clemens Dasenbrock³, Maren Fedrowitz⁴, Cesar Cobaleda⁵ & Isidro Sánchez-García⁶

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Keywords: Dosimetry (computational), ELF/LF, Work in Progress

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⁸Siemens Canada, Montréal, QC, Canada

Keywords: Human, ELF/LF, Completed (unpublished)

OBJECTIVE: Measuring effects of 60 Hz MF exposure up to 7.6 mT on human brain activity. **METHODS:** Integrated EEG/fMRI in 3, 5 and 7.6 mT MF conditions delivered by a 3T MRI scanner. **RESULTS:** No significant changes on the EEG alpha power (8-12 Hz) or fMRI activation were found in any of the three conditions tested. **CONCLUSIONS:** The threshold for acute, detectable changes in EEG or functional brain activation is higher than 7.6 mT at 60 Hz.

03-3 [14:40]

Does TETRA exposure affect brain activity during sleep?

Heidi Danker-Hopfe¹, Cornelia Sauter¹, Torsten Eggert¹, Gernot Schmid², Thomas Bolz³ & Hans Dorn¹

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Keywords: Human, RF/Microwaves, Completed (published)

Aim of the present randomized, double-blind cross-over study was to investigate acute effects of radiofrequency electromagnetic fields (RF-EMF) emitted by Terrestrial Trunked Radio (TETRA) handheld devices on the central nervous system (CNS). Possible effects on the sleeping brain as well as on the waking brain in resting state and under cognitive demand are studied. The present contribution focuses on sleep, that was used as a model.

Overall the data indicate that brain activity as measured by power spectra of the sleep EEG may differ between exposure conditions. The slight physiological changes, however, are typically not reflected by behavioural measures and symptoms.

03-4 [15:00] - STUDENT PAPER

Acute cognitive effects of MRI related magnetic fields: the role of vestibular responsiveness

Lotte Van Nierop¹, Pauline Slottje¹, Martine van Zandvoort², Herman Kingma³ & Hans Kromhout¹

¹Institute for Risk Assessment Sciences, Utrecht University, Utrecht, the Netherlands, 3584 CM

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³Division of Balance Disorders, University Hospital Maastricht, Maastricht, the Netherlands

Keywords: Behavioural, Static, Work in Progress

This paper describes a method to correlate low frequency magnetic field exposure from in vivo experiments to that of human using dosimetry. Four different mapping methods between human and rodents were proposed and analyzed. Based on the mapping and the ICNIRP standard, the volume averaged peak field values and the 50th percentile induced field values for whole body and all tissues were accessed and compared between children and rodents. Thus, the quantified human / rodent exposure levels provide comparison for experimental data with data from epidemiological studies.

04-3 [14:40]

Multimodal Imaging-Based Detailed Head Model for EMF-Neuron Interaction Related Applications

Maria Iacono¹, Esra Neufeld², Esther Akinagbe¹, Johanna Wolf^{2,3}, Ioannis Oikonomidis^{2,3}, Deepika Sharma^{2,3}, Bertram Wilm⁴, Michael Wyss⁴, Klaas Pruessmann⁴, Andras Jakob⁵, Ethan Cohen¹, Niels Kuster^{2,3}, Wolfgang Kainz¹ & Leonardo Angelone¹

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Keywords: Dosimetry (computational), ELF/LF, Completed (unpublished)

An anatomically precise head model with 115 anatomical structures differentiated has been created from multi-modal image data. The precision of the model was particularly enhanced in regions of relevance for interactions of neurons with electromagnetic (EM) fields generated by medical devices – i.e., ear, eye, and deep brain structures. The integrated diffusion tensor imaging (DTI) information allows for location-specific anisotropic brain tissue parameters to be assigned. The topologically conforming, non-self-intersecting, high-element-quality surfaces are suitable for a wide range of numerical methods and solvers, as demonstrated in an application derived from transcranial alternating current stimulation.

04-4 [15:00] - STUDENT PAPER

Study of the influence of the magnetic field orientation using Polynomial Chaos decomposition applied to the pregnant woman exposure at 50 Hz

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Keywords: Dosimetry (computational), ELF/LF, Completed (unpublished)

Acute negative effects of movement in the magnetic fields of MRI systems on concentration, memory, visuo-spatial orientation and postural body sway were characterized earlier. In the present study we aim to gain more insight whether healthy subjects with a relatively (non)responsive vestibular system perform differently on cognitive tasks when (moving) in a static magnetic stray fields of an MRI scanner.

03-5 [15:20]

Cattle under power lines – extremely low frequency magnetic fields (ELF MF) disturb magnetic alignment

Sabine Begall¹, Pavel Nemeč², Erich Malkemper¹, Julia Weiße¹ & Hyněk Burda^{1,3}

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Keywords: Behavioural, ELF/LF, Work in Progress

Cattle tend to align their body axes parallel to the geomagnetic field (GMF) lines when being on pastures with no power lines. We used aerial images to show that ELF MFs generated by high-voltage power lines disrupt the North-South alignment: Cattle exposed to ELF MFs under NS, NW-SE, or SW-NE trending power lines showed a random body orientation. In contrast, cattle under EW oriented power lines preferred to align their body axes parallel to the power lines and perpendicular to the resultant magnetic field. These results suggest that magnetic alignment of cattle is based on a polarity compass.

03-6 [15:40]

Effects of Early-Onset Radiofrequency Electromagnetic Field Exposure (GSM 900 MHz) on Behavior and Memory in Rats

Melanie Klose¹, Karen Grote¹, Oliver Spathmann², Joachim Streckert², Volkert Hansen² & Alexander Lerchl¹

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Keywords: Behavioural, RF/Microwaves, Completed (unpublished)

Female Wistar rats, from an age of 14 days to 19 months, were exposed in the head region for two hours per day, five days per week, to a GSM-modulated 900 MHz radiofrequency electromagnetic field (RF-EMF). The average specific absorption rates (SAR) in the brain were 0 (sham), 0.7, 2.5 and 10 W/kg. During the experiment, a set of four behavioral and learning tests (rotarod, Morris water maze, 8-arm radial maze, open field) were performed three times in juvenile, adult, and presenile rats. In these tests, no profound differences could be identified between the groups, indicating no harmful effects of long-term RF-EMF exposure beginning at an early age on subsequent development, learning skills and behavior in rats.

The change of the orientation of the **B**-field vector respect to the human body is a parameter to take into account for the estimation of the variability of the human exposure. The deterministic dosimetry would be too much time consuming to perform this analysis. In this paper the stochastic dosimetry is applied to the analysis of the pregnant woman exposure at 7 months of gestational age, to build-up a statistical meta-model of the induced electric field for each fetal tissue and in the fetal whole-body by means of the Polynomial Chaos expansion as a function of the **B**-field orientation, considering a uniform exposure at 50 Hz.

04-5 [15:20]

The absorption pattern of electromagnetic radiation from wireless devices in the skin at different sites of the body

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

Skin is the largest organ of the body and gets mainly exposed by portable wireless devices. In this study we examine the correlation between maximum SAR and peak spatial SAR averaged over 10g of tissue mass in skin for the cases where electrically small antennas are placed next to human models. From the results it becomes clear that the maximum SAR affecting a large number of cells in the skin can be several times higher than the average SAR.

04-6 [15:40]

Human Exposure to Magnetic Fields from 765 kV Transmission Lines: Measurements and 3-D Anatomical Body Dosimetry

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Keywords: Dosimetry (measurements), ELF/LF, Review, Commentary, Recommendation, Evaluation

Limits on human exposure to low frequency magnetic fields are specified for tissues/organs in *in-situ* electric fields. These dosimetric limits are referred to as *Basic Restrictions* for protection against potentially adverse effects from electro-stimulation. *Reference Levels* are given for compliant purposes and are derived from the Basic Restrictions based on uniform-fields with a provision that the basic restrictions must be observed for non-uniform cases. The human exposure to magnetic fields from Eskom's 756 kV transmission network operating at 50 Hz, is addressed

through physical measurements, predictions and 3-D human model dosimetry, which is presented in this paper.

Session: F
Student Flash Poster Session
June 9, 2014 • 16:30 - 16:50
The Ballroom, Table Bay Hotel
Chairs: Niels Kuster & Christopher Portier

F-1 [16:30] - STUDENT PAPER

Acute exposure to 1.8 GHz radiofrequency radiation influences cellular oxidation-reduction balance

AnaMarija Marjanovic¹, Ivan Pavicic¹ & Ivancica Trosic¹

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Keywords: In vitro, RF/Microwaves, Completed (unpublished)

Rapid technological expansion and increase in the number of mobile phone users has raised concern about possible health effects of radiofrequency radiation exposure. Non-thermal effects and their possible mechanism of action are still being controversial. One of the possible explanations could be connected to reactive oxygen species (ROS) and oxidative stress. The aim of this study was to investigate effect of 1.8 GHz mobile phone radiation on cell oxidative stress development by measuring level of ROS, lipid damage and antioxidant defence mechanism in Chinese hamster lung fibroblasts (V79).

F-2 [16:33] - STUDENT PAPER

Exposure to extremely low frequency magnetic fields in various Swiss and Belgium microenvironments

Milena Foerster¹, Damiano Urbinello¹, Benjamin Struchen¹ & Martin Roosli¹

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Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)

By using portable devices, extremely-low frequency magnetic field (ELF-MF: 40-800 Hz) measurements were conducted during two years in the city of Basel (Switzerland) and during one year in Ghent and Brussels (Belgium) in different microenvironments such as outdoor areas, public transports and indoor settings. We found high spatial variability of EMF within and between cities, but all average exposure values were far below the RF and ELF regulatory limits.

F-3 [16:36] - STUDENT PAPER

Application of the non-intrusive polynomial chaos for the evaluation of the uncertainty in the SAR calculation using a CAD-based mobile phone model

Xi Cheng¹ & Vikass Monebhurrn¹

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

The TC34/SC2 committee of the International Commission on Electromagnetic Safety is developing standardized procedures for using computational tools to evaluate the specific absorption rate (SAR) in the human body. For meaningful numerical simulation results, it is important to state the uncertainty of the SAR calculation induced by the uncertainties in the input parameters. The Monte Carlo method cannot be applied and the second order unscented transform was previously proposed as a potential alternative to evaluate the uncertainty. Herein the non-intrusive polynomial chaos method is proposed as a more efficient approach to evaluate the uncertainty induced in the SAR calculations using CAD-based mobile phone models.

F-4 [16:39] - STUDENT PAPER

EMF exposure metering: Dealing with pulsed RF signals

Marco Zahner¹ & Jürg Fröhlich¹

¹*Institute of Electromagnetic Fields, ETH Zurich, Zurich, Switzerland, 8092*

Keywords: Dosimetry (measurements), Pulsed, Work in Progress

In order to achieve a meaningful electromagnetic field (EMF) exposure assessment it is desirable to monitor the contributions of all potential sources at the location of interest. A solely frequency based measurement however lacks sufficient complexity to deal with signal shapes that strongly deviate from those encountered in communication and broadcast systems. The issue of measurement of highly pulsed signals is illustrated by assessing the exposure to radar signals. A hybrid time and frequency domain detection scheme is presented. This approach was successfully tested using an experimental hardware prototype.

F-5 [16:42] - STUDENT PAPER

2 mT Extremely Low Frequency Magnetic Fields have no effect on mouse oocytes meiotic maturation in vitro

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Keywords: In vitro, ELF/LF, Work in Progress

Widely applications of power lines, domestic appliances and electronic products make people exposed to unprecedented levels of extremely low frequency magnetic fields (ELF-MF) and raise concerns about the potential effects on female reproduction. In this study, we investigated the effects of 50 Hz ELF-MF of 2 mT for 24 hours on mouse oocytes cultured in vitro. We focused on several key events in the process of oocytes meiotic maturation, including the following: γ H2AX foci formation of oocytes on GV (Germinal vesicle) stage, Germinal vesicle breakdown (GVBD) rate, first polar body (PBI) extrusion rate, spindle and chromosome configurations, and activation of oocytes. No differences were found between sham-exposed and exposed groups.

F-6 [16:45] - STUDENT PAPER

A review of environmental data on where in the industrial and medical work environmental exposure to electromagnetic fields may be hazardous to users of active implantable medical devices (AIMD)

Wiesław Leszko¹, Jolanta Karpowicz¹, Patryk Zradziński¹ & Krzysztof Gryz¹

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Keywords: Occupational, RF/Microwaves, Work in Progress

The study was performed to identify the most common exposure situations in the industrial and medical work environments where AIMD EMF-related dysfunctions may be considered.

Session: PA
Poster Session A
June 9, 2014 • 17:00 - 18:30
The Pavilion Conference Centre, Clock Tower Square

Session: Sem I
BEMS seminar: international EMF research (invited presentations) - Refreshments will be provided
June 9, 2014 • 18:30 - 20:00
The Pavilion, Table Bay Hotel
Chairs: Philip Chadwick & Richard Nuccitelli

SemI-1 [18:30] -

Introduction to the winner of the Bioelectromagnetics Journal most-cited paper award

James Lin¹

¹University of Illinois, Chicago, IL, USA, 60607-7053

Keywords: , ,

Editor-in-chief of the journal will introduce the winner of the *Bioelectromagnetics* Journal most-cited paper award.

SemI-2 [18:30] - Winner of the Bioelectromagnetics Journal most-cited paper award

Exposure of seeds to static magnetic field enhances germination and growth characteristics in chickpea (Cicer arietinum L.)

Ananta Vashisth¹

¹Division of Agricultural Physics, Indian Agricultural Research Institute, New Delhi, India, 110012

Keywords: Dosimetry (measurements), Static,

In the modern agriculture of the 21st century, increasing attention has been paid to the productive growth of cultivated plants, which are also environmentally safe. The application of high quality sowing materials which has been properly pre-prepared is an important yield enhancing factor in plant cultivation. Most often chemical methods consisting seed dressing priming with various chemical substances are used in the presowing seed treatment. Such methods are considered as very effective but not neutral for the environment. The magnetic field is one of the physical pre-sowing seed treatment especially worth our attention since its impact on the seeds can change the processes taking place in the seed and stimulate plant development.

SemI-3 [18:45]

Effect of radiofrequency electromagnetic field on human blood cells

Yao-Xiong Huang¹

¹*Department of Biomedical Engineering, Ji Nan University, Guang Zhou, China, 510632*

Keywords: In vitro, RF/Microwaves,

The tremendous use of mobile phone nowadays has drastically increased the amount of radiofrequency electromagnetic field (GSM RFEMF) exposure in our daily lives. We therefore studied the effects of RFEMF radiation exposure on human blood cells.

Sem1-4 [19:00]

Challenges and opportunities for laboratory studies on EMF exposure and health: experiences from Bioelectromagnetics Laboratory, Zhejiang University School of Medicine

Zhengping Xu^{1,2} & Guangdi Chen^{1,2}

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²*Institute of Environmental Health, Zhejiang University School of Medicine, Hangzhou, China, 310058*

Keywords: In vitro, ELF/LF,

With the rapid development of electric power and wireless communication technologies over the past decades, public concerns have been raised about possible health impact of exposure to occupational and environmental electromagnetic fields (EMF). Epidemiological data suggest that exposure to EMF may be associated with an elevated risk of cancer and other diseases in humans. Based on limited epidemiological evidence, which indicates a correlation between ELF-MF exposure and childhood leukemia, and between RF-EMF exposure and glioma, the International Agency for Research on Cancer (IARC) has classified both ELF-MF and RF-EMF as human 2B carcinogens. However, the data available from laboratory studies neither provide consistent corroborating evidence nor suggest mechanisms of action to support or clarify the epidemiological findings. We propose to investigate the weak biological effects induced by low-intensity of EMF exposure using systemic strategies with more sensitive methods.

Sem1-5 [19:15]

Cellular response to electromagnetic fields exposure: experiences from in vitro studies

Guangdi Chen^{1,2} & Zhengping Xu^{1,2}

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²*Institute of Environmental Health, Zhejiang University School of Medicine, Hangzhou, China, 310058*

Keywords: In vitro, ELF/LF,

The potential health hazard of exposures to electromagnetic fields (EMF) continues to cause public concern. However, the possibility of biological and health effects of exposures to EMF remains controversial and their biophysical mechanisms are unknown. We have investigated the global gene and protein expression response to extremely low frequency magnetic fields (ELF-MF) and to radiofrequency electromagnetic fields (RF-EMF) exposures, using both mammalian cells and yeast cells. The gene expression profiles were analyzed by microarray screening and confirmed by real-time reverse transcription-polymerase chain reaction (RT-PCR). In this talk, I will present our findings on global gene expression response to EMF exposure.

Sem1-6 [19:30] -

Current RF-EMF related research activities in Malaysia

Kwan-Hoong Ng¹

¹*Department of Biomedical Imaging & University of Malaya Research Imaging Centre, University of Malaya, Kuala Lumpur, Malaysia, 50603*

Keywords: , ,

To be provided

June 10, 2014

Session: T1

Tutorial I: Dr. P. Thomas Vernier, Old Dominion University, USA - An introduction to electroporation and its applications

June 10, 2014 • 08:00 - 09:00

The Ballroom, Table Bay Hotel

Session: P I
Plenary Session I: Electromagnetic field effects on fauna
June 10, 2014 • 09:00 - 11:00
The Ballroom, Table Bay Hotel
Chairs: Meike Mevissen & John Tattersall

P1-1 [09:00]

Making sense of nonsense: The study of magnetic alignment in vertebrates

Hynek Burda^{1,2}, Sabine Begall¹, Vlastimil Hart², Erich Malkemper¹ & Petra Novakova²

¹*General Zoology, University Duisburg-Essen, Essen, Germany, 45117*

²*Game Management and Wildlife Biology, Czech University of Life Sciences, Praha, Czech Republic, 16521*

Keywords: Behavioural, Static, Completed (published)

Directional body orientation (heading) of resting, moving, or otherwise active animals is usually not random. We may expect that an individual would adopt a position which, under given conditions, saves energy, is more comfortable, or provides certain advantages, e.g. better access to food, oxygen, and information. Scanning for cases of magnetic alignment (MA), i.e. orientation of the body with respect to the geomagnetic field lines, represents a not only a simple method to monitor the existence of magnetoreception in animals, but also a suitable experimental paradigm for magnetobiological research. We review the known cases of MA in vertebrates and demonstrate heuristic potential of the study of this phenomenon.

P1-2 [10:00]

Reception and learning of electric fields in bees

Uwe Greggers¹

¹*Institut für Biologie, AG Neurobiologie, Berlin, Germany*

Keywords: Behavioural, Static, Original - work in progress, concept

Honeybees emit constant and modulated electric fields with low- and high-frequency components when flying, landing, walking and during the waggle dance. Both components induce passive antennal movements in stationary bees according to Coulomb's law. Using laser vibrometry, we show that the electrically charged flagellum is moved by constant and modulated electric fields and more strongly so if sound and electric fields interact. Recordings from axons of the Johnston organ document its sensitivity to electric field stimuli. Our analyses identify electric fields emanating from the surface charge of bees as stimuli for mechanoreceptors, and as biologically relevant stimuli, which may play a role in social communication.

Session: PB
Poster Session B
June 10, 2014 • 11:30 - 13:00
The Pavilion Conference Centre, Clock Tower Square

Session: EBEA
EBEA General Assembly
June 10, 2014 • 13:00 - 14:00
The Ballroom, Table Bay Hotel

Session: 05
Genomic instability
June 10, 2014 • 14:30 - 16:30
The Ballroom, Table Bay Hotel
Chairs: Luc Verschaeve & Anne Höytö

Impact of millimeter waves exposure on cellular response to energetic stress

Denis Habauzit¹, Yonis Soubere Mahamoud¹, Meziane Aite¹, Catherine Martin¹, Maxim Zhadobov², Ronan Sauleau² & Yves Le Dréan¹

¹IRSET, University of Rennes 1, Rennes, France, 35042

²IETR, University of Rennes 1, Rennes, France, 35042

Keywords: In vitro, RF/Microwaves, Completed (unpublished)

This study investigated possible additive effects of millimeter-waves (MMW) radiations on cellular response to metabolic stress. 4 groups of primary keratinocytes were included: 1) Sham; 2) MMW exposure at 60 GHz and 20 mW/cm²; 3) chemical treatment with 2 deoxy-glucose (2dG); 4) 2dG and MMW co-treatment. DNA microarray analysis was performed. Our results show that MMW do not induce significant modification in gene expression when cells do not experience stress. Comparison between MMW-2dG co-exposure and 2dG treatment alone, followed by RT-PCR validation identified 5 genes differentially expressed.

05-2 [14:50] - STUDENT PAPER
Differential Impact of Low Level EMF on Longevity, Apoptosis, and Oxidative Profile of *Drosophila melanogaster*

Areti Manta¹, Issidora Papassideri¹, Dimitrios Stravopodis¹ & Lukas Margaritis¹

¹Dept. of Cell Biology and Biophysics, Athens University, Athens, Greece, 15784

Keywords: In vivo, RF/Microwaves, Work in Progress

This study has focused on the biological impact of low level EMFs emitted by DECT cordless phone, used by millions of people in their everyday life. In order to examine possible effects *Drosophila melanogaster* was chosen to be the model system because of its advantages concerning studies for oxidative stress. It was found increase in ROS levels at all ages, deterioration of insects' wellbeing but no change in their viability, and accumulation of carbonylated proteins although MDA levels were unaffected.

05-3 [15:10] - STUDENT PAPER
The effects of magnetic fields exposure on DNA damage in human choriocarcinoma cells

Session: 06
MRI and medical devices
June 10, 2014 • 14:30 - 16:30
The Pavilion, Table Bay Hotel
Chairs: Jianqing Wang & Rosanna Pinto

06-1 [14:30]
Numerical Investigation of MRI Gradient Coil Switching Induced Nerve Stimulation

Esra Neufeld¹, Ioannis Oikonomidis^{1,2}, Deepika Sharma^{1,2}, Maria Iacono³, Leonardo Angelone³, Wolfgang Kainz³ & Niels Kuster^{1,2}

¹Foundation for Research on Information Technologies in Society (IT²IS), Zurich, Switzerland, 8004

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³Center for Devices and Radiological Health, U.S. Food and Drug Administration, Silver Spring, MD, USA

Keywords: Mechanistic/Theoretical, ELF/LF, Completed (unpublished)

Nerve stimulation by MRI gradient coil switching is a safety issue typically addressed through thresholds on slew rates, dB/dt, or E/M-field strength. Coupled EM-neuronal dynamics modeling was performed, considering the impact of tissue/field inhomogeneity, coupling mechanisms, neuron models, and local, RF-coil induced heating affecting ion-channel dynamics. It was found that: the inhomogeneous field affects the stimulation threshold, end-node stimulation is not the only dominant mechanism and local field foci are relevant - as opposed to the assumptions underlying the standards -, and temperature impacts significantly neuronal dynamics, but less so stimulation thresholds. The acceptability of field smoothing is discussed.

06-2 [14:50]
Miniaturized vivaldi antenna system for pneumothorax diagnosis: proposed air detection scenarios

Maria Christopoulou¹ & Stavros Koulouridis¹

¹Department of Electrical and Computer Engineering, University of Patras, Rio, Greece, 26504

Keywords: Clinical (diagnostics), RF/Microwaves, Work in Progress

A novel sensor model based on a miniaturized Vivaldi antenna is investigated, in order to non-invasively diagnose air volumes into the pleural cavity of lung area (i.e. pneumothorax). Proposed detection scenarios are calculated using simplified a) planar multilayered, b) closed rectangular layered thorax and c) MRI-based anatomical whole body phantoms. The frequency range of operation is set to 1 - 4 GHz. The best detection scenario for 1 cm air thickness consists of two antennas with given relative positioning onto the closed thorax model and results to 38.2 dB difference in S₁₂, at 3 GHz.

06-3 [15:10]
Estimation of the Electric Field Induced by Different Coil Configurations for Deep Transcranial Magnetic Stimulation

Xinyuan Zhao¹, Chuan Sun¹, Xiaoxia Wei¹, Liling Su¹,
Guangdi Chen¹ & Zhengping Xu¹

¹Bioelectromagnetics Lab, Zhejiang University, Hangzhou, China,
310058

Keywords: In vitro, ELF/LF, Work in Progress

Our comet assay analyses showed that 2.0 mT 50 Hz magnetic fields (MF) exposure induced DNA damage in human choriocarcinoma JAR cells with higher percentage of Tail DNA in exposure group (14.79 ± 4.65 %) compared to the sham-exposure group (11.30 ± 1.34 %). Furthermore, the exposure increased the proportion of cells at G2/M phase (20.71 ± 2.57 %) compared to the sham-exposure group (17.92 ± 1.84 %). However, we did not find changes of γ -H2AX foci formation in JAR cells between sham and exposure group. Key words: magnetic fields; DNA Damage; Comet Assay; γ -H2AX; human choriocarcinoma cell line

05-4 [15:30]

Effects of long-term exposure to 60 GHz millimeter-wave on genotoxicities in HCE-T and SRA cells derived from human eye

Shin Koyama¹, Eijiro Narita¹, Yukihisa Suzuki², Takeo Shina²,
Masao Taki², Naoki Shinohara¹ & Junji Miyakoshi¹

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Keywords: In vitro, RF/Microwaves, Work in Progress

Two kinds of cells (HCE-T and SRA) derived from human eye were exposed to a millimeter-wave for 24 hours. The micronucleus (MN) frequency of cells treated with bleomycin for 1 hour was high enough as a positive control. However there is no statistically significant increase in the MN frequencies of the cells exposed to 60 GHz millimeter-wave at 1 mW/cm² compared with sham-exposed controls and incubator controls. The comet assay to detect DNA strand breaks also showed that the exposure of the millimeter-wave for 24 hours did not have statistically significance. These results indicate that the exposure to the millimeter-wave would be considered to have no effect on the genotoxicity to the human eye cells.

05-5 [15:50]

Genomic instability and DNA damage responses after exposure to 50 Hz magnetic fields in human SH-SY5Y neuroblastoma cells

Jukka Luukkonen¹, Anne Höytö¹, Miiko Sokka², Anu
Liimatainen¹, Juhani Syväoja³, Jukka Juutilainen¹ & Jonne
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Finland

³Institute of Biomedicine, University of Eastern Finland, Kuopio,
Finland

Vanessa Guadagnin¹, Marta Parazzini¹, Ilaria Liorni^{1,2}, Serena
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Keywords: Dosimetry (computational), ELF/LF,
Completed (unpublished)

This paper presents the electric field distributions in the brain of a realistic human model induced by 14 different coils configurations used for deep transcranial magnetic stimulation, compared with two reference coils, i.e. circular coil and figure-8 coil. We found that some coils are able to reach subcortical white matter tracts at effective electric field level whereas few coils are able to reach deep brain structures with electric field values greater than 20% of the maximum in the cortex. However, the ability to directly stimulate deeper brain structures is obtained at the expense of inducing wider electrical field spread.

06-4 [15:30]

Estimation of in vivo Local RF-Induced Heating of Implanted Medical Devices during MRI: Method and Validation

Earl Zastrow^{1,2}, Eugenia Cabot¹, Myles Capstick¹, Andreas
Christ¹ & Niels Kuster^{1,2}

¹IT'IS Foundation, Zurich, Switzerland, 8004

²Department of Information Technology and Electrical
Engineering, ETH-Zurich, Zurich, Switzerland, 8092

Keywords: Standards, RF/Microwaves, Work in Progress

Patients with active implantable medical devices (AIMDs) are generally excluded from magnetic resonance imaging (MRI) diagnostics because the interaction of the AIMD with MRI-induced radiofrequency (RF) electromagnetic fields (EMFs) can lead to hazardous localized heating in surrounding tissues. In this paper, safety assessment method, based on Tier 3 of the Technical Specification ISO/IEC 10974 is implemented and the results of the assessment are illustrated. The uncertainty budget of the method is established and validated, using the generalized concept of Guide to the Expression of Uncertainty in Measurements (GUM).

06-5 [15:50] - STUDENT PAPER

Assessment of the induced SAR in the human brain during deep microwave hyperthermia in the head and neck region to investigate the stringency of the basic restrictions

Fatemeh Adibzadeh¹, Rene Verhaart¹, Valerio Franckena²,
Martine Franckena¹, Gerda Verduijn³, Gerard van Rhooon¹ &
Maarten Paulides¹

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Keywords: In vitro, ELF/LF, Completed (unpublished)

In this study, human SH-SY5Y neuroblastoma cells were exposed to a 50-Hz, 100 μ T extremely low frequency (ELF) magnetic field (MF) for 24 h, followed by menadione treatment for 1 or 3 h. The study evaluated the induction of genomic instability and a battery of endpoints relevant to DNA damage responses. This study showed, for the first time, that MF exposure induces genomic instability, reflected as an increased level of micronuclei at 8 and 15 days post-exposure. The results on the DNA damage response experiments will be presented in the meeting (including the level of several DNA damage response-related proteins, DNA damage level, and data on cell cycle distribution).

05-6 [16:10]

Comparison of the Genotoxic Effects Induced by 50Hz Extremely Low Frequency Electromagnetic Fields and 1800 MHz Radiofrequency Electromagnetic Fields in GC-2 Cells

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¹Department of Occupational Health, Third Military Medical University, Chongqing, China, 400038

Keywords: In vitro, ELF/LF, Completed (unpublished)

ELF-EMF resulted in a significant increase of DNA strand breaks at 3 mT, whereas RF-EMF did not. RF-EMF significantly induced oxidative DNA base damage at a SAR value of 4 W/kg, whereas ELF-EMF did not. Both ELF-EMF and RF-EMF may produce genotoxicity, but they create different patterns of DNA damage.

³Erasmus MC - Cancer Institute, Rotterdam, the Netherlands, 3074 ME

Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

To avoid any adverse health effect of electromagnetic field (EMF), ICNIRP has defined basic restrictions on SAR_{1g} and SAR_{10g}. The objective of this study is to exploit the experience obtained during HT in the head and neck region to investigate the stringency of the common basic restrictions. The results show that the exposure of the brain can exceed the common basic restrictions by 50 (SAR_{1g}) and 30 (SAR_{10g}) times. Evaluation of the acute effects based on common toxicity criteria (CTC) standard reveals no indication of the serious mental acute effects. So, this study brings into discussion that the current restrictions might be unnecessarily too rigorous and strict.

06-6 [16:10]

Development of a New Generation of High-Resolution Anatomical Models for Medical Device Evaluation: The Virtual Population 3.0

Marie-Christine Gosselin^{1,2}, Esra Neufeld¹, Heidi Moser¹, Eveline Huber¹, Silvia Farcito¹, Livia Gerber¹, Maria Jedensjoe¹, Isabel Hilber¹, Fabienne DiGennaro¹, Bryn Lloyd¹, Emilio Cherubini³, Dominik Szczerba¹, Wolfgang Kainz⁴ & Niels Kuster^{1,2}

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⁴Center for Devices and Radiological Health, U.S. Food and Drug Administration, Silver Spring, MD, USA

Keywords: Dosimetry (computational), RF/Microwaves, Completed (published)

This paper describes the R&D performed to upgrade the first generation of the Virtual Population (ViP 1.0) developed at the IT²IS Foundation and obtain anatomical models that meet the requirements of medical implant safety assessment applications. The work included implementation of quality control procedures, re-segmentation at higher resolution, more-consistent tissue assignments, enhanced surface processing, anatomical refinements, the development of tools for enhancing model functionality (e.g., posing, morphing), and the compilation of a comprehensive tissue properties database. *In silico* MRI exposure of an adult woman with an orthopedic spinal implant is used to illustrate the improvements achieved.

Session: W1
Discussion Workshop led by Dariusz Leszczynski: Ethical and social issues in bioelectromagnetics research
June 10, 2014 • 17:00 - 18:00
The Ballroom, Table Bay Hotel
Chair: Dariusz Leszczynski

W1-1 [17:00]

Ethics and Conflict of Interest in Bioelectromagnetics

Dariusz Leszczynski^{1, 2}

¹Chief Editor of 'Radiation and Health', *Frontiers in Public Health*, Lausanne, Switzerland

²Adjunct Professor, *Biochemistry and Biotechnology*, University of Helsinki, Helsinki, Finland

Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

The Institute of Medicine of The US National Academies defines Conflict of Interest (Col) as "a set of circumstances that creates a risk that professional judgment or actions regarding a primary interest will be unduly influenced by a secondary interest". Not all Col are equal. Some are more significant some are less significant though classification of the significance seems to be a very gray area.

Session: Dinner
Social event and sponsor recognition
June 10, 2014 • 19:00 -
BAIA Seafood Restaurant, V & A Waterfront

June 11, 2014

Session: T2
Tutorial 2: Prof. Bernard Veyret, Centre National de la Recherche Scientifique, France -
Overview of 50 years of laboratory, animal and human studies
June 11, 2014 • 08:00 - 09:00
The Ballroom, Table Bay Hotel

Session: P2
Plenary Session 2: Imaging and tomography
June 11, 2014 • 09:00 - 11:00
The Ballroom, Table Bay Hotel
Chairs: Theodoros Samaras & Nam Kim

P2-1 [09:00]

Microwave Breast Imaging: The Potential Role of Dielectric Properties Sensing in Breast Health and Disease Management

Susan Hagness¹

¹*Department of Electrical and Computer Engineering, University of Wisconsin-Madison, Madison, WI, USA, 53706*

Keywords: Clinical (diagnostics), RF/Microwaves, Other

This plenary talk will highlight recent progress in microwave imaging as a promising alternative to conventional breast imaging modalities for several important clinical applications.

P2-2 [10:00] -

Electrical Impedance Tomography: Clinical and Experimental applications and perspectives

Andy Adler¹

¹*Systems and Computer Engineering, Carleton University, Ottawa, ON, Canada, K1S 5B6*

Keywords: , , Original - work in progress, concept

Electrical Impedance Tomography (EIT) estimates the distribution of impedance within a body from electrical stimulation and measurement on the body surface. EIT shows significant promise for medical monitoring and imaging with applications to thoracic, brain, breast, abdominal and prostate imaging. Recent developments are promising: scientific interest in EIT is strong and growing, two companies have recently introduced commercial devices for clinical, and experimental results are promising. In this paper, we review the current state of the art in EIT, and discuss perspectives for its applications.

Session: W2
Workshop 2: Practical approaches to the implementation of the EMF Directive
June 11, 2014 • 11:30 - 13:00
The Ballroom, Table Bay Hotel
Chair: Georg Neubauer

W2-1 [11:30]

Workshop on Approaches on the implementation of the Directive 2013/35/EC

Georg Neubauer¹, Philip Chadwick², Joe Wiat³, Jolanta Karpowicz⁴, Hannelore Neuschulz⁵ & Georg Hilpert⁶

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⁴*Central Institute for Labour Protection, National Research Institute (CIOP-PIB), Warsaw, Poland, 00-701*

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⁶*Federal Ministry of Labour and Social Affairs, Bonn, Germany, 53123*

Keywords: Occupational, RF/Microwaves, Other

In 2013 the EU-Directive 2013/35/EC on health and safety requirements regarding the exposure of workers to EMFs was issued laying down obligations for employers to assess risk of their employees arising from electromagnetic fields at their workplaces. Member states have to bring into force laws, regulations and administrative provisions necessary to comply with the above mentioned Directive by 1 July 2016. This workshop is dedicated to give an overview on approaches within the member states on the approaches followed for implementation and to identify promising methods facilitating evaluation of workers exposure.

Session: -
Tours/free time
June 11, 2014 • 13:00 -

June 12, 2014

Session: T3

Tutorial 3: Dr. John Bolte, RIVM, Netherlands - Sources, levels of exposure & standards
June 12, 2014 • 08:00 - 09:00
The Ballroom, Table Bay Hotel

Session: P3

Plenary Session 3: Endogenous voltage gradients as mediators of cell-cell communication
June 12, 2014 • 09:00 - 10:30
The Ballroom, Table Bay Hotel
Chairs: Philip Chadwick & Micaela Liberti

P3-1 [09:00]

Staying in Shape: Membrane Voltage as a Master Regulator of Tissue Shape During Regeneration

Wendy Beane¹

¹*Department of Biological Sciences, Western Michigan University, Kalamazoo, MI, USA, 49008*

Keywords: Behavioural, Static, Completed (published)

Bioelectrical (ion flux-mediated) signaling is essential—not just for neurons, but for ALL cells. Ion currents and endogenous electric fields are crucial for wound healing, tissue outgrowth, and even cancer. This presentation reviews how voltage gradients and ion flux regulate these processes, then examines *in vivo* bioelectrical studies using the awesome regenerative powers of the planarian flatworm. The data suggest bioelectric signals may determine how changes in individual cells lead to overall animal shape (why a decapitated worm always regenerates with the typical “planarian” shape). Membrane voltage is shown to control the cell communication between old and newly regenerated tissues vital for proper shape.

Session: 07

Mechanisms 2

June 12, 2014 • 11:00 - 13:00

The Ballroom, Table Bay Hotel

Chairs: Andrei Pakhomov & Bernard Veyret

Session: 08

Occupational

June 12, 2014 • 11:00 - 13:00

The Pavilion, Table Bay Hotel

Chairs: Maila Hietanen & Georg Neubauer

07-1 [11:00]

An Improvement Method of Estimation for Cell Cytoplasm Conductivity Using Nanosecond Pulsed Electric Fields: Coupling of a Microdosimetric model with experiments for a single cell

Agnese Denzi¹, Caterina Merla², Cristiano Palego^{3,4}, Yaqing Ning³, Caroline Multari³, Xuanhong Cheng³, Francesca Apollonio¹, James C. M. Hwang³ & Micaela Liberti¹

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⁴*Bangor University, Bangor, UK, LL57 1UT*

Keywords: Mechanistic/Theoretical, Pulsed, Completed (unpublished)

Recently, with the improvement in nano and micro fabrication techniques, the possibility to manipulate and extract characteristics at single cell level has become a great challenge. In this work an improvement method for the assessment of the cytoplasm conductivity of a single cell is presented. In particular, comparing the current extracted experimentally from S-parameters measurements with a broadband microfluidic-integrated microchamber loaded with a single Jurkat cell and the same quantity simulated

08-1 [11:00]

Occupational Electric Shocks and Extremely Low Frequency Magnetic Fields Exposure and Mortality Due to Amyotrophic Lateral Sclerosis

Ximena Vergara¹, Leeka Kheifets² & Gabor Mezei³

¹*EMF/RF Health Assessment and Safety, EPRI, Palo Alto, CA, USA, 94304*

²*Epidemiology, UCLA, Los Angeles, CA, USA, 90024*

³*Exponent Health Sciences, Menlo Park, CA, USA, 94025*

Keywords: Occupational, ELF/LF, Completed (unpublished)

To investigate if “electric” workplace factors might be involved with amyotrophic lateral sclerosis (ALS), we conducted a case-control study of occupational electric shocks (ES), extremely low frequency magnetic fields (MF) and ALS using a nine-year period of U.S. mortality data. We found a moderately increased risk within “electric” occupations, inverse association between ES and ALS and no consistent association with MF. Furthermore, neither ES nor MF could explain the association observed within “electric” occupations.

with a microdosimetry model, a value for the cytoplasm conductivity of the Jurkat cell has been estimated.

07-2 [11:20]

Nanoelectroablation of tumor cells leads to the translocation of calreticulin to the cell surface and the initiation of immunogenic apoptosis

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Keywords: Clinical (therapy), Pulsed, Work in Progress

We have been developing a non-thermal nanoelectroablation therapy for ablating tumors and unwanted skin lesions. This therapy delivers short (100 ns long) electric pulses 30 kV/cm in amplitude to the target tissue using contact electrodes. When at least 100 pulses are delivered, the treated tissue undergoes immunogenic apoptosis. The key "eat me" signals that initiate an immune response are the translocation of calreticulin to the cell surface and the movement of phosphatidyl serine to the outer leaflet of the plasma membrane. Here we report on our measurements of this ecto-calreticulin expression following nsPEF treatment of two tumor cell lines. We will also summarize our progress documenting this immune response.

07-3 [11:40]

Actin cytoskeleton and cellular effects of the nanosecond pulsed electric field (nsPEF)

Andrei Pakhomov¹, Iurii Semenov¹, Shu Xiao^{1,2}, Olga Pakhomova¹, Marjorie Kuipers³ & Bennett Ibey³

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Keywords: Electroporation, Pulsed, Completed (unpublished)

We studied (1) the effect of 600-ns pulses at 19-20 kV/cm on actin cytoskeleton and (2) the role of the cytoskeleton in determining the cell permeabilization by nsPEF. A train of 4 pulses caused cell membrane poration, cell rounding, swelling, and disappearance of bright actin features. Blocking of swelling by isoosmotic addition of sucrose blocked disassembly of actin features. Hence, disintegration of the actin was downstream from nsPEF-induced cell swelling. Pharmacological disruption of the cytoskeleton by either Cytochalasin D or Latrunculin A did not affect the nsPEF-induced uptake of Yo-PRO-1, propidium iodide, or externalization of phosphatidylserine.

07-4 [12:00]

Pulsed E fields acting on metallo-enzymes: theoretical and experimental results

Elena Della Valle¹, Olga Pakhomova², Paolo Marracino¹, Shu Xiao², Andrei Pakhomov², Micaela Liberti¹ & Francesca Apollonio¹

¹Department of Information Engineering, Electronics and

08-2 [11:20]

Developing a job-exposure matrix with exposure uncertainty from expert elicitation and data modeling

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Keywords: Occupational, Static, Completed (unpublished)

This paper describes a methodology for creating a novel JEM which defines occupational exposures on a continuous scale and utilizes Bayesian methods to quantify exposure uncertainty by assigning exposures probability distributions with parameters determined through expert involvement.

08-3 [11:40] - STUDENT PAPER

Numerical dosimetry of pregnant woman models exposed to ELF-Magnetic Fields: Compliance to the current exposure regulation for the occupational exposure at 50 Hz

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Keywords: Occupational, ELF/LF, Completed (unpublished)

At the current time the new Directive 2013/35/EU suggests limits for the occupational exposure to ELF-MF. Pregnant woman exposure to ELF-MF is a concern because the woman and the fetus should be prevented to possible health hazards at workplaces. In this work the compliance of the pregnant woman exposure to the EU Directive 2013 was assessed, by means of advanced high resolution numerical pregnant woman models at 3, 7 and 9 months of gestational ages, exposed to differently polarized uniform MF of 1 and 6 mT at 50 Hz.

08-4 [12:00] - STUDENT PAPER

Acute transient symptoms among health care and research staff exposed to static magnetic stray fields from MRI scanners

Kristel Schaap¹, Yvette Christopher - De Vries¹, Catherine Mason¹, Frank De Vocht², Lutzen Portengen¹ & Hans Kromhout¹

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Keywords: Electroporation, Pulsed, Completed (unpublished)

The investigation of possible protein-unfolding effects induced by high intensity electric field pulses is becoming extremely interesting also due to the increasing use of nanopulses applications. In this context an integrated approach combining experimental biochemical endpoints with molecular modeling is challenging. Here experimental results on nanopulses applied to the superoxide dismutase enzyme have been interpreted by means of molecular dynamics simulations used as a tool to support investigation on possible protein unfolding mediated by high intense electric fields.

07-5 [12:20]

Molecular Mechanisms of Gene Electrotransfer induced by Nanopulses

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Keywords: Electroporation, Pulsed, Completed (unpublished)

We studied nucleic acids transport in lipid vesicles by nanopulses (NPs). First, we reported that a 10 ns pulse permeabilized giant unilamellar vesicles (GUVs) and allowed for siRNA delivery. Molecular dynamics (MD) suggested that siRNA can be funneled through large nanopores or slide electrophoretically along pores to enter vesicles. After a pulse, siRNA can be trapped in a collapsed pore in the membrane. Then we studied the use of NPs with the CM₁₈-Tat₁₁ peptide. Pore formation was confined to vesicle membranes without perturbing plasma membranes. Synergy was evaluated on GUVs. NPs induced transient pores on membranes and the CM₁₈ moiety stabilized membrane defects.

07-6 [12:40]

Nanosecond Pulsed Electric Fields Stimulate Mitochondrial Biogenesis through the Activation of PGC-1 α

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²Centre for Occupational and Environmental Health, The University of Manchester, Manchester, UK

Keywords: Occupational, Static, Completed (unpublished)

Incidence of acute transient symptoms in relation to static magnetic field exposure was assessed among health care and research staff working with magnetic resonance imaging (MRI) scanners, and compared to workers who were not exposed to static magnetic fields. This study among 361 workers showed an increased incidence of symptoms among MRI staff working with closed-bore MRI scanners of 1.5 to 7 Tesla, and suggests a positive exposure-response association with exposure to static magnetic fields and/or motion-induced time-varying magnetic fields.

08-5 [12:20]

Advanced methods to evaluate well-being of workers exposed to magnetic fields at MRI units

Maila Hietanen¹, Tommi Alanko¹, Maria Tiikkaja¹, Esko Toppila¹, Tim Toivo², Sami Kännälä² & Kari Jokela²

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Keywords: Occupational, Static, Work in Progress

MRI units are unique workplaces where workers may experience adverse health effects due to strong magnetic fields. These are mainly caused by movement in a static magnetic field which induces electric fields inside the body. A three year project on occupational well-being at MRI units was started in Finland in 2012. The aim of this project is to improve working conditions, well-being, and safety of workers at MRI units. The outcome of this project can be utilized by occupational health care professionals when assessing safety of MRI workplaces.

08-6 [12:40]

Occupational exposure to extremely low frequency magnetic fields and risk of electric shocks and cancer risk in four Nordic countries

Mònica Guxens¹, Pauline Slottje¹, Anke Huss¹, Jan Ivar Martinsen², Timo Kauppinen³, Sanni Uuksulainen³, Elisabete

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³AFRL, 711 Human Performance Wing, Joint Base San Antonio, TX, USA, 78235

Keywords: In vitro, Pulsed, Completed (unpublished)

Current *in-vitro* work from our laboratory shows the induction of mitochondrial activity after nanosecond pulsed electric field (nsPEF) exposure. Exposures at 10-ns/50 kV/cm resulted in increased metabolic capacity in oxygen consumption rate (OCR). We hypothesize that nsPEFs activate the induction of the peroxisome proliferator-activated receptor γ coactivator 1 (PGC-1 α) gene expression, thereby increasing mitochondrial biogenesis of the exposed cells and controlling reactive oxygen species levels. To show the correlation between the increased mitochondrial biogenesis and the PGC-1 α gene expression, RNAi target selection was used to knock-down the expression of the mRNA for PGC-1 α .

Weiderspass⁴, Pär Sparén⁴, Laufey Tryggvadóttir⁵, Kristina Kjaerheim², Hans Kromhout¹, Roel Vermeulen¹ & Eero Pukkala⁶

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⁶Finnish Cancer Registry, Helsinki, Finland

Keywords: Occupational, ELF/LF, Work in Progress

We evaluated the association between occupational exposure to extremely low frequency magnetic fields (ELF-MF) and occupational risk of electric shocks and brain cancer, haematopoietic and lymphatic malignancies, and breast cancer risk in a very large occupational cancer cohort. Thirty-five percent of the total population was ever exposed to medium levels of ELF-MF and 7% to high levels, whereas 19% was ever exposed to a medium risk of electric shocks and 13% to a high risk. We found no associations between occupational exposure to ELF-MF and occupational risk of electric shocks and any of the cancer outcomes.

Session: BEMS
BEMS Annual Business Meeting
June 12, 2014 • 13:00 - 14:00
The Ballroom, Table Bay Hotel

Session: 09
Neurological effects 2
June 12, 2014 • 14:30 - 16:30
The Ballroom, Table Bay Hotel
Chairs: Meike Mevissen & Sarah Loughran

09-1 [14:30] - STUDENT PAPER

The effects of RF-EMF exposure on DNA damage in nervous system origin cells

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Keywords: In vitro, RF/Microwaves, Work in Progress

In this study, three nervous system origin cells (SH-SY5Y, A172, cerebral cortex neurons) were exposed to 1800 MHz radiofrequency electromagnetic fields (RF-EMF) at SAR of 4.0 W/kg for 1 h, 6 h or 24 h to investigate the effects of RF-EMF on DNA damage. DNA damage was examined by γ -H2AX foci formation, using indirect immunofluorescence assay. We found that no difference between sham-exposed and exposed groups for any exposure condition. In conclusion, the RF-EMF exposure under current experimental conditions does not induce DNA damage in different cell types from nervous system. **Keywords:** Radiofrequency electromagnetic fields; DNA damage; γ -H2AX; nervous system

Session: 10
Public exposures and RF measurements
June 12, 2014 • 14:30 - 16:30
The Pavilion, Table Bay Hotel
Chairs: John Bolte & Eric Van Rongen

10-1 [14:30] - STUDENT PAPER

Whole-body Averaged SAR Assessment Using a Personal, Distributed Exposimeter

Arno Thielens¹, Peter Vanveerdeghem², Sam Agneessens²,
Patrick Van Torre², Gunter Vermeeren¹, Hendrik Rogier²,
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Keywords: Dosimetry (computational), RF/Microwaves,
Completed (unpublished)

The whole-body averaged specific absorption rate (SAR_{wb}) can be estimated using a personal, distributed exposimeter (PDE) when combining an on-body calibration of the PDE with numerical simulations. To this aim, a PDE for the GSM 900 downlink band is constructed using 4 textile antennas and 4 radio frequency (RF) receiver nodes. Using calibration measurements of the PDE worn by a human subject in an anechoic chamber, a 50% prediction interval (caused by the human body) on SAR_{wb} of 3.3 dB is determined. Measurements using the PDE are carried out in Ghent

(Belgium), during which median $S_{inc}=47 \mu W/m^2$ and $SAR_{wb}=0.25 \mu W/kg$ are measured.

09-2 [14:50]

ELF-MFs exposure potentiates the sensitivity to the neurotoxin MPP+ in an *in vitro* model of Parkinson's Disease

Barbara Benassi¹, Claudia Consales¹, Vanni Lopresto¹, Caterina Merla¹, Rosanna Pinto¹, Giuseppe Filomeni^{2,3} & Carmela Marino¹

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Keywords: In vitro, ELF/LF, Work in Progress

Parkinson's Disease (PD) is thought to have a multifactorial aetiology, including both genetic and environmental factors. As occupational/environmental exposure to Electromagnetic Fields has been recently associated with an increased risk of neurodegenerative diseases, we aimed at evaluating whether the Extremely Low Frequency (ELF) Magnetic Fields (MFs) may alter the response of SH-SY5Y to MPP⁺, a synthetic compound routinely used to mimic PD symptoms. We here demonstrate that ELF-MFs alter the cellular redox balance without affecting proliferation/survival, and, if administered 24 hours before MPP⁺, they sensitize cells to the pro-PD toxin through potentiation of the oxidative damage and caspase-de

09-3 [15:10]

Sodium Currents are Required for Vertebrate Appendage Regeneration

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Keywords: In vivo, Static, Completed (published)

Mammals have a limited ability to regrow organs whereas animals such as frog tadpoles can restore lost structures such as the tail. After tadpole tail amputation, a new tail is regrown by 7 days. We identified a novel role for a voltage-gated sodium channel, Nav1.2 (Nav), in regeneration. Inhibition of Nav blocks tail regeneration. In contrast, molecularly or chemically increasing Na⁺ transport promotes regenerative repair. Our study shows that Na⁺ transport is a critical and sufficient mechanism for initiating regeneration. Thus control of ion currents may represent an innovative approach to tissue repair in mammals.

09-4 [15:30]

Neurogenesis and neuroinflammation after mobile phone exposure

10-2 [14:50]

Sensitivity analysis of downlink received and uplink emitted powers in a geographical area to ICT usage parameters

Huang Yuanyuan^{1,2}, Emmanuelle Conil^{1,2}, Joe Wiart^{1,2}, Christian Person^{2,3} & Nadege Varsier^{1,2}

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³Institut Mines Telecom, Telecom Bretagne, France

Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

The study presented in this paper aims to analyze the sensitivity of downlink received and uplink emitted powers maps to Information and Communication Technologies (ICT) usage parameters. This study was conducted in the framework of the European FP7 project LEXNET, aiming at filling the gap between two separate ways of dealing with exposure by proposing the Exposure Index (EI). The EI covers the day-to-day exposure of a population in a given area incurred by a wireless network as a whole from base stations to individual devices. Using ICT usage data obtained from traffic measurements, we analyzed, for a given network, in a given geographical area the influence of usage parameters on downlink received and uplink emitted powers.

10-3 [15:10]

In-situ RF Exposure in Schools, Houses, and Public Places

Wout Joseph¹, Leen Verloock¹, Francis Goeminne¹, Mart Verlaek², Kim Constandt² & Luc Martens¹

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)

Exposure to radio-frequency (RF) electromagnetic fields (EMF) is assessed in various "sensitive" microenvironments such as schools and homes, where children are present. In-situ assessment is conducted by performing spatial broadband and accurate narrowband measurements. We distinguish external signals (broadcast and telecommunication signals) and internal signals (WiFi and DECT). All measured field levels satisfied the guidelines of ICNIRP. The highest cumulative field value for internal sources was 3.2 V/m and 0.3 V/m on average, measured in schools and originating from WiFi. FM, GSM, and UMTS dominate the total downlink outdoor exposure.

10-4 [15:30]

Novel Linearization of Dosimetric Sensors for Accurate Measurement of Complex Modulations

Marion Jany^{1,2}, Julie Enderlin^{1,2}, Florence Poulletier De Gannes^{1,2}, Emmanuelle Haro², Annabelle Hurtier², Gilles Ruffie³, Yann Percherancier², Bernard Veyret^{1,2} & Isabelle Lagroye^{1,2}

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Keywords: In vivo, RF/Microwaves, Work in Progress

There are some doubts related to neuroinflammation and cognitive functions following exposure to wireless communication signals. Our work aims at providing answers to these open questions. Rats were repeatedly exposed to two types of mobile phone signals (GSM-900 and UMTS), 2 hrs/day, 5 days/week, for 4 weeks at Brain Averaged SAR of 0, 0.5, 5, and 15 W/kg. Neurogenesis and neuroinflammation were investigated.

09-5 [15:50]

Increase in chromaffin cell membrane conductance evoked by 5-ns electric pulses

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Keywords: Electroporation, Pulsed, Work in Progress

Exposing chromaffin cells to 5 ns, 5-6 MV/m electric pulses stimulates catecholamine release by causing calcium influx via voltage-gated calcium channels. The objective of this study is to begin testing the hypothesis that voltage-gated calcium channel activation is due to reversible plasma membrane depolarization resulting from the formation of sodium-conducting nanopores in the lipid bilayer. For this purpose we designed an exposure system for monitoring whole cell currents in response to 5 ns pulses. The results of preliminary experiments demonstrate the presence of inward currents stimulated by a single pulse.

09-6 [16:10]

The association a novel variant of rat GRIN2B promoter region with the impairment of cognition function induced by microwave exposure

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¹Laboratory of Experimental Pathology, Beijing Institute of Radiation Medicine, Beijing, China, 100850

Keywords: Mechanistic/Theoretical, RF/Microwaves, Completed (unpublished)

Studies were performed to find the SNP sites of rat GRIN2B promoter region and the association of the SNP sites with cognition dysfunction induced by microwave exposure and the function in PC12 cells. 160 Wistar rats from different animal centers were exposed to microwave radiation (30mW/cm² for 5 min/d, 5 d /week, over a period of 2 months). We screened GRIN2B promoter region and

Romain Meyer¹, Mark Douglas², Sven Kuehn¹, Katja Pokovic¹ & Niels Kuster^{2,3}

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)

A novel method for linearization of diode-loaded dosimetric sensors is presented. Unlike previously published techniques, this method is accurate for measurement of various signal modulations without requiring separate calibration for each modulation. The sensor is calibrated in a reduced set of generic modulations, and linearization parameters are extracted based on signal characteristics such as the bandwidth, duty cycle and peak-to-average ratio. The use of this method significantly reduces the cost of calibration while maintaining low calibration uncertainty.

10-5 [15:50] - STUDENT PAPER

Investigation of the effect of the hand on the real-life performance of mobile phones

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¹Department of Electromagnetics, DRE-L2S, SUPELEC, Gif-sur-Yvette, France, 91192

Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

The measurements of both the peak spatial-average specific absorption rate (SAR) and the over-the-air (OTA) performance of a mobile phone under laboratory conditions is not representative of its use in real-life scenario. To account for both SAR and OTA performance, the SAROTA concept was previously proposed to evaluate the real-life exposure due to mobile phones. Although a hand phantom is not used for SAR measurements, it is recommended for the OTA performance measurements. To effectively apply the SAROTA concept, the effect of the presence of the hand requires investigation. Herein the influence of the hand on the transmit power level of a mobile phone in a real-life scenario is evaluated.

10-6 [16:10] - STUDENT PAPER

Influence of an Indoor Small Cell on the Human Exposure to Radio Frequency Electromagnetic Fields

Sam Aerts¹, David Plets¹, Leen Verloock¹, Luc Martens¹ & Wout Joseph¹

¹Department of Information Technology, Ghent University / iMinds, Ghent, Belgium, 9050

Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)

In this study, the impact of the deployment of a small cell in a train and an office on the total exposure (both downlink and uplink) of a mobile-phone user to radio frequency (RF) electromagnetic fields (EMF) was studied for two technologies. To determine the exposure, the total RF-EMF dose absorbed by the user was calculated, using

revealed a C-to-T variant at nucleotide position -217. The variant was exist stably and not induced by microwave exposure. Then we detected the learning and memory ability, the contents of amino acids in hippocampus and cerebrospinal fluid, NR2B expression of the different genotypes. The results showed that NR2B protein expressions were decreased, the con

measurements of the received and transmitted powers of the mobile phone. For GSM, a decrease in exposure by a factor 60 can be achieved, while the reduction for UMTS is limited. The presented framework can be used for any exposure scenario, featuring any number of technologies, base stations, users, and duration.

Session: W3
Workshop 3: New avenues in epidemiological exposure assessment
June 12, 2014 • 17:00 - 19:00
The Ballroom, Table Bay Hotel
Chair: Martin Roosli

W3-1 [17:00]

The principles of epidemiological exposure assessment concepts

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Keywords: Epidemiology, RF/Microwaves, Concept

The goal of each epidemiological exposure assessment is to find a good proxy or surrogate measure representative of the exposure of interest. The exposure measure should be both biologically relevant and show a range of levels in the study collective. The availability of appropriate exposure assessment methods determines the design and feasibility of an epidemiological study. Nevertheless, errors in exposure assessment are unavoidable. Under certain circumstances small errors may have a major impact on the study results whereas under different circumstances seemingly large errors affect the study results only to a small degree. Thus, for each specific study appropriate evaluation of the effect of exposure errors on the result

W3-2 [17:15]

ExpoM - A Personal RF Electromagnetic Field Exposure Meter

Marco Zahner¹ & Jürg Fröhlich¹

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)

A band selective RF-EMF exposure meter module is presented that can be used standalone or can be connected to a smartphone featuring extended monitoring and communication capabilities as well as user interaction, i.e. diaries. The exposure meter module covers a frequency range from 87.5 MHz to 5.875 GHz and performs band selective true-RMS detection on 16 different frequency bands. Furthermore, integrated GPS and Bluetooth functionality allow for a high degree of versatility.

W3-3 [17:25]

Use of apps for collecting information for exposure assessment

Joë Wiart^{1,2}, Thierry Sarrebourse^{1,2}, Nadege Varsier^{1,2}, Abdelhamid Hadjem^{1,2} & Azeddine Gati^{1,2}

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

More than 6 billions people are using a mobile phone over the world. Despite the existing protection limits, the tremendous increase in wireless phone use observed during the last decade has induced a public concern about possible health effects of human exposure to radio-frequency (RF) electromagnetic waves (EMF). International epidemiological studies such as Interphone, Cephalo, Cosmos, Mobikids and Geronimo have studied or are investigated possible sanitary effect linked to phone use. For these studies the brain exposure is a key question and the level of exposure is a key question. Several studies have shown that the mobile is an important source of exposure often several thousand time above the exposure induced by the emission of base stations and access points.

W3-4 [17:35]

New Modelling Approaches

Wout Joseph¹, Sam Aerts¹, David Plets¹ & Luc Martens¹

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)

In this presentation we will discuss surrogate modelling as a way to create heat maps and indoor network planning accounting for downlink and uplink exposure.

W3-5 [17:45]

Validity and uncertainty in RF-EMF modelling of base station exposure

Roel Vermeulen¹, Johan Beekhuizen¹, Gerard Heuvelink², Hans Kromhout¹, Alfred Bürgi³ & Anke Huss¹

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Keywords: Epidemiology, RF/Microwaves, Completed (unpublished)

We performed a Monte Carlo uncertainty propagation analysis to estimate the effect of input uncertainty on the prediction of RF-EMF levels. The largest model uncertainties stemmed from the uncertainty in the height of the indoor site, the building damping and building height. Uncertainty in the antenna power, tilt, height and direction had distinctly smaller impact. These findings will help epidemiological studies in focusing the extensive data collection necessary for predicting RF-EMF exposure from base stations.

W3-6 [18:00]

Development of an RF-EMF exposure surrogate for epidemiologic research from modelling, personal measurements and operator data

Katharina Roser^{1,2}, Anna Schoeni^{1,2} & Martin Roosli^{1,2}

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²*University of Basel, Basel, Switzerland*

Keywords: Epidemiology, RF/Microwaves, Work in Progress

The exposure assessment is a crucial part to study potential effects of radiofrequency electromagnetic fields (RF-EMF). We developed an integrative exposure surrogate measure to combine the exposure from near- and far-field RF-EMF sources to one single whole-body and brain exposure measure which can be used for epidemiologic research. Relevant far-field exposure predictors have been modelled or identified by multivariable regression models of personal RF-EMF measurements. Near-field contribution has been determined from the literature. Preliminary evaluation of the exposure surrogate indicates that type of mobile phone network (GSM or UMTS) for calls is a relevant predictor to be included in epidemiological exposure assessment.

W3-7 [18:15]

Interrelations between environmental exposures: air pollution, noise and RF-EMF – potential for confounding?

Anke Huss¹, Manon van Eijnsden², Mònica Guxens¹, Johan Beekhuizen¹, RobT. van Strien², Marieke Dijkema², TanjaG.M.

Vrijlkotte³, Hans Kromhout¹ & Roel Vermeulen¹

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Keywords: Epidemiology, RF/Microwaves, Completed (published)

In a birth cohort study of 3249 children in Amsterdam, we assessed i) if environmental radiofrequency electromagnetic field (RF-EMF) exposure was correlated with traffic related air pollution or noise from roads/trams or from aircrafts, and ii) if environmental RF-EMF exposures was correlated with socio-economic position (SEP). We observed low correlations between RF-EMF and the other environmental exposures, with the highest being the one between RF-EMF and noise ($r=0.18$), and low correlations between RF-EMF exposure and SEP. Although these correlations are low and confounding therefore is likely to be weak, it is advisable to include noise and SEP in future studies to assess the potential for confounding.

June 13, 2014

Session: T4

Tutorial 4: Prof. Martin Röösli, TPH, Swiss - A tutorial on epidemiology

June 13, 2014 • 08:00 - 09:00

The Ballroom, Table Bay Hotel

Session: 11
Clinical
June 13, 2014 • 09:00 - 11:00
The Ballroom, Table Bay Hotel
Chairs: Richard Nuccitelli & Lluís M. Mir

11-1 [09:00]

Thermal effects improve the efficiency of nonthermal electrotherapies

Karl Schoenbach¹, Amy Donate¹, Chelsea Edelblute¹, Anna Bulysheva¹, Derrick Jung², Benjamin Wisecarver², Muhammad Malik¹, Shu Xiao^{1,2} & Richard Heller¹

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Keywords: Electroporation, Pulsed, Work in Progress

Rapid heating of cells to values above the physiological temperature has been shown to reduce considerably the energy required for electroporation. This effect allows us to reduce stress on patients being treated with electroporation-based therapies and has been confirmed for picosecond pulses as well as for millisecond pulses. In *in vivo* studies designed to measure the efficiency of thermally assisted electro transfer of plasmid DNA to the skin, an IR laser was used that allowed us to rapidly heat the tissue through an optical fiber. Heating the tissue to temperatures of 43 degree C resulted in significantly higher transgene expression.

11-2 [09:20]

In vivo electroporation: therapeutic effects are not just the consequence of a facilitated drug and gene delivery

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Keywords: Electroporation, Pulsed, Completed (unpublished)

Cell electroporation allows the introduction into the cells in culture of various types of molecules. *In vivo* as well, adequate electric pulses facilitate this uptake. However, *in vivo*, the electric pulses have consequences other than the increase of exogenous molecules uptake by the target cells: on the one hand, the occurrence of a vascular lock that has been extensively described; on the other hand, the exposure at the cell surface and the release in the extracellular space of intracellular substances that play pivotal roles in raising an effective immune response. Therefore, *in vivo*, cells electroporation is not merely a way to increase the uptake of drugs or nucleic acids by the cells.

11-3 [09:40]

Session: 12
Standards, policy and compliance
June 13, 2014 • 09:00 - 11:00
The Pavilion, Table Bay Hotel
Chairs: Martin Roosli & Luc Martens

12-1 [09:00]

Intuitive exposure and risk perception of RF EMF

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²University of Wollongong, Wollongong, Australia

Keywords: Standards, RF/Microwaves, Work in Progress

One of the main assumptions of the LEXNET project is that a reduction of the RF EMF exposure will result in more acceptance of wireless communication networks in the public sphere. We assumed that the effects of any reduction of EMF exposure will depend on the subjective link between exposure perception and risk perception. Therefore, our survey focused on the analysis of the associations among various exposure characteristics and risk perception. The results suggest that perception of RF EMF risks is only marginally determined by exposure characteristics. This finding creates new challenges for further research, especially the question, under which circumstances exposure reduction might affect risk perception.

12-2 [09:20]

EMF Exposure Standards Established Adverse Health Effects vs Possible Biological Effects

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Keywords: Standards, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

Publications on the biological effects of non-ionizing electromagnetic exposure vary from established effects to possible, questionable and obviously flawed responses. To evaluate the reported effects, most expert review groups, health authorities and standard setting committees such as IEEE and ICNIRP use weight of evidence to review the literature. IEEE and ICNIRP set exposure limits to protect against established adverse health effects with large safety margins. In contrast, those promoting precautionary principle selectively discuss possible biological effects and promote limits to avoid any possible effect. The two different approaches that lead to the recommended safety limits differ by orders of magnitude.

12-3 [09:40]

Intrinsic Apoptotic Cell Death and a Vaccine Effect with Clearance of an Orthotopic Rat Hepatocellular Carcinoma by Nanosecond Pulsed Electric Fields (nsPEFs)

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Keywords: In vivo, Pulsed, Work in Progress

NsPEFs have shown promise in pre-clinical skin cancers or xenografts in mice and human clinical studies with basal cell carcinoma. In this report, the first orthotopic hepatocellular carcinoma (HCC) model is established in rats. In a single treatment 80-90% of NI-SI tumors were eliminated. Intrinsic apoptosis was evident and after tumor clearance rats were resistant to challenge injections of the same cancer in all trials. The protective effect, infiltration of immune cells and the presence of granzyme B expressing cells within days of treatment indicate that nsPEFs not only eliminate HCC tumors, but also likely induce an immunoprotective effect that essentially vaccinates animals against recurrences of the same tumors.

11-4 [10:00]

Suppression of angiogenesis by electric stimulation

Yusuke Inoue^{1,2}, Masaki Sekino^{1,2}, Tsuyoshi Sekitani^{1,2}, Itsuro Saito³, Takashi Isoyama³, Yusuke Abe³ & Takao Someya^{1,2}

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Keywords: Clinical (therapy), IF, Completed (unpublished)

The purpose of this study is to observe angiogenesis in vivo under application of electric stimulations. We developed an implantable device equipped with a CMOS-camera and electrodes for real-time observation. The device was implanted under the skin of a goat, and applied the electric stimulations for 60 days. The electric stimulations were applied with a 60 kHz sinusoidal waveform and a current density of 300 uA/mm². Angiogenesis occurred in 0.1 mm/day in the non-stimulated device, while no angiogenesis was observed in the device without stimulation. These results show that electric stimulations of this condition are effective for suppressing angiogenesis.

11-5 [10:20]

Search for tumor-specific frequencies of amplitude-modulated 27 MHz electromagnetic fields in mice with hepatocarcinoma xenografted tumors

Yann Percherancier¹, Sophie Kohler², Renaud Charlet De Sauvage¹, Sokha Khiev¹, Gilles N'Kaoua¹, Annabelle Hurtier¹, Emmanuelle Haro¹, Florence Poullietier De Gannes¹, Isabelle Lagroye^{1,3}, Philippe Leveque² & Bernard Veyret^{1,3}

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The direct measurement of temperature rise in tissue: from single cells to humans. Time to replace SAR?

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Keywords: Dosimetry (measurements), RF/Microwaves, Review, Commentary, Recommendation, Evaluation

Novel and emerging techniques enable temperature rise to be measured in tissue directly rather than being inferred from SAR measurements. The presentation will report on the use of fluorescent dyes for estimating temperature change in fresh tissue samples and will review other techniques for doing this in cell culture, in whole animals and in the intact human. At this stage, replacing SAR in compliance testing with direct estimates of temperature rise may be premature, but should be considered in dosimetry protocols for in-vivo and in-vitro experiments.

12-4 [10:00]

A Non-Electric (E) Field Based Method for Safety Assessment of RF and Microwave Emitting Devices

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)

Compliance testing is required to ensure that wireless devices entering the consumer market meet safety standards. Current safety testing is conducted using electric (E) field probe measurement systems that measure the E field in a point-by-point fashion and calculate the spatial average SAR at each location. In this work, an alternative method for spatial average SAR calculation is described based on inversion of the heat equation in non-perfused media. An experimental demonstration of the method is shown such that the proposed approach can be applied routinely for safety assessment of RF/microwave emitting devices.

12-5 [10:20]

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

Stephen M. Moore^{1,4}, Robert McIntosh^{2,3,4}, Steve Iskra^{2,3,4} & Andrew Wood^{3,4}

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²Telstra, Melbourne, Australia, 3000

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Keywords: In vivo, RF/Microwaves, Completed (unpublished)

Some evidence has been provided by the Pasche group that RF fields, amplitude-modulated at discrete frequencies (AM-RF), elicit therapeutic responses in patients with tumors [e.g., Zimmerman et al., Br J Cancer 2012]. We have attempted to implement a complementary approach using a mouse tumor model for searching for frequency specificity in order to facilitate further mechanistic research in animals. So far, we have not found any exposure conditions that produced an alteration of the pulse in mice.

11-6 [10:40]

Pulsed E-field as an enhancement of drug release from molecular vectors: a molecular dynamics study

Silvia Tofani¹, Paolo Marracino¹, Maura Casciola¹, Micaela Liberti¹ & Francesca Apollonio¹

¹Dept. of Information Engineering, Electronics, Telecommunications, Sapienza University of Rome, Rome, Italy, 00184

Keywords: Mechanistic/Theoretical, Pulsed, Completed (unpublished)

Aim of this work is to theoretically investigate a drug-delivery system consisting of a zwitterionic micelle encapsulating a drug molecule and to verify if intense electric fields may be able to enhance the delivery of the drug. With this objective in mind we present a method to quantitatively evaluate the exit diffusion process of the drug molecule from a molecular vector towards the external aqueous medium, by defining a proper boundary interface as obtained by a complete electrostatic map of the system. Preliminary results showed a significant variation of the exit kinetic constant up to 50% when an external electric field of $5 \cdot 10^8$ V/m is applied to the system.

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

This study considers whether environmental conditions, especially harsh environments with high ambient temperature and humidity, should be accounted for in the radio frequency (RF) electromagnetic field (EMF) safety standards. A computational thermal model of the human body, incorporating a clothing model and allowance for different activity levels (e.g. simulating workers, with protective clothing, climbing radio towers on a hot and humid day), has been developed for this study. An initial observation is that while RF-EMF at the occupational safety limit will contribute an additional thermal load to the tissues, the magnitude of this effect is far outweighed by that due to the environmental conditions and the type of clothing worn.

12-6 [10:40]

Dynamic parameters of exposure to static magnetic field near magnetic resonance imaging scanners –pilot experimental studies in the context of new ICNIRP guidelines on movement in a static magnetic field and magnetic field <1Hz

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Keywords: Occupational, Static, Work in Progress

The dynamic parameters of 100 exposimetric profiles registered at workers' activities near 0.2-3 T MRI scanners have been analysed in the context of ICNIRP'2014 guidelines.

Session: SA
Student Awards Presentation
June 13, 2014 • 11:30 - 12:00
The Ballroom, Table Bay Hotel

Session: CC
Rapporteur's Reports and Closing Ceremony
June 13, 2014 • 12:00 - 13:00
The Ballroom, Table Bay Hotel

Session: BEMS & EBEA
BEMS Board and EBEA Council meetings
June 13, 2014 • 14:00 - 17:00
The Ballroom, Table Bay Hotel

Session: PA
Poster Session A
June 9, 2014 • 17:00 - 18:30
The Pavilion Conference Centre, Clock Tower Square

PA-1 [17:00]

The Effect of Exposure to Weak Radiofrequency Radiation from GSM 900 MHz Mobile Phone and Base Station on the Growth of Soybean Seedlings

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Keywords: , Behavioural, RF/Microwaves, Completed (unpublished)

The aim of the study is to study possible harmful effects of environmental radiation pollution on plants. The association between cellular telephone (short duration, higher amplitude) and base station (long duration, very low amplitude) radiation exposure and growth rate of soybean (*Glycine max*) seedlings was investigated. In this experiment growth of stems and central roots was reduced as seen in the short-term exposure experiments whereas the outgrowth of hair-roots was stimulated.

PA-3 [17:00]

An Analysis of In vitro Studies from Mobile Phone Radiation

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Keywords: , In vitro, RF/Microwaves, Completed (unpublished)

In this paper, we perform a meta-analysis of data from 191 scientific journals (1992-2012) with 883 in vitro experimental observations carried out in the literature that discussed using different experimental techniques (cytogenetic, gene and protein expression analysis) and different cell types (cultured rodent, human cells and human blood lymphocytes) due to non-thermal radio-frequency electromagnetic exposure. Our results show that, based on the papers included in our study, that there appears to indicate that there may be a minimal effect, with no conclusive evidence to prove or disprove non-thermal effects of mobile phone radiofrequency radiation for in-vitro model systems.

Magnetic nest building orientation in the wood mouse *Apodemus sylvaticus*

Erich Malkemper¹, Stephan Eder², Michael Winklhofer², John Phillips³, Sabine Begall¹ & Hynek Burda¹

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Keywords: Behavioural, Static, Completed (unpublished)

Knowledge about the distribution and characteristics of a magnetic sense in mammals is still sparse. We tested the wood mouse *Apodemus sylvaticus* for its ability to sense the Earth's magnetic field. The mice were allowed to construct a nest in a circular arena in the unchanged Earth's magnetic field or with north shifted by 90deg. Different low intensity RF-magnetic fields (MHz-range) were added in some of the tests. Under control conditions the wood mice preferred to build their nests in either the north or south sector of the arena and this preference shifted with the magnetic field. RF-fields also influenced nest distributions, suggesting a RF-sensitive magnetic compass in wood mice.

PA-7 [17:00] - Clinical (diagnostics)

New applications of Corona discharges for photonics characterization of inert or living matter

Georges Vieilledent¹, Raymond Herren², Marc Henry³, Vincent Morard⁴ & Quynh Nhu Xuan Trinh-Kramer⁵

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Keywords: Clinical (diagnostics), Optical, Work in Progress

Water is everywhere in nature, requiring new imaging techniques for visualization of information storage or transfer in liquids or hydrated solids. Corona discharges created by exciting matter in the UV spectrum is a mean to measure in a reproducible way « bio-compatibility » between a living body and any chemical substance. In medicine, a better match between drugs and receiving bodies is expected. Through its coherence domains, we demonstrate that water is highly sensitive to electromagnetic fields and micro-currents in well-defined frequency ranges. Reproducible exchange of information, through a quartz support, between water and informed ceramics materials will also be presented.

PA-9 [17:00] - Dosimetry (computational)

The Effects of Body Height and Mass on the Calculated Induced Electric Fields in the MAXWEL Human model at 50 Hz and Comparisons with the EMF Directive

Richard Findlay¹

¹*EMFcomp, www.emfcomp.com, Oxfordshire, OX128HG*

Keywords: Dosimetry (computational), ELF/LF, Other

Induced electric fields were calculated in mass and height adjusted variations of the MAXWEL surface-based human model from exposure to external electric and magnetic fields to investigate the effect of body shape on field absorption. Calculations showed that there was a correlation between the change in surface area of the human body and the change in the induced electric field for applied magnetic fields. This correlation did not exist for exposure to external electric fields. Calculations of the fields required to produce the EMF Directive ELVs were carried out and compared with the ALs. It was found that the ALs provided a conservative estimate of the ELVs for the six phantoms studied.

PA-11 [17:00] - Dosimetry (computational)

Specific Absorption Rate (SAR) in the Surface-based MAXWEL Human Model from Exposure to TETRA Handsets

Richard Findlay¹

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

A Finite-Difference Time-Domain (FDTD) code, produced in-house and written in FORTRAN, was used to model the Maxwell curl equations. The SAR in the head was calculated from exposure to the TETRA handset positioned to the left, right and in front of the head. The eye is particularly susceptible to the fields produced by TETRA handsets as it lacks blood supply to its internal transparent regions (so central regions are prone to hotspots), and has limited capacity for repair.

Comparison of the calculated peak localised SAR results, averaged over 10 g of contiguous tissue, with ICNIRP restrictions from exposure to the TETRA handset showed compliance in all exposure configurations studied. &am

PA-13 [17:00] - Dosimetry (computational)

SAR assessment in different models and positions from Wireless Local Area Networks (WLAN) system

Serena Fiocchi¹, Marta Parazzini¹, Ilaria Liorni^{1,2}, Norbert Zentai³, Vanessa Guadagnin¹, György Thuroczy⁴ & Paolo Ravazzani¹

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²*Dipartimento di Elettronica, Informazione e Bioingegneria- DEIB, Politecnico di Milano, Milan, Italy, 20133*

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

The exposure to WLAN systems has been little investigated until now. However, their recent broad diffusion makes particularly urgent the assessment of EMF exposure in typical everyday scenarios. These include different subjects with variable positions close to the antenna of the client unit, which is also often close to the head of the user. In particular, the specific assessment of brain tissues exposure, where the absorption of Wi-Fi energy could be relatively large, is highly valuable to integrate the process of health risk assessment necessary to reduce population concern.

PA-15 [17:00] - Dosimetry (computational)

A dynamic map of EMF exposure due to wireless systems

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

The main objective of this presentation is to report on development of a dynamic e-MAP registry of wireless systems which are sources of radio frequency electromagnetic fields (EMF) on the territory of Republic of Slovenia. The Signal Spy application serves as a basis for a publicly accessible interactive map of EMF exposure of general public that summarize the field strengths distribution of all radiofrequency (RF) sources in the environment. This project brings also added value for

consumers - the mobile phone users - because it allows monitoring of personal exposure due to mobile phone which encourages people to minimize the EMF exposure and, consecutively, to reduce the potential health risks.

PA-17 [17:00] - Dosimetry (computational)

CALCULATED SPINAL CORD FIELDS AND CURRENT DENSITIES FROM ELECTRICAL STIMULATION

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Keywords: Dosimetry (computational), ELF/LF, Completed (unpublished)

Using a simplified model of the spinal cord lumbar region and the SEMCAD-X program, we have calculated electric field and current density patterns induced by electrical and magnetic stimulation. When scaled to level used in the lab, both electrodes outside the vertebrae and within the spinal canal gave fields orders of magnitude below the essentially DC fields used in vitro to stimulate nerve growth. Magnetic stimulation at 1 kHz produced stronger fields and currents in the spinal cord.

PA-19 [17:00] - Dosimetry (computational)

Peak-to-average power density ratio in the vicinity of antenna system for small base station

Junji Higashiyama¹, Yoshiaki Tarusawa¹ & Teruo Onishi¹

¹*Research Laboratories, NTT DOCOMO, INC., Yokosuka, Japan, 239-8536*

Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

This paper presents calculation results of the peak-to-average electromagnetic power density ratio for the human height from small cell enhancement base station antennas which the maximum dimension is comparable or shorter than the human height in the 800-MHz and 3.5-GHz radio frequency bands using the moment method in order to evaluate the compliance boundary regarding human exposure to an RF electromagnetic field. The peak-to-average power density ratios within the vertical range of 2 m exceed the value of two when the maximum dimension of the array antenna is less than 2 m.

PA-21 [17:00] - Dosimetry (computational)

Numerical Modeling for SAR Evaluation in Human Implanted with Osteosynthesis Plates of mandibular fractures

Takashi Hikage¹, Taisuke Ono¹, Toshio Nojima¹, Tomoaki Nagaoka² & Soichi Watanabe²

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

With regard to the electromagnetic field (EMF) emitted from wireless communication devices, radio radiation protection guidelines for human exposure to EMF have been established. These guidelines provide no quantitative discussions about their relevance to humans with metallic objects embedded in their bodies. However, given the progress in biomedical technologies, the number of such users continues to increase, such as active implantable pacemakers and medical metallic plates, upper limb prostheses, and prosthetic legs. It is important to estimate the amount of exposure that users with metallic implants will experience. Some papers regarding interaction of radio frequency (RF) EMF and metallic implants have been pub

PA-23 [17:00] - Dosimetry (computational)

Human Exposure to Electric Fields from 765 kV Transmission Lines: Measurements and 3-D Anatomical Body Dosimetry

Roy Hubbard¹, Ian Jandrell² & Steven Dinger³

¹*Eskom Research, Testing and Development, Eskom Holdings SOC Limited, Johannesburg, Afghanistan, 2000*

²*Faculty of Engineering and the Built Environment, University of Witwatersrand, Johannesburg, South Africa, 2000*

³*Biomedical Engineering Research Group in the School of Electrical & Information Engineering, University of Witwatersrand, Johannesburg, South Africa, 2000*

Keywords: Dosimetry (computational), ELF/LF, Review, Commentary, Recommendation, Evaluation

Limits on human exposure to low frequency electric fields are fundamentally specified for in-situ fields in tissues/organs. Basic Restrictions are defined to protect against potentially adverse effects. Secondary limits, Reference Levels, are also given. These are derived from the Basic Restrictions based on uniform-fields with a provision that the basic restrictions must be observed for non-uniform cases. The human exposure of the general public to electric fields from Eskom's 756 kV transmission network operating at 50 Hz, is addressed through physical measurements, theoretical predictions and 3-D human model dosimetry, which is presented in this paper.

PA-25 [17:00] - Dosimetry (computational)

Calculation of RF Electromagnetic Fields Strength from Radio Base Station's Antenna

Byung Chan Kim¹, Ae-kyoung Lee¹ & Hyung-Do Choi¹

¹*Radio Technology Research Department, ETRI, Daejeon, Korea*

Keywords: Dosimetry (computational), RF/Microwaves, NA

In this paper, the practical prediction equation is proposed. The antenna of base station is assumed to have a form of dipole. Prediction of RF electromagnetic field strength can be made to evaluate it around radio base stations and to select the most appropriate position to evaluate the RF field strength

PA-27 [17:00] - Dosimetry (computational)

SAR Comparison between SAM and Anatomical Head Models for Radiation from a Bar-Type Phone Model

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

A typical bar-type phone model with an internal antenna at the bottom of the phone body has been implemented at 1850 MHz. It provides very similar SAR pattern and levels with commercial bar phones released in Korea. For the cheek and tilt positions spatial peak 1 g- and 10 g-SARs were calculated and compared in the SAM and four anatomical head models at different ages.

PA-29 [17:00] - Dosimetry (computational)

A Comparison of Fetal and Whole-Body SARs in Computational Human Models of Pregnancy for Far-Field Exposure

Tomoaki Nagaoka¹, Tetsu Niwa², Kazuyuki Saito³, Masaharu Takahashi³, Koichi Ito³ & Soichi Watanabe¹

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

Recently, one important issue of electromagnetic field safety is the specific absorption rate (SAR) dosimetry in pregnant females and their fetuses. We estimated the SARs in mothers and fetuses under exposure to vertically and horizontally polarized electromagnetic waves ranging from 30 MHz to 3GHz by using novel female models with anatomically realistic fetal and gestational tissues in the second and third trimesters of pregnancy. We also compared the SARs with those of traditional pregnant female models.

PA-31 [17:00] - Dosimetry (computational)

Characteristics of resonance-based wireless power transfer technique for biomedical applications

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Keywords: Dosimetry (computational), IF, Work in Progress

The resonance-based wireless power transfer technique is applied to biomedical devices implanted in the human body. The wireless power transfer system is designed for maximum power transfer into a small receiving coil. The power transfer efficiency from the transmitting resonant coil outside the phantom into the receiving resonant coil inside the phantom is calculated with varying the size of the free space placing the receiver in the phantom. The results represent that securing the free space surrounding the receiver in the phantom is closely related to the power transfer efficiency and absorbed electromagnetic energies in the human body.

PA-33 [17:00] - Dosimetry (computational)

Exposure Optimization in Indoor Wireless Networks: Application to Heterogeneous WiFi-LTE Case

David Plets¹, Wout Joseph¹, Kris Vanhecke¹ & Luc Martens¹

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²Department of Environment, Nature and Energy (LNE), Flemish government, Brussels, Belgium, 9050

Keywords: Dosimetry (computational), RF/Microwaves, Completed (published)

An exposure minimization algorithm to optimize and design wireless networks with satisfying coverage and minimal electromagnetic exposure is presented. It is applied to a heterogeneous WiFi-LTE network. Compared to a traditional network deployment, a field strength reduction of a factor 2.4 for the considered case and a higher homogeneity of the field strength distribution on the building floor are obtained. The algorithm is integrated in a heuristic indoor network planner for exposure calculation and optimization of wireless networks

PA-35 [17:00] - Dosimetry (measurements)

A Study on the Improvement of the Flat Phantom Size for SAR Validation Test at 150 MHz Band

Dong-geun Choi¹, Kihwea Kim¹, Judong Jang¹, Samyoung Chung¹, Yoon-Myoung Gimm² & Jaehoon Choi^{3,4}

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

In 2013, the physical dimensions of the reference dipole antenna, the flat phantom, and the numerical target SAR values for the validation test at 150 MHz band were suggested. However, the size of flat phantom becomes a problem for SAR measurement because it requires a great amount of human body tissue equivalent liquid. This paper shows how to gain appropriate flat phantom size. The optimized minimum size was suggested by applying a numerical analysis method in this paper. The results of this study are expected to be used to update the SAR measurement related standards domestically and internationally.

PA-37 [17:00] - Dosimetry (measurements)

Exposure assessment in the French Comop program

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)

Exposure measurements were performed in people's home in the most exposed places of a city. 6 configurations were defined for 16 communes: rural in plain or in mountain, suburbs, modern dense city, old dense city, high density business district. Measurements were compared with window open or closed, outside and inside, at different heights (1.1, 1.5 and 1.7m). Individual exposure was related to geolocalised measurements in the city.

PA-39 [17:00] - Dosimetry (measurements)

Measurement Technique to Determine Specific Absorption Rate of N-element Transmitting Antenna Devices

Dinh Thanh Le¹, Lira Hamada¹, Soichi Watanabe¹ & Teruo Onishi²

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

This paper presents an estimation technique to evaluate the Specific Absorption Rate (SAR) of multiple transmitting antenna devices with conventional scalar SAR probes. For devices with N-element antenna, measurements for $N(N - 1) + 1$ known relative phase combinations of the antennas are required in order to evaluate SAR for any other relative phase combinations. The technique provides accurate estimated SAR, and is able to identify the maximum SAR corresponding to particular phase combinations of the sources.

PA-41 [17:00] - Dosimetry (measurements)

Validation of Magnetic Field Measurement Close to Wireless Power Transfer Systems for Exposure Assessment

Teruo Onishi¹, Satoshi Ishihara¹ & Akimasa Hirata²

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Keywords: Dosimetry (measurements), IF, Work in Progress

Recently wireless power transfer (WPT) systems for mobile phones, electric vehicles and etc. have been paid attention and standardized by some international bodies. In order to ascertain the actual exposure level from a commercial WPT system, it is important to measure the electromagnetic field close to the WPT source because it is anticipated that the measured field could be different due to coupling between the source and field sensors. This paper describes investigated results on magnetic field measurements close to a simple loop coil at 100 kHz and 6.78 MHz. One of results shows that isotropy is less than 15% although the source-sensor distance is very close. Based on the results, magnetic field measurements can be

PA-43 [17:00] - Dosimetry (measurements)

Comparison of various methods allowing the study of the power radiated by a mobile phone on the network

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¹Electromagnetism, Supélec, Gif sur Yvette, France, 91192

Keywords: Dosimetry (measurements), RF/Microwaves, Review, Commentary, Recommendation, Evaluation

The SAR of mobile phones is measured following the protocol described by the IEC62209-1 standard, which imposes the power level to be at its maximal value. In real use, the base station imposes the mobile phone radiated power by mean of power control (PWC). The PWC dynamic range is 30dB for GSM technology and 70dB for WCDMA technology.

Consequently, the emitted power of the mobile phone may be very lower than its maximum value and the real mobile phone exposure may be very lower than the standardized value. This paper describes and compares several methods allowing the evaluation of the variations of the emitted power by a mobile phone.

PA-45 [17:00] - Dosimetry (measurements)

GSM mobile phones exposure: reception of a call and issuing of a call

Dominique Picard¹ & Joël Legrand¹

¹*Electromagnetism, Supélec, Gif sur Yvette, France, 91192*

Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)

The mobile phone is the main source of exposure of the population. The exposure level to GSM mobile phone is higher than that to WCDMA mobile phone. The use of a mobile telephone for voice communications can be decomposed into several steps among which in particular the reception of a call and the issuing of a call from the mobile phone. This study is the characterization of the user exposure to GSM mobile phones during these two steps.

PA-47 [17:00] - Dosimetry (measurements)

Measurement of magnetic fields originating from electric vehicle charger system

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Keywords: Dosimetry (measurements), Static, Completed (unpublished)

The magnetic fields and their frequencies were measured in the quick and normal charging modes in the immediate vicinity of an electric vehicle charging system composed of a main charger body, vehicle charging inlet connector and charging cable. All of the static magnetic fields, and low frequency magnetic fields in the quick and normal charging modes, are much lower than the magnetic field reference levels for general public exposure provided in the ICNIRP Guidelines.

PA-49 [17:00] - Electroporation

Electroporation by means of injection of elongated conducting micro-spheroids together with chemotherapeutic drugs into cancer tumours

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Keywords: Electroporation, Pulsed, Work in Progress

We explore the possibility of electroporation by means of injection of elongated conducting micro-spheroids together with chemotherapeutic drugs into cancer tumours.

PA-51 [17:00] - Epidemiology

Development and pre-test of a novel RF-EMF and ELF-MF exposure unit for experimental studies

Anke Huss¹, Manuel Murbach², Niels Kuster², RobT. van Strien³, Imke van Moorselaar³, Hans Kromhout¹, Roel Vermeulen¹ & Pauline Slottje¹

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

We developed novel mobile exposure units that can generate extremely-low frequency magnetic field exposures as well as radiofrequency electromagnetic fields resembling real-life signals at different exposure levels. In the future, we plan to use the exposure units to perform an experimental study with persons who report to react to exposure to electromagnetic fields, and to do this at the home or another environment of choosing of the participant. It is important, however, that the units are able to produce truly double blind exposure conditions. We are currently pre-testing our exposure units for this purpose. The units' characteristics and the results of the pre-testing will be presented at the conference.

PA-53 [17:00] - Epidemiology

Brain Cancer Has Increased in the USA, 1992-2010: Average Annual Percent Change Incidence Increases for Cancer in Younger Age Groups, for Frontal Lobe Glioma, and for Male Glioblastoma

L. Lloyd Morgan¹, Anthony B. Miller², Annie J. Sasco³ & Devra Davis¹

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

Using the SEER 13 database, for age specific brain tumor incidence, by gender for malignant, glioma and glioblastoma histologies, and for frontal and temporal lobe anatomical regions for years 1992-2010 was collected. Joinpoint calculation

was used to calculate the Average Annual Percent Change (AAPC) for years 1992-2010. Glioma AAPC= 1.3%, CI[1]= 0.6% to 2.1%, and in the 20-29 age group, the AAPC=3.5%, CI= 0.9% to 6.1%, and 3.2%, CI= 0.5% to 2.1% for women and men respectively. For frontal lobe glioma in the 20-29 year group AAPC=5.5%, CI= 2.3% to 8.7%. Male glioblastoma, age 20-29 AAPC=2.7%, CI= 1.0% to 4.4%. However, all malignant brain tumor decreased slightly (AAPC=-0.90. p-trend <0.01).

PA-55 [17:00] - In vitro

Effect of combined radiofrequency fields exposure on Amyloid-beta-induced cytotoxicity in HT22 mouse hippocampal neuronal cells

Jong-Sun Lee¹, Jeong-Yub Kim¹ & Myung-Jin Park¹

¹*Korea Institute of Radiological and Medical Sciences, Seoul, Korea, 139-706*

Keywords: In vitro, RF/Microwaves, Work in Progress

In the present study, we examined the effect of combined radiofrequency fields (RF) radiation on the cytotoxicity of amyloid-beta in HT22 hippocampal neuronal cells. Our results demonstrate that RF exposure did not significantly affect amyloid-beta-induced decrease of cell proliferation, increase of reactive oxygen species production, and induction of Annexin V/PI positive population in these cells.

PA-57 [17:00] - In vitro - STUDENT PAPER

2 mT Extremely Low Frequency Magnetic Fields have no effect on mouse oocytes meiotic maturation in vitro

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²*Life Science Institute of Zhejiang University, Hangzhou, China, 310058*

Keywords: In vitro, ELF/LF, Work in Progress

Widely applications of power lines, domestic appliances and electronic products make people exposed to unprecedented levels of extremely low frequency magnetic fields (ELF-MF) and raise concerns about the potential effects on female reproduction. In this study, we investigated the effects of 50 Hz ELF-MF of 2 mT for 24 hours on mouse oocytes cultured in vitro. We focused on several key events in the process of oocytes meiotic maturation, including the following: γH2AX foci formation of oocytes on GV (Germinal vesicle) stage, Germinal vesicle breakdown (GVBD) rate, first polar body (PBI) extrusion rate, spindle and chromosome configurations, and activation of oocytes. No differences were found between sham-exposed and exposed groups.

PA-59 [17:00] - In vitro

Pro-inflammatory responses of astrocytes and microglia are differentially modulated by radiofrequency radiation through differential STAT3 activation

Yong-Hui Lu¹, Chun-Hai Chen¹, Lei Zhang¹, Zheng-Ping Yu¹ & Zhou Zhou¹

¹*Department of Occupational Health, Third Military Medical University, Chongqing, China, 400038*

Keywords: In vitro, RF/Microwaves, Completed (unpublished)

Microglia and astrocytes were activated by RF exposure which showed differential pro-inflammatory responses, characterized by different expression and release profiles of pro-inflammatory cytokines. The RF exposure activated STAT3 in microglia but not in astrocytes.

PA-61 [17:00] - In vitro

Extremely low-frequency electromagnetic fields affect transcript levels of neuronal differentiation-related genes in embryonic neural stem cells

Qin-Long Ma¹, Chun-Hai Chen¹, Zheng-Ping Yu¹, Zhou Zhou¹ & Lei Zhang¹

¹*Department of Occupational Health, Third Military Medical University, Chongqing, China, 400038*

Keywords: In vitro, ELF/LF, Completed (unpublished)

There was no significant change in NSC proliferation after 50 Hz ELF-EMF exposure. A down-regulation of Sox2 and up-regulation of Math1, Math3, Ngn1 and Tuj1 mRNA levels after 50 Hz ELF-EMF exposure (2 mT for 3 days) was observed without alteration in the percentages of neurons and astrocytes.

PA-63 [17:00] - In vitro - STUDENT PAPER

Acute exposure to 1.8 GHz radiofrequency radiation influences cellular oxidation-reduction balance

AnaMarija Marjanovic¹, Ivan Pavicic¹ & Ivancica Trosic¹

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Keywords: In vitro, RF/Microwaves, Completed (unpublished)

Rapid technological expansion and increase in the number of mobile phone users has raised concern about possible health effects of radiofrequency radiation exposure. Non-thermal effects and their possible mechanism of action are still being controversial. One of the possible explanations could be connected to reactive oxygen species (ROS) and oxidative stress. The aim of this study was to investigate effect of 1.8 GHz mobile phone radiation on cell oxidative stress development by measuring level of ROS, lipid damage and antioxidant defence mechanism in Chinese hamster lung fibroblasts (V79).

PA-65 [17:00] - In vitro

Decreased electrical activity in neuronal networks exposed to CW and GSM-1800 signals

Daniela Moretti¹, André Garenne², Florence Poulletier De Gannes¹, Stéphane Azzopardi¹, Raphaël Roder¹, Emmanuelle Haro¹, Isabelle Lagroye^{1,3}, Bernard Veyret^{1,3} & Noëlle Lewis¹

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Keywords: In vitro, RF/Microwaves, Work in Progress

Alteration of the EEG spectrum in humans following exposure to the GSM signal has been reported by several groups. This suggests that the activity of neuronal networks may be affected by RF exposure. Following 15-20 days of culture, neuronal cultures from rat embryonic cortices were exposed in MEAs (MultiElectrode Arrays) for 3 or 15 min, inside a TEM cell (transverse electromagnetic; GSM-1800 or CW; SAR level: 4.6 W/Kg). We showed that the mean bursting rate decreased by ca. 30% and 67% during the 3 min and 15 min exposures to RF, respectively. Further work is ongoing to search for the SAR threshold of this effect.

PA-67 [17:00] - In vitro - STUDENT PAPER

Apperance of polar and non-polar cytoskeleton filaments in neuronal cells after GSM modulated RF exposure

Ivan Pavicic¹, AnaMarija Marjanovic¹ & Ivancica Trosic¹

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Keywords: In vitro, RF/Microwaves, Completed (unpublished)

The study was carried out on the purpose to assess the reaction of polar and non-polar cytoskeleton filaments after Global System of Mobile (GSM) modulated radiofrequency (RF) radiation. Culture of neuronal cell line SH-SY5Y was exposed to GSM modulated RF radiation frequency of 915 MHz, electric field strength of 10, 20 and 30 V/m. Average specific absorption rate (SAR) was calculated at 0.23, 0.8 and 1.6 W/kg. Cell exposure treatment lasted for 1, 2, and 3 hours. Negative- and positive control cell samples were matched with experimental cells samples. Gigahertz Transversal Electromagnetic Mode chamber (GTEM), generator, power amplifier and signal modulator were the parts of the radiation exposure set-up. To define polar ac

PA-69 [17:00] - In vitro

Mitochondrial Hyperpolarization and Cytochrome-c Release in Microwave Exposed MCF-7 cells

Nesrin Seyhan¹, Ayse Canseven Kursun¹, Meric Arda Esmekaya¹, Handan Kayhan, Mehmed Tuysuz¹, Bahriye Sirav¹ & Munci Yagci

¹Department of Biophysics, Gazi University, Ankara, Turkey

Keywords: In vitro, RF/Microwaves, Completed (unpublished)

The effects of 2.1 GHz Wideband Code-Division Multiple Access (W-CDMA) Microwave (MW) radiation on apoptotic activity and mitochondrial membrane potential ($\Delta\Psi_m$) in MCF-7 human breast carcinoma cells were studied

PA-71 [17:00] - In vitro

Effects of Static Magnetic Fields on Biological Behaviors and Electromagnetic Properties of Bone Cells

Peng Shang¹, Jian Zhang¹, Chong Ding¹, Airong Qian¹, Zhe Wang¹ & Lifang Hu¹

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Keywords: In vitro, Static, Work in Progress

The behaviors of bone cells can be affected by SMF. HyMF and MMF disrupted the balance of bone remodeling with decreased bone formation and increased bone resorption. Therefore, exposure to the environments with magnetic intensity far away the geomagnetic field was harmful to bone metabolism.

PA-73 [17:00] - In vitro

WITHDRAWN

PA-75 [17:00] - In vitro

Biological Properties of Blue Light Radiated from Different Dental Cured Binding Units

Ivancica Trosic¹, Ivan Pavicic¹, AnaMarija Marjanovic¹, Ana IvanisevicMalcic² & Silavana JukicKrmek²

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²University of Zagreb, Zagreb, Croatia, 10000

Keywords: In vitro, Optical, Completed (unpublished)

The attempt to increase dental resin polymerization quality discharges the commercially available high power light density dental curing units. Widespread worry in both, patients and dentists rises with regard to the adverse effects on the pulp

tissue since the emitted visible blue light belongs to the nonionizing radiation of electromagnetic spectrum. Two devices, halogen curing lights of Elipar[®] TriLight, ESPE Dental AG (Germany) unit and Bluephase C8[®] LED light source (Vivadent, Schaan, Lichtenstein) have been evaluated and compared for radiation effects on cell viability, colony-forming ability (CFA) and proliferation of continuous cell culture. Quartz-tungsten-halogen light source emits radiation of the w

PA-77 [17:00] - In vitro

Research on Optimized Multi-scale Sample Entropy Evaluation for Flickering of Human Erythrocytes by the Effects Electromagnetic Field Exposure

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Keywords: In vitro, ELF/LF, Work in Progress

An optimized multi-scale sample entropy (mSampEn) method which inflect damage of the human erythrocytes in terms of the dynamic complexity of the flickering motion of erythrocytes membrane was proposed to analyze the effect of extreme low frequency electromagnetic field exposure and 1950MHz radiofrequency electromagnetic field to the flickering of the stored erythrocytes. Results showed that both ELF-EMF (f=50 Hz, power line signals, B=2.29 mT and duration=2 hours/day) and RF-EMF (f=1950MHz, UMTS, SAR=3W/kg, duration=2 hours/day) exposure enhanced the dynamic complexity of the cytomembranes and thus could be the potential treatment for increasing conservation of stored erythrocytes.

PA-79 [17:00] - In vivo

The effect of radiofrequency-electromagnetic field on microglia in post-natal rat brain

Young Hwan Ahn^{1,2}, Hae Sun Kim¹, You Hee Lee^{1,2}, Yun-Sil Lee³, Jangwon Park⁴, Jeong-Ki Park⁵, Hyung Do Choi⁶ & Nam Kim⁷

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Keywords: In vivo, RF/Microwaves, Work in Progress

The study investigated whether activation and proliferation of microglial cell could be induced by a short exposure to RF-EMF in the post-natal developing rat brain. After RF-EMF exposure for 15 min at whole-body SAR of 6 W/kg to the post-natal day-7 littermate Sprague-Dawley rats did not cause any change in the number of ionized calcium binding adaptor molecule 1 (Iba-1) positive microglia, however, induced activation of Iba-1 positive microglia in the developing rat brain.

PA-81 [17:00] - In vivo

Microwave exposure induces Jaks phosphorylation in rat hippocampus

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Keywords: In vivo, RF/Microwaves, Work in Progress

JAK/STAT pathway plays important role in brain development and brain injury. It participates the progress of neuronal degenerative diseases. JAK/STAT signaling pathway was activated after microwave exposure, which indicated that JAK/STAT signaling pathway may participate microwave induced central nervous system injury.

PA-83 [17:00] - In vivo

Characterisation of the effects of 50 Hz magnetic fields on cognitive functions and cerebral markers of ageing and Alzheimer's disease in aged mice

Isabelle Lagroye^{1,2}, Olivier Nicole³, Nathalie Macrez³, Nathalie Biendon³, Emmanuelle Haro², Florence Poulletier De Gannes^{1,2}, Annabelle Hurtier², Bernard Veyret^{1,2} & Bruno Bontempi³

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Keywords: In vivo, ELF/LF, Work in Progress

Recent epidemiological studies (Huss et al, 2009 ; Frei et al. 2013) have suggested a possible association between residential exposure to extremely-low frequency (ELF) magnetic fields (MF) of elderly people and Alzheimer disease (AD). We are currently investigating whether repeated exposures of mice to a 50 Hz magnetic field during the course of normal ageing may

translate into exacerbated learning and memory deficits associated with the abnormal expression of specific molecular brain markers related to AD pathogenesis.

PA-85 [17:00] - In vivo

Thermal effects of high-power radio frequency-electromagnetic field (RF-EMF) exposure in vivo

Shin Ohtani¹, Akira Ushiyama², Machiko Maeda¹, Kenji Hattori¹, Naoki Kunugita², Jianqing Wang³ & Kazuyuki Ishii¹

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Keywords: In vivo, RF/Microwaves, Work in Progress

To discuss the relationship between RF-EMF exposure and heat shock protein expression, we analyzed the expression of heat shock proteins in rat brains with real-time PCR and western blotting. Rats were exposed to RF-EMFs [2.14 GHz, W-CDMA signals] for 3 or 10 consecutive days with a WBA-SAR of 4 W/kg or 0.4 W/kg, respectively. The Hsp27 and Hsp110 genes were significantly upregulated at 4 W/kg, but protein upregulation was not detected. In contrast, there was no significant change in any of the genes at 0.4 W/kg. These results indicated that the threshold for the upregulation of the Hsp27 and Hsp110 genes in rat brains exposed to RF-EMF was between 0.4 W/kg and 4 W/kg.

PA-87 [17:00] - In vivo

What is the effect of chronic RF-EMF exposure on thermal preference in juvenile rats?

Amandine Pelletier¹, Rene De Seze^{1,2}, Stéphane Delanaud¹, Jean-Pierre Libert¹ & Véronique Bach¹

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Keywords: In vivo, RF/Microwaves, Completed (unpublished)

The present study aimed at assessing the changes in thermal preference and sleep stage distribution with RF-EMF exposure. Young male Wistar rats were exposed to RF-EMF (900 MHz, 1 V.m⁻¹) for 5 weeks and compared with non-exposed rats. The animals were free to choose air temperature value. The tail skin temperature of the exposed group was significantly lower (-1.6°C). The controls preferred to sleep at 28°C whereas the exposed group preferred 31°C. The mean sleep duration in the exposed group was significantly greater at 31°C by 15.5% than in the control group. RF-EMF exposure induced a shift in thermal preference towards higher temperatures which was accompanied by a change in sleep stage distribution.

PA-89 [17:00] - In vivo

Effects of WiMAX exposure on mice immune system

Florence Poulletier De Gannes^{1,2}, Emmanuelle Haro², Annabelle Hurtier², Marion Jany^{1,2}, Gilles Ruffie³, Yann Percherancier², Bernard Veyret^{1,2} & Isabelle Lagroye^{1,2}

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Keywords: In vivo, RF/Microwaves, Work in Progress

For the first time, the effects of the new signal WiMax (3.5 W/kg) were tested on the immune system of hairless mice. Exposure was blind and lasted 2 hrs/day, 5 days/week, for 5 weeks. The whole-body SAR tested were 0, 0.08, 0.4 and 4 W/kg.

PA-91 [17:00] - In vivo

Dosimetry Assessment for 6-GHz Whole-Body Non-Constraint Exposure of Rats in Reverberation Chamber

Jingjing Shi¹, Jerdvisanop Chakarothai², Jianqing Wang¹, Kanako Wake², Soichi Watanabe² & Osamu Fujiwara¹

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Keywords: In vivo, RF/Microwaves, Work in Progress

With the rapid increase of various uses of wireless communications, the higher microwave and millimeter wave frequency bands are attracting much attention in recent years. However, the existing databases on above 6 GHz radio-frequency (RF) electromagnetic (EM) field exposure of biological bodies are obviously insufficient. In Japan an *in-vivo* research project on local and whole-body exposure of rats to RF-EM fields above 6 GHz was started last year. This study aims to perform a dosimetric design for the whole-body-average specific absorption rate (SAR) of the whole-body exposed rats in order to determine an input power into a reverberation chamber (RC) required for achieving a target exposure level.

PA-93 [17:00] - In vivo

75GHz millimeter wave exposure to eye: role of environment factors in effects

Cheng-Yu Tsai¹, Masami Kojima¹, Yukihisa Suzuki², Kensuke Sasaki³, Kanako Wake³, Soichi Watanabe³, Masao Taki², Yoshitsugu Kamimura⁴, Akimasa Hirata⁵, Kazuyuki Sasaki¹ & Hiroshi Sasaki¹

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Keywords: In vivo, RF/Microwaves, Work in Progress

Millimeter waves are increasingly employed in airport security, automobile safety and mobile communication systems resulting in more exposure to humans. It is known that millimeter waves are absorbed by surface tissue, such as skin or cornea. In the present study, it was revealed that millimeter waves damage the eye by heat induction and convection. We hypothesized that convection of aqueous humor is involved in heat transfer from the cornea to the lens. We showed the roles of environment factors, airflow and humidity, in this process. Airflow at 0.5 m/s and low humidity during exposure decreases heat accumulation and transfer.

PA-95 [17:00] - Human

Mitigation of Sensory Effects Associated with Exposure to Power Frequency Electric Fields

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Keywords: Human, ELF/LF, Work in Progress

The sensory effects associated with spark discharges range from barely perceptible to painful reactions depend on amount and pattern of the charge transfer. Mitigating these effects can be done by design of electric-field source, by shielding or reducing the field at locations of interest, or by preventing/providing alternate paths for charge transfer or reduction of coupling. The latter approach includes mitigation through grounding/earthing, bonding, using protective clothing/footwear, applying working practices, training & information program. These mitigation methods will be discussed with a number of case studies, including progress of a pilot study measuring spark-discharge current in volunteers.

PA-97 [17:00] - Human

Risk perceptions of mobile communication in Japan

Ayumi Masuchi¹

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Keywords: Human, RF/Microwaves, Completed (unpublished)

This study analysed average people's knowledge and risk perceptions related to mobile communication in Japan. A mail survey was distributed to 724 respondents, and 2,000 respondents completed a web survey questionnaire. The results indicated that most respondents were concerned about the risk of exposure to electromagnetic fields radiating from mobile phones. However, they might not have formed opinions on this topic yet. Several respondents, however, were more concerned about the risk of using mobile phones. These respondents were relatively sensitive to risk information on potential health threats. A structural equation modelling procedure was used to analyse the relationships between variables.

PA-99 [17:00] - Mechanistic/Theoretical

Straight Astral Microtubule Mechanical Longitudinal Resonance Disrupts the Mitotic Spindle of Hepatocellular and Breast Adenocarcinoma Cells "in vitro"

Gerard Dubost¹, James Bare² & Frederic Bellossi³

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²*DC Albuquerque, NM, USA*

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

An electrical field generated by a cylindrical plasma antenna fed with a square wave modulated carrier is applied to tumor cells. Cell proliferation is reduced by using modulation frequencies corresponding to the astral microtubules longitudinal mechanical resonance. Mitotic spindle disruption occurs following resonance induced axial microtubule depolarization. This model can be connected to the treatment responses shown by Boris Pasche et al with an amplitude modulated electromagnetic field intrabuccally administered at the same modulation frequency range. The plasma antenna can then be considered as a possible alternative device for treatment.

PA-101 [17:00] - Mechanistic/Theoretical

Analysis of whole body specific absorption rate for 100-W wireless power transfer system

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Keywords: Mechanistic/Theoretical, ELF/LF, Work in Progress

In this paper, we proposed a 100-W wireless power transfer system which has resonance frequency at 125 kHz, and then analyzed the whole body specific absorption rate and the induced currents by distance from the system to the human phantom. The human phantom is used to the homogeneous model according to the IEEE standards. The designed WPPT system is consisted of two resonant coils, which are the transmitting and receiving parts. The coil size is about 500 mm x 55 mm. The distance between two coils is 200 mm. The calculated average SAR value is 1.3 W/kg when the human phantom is located at 200 mm away from the suggested WPPT system. In addition, the calculated induced current is 3.5 A/m².

PA-103 [17:00] - Mechanistic/Theoretical

The compound Chinese medicine "Kang Fu Ling" protects against microwave-induced myocardial

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Keywords: Mechanistic/Theoretical, RF/Microwaves, Completed (unpublished)

This study aimed to investigate myocardial protection by the compound Chinese medicine "Kang Fu Ling" (KFL) against microwave-induced myocardial injury and the role of the mitochondrial permeability transition pore in such protection in vivo and in vitro. The results showed that 30 mW/cm² microwave radiation can cause histological and electrophysiological changes in the heart, and 0.75~3.0 g/kg/day KFL may protect against such injury; KFL at 1.5 g/kg/day had the greatest protective effects; Myocardial protection by KFL is related to inhibition of mitochondrial permeability transition pore opening.

PA-105 [17:00] - Occupational

The system of occupational safety and health legislation implemented in Poland in the context of the process of transposing the provisions of European Directive 2013/35/EU

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Keywords: Occupational, IF, Review, Commentary, Recommendation, Evaluation

Occupational EMF legislation binding in Poland has been discussed in the context of the principles of Directive 2013/35/EU and their transposition into national legislation.

PA-107 [17:00] - Occupational

Possible health symptoms associated with electromagnetic field exposure in the welding industry

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Keywords: Occupational, ELF/LF, Completed (unpublished)

A questionnaire survey was conducted among employees in a welding company located in the Mangaung Metropolitan Municipality, Free State Province, South Africa in November 2011. The objective of the survey was to describe and calculate the prevalence of health symptoms among subjects exposed to extremely low frequency electromagnetic fields. Subjects completed consent forms and self-administered questionnaires. The majority of exposed group (65%) and unexposed group (56%) experienced headaches most of the time. The exposed group also suffered from sleep disorders (27%), fatigue (36%) and distress (27%). Implementation of safety measures is necessary to prevent these symptoms.

PA-109 [17:00] - Occupational

Advanced Electric Shock Job Exposure Matrix Quantifies Uncertainty

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Keywords: Occupational, ELF/LF, Completed (unpublished)

We present an update to a previously published electric shocks job exposure (JEM) matrix, geared to disentangle exposures within the electric occupation environment and examine their relationship to neurodegenerative diseases, such as

amyotrophic lateral sclerosis (ALS). We describe overall results and highlight examples demonstrating the impacts cutpoint selection has on exposure assignment. Using uncertainty intervals, we show where more information on exposure to electric shocks might be needed.

PA-111 [17:00] - Public Health Policy
Health Effects From Overhead Power Lines: A South African Perspective

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Keywords: Public Health Policy, ELF/LF, Work in Progress

In South Africa there is a dire need to increase the supply of electricity to the wider community and thus a need for the increase in generation and distribution of electricity. The question whether the leukaemia risk in children living near overhead power lines need to be further investigated in the South African context. If so true, how many leukaemia cases in South Africa could be related to overhead power lines? Furthermore, the possibility of policy changes should be considered taking into account the dire need for further electrification of households in South Africa. It is concluded that the ICNIRP guidelines (2010) for exposure to electromagnetic fields of workers and the public that are currently appl

PA-113 [17:00] - Public Health Policy
A new approach for the conflict resolution of power facilities including EMF in Korea

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¹*Construction Planning Team, Korea Electric Power Corporation, Seoul, Korea*

Keywords: Public Health Policy, ELF/LF, Completed (published)

As a part of risk communications, there are many efforts to improve understandings about EMF conducted by a power company KEPCO. Nevertheless, the conflicts have still not reduced. In collaboration with the government, KEPCO is trying to make and enforce the law on compensation and support for the surrounding area of power facilities for the resolution of public conflicts including EMF.

PA-115 [17:00] - Public Health Policy
US Federal Communications Commission Review of Radiofrequency Exposure Policies

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Keywords: Public Health Policy, RF/Microwaves, Completed (published)

In 2013, the United States Federal Communications Commission released a document covering various regulatory issues in connection with radiofrequency exposure limits and implementation procedures. The document contains three parts: (1) finalized rules, (2) proposed new rules, and (3) an inquiry. A large number of public comments were received in this proceeding and are being processed.

PA-117 [17:00] - Public Health Policy
Electric and Magnetic Fields from an Upgraded 132 kV Double Circuit Power Line – A Probabilistic Approach in Field Calculation and Exposure Assessment

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¹*TERRATECH, Johannesburg, South Africa*

²*Eskom Holdings SOC Ltd, Johannesburg, South Africa*

Keywords: Public Health Policy, ELF/LF, Completed (unpublished)

A probabilistic approach in power line electric and magnetic field calculation, taking into account influence of environmental factors on conductor temperature and how these affect fields at ground level, is covered. Field levels were calculated based on anticipated line loading for a 20 year period, under both normal and contingency operations, for a 132 kV double circuit power line. Exposure to the fields was assessed against the guidelines set by ICNIRP. The paper concludes by showing that, despite the fact that the field levels under deterministic conditions were within the ICNIRP guidelines, the probabilistic approach yield more realistic values showing an inherent component of precaution with a safety factor of 50.

PA-119 [17:00] - Public Health Policy
Study of Increased EMF levels generated by Collocated Base Station Sites

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Keywords: Public Health Policy, RF/Microwaves, Concept

Last few years have witnessed a lot of emphasis being put on the collocation of Base Stations of different operators and different technologies majorly due to unavailability of space especially in Dense Urban areas. This approach has not just resulted in faster rollout but was also cost effective. However, with this has increased overall EMR generated from the same location. This has resulted in increased risk on the general public who are living in the close proximity of these Base stations.

This paper is an attempt to study the impact in terms of increase in the overall power density for the collocated base stations with respect to the EMF limit thresholds defined by ICNIRP (International Commission for Non Ionization Radi

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Poster Session B
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PB-2 [11:30] - Behavioural
Biomagnetic Pair Effect on Neuromuscular Excitability

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Keywords: Behavioural, Static, Completed (published)

A significant statistical difference of neuromuscular excitability during magnetic pair application occurs by significantly altering the curves as measured with Rheotome.

PB-4 [11:30] - Behavioural
Short-term and Long-term Exposure to Radiofrequency Electromagnetic Field Exposure (GSM 900 MHz) has no Effect on Blood-Brain Permeability in Rats

Melanie Klose¹, Karen Grote¹ & Alexander Lerchl¹

¹*Jacobs University Bremen, Bremen, Germany, 28759*

Keywords: Behavioural, RF/Microwaves, Completed (unpublished)

Female and male Wistar rats were exposed in the head region to a GSM-modulated 900 MHz radiofrequency electromagnetic field (RF-EMF). The average specific absorption rates (SAR) in the brain were 0 (sham), 0.7, 2.5 and 10 W/kg. Female rats (n = 24 / group) were long-term exposed beginning at an age of 14 days to 19 months, for two hours per day, five days per week. Male rats (n = 48 / group) were distributed into 3 groups and short-term exposed to RF-EMF on day 14 and 15, 16 and 17, or 18 and 19, respectively. A histopathological analysis revealed no higher tumor incidence in the central nervous system (CNS) due to long-term or short-term exposure, or a difference in the blood-brain-barrier (BBB) permeability, respectively.

PB-6 [11:30] - Clinical (diagnostics)
Study and Analysis of Medical Data using structural and functional Magnetic Resonance Imaging procedures (MRI/DTI/fMRI): Assessment of changes induced by Brain Radiotherapy

Irene Karanasiou¹, Melina Giamalaki¹, Konstantinos Bromis¹, George Matsopoulos¹, Eric Ventoura², Vasileios Kouloulis³ & Nikolaos Uzunoglu¹

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Keywords: Clinical (diagnostics), RF/Microwaves, Work in Progress

While the use of prophylactic brain irradiation (PCI) in certain types of cancer has considerably increased life expectancy, it is questionable whether it could result in serious side-effects on the patient's cognitive functions. The aim of the present research is the multilevel combined study of data from conventional and advanced techniques of Magnetic Resonance Imaging (MRI), such as diffusion tensor imaging (DTI) and functional MRI (fMRI) of healthy volunteers and cancer patients before and after being administered brain radiotherapy. The scope is to investigate neurocognitive underlying mechanisms of cancer progress and treatment using functional and structural neuroimaging.

PB-8 [11:30] - Clinical (therapy)
Biophysical stimulation of cartilage repair by pulsed electromagnetic fields

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Keywords: Clinical (therapy), ELF/LF, Review, Commentary, Recommendation, Evaluation

It is known that physical stimuli modulate cartilage metabolism. In particular, low frequency pulsed electromagnetic fields (PEMF) allow to treat homogeneously the whole cartilage surface and thickness and the underlying subchondral bone. PEMF represents an innovative therapeutic approach in tissue engineering for cartilage repair and an effective treatment to promote cartilage anabolic activity thus optimizing clinical results and preventing cartilage degeneration over time.

PB-10 [11:30] - Clinical (therapy)
Intracavitary microwave heating for treatment of bile duct carcinoma - Numerical calculations in consideration of practical treatments

Kazuyuki Saito¹, Erika Yashima¹, Erika Ishihara¹, Masaharu Takahashi¹ & Koichi Ito¹

¹Chiba University, Chiba, Japan, 2638522

Keywords: Clinical (therapy), RF/Microwaves, Work in Progress

Microwave thermal therapy is one of the modalities for cancer treatment. There are several schemes of microwave heating. The authors have been studying thin coaxial antenna for intracavitary microwave heating aiming at the treatment of bile duct carcinoma. Up to now, the heating characteristics of the antenna are investigated by numerical simulation and experiment for finding a possibility of the treatment. In this study, in order to consider practical situations of the treatment, heating characteristics of the antenna are calculated by use of some different models. As the results of calculations, possibilities of microwave heating could be confirmed under the practical situations.

PB-12 [11:30] - Clinical (therapy) - STUDENT PAPER

Development on microwave forceps for coagulation of biological tissue

Kenta Suzuki¹, Yuta Endo¹, Yoshito Tezuka¹, Kazuyuki Saito¹, Masaharu Takahashi¹ & Koichi Ito¹

¹Chiba University, Chiba, Japan

Keywords: Clinical (therapy), RF/Microwaves, Work in Progress

In recent years, various types of medical applications using microwave energy have widely been investigated and reported. In this paper, we propose a novel forceps type device for biological tissue coagulation. In addition, temperature distribution at 2.45 GHz is evaluated by Finite-Difference Time-Domain (FDTD) method. Results indicated proposed device can effectively coagulate biological tissue.

PB-14 [11:30] - Clinical (therapy)

Numerical Modeling of Radiofrequency Ablation of Tumors Embedded in Realistic Anatomy

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Keywords: Clinical (therapy), RF/Microwaves, Work in Progress

Thermal treatments in most studies are modeled usually by theoretical models which comprise either one or two compartments of different tissues. The objective of the current work was to simulate radiofrequency ablation (RFA) treatment in numerical models of tumors embedded in a realistic anatomy and compare the results with those of two compartment models (healthy tissue and tumor). Generally, it was found that in most realistic models the specific absorption rate (SAR) distribution was affected by surrounding tissues.

PB-16 [11:30] - Dosimetry (computational)

Correlation between electromagnetic power absorption and induced temperature elevation in the human body for plane wave exposure

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

The correlation between power absorption and temperature increase has been considered for a plane wave exposure at 64 MHz, to compare the obtained results with similar data obtained for a MRI exposure. Different metrics have been considered for representing the power absorption, as well as several averaging masses

PB-18 [11:30] - Dosimetry (computational) - STUDENT PAPER

Application of the non-intrusive polynomial chaos for the evaluation of the uncertainty in the SAR calculation using a CAD-based mobile phone model

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

The TC34/SC2 committee of the International Commission on Electromagnetic Safety is developing standardized procedures for using computational tools to evaluate the specific absorption rate (SAR) in the human body. For meaningful numerical simulation results, it is important to state the uncertainty of the SAR calculation induced by the uncertainties in the input parameters. The Monte Carlo method cannot be applied and the second order unscented transform was previously proposed as a potential alternative to evaluate the uncertainty. Herein the non-intrusive polynomial chaos method is proposed as a more efficient approach to evaluate the uncertainty induced in the SAR calculations using CAD-based mobile phone models.

PB-20 [11:30] - Dosimetry (computational)

Induced Electric Fields in the MAXWEL Surface-based Human Model from Exposure to External Low-frequency Electric Fields

Richard Findlay¹

¹*EMFcomp, www.emfcomp.com, Oxfordshire, OX128HG*

Keywords: Dosimetry (computational), ELF/LF, Completed (published)

This work presents calculations of internal induced electric fields in the model of the male human body, MAXWEL, from exposure to external low frequency electric fields under grounded and isolated conditions. The E99 induced electric fields calculated in the MAXWEL central nervous system were 3.49 (grounded) and 1.54 (isolated) mV/m per kV/m at 50 Hz. The E99 value for NAOMI, calculated by Dimbylow in bone, was 49.4 mV/m per kV/m at 50 Hz under grounded conditions. The corresponding value calculated in MAXWEL was 15.7 per kV/m, considerably lower due to anatomical differences between the male MAXWEL and female NAOMI models.

PB-22 [11:30] - Dosimetry (computational)

Development of new high resolution surface-based mouse and foetus anatomically realistic models for electromagnetic field dosimetry

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

Accurate dosimetry is desirable when carrying out studies to investigate the exposure of animals to electromagnetic fields. The specific absorption rate (SAR) is the quantity commonly associated with electromagnetic field exposure in the RF range. High resolution, anatomically correct models of the mouse and mouse foetus are required to accurately calculate the SAR in exposed pregnant mice during the course of an exposure assessment.

The purpose of this work is to present very high resolution models of a mouse and mouse foetus for use in computational dosimetry studies. The 3D surface-based mouse and foetal models have been developed from 0.1 mm resolution 2D images and present very detailed represen

PB-24 [11:30] - Dosimetry (computational)

Characterization of far-field and near-field exposure of the population for RF-EMF in realistic configurations of ICT usages

Abdelhamid Hadjem^{1,2}, Gunter Vermeeren⁴, Nadege Varsier^{1,2}, Emmanuelle Conil^{1,2}, Anis Krayni^{1,2,3}, Michal Mackowiak⁵, Christophe Roblin³, Wout Joseph⁴, Alain Sibille³, Luc Martens⁴ & Joe Wiat^{1,2}

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

The study presented in this paper is part of a larger study within the European project LEXNET. In the framework of the project a new exposure metric named Exposure Index (EI) is proposed. The EI quantifies the global exposure of a population induced by both mobile devices and base station antennas or wireless access points. The EI requires a set of SAR values (whole-body and local-body) for typical postures and usages of mobile devices in a population. In our study, we assessed these SAR values by 3D electromagnetic simulations. We used an adult and a child numerical model in two postures and in three usages. The whole-body SAR for each exposure configuration was evaluated at different frequencies (400, 900, 1940 and 2600MHz).

PB-26 [11:30] - Dosimetry (computational)

Impact of the Dielectric Parameters on the Specific Absorption Rate in the RF Computational Dosimetry of Wireless Communication Devices

Jafar Keshvari¹, Andreas Christ² & Anssi Toropainen¹

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

When simulating CAD models of wireless devices, scaling factors are determined to adjust the feedpoint power of the simulation to experimental reference data. Investigations of different configurations show that these factors depend on the loading conditions of the simulated device. This work discusses the impact of changing the loading conditions on the scaling factor with respect to dielectric losses of the materials of the phone, normalization and matching for different realistic device models.

PB-28 [11:30] - Dosimetry (computational)

Development of Chinese Infant Models for Numerical Dosimetry

Congsheng Li^{1,2}, Lei Yang¹, Bin Lv¹, Nadege Varsier^{3,4}, Joe Wiart^{3,4} & Tongning Wu¹

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Keywords: Dosimetry (computational), ELF/LF, Work in Progress

The purpose of this study was to develop young child anatomical models. Two models were developed, one of a 12-months-old male whole body anatomical model and one of a 17-months-old male head model for evaluation of electromagnetic field exposure. These two models were built from magnetic resonance (MR) images. Using image segmentation algorithms, 28 and 30 tissues were identified for the whole body model and the head model respectively. We compared differences between these two models and existing human models.

PB-30 [11:30] - Dosimetry (computational)

Dosimetric assessment of an in vitro setup at 50 Hz

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Keywords: Dosimetry (computational), ELF/LF, Work in Progress

A first dosimetric assessment of the induced electric (E) field making numerical simulations on different samples (dimensions, culture medium volume) exposed to an homogeneous 50 Hz magnetic field is proposed. From such an analysis, the induced E field resulted to be strongly depended on the geometry of the sample (i.e. Petri dish dimension) and the volume of the simulated culture medium. This study can be useful to guide the biologist to expose their samples in the best configuration and with a known dose level according to the specific biological endpoint and hypothesized interaction mechanisms.

PB-32 [11:30] - Dosimetry (computational)

Conservativeness of the SAM phantom for the SAR evaluation of mobile phones with bottom-mounted antennas

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

The conservativeness of the SAM phantom for the compliance test of mobile phones with bottom-mounted antennas is investigated. Numerical simulations using half-wave dipole antennas positioned against either the visible human head or the SAM phantom are performed at 900 MHz, 1750 MHz, 1950 MHz and 2450 MHz. The homogeneous counterpart of the visible human is found to be always conservative with respect to the inhomogeneous model. The SAM phantom provides less conservative values above 1750 MHz for the peak 1g SAR. This is probably observed because of the difference in the morphologies around the cheek region and the difficulty of positioning the dipole antennas in a comparable way as already reported elsewhere.

PB-34 [11:30] - Dosimetry (computational)

Numerical Modelling of Transcutaneous Spinal Direct Current Stimulation (tsDCS)

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Keywords: Dosimetry (computational), Static, Completed (published)

This work estimates the distribution of the current density on the spinal cord due to transcutaneous spinal direct current stimulation. We used computation method applied to realistic human model of different age and sex and we compared three different electrode montages. Data showed that the current density tends to be primarily directed longitudinally along the spinal cord with the region of higher amplitude influenced by the reference electrode position, while on transversal sections the J amplitude distributions were quite uniform.

PB-36 [11:30] - Dosimetry (computational)

Analysis of the Impact on Humans caused by pulsed electromagnetic Radiation from a Remote Piloted Aerial System

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Keywords: Dosimetry (computational), Pulsed, Work in Progress

The project Aeroceptor has the aim to develop tools to remotely and safely control, slow and stop “non-cooperative” vehicles, such as cars used for illegal trafficking or for conducting terrorist attacks, in a safe way. Various techniques are tested and applied such as payloads emitting pulsed electromagnetic radiation to disturb or damage electronic components of the vehicles. To ensure that human health is not threatened by the emissions of the payload an exposure evaluation is performed by numerical simulations using the Finite-Difference Time-Domain (FDTD) algorithm.

PB-38 [11:30] - Dosimetry (computational)

Induced electric field strengths and current densities caused by exposure against Electronic Article Surveillance (EAS) systems

Gernot Schmid¹, Rene Hirtl¹, Stefan Cecil¹, Richard Überbacher¹, Ana Escorihuela-Navarro¹, David Sainitzer¹, Pia Schneeweiss¹ & Tobias Jhala¹

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Keywords: Dosimetry (computational), ELF/LF, Completed (unpublished)

Personal exposure caused by 21 different electronic article surveillance (EAS) systems was systematically assessed based on measurements and numerical computations using an adult and a child body model. The obtained results demonstrated that present RF-EAS technology, typically operating in the frequency range around 8.2 MHz, does not pose any conflicts with basic restrictions, even under adverse exposure conditions. In contrast, EM- and AM-EAS systems, typically operating in the frequency ranges of 5-7.5 kHz and 58 kHz, respectively, may lead to induced current densities inside the central nervous system of children above the basic restrictions according to ICNIRP 1998, even though those systems meet the required standards.

PB-40 [11:30] - Dosimetry (computational) - STUDENT PAPER

SAR Calculations in the Human Fetus Radiated from a Typical Tablet Computer Placed Variant Positions

Akihiro Tateno¹, Tomoaki Nagaoka², Kazuyuki Saito¹, Soichi Watanabe², Masaharu Takahashi¹ & Koichi Ito¹

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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

Recently, as the new type of portable radio terminals such as tablet computers and smart phone are expanding rapidly, it is essential to estimate the exposure of pregnant females and their fetuses to electromagnetic (EM) waves radiated from these portable radio terminals. Therefore, we calculated specific absorption rates (SARs) in a fetus when a typical tablet computer was placed variant positions near to the maternal abdomen close to the abdomen of the pregnant female.

PB-42 [11:30] - Dosimetry (computational)

ACTE: a new project analyzing the exposure of very young children to LTE wireless communication systems

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

This paper introduces a new project that has been launched in January 2013. The purpose of the ACTE project is to analyze the exposure of new-born and very young children to RF EMF from LTE wireless systems. The proposed objectives of the ACTE project are to develop new RF LTE source models and very young child models based on Magnetic Resonance Images that can be used in numerical dosimetry. These models are then used in order to assess the exposure of very young children in different usage configurations and analyze the influence of parameters such as posture, frequency and tissue dielectric properties.

PB-44 [11:30] - Dosimetry (measurements)

Measurement and Analysis of Driver Exposure to Electric Fields on Public Transport Bus Services in Seoul, Korea

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

There has been an unprecedented increase of various RF devices on the public transport bus service. For the representative RF devices are the bus information system (BIS) that is a kind of automatic vehicle location system by using CDMA wireless

communication, the Wi-Fi system, etc. In this paper, electric field levels sitting in the driver's seat on the public buses are measured and compared with exposure limit values. As a result of measurement by using the personal EMF meters, the electric field value is only 0.08 V/m which is extremely lower than the human EMF exposure limit of 40.53 V/m in the field of CDMA wireless communication.

PB-46 [I I:30] - Dosimetry (measurements)
Characterization of a personal exposure dosimeter

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)

To be able to perform occupational exposure assessment in an airport area with personal dosimeters, two models of personal dosimeters were in deep characterized. Frequency response, linearity, cross-over, reproducibility, isotropy were measured, and results are presented in view of practical considerations for daily use.

PB-48 [I I:30] - Dosimetry (measurements)
Array Techniques for Measurement and 3D Reconstruction of Specific Absorption Rate

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)

The current standardized SAR evaluation technique is optimized with respect to maximal repeatability and minimal measurement uncertainty. However, it is also time consuming. Due to an increased demand for faster evaluation methods, novel techniques have recently been proposed and implemented for reconstructing the 3D SAR pattern based on sensor arrays and intelligent scanning protocols. The measurement time can be reduced to less than 1s for array systems and less than two minutes for intelligent scanning. We compare the performance of 35 commercial phones for two array-system implementations. We will discuss the advantages and limitations of each of the methods for the compliance testing of wireless devices.

PB-50 [I I:30] - Dosimetry (measurements) - STUDENT PAPER
Exposure to extremely low frequency magnetic fields in various Swiss and Belgium microenvironments

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Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)

By using portable devices, extremely-low frequency magnetic field (ELF-MF: 40-800 Hz) measurements were conducted during two years in the city of Basel (Switzerland) and during one year in Ghent and Brussels (Belgium) in different microenvironments such as outdoor areas, public transports and indoor settings. We found high spatial variability of EMF within and between cities, but all average exposure values were far below the RF and ELF regulatory limits.

PB-52 [I I:30] - Dosimetry (measurements)
Simplified LTE Portable Handsets For RF Exposure Analysis

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

Three simplified wireless handheld devices for LTE applications are described and studied in this paper. The study focuses mainly on the design and the radiation characteristic of the LTE antennas. From the FDTD simulations, antenna performances are computed in free space as well as in the presence of a flat phantom. The paper highlights the challenges of LTE antennas for miniaturized and simplified multi-band system that are suitable for the latest wireless systems.

PB-54 [I I:30] - Dosimetry (measurements)
Exposure to Magnetic Fields in Residential Situations

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Keywords: Dosimetry (measurements), ELF/LF, Work in Progress

New approaches are required to reduce the scientific uncertainty surrounding the association between residential power frequency, 50 Hz (extremely low frequency magnetic fields (ELF-MF) and health problems such as head-aches, fatigue, memory and concentration problems, sleep problems, low immunity, heart palpitations, skin rashes, and diseases such as childhood leukemia. Low frequency residential electromagnetic fields are emitted by household electrical appliances, wiring, conductive plumbing and nearby power lines, which operate at frequencies of 50 or 60 Hz. These types of studies have the potential to add significantly to scientific understanding of a range of health problems.

PB-56 [11:30] - Dosimetry (measurements)

A Preliminary Analysis of Magnetic Fields Emitted from Non-hybrid and Hybrid Cars

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Keywords: Dosimetry (measurements), ELF/LF, Work in Progress

The investigation of the exposure of the general public to Extremely Low-Frequency magnetic fields caused by the transportation system is of interest. In this study, measurements of magnetic fields emitted from both hybrid and non-hybrid cars at different speeds (0-80 km/h) and in different locations within a vehicle were investigated. Details of measurements in different locations of the vehicles and under different driving scenarios would be presented. Levels of magnetic fields in hybrid cars would be compared to non-hybrid cars.

PB-58 [11:30] - Dosimetry (measurements)

EMF Field Measurement Around the Vulnerables (Kindergarten) About EMF in Korea

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

This paper analyses the results of electromagnetic field strength measurement around the kindergarten environments. The data is considered very important with its high reliability to use in epidemiological researches and prediction model for EMF exposure including researches on EMF health effects.

PB-60 [11:30] - Dosimetry (measurements)

Electric field uniformity in a GTEM cell for in-vitro exposure studies: simulations and measurements

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

In this paper we present field uniformity measurements inside a GTEM cell at mobile communication frequencies for different modulation types and stress levels. In addition, a numerical GTEM model is developed and simulations of the electric field are carried out. Measured and simulated field values are in satisfactory agreement with a maximum difference lower than 3 dB.

PB-62 [11:30] - Dosimetry (measurements)

Frequency Selective Simultaneous LF and RF EMF Monitoring

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)

The requirements for a combined isotropic and automated measurement of LF and RF in the frequency range 5 Hz to 3 GHz are: Overlap in frequency range requires evaluation according both criteria from 100 kHz to 10 MHz, Using the accepted and established test and communication platforms also for LF and RF ensures public trust.

PB-64 [11:30] - Dosimetry (measurements)

Evaluation of the exposure to radiofrequency portable transmitters

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

Several activities, in particular serviceman, require the use of a portable transmitter. These portable transmitters can emit several Watts in the VHF frequency band. These devices are worn near the body and there are questioning on the level of the exposure to the electromagnetic field which they get. This study consists of the numeric and experimental dosimetry of the whole body exposed to a radiofrequency portable transmitter at the frequency 90MHz.

PB-66 [11:30] - Dosimetry (measurements)

Pulsed EM field characteristics and dosimetric relevance

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

Despite the controversy regarding the non thermal effects of NIR, it is clear that biological effects depend on the radiation source properties (frequency, repetitive or discontinuous emission, peak and average values). Near and far field electric field strength measurements were performed in air and different materials in an attempt to analyze the special characteristics of pulsed wireless communication devices and check for differences in absorption characteristics depending on the wave form. Three types of commonly used sources were used: cell phones, Wi-Fi routers and DECT devices. Their complicated spectrum in regard to frequency as well as power was recorded and the different absorption depending on waveform was realised.

PB-68 [11:30] - Dosimetry (measurements) - STUDENT PAPER

EMF exposure metering: Dealing with pulsed RF signals

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Keywords: Dosimetry (measurements), Pulsed, Work in Progress

In order to achieve a meaningful electromagnetic field (EMF) exposure assessment it is desirable to monitor the contributions of all potential sources at the location of interest. A solely frequency based measurement however lacks sufficient complexity to deal with signal shapes that strongly deviate from those encountered in communication and broadcast systems. The issue of measurement of highly pulsed signals is illustrated by assessing the exposure to radar signals. A hybrid time and frequency domain detection scheme is presented. This approach was successfully tested using an experimental hardware prototype.

PB-70 [11:30] - Electroporation

Activation of Autophagy in Response to Nanosecond Pulsed Electric Field Exposure

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Keywords: Electroporation, Pulsed, Work in Progress

Previous work demonstrated significant changes in cell membranes following exposure of cells to nanosecond pulsed electric fields (nsPEF), including nanoporation and plasma membrane damage. We hypothesize that autophagy is activated to repair nsPEF-induced plasma membrane damage and overwhelming this compensatory mechanism results in cell death. Results show that autophagy is activated at subtoxic nsPEF doses, as a compensatory mechanism to repair membrane damage, but is not present at toxic nsPEF doses. The results of the current study suggest that nsPEF can activate intracellular mechanisms to repair membrane damage. Thus, nsPEF can be used to permeabilize cells without cellular toxicity at sublethal doses.

PB-72 [11:30] - Epidemiology

Car-mounted mobile measurements used for radio-frequency spectrum monitoring may have a wider application for population exposure studies: A test survey in Cambridge, UK and Amersfoort, The Netherlands

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Keywords: Epidemiology, RF/Microwaves, Completed (unpublished)

The objectives of the E-Monument project were firstly to assess whether RFeye, the car-mounted measurement system originally built for radio frequency (RF) spectrum monitoring, can be reused in (epidemiological) studies on adverse health effects in humans or ecological effects on flora and fauna, and secondly to compare measurements between types of area in different cities and look for time trends in RF exposure. The car mounted measurement system and the body worn exposimeters show a good correlation for the exposure means per area. Though the absolute values of the RFeye, with the settings used in spectrum monitoring measurements, give an overestimation of the actual electric field strength they are certainly useful in monitoring

PB-74 [11:30] - Epidemiology

Childhood leukemia with and without Down syndrome

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Keywords: Epidemiology, ELF/LF, Completed (unpublished)

Down syndrome (DS) is a common congenital anomaly, and children with DS have a substantially higher risk of leukemia. We provide background on DS epidemiology and review the similarities and differences in biological and epidemiologic features of leukemia in children with and without DS. We propose that both acute lymphoblastic (ALL) and acute myeloblastic leukemia (AML) among DS children can serve as an informative model for development of childhood leukemia.

PB-76 [I I:30] - In vitro

Effects of mobile phone radiation on the hematopoietic system?

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Keywords: In vitro, RF/Microwaves, Completed (unpublished)

The aim of this study is to elucidate, whether cells of the hematopoietic system can be affected by different forms of mobile phone radiation. HL-60 cells and hematopoietic stem cells were exposed to GSM-, UMTS-, and LTE-modulated radiation and various biological endpoints were investigated, including oxidative stress, differentiation, DNA repair, cell cycle, DNA damage, histone acetylation, and apoptosis.

PB-78 [I I:30] - In vitro

In vitro and in vivo studies to elucidate mechanisms of RF and IF radiation in GERoNiMO-project

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Keywords: In vitro, IF, Work in Progress

This study is performed at University of Eastern Finland as a part of EU 7th Framework Programme project called Generalised EMF Research using Novel Methods – an integrated approach: from research to risk assessment and support to risk management (GERoNiMO). We will study mechanisms of biological effects of radiofrequency fields (RF) and intermediate frequencies (IF) using both *in vitro* and *in vivo* approaches.

PB-80 [I I:30] - In vitro

Investigation of the effects of oscillating temperature and pulsed magnetic fields on HT1080 cell proliferation

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Keywords: In vitro, Pulsed, Work in Progress

Frequency dependent inhibition of cell proliferation of up to 60% has been observed by us in HT1080 cells on exposure to low level temperature oscillations. Similar exposures to static temperatures within physiological range did not show significant changes in proliferation. Exposures of non-cancerous fibroblast cells also do not result in similar inhibition. Further scrutiny of the mechanisms of inhibition of cell growth needs to be performed to separate the effects of the temperature oscillations from magnetic field oscillations. We hypothesize that the stimuli influence the rates of autonomous NADPH and calcium oscillations inside the cells through a process similar to phase locking in electronic circuits.

PB-82 [I I:30] - In vitro

Can we find experimental evidence in favour of an association between extreme low frequency magnetic field exposures and an increased risk for Alzheimer's disease?

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Keywords: In vitro, ELF/LF, Completed (unpublished)

There are a few publications in scientific journals suggesting that persons who are exposed to ELF-magnetic fields (occupational-, but also residential exposures) may be at risk for contracting Alzheimer's disease (Garcia et al., 2008; Davanipour and Sobel, 2009; Kheifets et al., 2009; Huss et al., 2009). It should be noted that these reports are only pointing to a possible association but do not at present provide any proof of association. We have performed a number of preliminary *in vitro* investigations to explore the plausibility of such an association.

PB-84 [I I:30] - In vitro

Low-frequency pulsed electromagnetic fields significantly improve time of closure and proliferation of human tendon fibroblasts

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Keywords: In vitro, ELF/LF, Completed (unpublished)

The promotion of the healing process following musculoskeletal injuries comprises growth factor signalling, migration, proliferation and apoptosis of cells. If these processes could be modulated, the healing of tendon tissue may be markedly enhanced. Here we report the use of the Somagen® device generating low-frequency pulsed electromagnetic fields (PEMF) that trigger effects that need to be determined more precisely, yet. However, the instrument is certified for medical use according to European laws.

PB-86 [I I:30] - In vitro

Effects of Pulsed Radiofrequency Fields on Viability of Cell Cultures

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Keywords: In vitro, Pulsed, Work in Progress

Although ICNIRP and IEEE guidelines specify limits on peak field intensity for pulses, these limits are not based on any established biological effect. To investigate the possible relationship between biological effects and peak field intensity, we have developed a novel system that can achieve high peak field intensities for the exposure of cell cultures. We have now begun to characterise the thermal characteristics of exposures in this system and their effects on cell viability, in preparation for future studies to search for effects related to peak field intensity alone.

PB-88 [I I:30] - In vivo

RF Exposure and Changes of Body Temperature: A trial with 915 MHz RFID in 339gm Sprague-Dawley rats

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Keywords: In vivo, RF/Microwaves, Work in Progress

Increase of body temperature of 1°C or more by RF-EMF energy absorption is known to be a dominant factor causing adverse health effects. In this trial, rats weighing 339 gm were exposed to the 915 MHz RFID for 8 hours at SAR of 4 W/kg. The body temperature in anesthetized RFID group (anesthetized using chloral hydrate during RFID exposure) increased dramatically, while not in non-anesthetized RFID rats. We suggest that body temperature do not change during RF exposure at 4 W/kg as a compensating thermoregulation mechanism works, if normal activity allowed in rats.

PB-90 [I I:30] - In vivo

Oxidative stress effects of 1880-1900 MHz electromagnetic radiation emitted from cordless phone on mouse brain.

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Keywords: In vivo, RF/Microwaves, Work in Progress

Whole body exposure of C57BL/6J mice to DECT base EMR (1880-1900 MHz frequency band) at an average electrical field intensity of 2.7 V/m for 14 h/day [constantly or intermittently (1h45*8 ON, 1h15*8 OFF)] x 2 months is not capable to induce any increase or decrease of the lipid peroxidation content in the mouse brain as revealed by the measurement of the malondialdehyde (MDA) levels. The MDA content, as well as other oxidative stress markers are under further investigation in individual brain regions (hippocampus, cerebellum, frontal lobe), as well as in more time points of exposure duration.

PB-92 [I I:30] - In vivo

Long Term Effect of WCDMA Radiofrequency Electromagnetic Fields on Memory Impairment in Alzheimer's Disease Mice

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Keywords: In vivo, RF/Microwaves, Completed (unpublished)

To investigate whether electromagnetic fields emitted by mobile phone effects on brain function, we evaluated memory function by behavioral test in Alzheimer's disease mice. Transgenic mice enhanced passive avoidance performance and alteration behavior (spatial working memory) by long term RF exposure (1.95 GHz, SAR 5W/kg, 2 hr/day for 8 months). Reduction of Amyloid- β (Ab) deposits in histopathological analysis correlated with behavior test. We concluded that RF exposure may have preventive effect against memory impairment in Alzheimer's disease mice.

PB-94 [11:30] - In vivo

Millimeter wave exposure induces cornea and lens epithelium damage

Masami Kojima¹, Cheng-Yu Tsai¹, Yukihisa Suzuki², Kensuke Sasaki³, Kanako Wake³, Soichi Watanabe³, Yoshitsugu Kamimura⁴, Akimasa Hirata⁵, Masao Taki², Kazuyuki Sasaki¹ & Hiroshi Sasaki¹

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Keywords: In vivo, RF/Microwaves, Work in Progress

International guideline for millimeter waves (MMW) pertain to the surface of biological tissues or organs. MMW effects on ocular tissues, especially inside the eye, remain unclear. Lens damage by 75 GHz MMW exposure was investigated in rabbit eye. Exposure to 75 GHz MMW induced not only corneal damage but also lens epithelial cell damage in rabbit eye. MMW absorbed by cornea caused heat transport to the crystalline lens.

PB-96 [11:30] - In vivo

Reactivity of different brain structures in response to magnetic and electromagnetic field of low intensity

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Keywords: In vivo, RF/Microwaves, Completed (published)

Rabbits was exposed by a magnetic field and electromagnetic field of low intensity with different parameters and conditions of exposure. Was made analysis of total and pulsed bioelectric activity of different brain regions of the rabbits. Result of analysis showed that brains regions has different influence for general reactions of the central nervous system.

PB-98 [11:30] - In vivo

Differential Effects of CW, FM and Pulsed EMF Signals in Model Biological Systems; the Role of Dosimetry

Lukas Margaritis¹, Areti Manta¹, Aikaterina Stefi^{1,2}, Rallou Selimou^{1,3}, Michael Fasseas⁴, Popi Syntichaki⁴, Anastasios Argyriou³, Giannis Giannarakis¹ & Kostas Kefalas²

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Keywords: In vivo, RF/Microwaves, Completed (unpublished)

We attempted to answer questions on the effects of EMFs created by wireless devices: a) what is the role of the selected biological system, b) which is the threshold in terms of dose, modulation, duration to initiate bioeffects, c) is the kind of pulse characteristics crucial to induce biomolecular changes compared to pure CW signals?, d) is the two-source or three-source exposure creating additive results? To answer these questions we used 1) ex vivo human sperm, 2) dipteran flies of the genus *Drosophila*, 3) nematodes *C. elegans*, 4) microcrystallization process of CaCO₃ saturated solution. EMF sources included cell phone, DECT base and handset, signal generator, Wi-Fi router and cell phone jammer.

PB-100 [11:30] - Human

Mobile Phone Exposure and Sleep in Children and Adolescents

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Keywords: Human, RF/Microwaves, Work in Progress

There are now numerous studies showing that radiofrequency electromagnetic fields (RF EMF), such as those emitted by mobile phones, affect the EEG during sleep and waking in adults. Despite this, whether this effect is also present in children and adolescents, and to what extent, remains to be investigated. Therefore, the current experiment aims to determine whether RF EMF exposure influences the EEG during sleep in children and adolescents, if the influence is similar to effects seen previously in adults, and whether a dose-response relationship exists.

PB-102 [11:30] - Mechanistic/Theoretical

Effects of Pulsed Magnetic Fields on neurons: a study on how the Cnp signal silences neuron model

Francesca Camera¹, Alex Thomas², Alessandra Paffi¹, Guglielmo d'Inzeo¹, Francesca Apollonio¹, Frank Prato² & Micaela Liberti¹

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

The Complex Neuroelectromagnetic Pulse (Cnp) is one of the most used pulsed magnetic signal specially designed to interact with the neurophysiology of biological systems, and has shown to be able to stop the activity of a slightly suprathreshold neuronal model. In this work, we want investigate about the causes of this effect, making a systematic analysis of the neural response and trying to figure out which characteristics of Cnp may be responsible for the attested effects.

PB-104 [11:30] - Occupational

The influence of different types of barrier creams on skin barrier function

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Keywords: Occupational, Static, Other

Barrier creams are used in the industry as a protective measure to prevent the penetration of harmful substances through the skin surface. Controversy exists about the frequency and adequate application of barrier creams on the skin and their effect on skin barrier function. Studies have reported differences in stratum corneum hydration and transepidermal water loss while others reported none. Numerous studies have reported skin surface pH differs significantly between Caucasian and African subjects. Aim: The aim of this study was to investigate the effects and the possibility of disadvantages of three different types of barrier creams on the skin barrier function.

PB-106 [11:30] - Occupational - STUDENT PAPER

A review of environmental data on where in the industrial and medical work environmental exposure to electromagnetic fields may be hazardous to users of active implantable medical devices (AIMD)

Wiesław Leszko¹, Jolanta Karpowicz¹, Patryk Zradziński¹ & Krzysztof Gryz¹

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Keywords: Occupational, RF/Microwaves, Work in Progress

The study was performed to identify the most common exposure situations in the industrial and medical work environments where AIMD EMF-related dysfunctions may be considered.

PB-108 [11:30] - Occupational

Influence of electromagnetic fields of mobile radio systems TETRA, GSM and UMTS on the behaviour of humans in different demand situations

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Keywords: Occupational, RF/Microwaves, Completed (published)

In five studies health risk and effects of radiofrequency fields on cognitive function and psychological basic activity during use of handsets of TETRA (range 400 MHz), GSM (range 900 MHz) and UMTS (range 2000 MHz) were assessed. Using generic antennas or/and modified handsets the members of carefully selected homogeneous samples of 20 to 30 years old male volunteers were exposed to the RF-field or a sham exposure (no field) according a crossover design. In double blind tests the subjects fulfilled computer-based visual demands as well as a test known as "autokinetic illusion" in a Faraday room. The investigations revealed no statistically significant differences ($p < 0.05$) between field exposures and sham conditions.

PB-110 [11:30] - Occupational

The use of antropometric data of human body and virtual body models to personalise assessment of SAR caused by exposure to radiofrequency fields

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Keywords: Occupational, RF/Microwaves, Work in Progress

Statistical relations between SAR in human body and its anthropometric dimensions were used to personalise RF EMF exposure assessments, especially desired for workers.

PB-112 [11:30] - Public Health Policy

Australian Centre for Electromagnetic Bioeffects Research (ACEBR)

Rodney Croft^{1,2}, John Finnie^{1,3}, Andrew Wood^{1,4}, Irene Yarovsky^{1,5}, Peter Blumbergs^{1,3}, Boris Martinac^{1,6}, Elena P. Ivanova^{1,7}, Robert Vink^{1,8}, Nigel Taylor^{1,9}, Mark Elwood^{1,10} & Sarah Loughran^{1,2}

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Keywords: Public Health Policy, RF/Microwaves, Work in Progress

The Australian Centre for Electromagnetic Bioeffects Research (ACEBR) was successful in gaining funding as an NHMRC Centre of Research Excellence. ACEBR will now embark on a 5-year research program to promote Australia's EME health through research, both in the immediate future, and through the development of human research capacity in this field into the future.

PB-114 [11:30] - Public Health Policy

New open-access journal 'Frontiers in Radiation and Health'

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Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

New open-access journal 'Frontiers in Radiation and Health', part of the *Frontiers in Public Health*, is published by the Swiss Frontiers and by the British Nature publishers.

PB-116 [11:30] - Public Health Policy

Crowdtasking – A Solution to Evaluate Workers Combined Exposure due to Multiple Sources

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Keywords: Public Health Policy, RF/Microwaves, Completed (unpublished)

In summer 2013 the EU-Directive 2013/35/EC on the exposure of workers to EMFs was released obligating employers to evaluate workplaces of their employees. The platform EMES makes such an evaluation for several environments like the crafting industry, medical or office workplaces possible. EMES is based on an exposure data repository and offers an interface allowing qualified experts to provide relevant data in order to extend the database. A crowd of experts would make it possible to share and combine all relevant exposure data all over Europe in order to ensure workers safety.

PB-118 [11:30] - Public Health Policy

Electric Field Coupling from an Overhead Power Line to a Large Refrigerated Truck – A Case Study And Safety Assessment

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Keywords: Public Health Policy, ELF/LF, Completed (unpublished)

Electric field coupling from a 400 kV overhead power line to a large delivery vehicle was evaluated to ensure the safety of persons coming in contact with the vehicle. A safety assessment based on a numerical model of a large vehicle underneath a power line was done and comparison with experimental results obtained from earlier measurements. The numerical model was extended to include the shape of the actual refrigerated vehicle and power line. The 5 mA “safe-let-go” current noted by the NESC and EPRI was used as reference. The induced voltage on the vehicle and current, that may flow through a person when touching the vehicle when parked parallel or perpendicular to the line, was also addressed.

PB-120 [11:30] - Public Health Policy
Recent Findings of Gazi Biophysics GNRK on RF

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Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

Gazi Biophysics is located in Ankara at the Medical Faculty of Gazi University and has been carrying out in vivo, in vitro and clinical research studies on the biological impacts of Static, Extremely Low Frequency (ELF) and Microwave (MW) electromagnetic fields (EMF) since 1989. Our laboratory includes: physicists, biologists, electrical engineers, all of whom are studying how living systems respond to EMF. Our research team includes physicists, biologists, electrical engineers, physicians, biochemists, pathologists and veterinarians.

PB-122 [11:30] - Public Health Policy
Estimation of Safe Height of Structures Surrounding Base Stations with respect to EMF Exposure Compliance Standards

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Keywords: Public Health Policy, RF/Microwaves, Concept

An attempt has been made to estimate the compliance height for the structures surrounding a Base Station (BTS) under the worst case conditions of EMR Exposure to General Public. Equivalent Isotropically Radiated Power Threshold is used as a basis for the estimation. The methodology and calculations are based on the ITU-T recommendation K.52 and K.61. For this, a hypothetical site located in an urban area is considered, which is radiating with maximum EIRP as per the limits defined by ICNIRP