

# **Joint Meeting of the Bioelectromagnetics Society and the European BioElectromagnetics Association**

**(BioEM2013)**

**Abstract Collection – Complete Collection**

**Thessaloniki, Greece  
10-14 June 2013**

**ISBN: 978-1-62748-901-0**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2013) by the Bioelectromagnetics Society  
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Bioelectromagnetics Society  
at the address below.

Bioelectromagnetics Society  
2414 Cobblestone Way  
Frederick, MD 21702-2626

Phone: (301) 663-4252  
Fax: (301) 694-4948

[www.bioelectromagnetics.org](http://www.bioelectromagnetics.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Technical Program

**June 10, 2013**

**Session: OC**  
**Opening Ceremony**  
**June 10, 2013 • 08:30 - 09:00**  
**A. Riadis**  
**Chairs: David Black & Lluís M. Mir**

**Session: P1**  
**Plenary Session 1: Therapeutic Applications: Electroporation, Electrochemotherapy, Electro Gene Transfer, and Low Frequency Magnetic Fields**  
**June 10, 2013 • 09:00 - 10:30**  
**A. Riadis**  
**Chairs: P. Thomas Vernier & Lluís M. Mir**

## **P1-1 [09:00]**

**Medical experience and perspectives in drug and gene electrotransfer ..... 5**

Julie Gehl<sup>1</sup>

<sup>1</sup>*Center for Experimental Drug and Gene Electrotransfer, Copenhagen University Hospital Herlev, Copenhagen, Denmark, 2730*

Brief electric pulses can cause transient permeabilisation of cell membranes, enabling delivery of drugs (e.g. chemotherapeutic agents, ions, isotopes), and/or DNA, RNA, and oligonucleotides to cells and tissues. This opens a plethora of new possibilities, some of which are already in clinical use. Thus, electrochemotherapy for treatment of cutaneous metastases is now standardly used in many clinical centers, and treatment of tumors in internal organs is in clinical trial. Gene therapy trials are ongoing.

## **P1-2 [09:30]**

**Electrochemotherapy - towards treatment of deep seated tumors ..... 5**

Damijan Miklavcic<sup>1</sup>

<sup>1</sup>*University of Ljubljana, Slovenia*

Electrochemotherapy is an efficient local treatment of solid tumors in which a combination of a chemotherapeutic drug and electric pulses is used. Drug's cytotoxicity with its intracellular target and membrane as barrier is greatly potentiated. In the past few years electrochemotherapy became standard treatment for tumors on the skin. Deep seated tumors can also be treated provided that the target tissue is exposed to sufficiently high electric field leading to cell membrane permeabilization.

## **P1-3 [10:00]**

**The specificity of modulation frequencies in the treatment of cancer with amplitude-modulated electromagnetic fields ..... 6**

Boris Pasche<sup>1</sup>

<sup>1</sup>*Department of Medicine, University of Alabama at Birmingham & UAB Comprehensive Cancer Center, Birmingham, AL, USA, 35294-3300*

To test the hypothesis that tumor-specific frequencies may block tumor growth, patients with a diagnosis of cancer were exposed to intrabuccally-administered electromagnetic fields, amplitude-modulated at frequencies identified in patients with the same tumor type. Long-lasting responses were observed and *in vitro* experiments show that the proliferation of cancer cells is decreased by the same frequencies.

**Session: FA**  
**Student Flash Poster Session A**  
**June 10, 2013 • 11:00 - 11:40**  
**A. Riadis**  
**Chair: Christopher Portier**

**FA-1 [11:00] - STUDENT PAPER**

**Are children more vulnerable than adults to RF? Different physiology, different vulnerabilities ..... 7**

Mary Redmayne<sup>1</sup>

<sup>1</sup>*School of Geography, Environment and Earth Sciences, Victoria University of Wellington, Wellington, New Zealand, 6012*

The difference in responses of young and old to RF exposure are more numerous and complex than those generally proffered. This paper explores relevant changes that occur physiologically from child to adulthood. These include development of the CNS/brain, alpha activity, melatonin levels, ear and skull thickness, dielectric tissue values, water and ions in tissues, weight, and size. It will then review research indicating age-dependent effects from RF exposure under the same conditions.

**FA-2 [11:03] - STUDENT PAPER**

**Analysis of gene expression modulation by exposure to low frequency (LF) electric fields ..... 7**

Tania Rescigno<sup>1</sup>, Mariella Caputo<sup>1</sup>, Hylde Zirpoli<sup>1</sup>, Maria Caterina De Rosa<sup>1</sup>, Francesco Chiadini, Antonio Scaglione, Claudia Stellato, Giorgio Giurato, Alessandro Weisz, Mario Felice Tecce<sup>1</sup> & Bruno Bisceglia

<sup>1</sup>*Department of Pharmacy, University of Salerno, Fisciano (SA), Italy, 84084*

We analyzed the effects on gene expression of capacitively coupled electric signals (60 kHz, burst 12.5 Hz), produced by an apparatus used in bone disease therapy, by microarrays technology in human SaOS-2 cell line. After a 24 h exposure only the expression of a small number of genes, mostly of transcription factors and DNA binding proteins, is affected. Since enzymatic variations can be observed earlier, we conclude that exposure affects only indirectly gene regulation mechanisms.

**FA-3 [11:06] - STUDENT PAPER**

**Whole-Body SAR Simulation of Growing Rodents Employing Anatomical and Homogeneous Voxel Models and Geometrical Structures ..... 7**

Thomas Fiedler<sup>1</sup>, Joachim Streckert<sup>2</sup>, Markus Clemens<sup>2</sup> & Stefan Dickmann<sup>1</sup>

<sup>1</sup>*Chair of Fundamentals of Electrical Engineering, Helmut Schmidt University, Hamburg, Germany, 22043*

<sup>2</sup>*Chair of Electromagnetic Theory, University of Wuppertal, Wuppertal, Germany, 45119*

In order to reduce simulation time, anatomical rat models are substituted by homogeneously filled models of rat or ellipsoidal shape. In the range from 1 to 30 g body mass, the absorbed power and SAR will be compared. It is shown that a time-saving worst-case assessment is possible with the ellipsoid models from 3 to 21 g with a maximum overexposure of 42%. With the homogeneous models of rat shape a worst-case assessment is achieved throughout the considered body mass range with a maximum overexposure of 22%.

**FA-4 [11:09] - STUDENT PAPER**

**An Ultra Broadband Measurement System for Electromagnetic Field Exposure Monitoring ..... 8**

Marco Zahner<sup>1</sup>, Patrick Leidenberger<sup>1</sup>, Fabian Schneider<sup>1</sup>, Philipp Bachmann<sup>1</sup> & Jürg Fröhlich<sup>1</sup>

<sup>1</sup>*Laboratory for Electromagnetic Fields and Microwave Electronics, D-ITET, ETH Zürich, Zurich, Switzerland, 8092*

A low frequency magnetic field meter is presented as part of a versatile smartphone based personal exposure assessment platform developed during the last years. The proposed magnetometer operates in the frequency range of 5 Hz up to 2 kHz and features a measurement range of 100 nT to 130  $\mu$ T. Time domain signal sampling enables an unprecedented level of flexibility for the analysis of the magnetic fields generated by electric power transfer and conversion systems.

**FA-5 [11:12] - STUDENT PAPER**

**Protective effects of traditional Chinese medicine Kangfuling against microwave-induced cognitive impairment through antioxidant ..... 8**

Rui-yun Peng<sup>1</sup>, Shao-hua Hu<sup>1</sup>, Guo-shan Yang<sup>2</sup> & Lin Wang<sup>3</sup>

<sup>1</sup>*Dept. of Experimental Pathology, Beijing Institute of Radiation Medicine, Beijing, China, 100850*

<sup>2</sup>*Division of Radiation Protection and Health Physics, Beijing Institute of Radiation Medicine, Beijing, China, 100850*

<sup>3</sup>*Department of Pharmaceutical Chemistry, Beijing Institute of Radiation Medicine, Beijing, China, 100850*

To evaluate the potential protective effects of a traditional Chinese medicine KFL on cognitive ability and oxidative stress induced by microwave. Behavioral parameters, histopathology, amino acid neurotransmitters level, and biochemical parameters in hippocampus were assessed at the end of the administration. We also examined free radical scavenging activity and antioxidant effect in PC12 cells induced by microwave of the extracts of KFL.

#### **FA-6 [11:15] - STUDENT PAPER**

##### **Wireless Device 10g SAR Calculation from 3D MRI Temperature Measurements ..... 8**

Leeor Alon<sup>1,2</sup>, Gene Y. Cho<sup>1,2</sup>, Daniel K. Sodickson<sup>1,2</sup> & Cem M. Deniz<sup>1,2</sup>

<sup>1</sup>*Department of Radiology, New York University, New York, NY, USA, 10016*

<sup>2</sup>*Sackler Institute of Graduate Biomedical Sciences, New York University School of Medicine, New York, NY, USA, 10016*

Deposition of RF energy can be quantified via local SAR and temperature-change measurements. MRI provides a tool to measure small temperature changes in phantoms being exposed to RF radiation. Conversion from temperature-change to SAR is nontrivial when heating duration is long, since the heat-diffusion effect is prominent. In this work, a method for 3D calculation of 10g SAR is shown via inversion of the heat equation using high-resolution 3D temperature maps and measured thermal properties.

#### **FA-7 [11:18] - STUDENT PAPER**

##### **Patient exposure in MRI environments ..... 9**

Henrik Sundström<sup>1</sup>, Kjell Hansson Mild<sup>1</sup> & Jonna Wilen<sup>1</sup>

<sup>1</sup>*Department of Radiation Sciences, Umeå University, Umeå, Sweden, S-90713*

During MRI procedures, patients are exposed to switched gradient magnetic fields as well as radiofrequency magnetic fields. The complex nature of both exposures makes it difficult to apply common methods such as rms values, spatial averaging etc. In this project the gradient field exposure has been evaluated by the use of dedicated measurement technique to understand the exposure in more detail. The aim is to assess if the gradient current, which is well defined and available, is a good proxy for the gradient field exposure.

#### **FA-8 [11:21] - STUDENT PAPER**

##### **Electromagnetic fields and cardiac pacemakers/ICDs – is there a risk of electromagnetic interference in occupational environment ..... 9**

Maria Tiikkaja<sup>1</sup>, Tommi Alanko<sup>1</sup>, Harri Lindholm<sup>1</sup> & Maila Hietanen<sup>1</sup>

<sup>1</sup>*Finnish Institute of Occupational Health, Helsinki, Finland*

This *in vivo*- study investigated electromagnetic interference (EMI) of pacemakers and implantable cardioverter-defibrillators (ICDs) with external electromagnetic fields (EMFs). Various common sources of EMFs were used to expose 35 volunteers bearing a pacemaker or an ICD. None of the pacemakers with bipolar programming and none of the ICDs experienced EMI in the exposure situations, whereas three pacemakers tested also with unipolar programming were seriously disturbed during the exposures.

#### **FA-9 [11:24] - STUDENT PAPER**

##### **Investigation of potential effects of ELF pulsed magnetic fields on the interaction of Calcium with proteins Calmodulin & STIM1 ..... 9**

Christian Beyer<sup>1</sup>, Jürg Fröhlich<sup>1</sup>, Marcel Egli<sup>2</sup> & Fabian Ille<sup>2</sup>

<sup>1</sup>*Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zürich, Zürich, Switzerland, 8092*

<sup>2</sup>*Center of Competence in Aerospace Biomedical Science and Technology, Lucerne University of applied Science and Arts, Lucerne, Switzerland, 6052*

This study addresses the possible effects of extremely low frequency pulsed magnetic fields (pMF) on potential target proteins in biological systems. A novel experimental exposure unit that can be directly placed into the measurement compartment of a circular dichroism spectrophotometer was used to investigate pMF induced conformational changes, altered protein folding kinetics as well as changes in the rate of calcium binding in solutions of highly purified Calmodulin (CaM) and STIM1.

#### **FA-10 [11:27] - STUDENT PAPER**

##### **Systems approach to study cellular responses to non-ionizing electro-magnetic fields ..... 9**

Arnold Kuzniar<sup>1</sup>, Berina Eppink<sup>1</sup>, Charlie Laffeber<sup>1</sup>, David Schuermann<sup>4</sup>, Manuel Murbach<sup>5</sup>, Mascha Schoonakker<sup>1</sup>, Alex Zelensky<sup>1</sup>, Jeroen Demmers<sup>2</sup>, Primo Schär<sup>4</sup> & Robert Kanaar<sup>3</sup>

<sup>1</sup>*Department of Genetics, Erasmus Medical Center, Rotterdam, the Netherlands, 3000 CA*

<sup>2</sup>*Proteomics Center, Erasmus Medical Center, Rotterdam, the Netherlands, 3000 CA*

<sup>3</sup>Department of Radiation Oncology, Erasmus Medical Center, Rotterdam, the Netherlands, 3000 CA

<sup>4</sup>Department of Biomedicine, University of Basel, Basel, Switzerland, 4058

<sup>5</sup>Foundation for Research on Information Technologies in Society, Swiss Federal Institute of Technology, Zürich, Switzerland, CH-8092

There is a public health concern about the influence of non-ionizing electromagnetic fields (EMFs), such as those produced by power lines, mobile or wireless devices, on the development of cancer. We are interested in whether exposure to EMFs can indirectly cause DNA damage. For this, we developed ultra-sensitive DNA damage detection systems based on a collection of mutant cell lines, as well as implemented a semi-quantitative proteomics approach coupled with bioinformatics analyses.

#### **FA-11 [11:30] - STUDENT PAPER**

**Ex vivo neutrophil extracellular trap (NET) formation during Low Frequency Electromagnetic Fields (LF-EMF) exposure .....**

Lieke Golbach<sup>1</sup>, Jan Cuppen<sup>2,3</sup>, Huub Savelkoul<sup>1</sup> & Lidy Verburg-van Kemenade<sup>1</sup>

<sup>1</sup>CBI, Wageningen University, the Netherlands

<sup>2</sup>Eindhoven University of Technology, the Netherlands

<sup>3</sup>Neiding BV, the Netherlands

Neutrophil extracellular traps (NETs) are extracellular DNA structures released by neutrophils upon infection. NETs contain antimicrobial proteins that capture and kill microbes. An *ex vivo* NET formation assay with human neutrophils indicates a yet unknown correlation between EMF and NETosis. LF-EMF (Immune, 300 µT) increased the amount of NET released by an unknown mechanism. We are currently investigating a possible interaction of LF-EMF with actin dynamics and ROS dependant NETosis

**Session: PA**  
**Plenary Poster Session A**  
**June 10, 2013 • 11:00 - 12:30**  
**Foyer**

**Session: 01**  
**Epidemiology I - ELF EMF**  
**June 10, 2013 • 14:00 - 16:00**  
**A. Riadis**  
**Chairs: Maria Feychting & Joachim Schuz**

**Session: 02**  
**Electroporation I - Mechanisms**  
**June 10, 2013 • 14:00 - 16:00**  
**M. Saltiel**  
**Chairs: Damijan Miklavcic & Francesca Apollonio**

#### **01-1 [14:00]**

**Mobile phone use and risk of brain neoplasms and other cancers: prospective study .....** 469

Victoria S Benson<sup>1</sup>, Kirstin Pirie<sup>1</sup>, Joachim Schuz<sup>2</sup>, Gillian K Reeves<sup>1</sup>, Valerie Beral<sup>1</sup> & Jane Green<sup>1</sup>

<sup>1</sup>Cancer Epidemiology Unit, University of Oxford, Oxford, UK

<sup>2</sup>International Agency for Research on Cancer (IARC), Section of Environment and Radiation, Lyon, France

The relation between mobile phone use and incidence of CNS tumours was examined in 791710 women in a UK prospective cohort. Risk among ever versus never users was not increased. Among long-term users of 10+ years, no association with the risk of glioma or meningioma was observed. For acoustic neuroma, there was an increase in risk with increasing duration of use. This prospective study weakens the evidence for glioma, but leaves open the possibility of an increased risk of acoustic neuroma.

#### **02-1 [14:00]**

**Molecular Mechanisms of Electroporation/Electropermeabilization: Evidence For a Chemical Modification of Membrane Phospholipids .....** 474

Marie Breton<sup>1,2,3</sup> & Lluís M. Mir<sup>1,2,3</sup>

<sup>1</sup>Laboratoire de Vectorologie et Thérapeutiques Anticancéreuses, UMR 8203, Université Paris-Sud, Orsay, France, F-91405

<sup>2</sup>Laboratoire de Vectorologie et Thérapeutiques Anticancéreuses, UMR 8203, CNRS, Orsay, France, F-91405

<sup>3</sup>Laboratoire de Vectorologie et Thérapeutiques Anticancéreuses, UMR 8203, Institut Gustave Roussy, Villejuif, France, F-94805

Many questions remain on the use of electrical pulses. Our group has proven the formation of pores in phospholipid bilayers during the application of nanopulses. However, these pores do not explain several observations. We investigated the effect of electric pulses on the chemistry of membranes. Thanks to microscopy and MS analyses, we demonstrated that pulses can induce chemical reactions. This result allows us to propose a new mechanism for the interaction of electric fields with membranes.

**01-2 [14:20]****Epidemiologic study of residential proximity to transmission lines and childhood cancer in California: Description of design, epidemiologic methods and study population..... 469**

Leeka Kheifets<sup>1</sup>, CM Crespi<sup>1</sup>, Chris Hooper<sup>1,4</sup>, Sona Oksuzyan<sup>1</sup>, Myles Cockburn<sup>3</sup>, Thomas Ly<sup>3</sup> & Gabor Mezei<sup>2</sup>

<sup>1</sup>*Epidemiology, UCLA, Los Angeles, USA, 90095*

<sup>2</sup>*EPRI, Palo Alto, USA, 94022*

<sup>3</sup>*Department of Preventive Medicine, University of Southern California, Los Angeles, USA*

<sup>4</sup>*Enertech Consultants, Campbell, USA*

We conducted a large epidemiologic case-control study in California to examine the association between childhood cancer risk and distance from the home address at birth to the nearest high voltage overhead transmission line as a replication of the study of Draper et al. in the United Kingdom. We present a detailed description of the study design, methods of case ascertainment, control selection, exposure assessment and data analysis plan.

**01-3 [14:40]****Novel Epidemiologic Approaches to Investigate the Magnetic Field—Childhood Leukaemia Association 46:**

Leeka Kheifets<sup>1</sup>, Gabor Mezei<sup>2</sup> & Madhuri Sudan<sup>1</sup>

<sup>1</sup>*Epidemiology, UCLA, Los Angeles, CA, USA, 95106*

<sup>2</sup>*EPRI, Palo Alto, CA, USA, 94022*

While existing epidemiological studies of childhood leukemia and magnetic field show a consistent association, most studies are case-control and subject to selection bias. Alternative is cohort study in which selection bias is less likely, but low incidence of disease and exposure would require an enormous study size rendering the cohort unfeasible. We present three innovative variations on a cohort design that can provide new information on the association between MF and childhood leukemia.

**01-4 [15:00]****The relationship between Extremely Low Frequency Electromagnetic Fields and mortality and cancer incidence 46;**

Tom Koeman<sup>1</sup>, Piet A. vandenBrandt<sup>2</sup>, Pauline Slottje<sup>1</sup>, Leo Schouten<sup>2</sup>, R. Alexandra Bausch-Goldbohm<sup>3</sup>, Anke Huss<sup>1</sup>, Hans Kromhout<sup>1</sup> & Roel Vermeulen<sup>1,4</sup>

<sup>1</sup>*Institute for Risk Assessment Sciences, Utrecht University, Utrecht, the Netherlands*

<sup>2</sup>*Department of Epidemiology, Maastricht University Medical Centre, Maastricht, the Netherlands*

<sup>3</sup>*Netherlands Organization for Applied Research (TNO), Leiden, the Netherlands*

<sup>4</sup>*Julius Centre for Public Health Sciences and Primary Care, University Medical Centre, Utrecht, the Netherlands*

**02-2 [14:20]****Impact of pulse accumulation on transmembrane voltage induced by pulsed electric field..... 475**

Aude Silve<sup>1</sup>, Ralf Straessner<sup>1</sup>, Sarah Rocke<sup>1</sup> & Wolfgang Frey<sup>1</sup>

<sup>1</sup>*Institut für Hochleistungsimpuls- und Mikrowellentechnik (IHM), Karlsruher Institut für Technologie (KIT), Eggenstein-Leopoldshafen, Germany, 76344*

Intense electric pulses are known to induce electroporation on biological membranes. It is well accepted that it is triggered by a modulation of the transmembrane voltage induced by the electric field. This work addresses the impact of repetition of pulses on transmembrane potential for pulses in the nanosecond and in the microsecond range. Measurements of the transmembrane voltage is based on the fluorescence emitted by a voltage sensitive dye, ANNINE-6, which incorporates in cells membrane.

**02-3 [14:40]****Sensitivity of Cells to Nanosecond Pulsed Electric Fields is Dependent on Membrane Cholesterol Content ..... 477**

Jody Ullery<sup>1,3</sup>, Hope Beier<sup>2</sup> & Bennett Ibey<sup>1</sup>

<sup>1</sup>*Air Force Research Laboratory, 711th Human Performance Wing, Radio Frequency Bioeffects Branch, Fort Sam H, San Antonio, TX, USA, 78234*

<sup>2</sup>*Air Force Research Laboratory, 711th Human Performance Wing, Optical Radiation Bioeffects Branch, Fort Sam, San Antonio, TX, USA, 78234*

<sup>3</sup>*General Dynamics Information Technology, Fort Sam Houston, San Antonio, TX, USA, 78234*

Previous work from our laboratory showed significant nanopore formation in the plasma membrane (PM) after exposure of cells to nanosecond pulsed electric fields (nsPEF). We hypothesize that the sensitivity of cells to nsPEF is dependent on the properties of the PM, including cholesterol content. Results show PM cholesterol depletion increases permeability of cells to small molecules at less intense electric fields, suggesting that PM cholesterol content is significant in the cellular response to nsPEF.

**02-4 [15:00]****Toward the physical mechanisms of nanopulse-induced pore formation combining Molecular Dynamics and a 3D electromagnetic tool ..... 478**

P. Thomas Vernier<sup>3,4</sup>, Sophie Kohler<sup>1</sup>, Ming-Chak Ho<sup>2,3</sup>, Zachary A. Levine<sup>2,3</sup>, Philippe Leveque<sup>1</sup> & Delia Arnaud-Cormos<sup>1</sup>

<sup>1</sup>*XLIM - UMR CNRS n°7252, University of Limoges, Limoges, France, 87060*

<sup>2</sup>*Department of Physics and Astronomy, Dornsife College of Letter, Arts, and Sciences, University of Southern California, Los Angeles, CA, USA*

<sup>3</sup>*Ming Hsieh Department of Electrical Engineering, Viterbi School of Engineering, University of Southern California, CA, USA*

We investigated the association between occupational exposure to extremely low frequency magnetic fields (ELF-MF) and selected causes of death and cancer incidence in the prospective Netherlands Cohort Study (NLCS). Acute myeloid leukaemia and follicular lymphoma showed some associations with ELF-MF exposure, while cardiovascular disease mortality, lung, brain and breast cancer incidence showed no statistically significant associations.

#### 01-5 [15:20]

##### **Occupational exposure to magnetic fields and electric shocks and risk of ALS – analysis of the Swiss National Cohort ..... 46;**

Anke Huss<sup>1,2</sup>, Adrian Spoerri<sup>2</sup>, Matthias Egger<sup>2</sup>, Hans Kromhout<sup>1</sup> & Roel Vermeulen<sup>1</sup>

<sup>1</sup>*Institute for Risk Assessment Sciences, Utrecht University, Utrecht, the Netherlands, 3508TD*

<sup>2</sup>*Institute for Social and Preventive Medicine, University of Bern, Bern, Switzerland, 3012*

We analysed the association of amyotrophic lateral sclerosis with occupational magnetic field exposure as well as risk of shocks in the Swiss National Cohort. We observed an association of long-term exposure to extremely low frequency magnetic fields and mortality from ALS, but not of risk of electric shocks and ALS.

#### 01-6 [15:40]

##### **Children's Exposure to Extremely Low Frequency Magnetic Fields: A personal exposure measurement study..... 472**

Benjamin Struchen<sup>1</sup>, Ilaria Liorni<sup>2,3</sup>, Marta Parazzini<sup>2</sup>, Stephanie Gängler<sup>1</sup>, Paolo Ravazzani<sup>2</sup> & Martin Roosli<sup>1</sup>

<sup>1</sup>*Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland, 4051*

<sup>2</sup>*Istituto di Ingegneria Biomedica (ISIB CNR), Consiglio Nazionale delle Ricerche (CNR), Milano, Italy, 20133*

<sup>3</sup>*Dipartimento di Elettronica, Informazione e Bioingegneria (DEIB), Politecnico di Milano, Milano, Italy, 20133*

This study measures exposure to extremely low frequency magnetic fields (ELF-MF) of 150 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 spot measurements, in order to learn more about the levels and temporal patterns of ELF-MF exposure of children in their daily lives.

<sup>4</sup>*Frank Reidy Research Center for Bioelectrics, Norfolk, VA, USA, 23508*

The general objective of this study is to contribute to a more complete model of the process of pore formation in cell membrane when a large external nanosecond electrical pulse is applied to the membrane. For this purpose we developed an electromagnetic tool that computes and maps 3D electrostatic profiles of potential, electric field and electric field gradient at the membrane, from the charge density obtained with molecular dynamics simulations. In this study, we show some preliminary results of the ongoing work.

#### 02-5 [15:20]

##### **Modeling Both Conducting and Permeable States of Cell Membrane Submitted to High Voltage Pulses ..... 47:**

Michael Leguebe<sup>1</sup>, Lluís M. Mir<sup>2</sup>, Clair Poignard<sup>1</sup> & Aude Silve<sup>3</sup>

<sup>1</sup>*Applied Mathematics, INRIA, Bordeaux, France, 5251*

<sup>2</sup>*Laboratoire de vectorologie et thérapeutiques anticancéreuses, CNRS & Institut Gustave Roussy, Villejuif, France*

<sup>3</sup>*Institute for Pulsed Power and Microwave technology, Karlsruhe Institute of Technology, Karlsruhe, Germany*

The paper aims at presenting a new model of cell electroporation, which describes separately the conducting state and the permeable state of the membrane. After the setting of the equations, numerical simulations are shown that corroborate qualitatively the experimental data dealing with the uptake of PI after millipulses. Forthcoming work will be to calibrate the parameters of the model for quantitative description of the uptake.

#### 02-6 [15:40] - STUDENT PAPER

##### **MD simulations of transient water pores produced by transmembrane ionic Charge Imbalance in cholesterol containing bilayers ..... 483**

Maura Casciola<sup>1,2</sup>, Daniel Bonhenry<sup>3</sup>, Micaela Liberti<sup>1</sup>, Francesca Apollonio<sup>1</sup> & Mounir Tarek<sup>3</sup>

<sup>1</sup>*ICEmB at DIET, "La Sapienza", University of Rome, Rome, Italy, 00184*

<sup>2</sup>*Istituto Italiano di Tecnologia, Genoa, Italy, 16163*

<sup>3</sup>*Théorie, Modélisation et Simulations, Université de Lorraine, Nancy, France, 54506 V*

We report a Molecular Dynamic (MD) study of the electroporation of a POPC (1-palmitoyl-2-oleoyl-sn-glycero-3-phosphatidylcholine) lipid bilayer containing cholesterol (Chol) in different molar concentrations. To obtain the transmembrane potential (TMP) needed to overcome the electroporation threshold, we have produced a displacement of charges that result in a charge imbalance across the membrane. Simulations show a different kinetic in the pore formation from what presented in previous studies of pure POPC bilayers.



**Session: 03**  
**RF EMF and effects on the nervous system (in vitro and in vivo)**  
**June 10, 2013 • 16:30 - 18:30**  
**A. Riadis**  
**Chairs: Heidi Danker-Hopfe & Maren Fedrowitz**

**03-1 [16:30] - STUDENT PAPER**

**The effects of electromagnetic fields on DNA damage in different cell types from nervous system ..... 487**

Liling Su<sup>1</sup>, Xinyuan Zhao<sup>1</sup>, Chuan Sun<sup>1</sup>, Guangdi Chen<sup>1</sup> & Zhengping Xu<sup>1</sup>

<sup>1</sup>*Bioelectromagnetics Laboratory, Zhejiang University School of Medicine, Hangzhou, China, 310058*

To determine whether EMF does induce DNA damage in cells from nervous system, primary cultured microglia cells and U251 cells were exposed to GSM 1800 MHz RF-EMF at SAR of 4.0 W/kg or 50 Hz MF at 2.0 mT, 1.0 mT for 1 h, 6h or 24 h, and then subjected to  $\gamma$ H2AX foci formation analysis. The results showed no significant difference of  $\gamma$ H2AX foci between the sham and EMF exposure groups in the examined cells.

Keywords: Electromagnetic fields; Magnetic field; Radiofrequency; DNA damage;  $\gamma$ -H2AX

**03-2 [16:50] - STUDENT PAPER**

**Effects of RF-EMF on apoptosis, AIF, P53, PARP-1 in SH-SY5Y and N9 cells ..... 488**

Anja Moeller<sup>1</sup>, Nadja Peduto<sup>1</sup>, Niels Kuster<sup>2,3</sup>, Manuel Murbach<sup>2,3</sup> & Meike Mevissen<sup>1</sup>

<sup>1</sup>*Division Veterinary Pharmacology and Toxicology, University of Berne, Berne, Switzerland*

<sup>2</sup>*IT'IS Foundation for Research on Information Technologies in Society, Zurich, Switzerland*

<sup>3</sup>*Swiss Federal Institute of Technology (ETH), Zürich, Switzerland*

Effects on stress response including apoptosis were investigated in human neuroblastoma cells (SH-SY5Y) and murine microglia cells (N9) at different exposure times. An increase in apoptosis was seen in RF EMF-exposed both cell lines. Preliminary results indicated an increase in p53 and PARP-1 and an elevated AIF expression in the nuclear fraction of RF EMF-exposed N9 cells after 21 hrs. Currently we investigate the effects of RF EMF on oxidative stress and autophagy.

**03-3 [17:10]**

**Assessment of resting electroencephalogram under radio frequency exposure: a human controlled study 489**

Rania Ghosn<sup>1,2</sup>, György Thuroczky<sup>3</sup>, Rene De Seze<sup>1,2</sup> & Brahim Selmaoui<sup>1,2</sup>

<sup>1</sup>*Department of Toxicology, INERIS, Verneuil en Halatte, France, 60550*

<sup>2</sup>*Péritox Laboratoire de Périnatalité & Risques, EA 4285-UMI 01 Unité Mixte INERIS, University of Picardie Jules Verne (UPJV), Amiens, France, 80036*

<sup>3</sup>*Department of Non-Ionising Radiation, National Research*

**Session: 04**  
**Public Exposures & Standardisation**  
**June 10, 2013 • 16:30 - 18:30**  
**M. Saltiel**  
**Chairs: Theodoros Samaras & Nam Kim**

**04-1 [16:30]**

**The role of skin conductivity in exposure assessment for peripheral nerve tissue according to the ICNIRP 2010 guidelines ..... 49:**

Gernot Schmid<sup>1</sup>, Stefan Cecil<sup>1</sup> & Richard Überbacher<sup>1</sup>

<sup>1</sup>*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444*

Based on numerical computations the importance of skin conductivity in numerical exposure assessment concerning peripheral nerve (PNS) tissue according to the ICNIRP 2010 guidelines is demonstrated. Skin conductivity values as obtainable from the most widely used parametric tissue property data base (Gabriel et al 1996) are demonstrated to be not suitable in this context.

**04-2 [16:50]**

**Study of the influence of a CTIA hand phantom on the specific absorption rate measurements of mobile phones ..... 4: 3**

Vikass Monebhurrn<sup>1</sup>

<sup>1</sup>*Department of Electromagnetics, SUPELEC, Gif-sur-Yvette, France, 91192*

The morphology of the specific anthropomorphic mannequin ensures that the measured specific absorption rate (SAR) is conservative without a hand phantom to hold the mobile phone during the measurement. Some recent reports show that the presence of the hand could eventually lead to a higher SAR value for some rare cases. A CTIA hand phantom is used to investigate the influence of the hand on the SAR of a few mobile phones. Overall the presence of the CTIA hand phantom leads to a less conservative SAR value.

**04-3 [17:10]**

**Improved Estimation of SAR in the Head of Mobile Phone Users Due to the Hand ..... 4: 5**

Mark Douglas<sup>1</sup>, Cecile Bachmann<sup>3</sup>, Adrian Aeschbacher<sup>3</sup>, Anastasija Ichsanow<sup>3</sup> & Niels Kuster<sup>1,2</sup>

<sup>1</sup>*Foundation for Research on Information Technologies in Society, Zurich, Switzerland, 8802*

<sup>2</sup>*Swiss Federal Institute of Technology (ETH), Zurich, Switzerland, 8802*

<sup>3</sup>*Schmid & Partner Engineering AG, Zurich, Switzerland, 8802*

*Institute for Radiobiology and Radio-hygiene, Budapest, Hungary*

The aim of this study was to examine the possible effect of exposure to radiofrequency electromagnetic field (RF EMF) GSM 900 MHz, on brain electrical activity. 30 healthy volunteers aged 18-35 years underwent two experimental sessions in which one session served as control and second one as exposure session. Subjects were exposed to mobile phone signals at intensity of 0.49 W/kg. In each session, waking EEG was recorded before, during and after an exposure period. Completed data will be presented at the meeting.

#### **03-4 [17:30]**

**The alteration of spontaneous low frequency oscillations by LTE electromagnetic fields exposure** ..... 48:

Bin Lv<sup>1</sup>, Tongning Wu<sup>1</sup>, Lei Yang<sup>1</sup> & Zhiye Chen<sup>2</sup>

<sup>1</sup>*China Academy of Telecommunication, Research of Ministry of Industry and Information Technology, Beijing, China, 100191*

<sup>2</sup>*Department of Radiology, PLA General Hospital, Beijing, China, 100853*

We studied the effect of LTE electromagnetic fields exposure to the alteration of regional resting state brain activity with 18 subjects. The resting state fMRI was collected pre/post- exposure. The amplitude of low frequency fluctuation (ALFF) was measured for the exposed and the sham groups. This value was decreased for the exposed group whilst remained stable for the shams. The result indicated that the spontaneous low frequency oscillations in brain were altered by this kind of exposure.

#### **03-5 [17:50] - STUDENT PAPER**

**Activity of neuronal networks exposed to the GSM-1800 signal** ..... 494

Daniela Moretti<sup>1</sup>, André Garenne<sup>2,3</sup>, Florence Poulletier De Gannes<sup>1</sup>, Emmanuelle Haro<sup>1</sup>, Isabelle Lagroye<sup>1</sup>, Bernard Veyret<sup>1</sup> & Noëlle Lewis<sup>1</sup>

<sup>1</sup>*IMS Laboratory, UMR 5218, Talence, France, 33400*

<sup>2</sup>*IMN laboratory, UMR 5293, Bordeaux, France, 33000*

<sup>3</sup>*Bioelectromagnetics Laboratory, EPHE, Talence, France, 33400*

There are suggestions that neuronal networks may be the target of RF. Rat primary neurons (N=16) were cultured and exposed for 3 min in a TEM cell (GSM-1800; 3.2 W/Kg; 0.06° C, ΔT over 3 min) in MEAs (MultiElectrode Arrays). There was a phasic and reversible 30% decrease in mean firing rate and bursting rate during exposure. Feasibility of this approach was thus demonstrated in terms of exposure setup, culture of the neuronal networks, recording under RF exposure and analysis of signals.

#### **03-6 [18:10]**

**Evaluation of 60 Hz MF effects thresholds on the EEG using biophysical modelling** ..... 497

Julien Modolo<sup>1,2,3</sup>, Alex Thomas<sup>1,2,3</sup> & Alexandre Legros<sup>1,2,3,4</sup>

<sup>1</sup>*Human Threshold Research Group, Lawson Health Research Institute, London, ON, Canada, N6A4V2*

The influence of the user's hand holding a mobile phone on the peak spatial-average Specific Absorption Rate (psSAR) in the head is analyzed in a volunteer study. The results of 14 adult volunteers and 27 mobile phone models show that the SAR in a head phantom is sensitive to the finger location and palm distance, and it can be significantly underestimated by measurements made without a hand. A practical measurement procedure using standardized hand phantoms is proposed to reduce the underestimation.

#### **04-4 [17:30] - STUDENT PAPER**

**Numerical analysis of specific absorption rate in the human head due to a 13.56 MHz RFID-based intra-ocular pressure measurement** ..... 4: 8

Rene Hirtl<sup>1,2</sup> & Gernot Schmid<sup>1,2</sup>

<sup>1</sup>*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

<sup>2</sup>*University of Applied Sciences, Technikum Wien, Vienna, Austria, 1200*

A numerical FDTD-based assessment of SAR inside the head and the eye, due to localized magnetic field exposure caused by the reader antenna of the inductively coupled transmission system was carried out using a high resolution eye model. For common reader antenna currents, induced SAR in the head was well below the ICNIRP basic restrictions and SAR inside the eye was substantially below levels which have been reported to be critical with respect to thermally induced adverse effects.

#### **04-5 [17:50]**

**Development of Test Conditions for Ultra-Wide Mobile Phones: a Grip Study for Talk Mode** ..... 4; 2

Anastasija Ichsanow<sup>1</sup>, Erdem Ofli<sup>1</sup>, Dominik Szczerba<sup>2</sup> & Niels Kuster<sup>2,3</sup>

<sup>1</sup>*Schmid & Partner Engineering AG, Switzerland*

<sup>2</sup>*Foundation for Research on Information Technologies in Society, Switzerland*

<sup>3</sup>*Swiss Federal Institute of Technology (ETH), Zurich, Switzerland*

Standardized over-the-air (OTA) test conditions have been defined for any kind of mobiles with a width up to 72 mm. However, a variety of wider phones have been marketed in the meantime. To close this gap, a human factor study has been performed with a sample population of 40 subjects. One dominating handgrip is identified that shows strong correlations of finger locations within a range of 74 – 92 mm. A 3D model has been derived and is currently being evaluated with respect to OTA performance.

#### **04-6 [18:10]**

**Preliminary SAR simulation is highest for smallest volumes, youngest age groups, and highest dielectric constant** ..... 4; 5

Claudio Fernández<sup>1</sup>, Alvaro de Salles<sup>2</sup> & Devra Davis<sup>3</sup>

<sup>1</sup>*Instituto Federal de Educação, IFRS, Canoas, Brazil*

<sup>2</sup>*UFRGS, P. Alegre, Brazil*

<sup>2</sup>Department of Medical Biophysics, Western University,  
London, ON, Canada

<sup>3</sup>Department of Medical Imaging, Western University,  
London, ON, Canada

<sup>4</sup>School of Kinesiology, Western University, London, ON,  
Canada

**OBJECTIVE:** To evaluate, using a mathematical model of brain activity, the MF flux density at 60 Hz that should result in reproducible human EEG modulation.

**METHODS:** We have developed a mathematical model of cortical activity during 60 Hz MF exposure.

**RESULTS:** MF exposure resulting in a membrane depolarization between 250 and 500 microV should decrease EEG alpha (8-12 Hz) activity.

**CONCLUSION:** Novel perspectives to identify interaction mechanism of 60 Hz MF exposure are proposed.

<sup>3</sup>Research Section, Environmental Health Trust, Teton  
Village, WY, USA, 83025

Standards for cellphones are based on the Standard Anthropomorphic Mannequin (SAM) that employs a phantom head size taken from the 90th percentile of U.S. military recruits in 1989. In the 5 situations simulated with SEMCAD X software, the average SAR over 10 grams had a value substantially lower compared to those simulated in smaller volumes (or weights). During the preliminary simulation for the 6 years old child it was observed that 10 g SAR is around 10 times lower than 1 mg SAR.

**Session: W1**  
**Workshop 1: Clinical advances in cancer therapy using electromagnetic fields**  
**June 10, 2013 • 18:30 - 20:00**  
**A. Riadis**  
**Chair: Richard Nuccitelli**

**W1-1 [18:30]**

**Clinical electroporation: results in cancer treatment and perspectives for use ..... 4; 8**

Ruggero Cadossi<sup>1</sup> & Mattia Ronchetti<sup>1</sup>

<sup>1</sup>IGEA, Carpi, Italy

Electroporation therapies have been successfully introduced in clinical practice. The most frequent application of electroporation is electrochemotherapy (ECT). ECT combines cell membrane electroporation with chemotherapeutic drugs. Over 70% of the nodules being in complete response following ECT. Recently the technology was used to treat tumour metastases located deep into the body. Electroporation can be used to electrotransfer genetic material (EGT) into the cell. The results of wide clinical experiences and the perspectives for use of the technology will be discussed.

**W1-2 [19:00]**

**Clinical progress in the use of irreversible electroporation for cancer therapy ..... 4; 8**

Paulo Garcia<sup>1</sup>, Christopher B. Arena<sup>1</sup>, John H. Rossmeisl, Jr.<sup>1,2</sup> & Rafael Davalos<sup>1</sup>

<sup>1</sup>Biomedical Engineering, Virginia Tech, Wake Forest University, Blacksburg, VA, USA

<sup>2</sup>Department of Small Animal Clinical Sciences, Virginia-Maryland College of Veterinary Medicine, Blacksburg, VA, USA

Irreversible electroporation (IRE) is a new, safe, and effective minimally invasive ablation modality with the potential to treat many currently unresectable and/or untreatable tumors. The non-thermal mode of cell death allows for successful treatment even in close proximity to critical structures and without being affected by the heat sink effect. We present promising results of IRE treatments from our translational research in canine patients and from clinical studies in human patients.

## June 11, 2013

**Session: T1**  
**Tutorial 1: Systems Biology relating to EMF Exposure**  
**June 11, 2013 • 08:30 - 09:30**  
**A. Riadis**  
**Chairs: Meike Mevissen & Jukka Juutilainen**

**T1-1 [08:30]**

**The Concept and the Goal of Systems Biology in EMF Research ..... 524**

Myrtill Simko<sup>1</sup>

<sup>1</sup>Institute of Technology Assessment, Austrian Academy of Sciences, Vienna, Austria, 1030

Systems biology is an approach that considers biology as an information science. It studies biological systems in a holistic manner and their interactions with the environment, it studies biological systems and processes in dynamic and integrated networks. This tutorial gives an overview about the possibility to employ systems biology in EMF research although both disciplines face the same difficulty namely the lack of using experimental standards.

**T1-2 [09:00]**

**Systems biology and its use in environmental health research ..... 524**

Christopher Portier<sup>1, 2, 3</sup>

<sup>1</sup>*National Center for Environmental Health, Atlanta, GA, USA*

<sup>2</sup>*Agency for Toxic Substances and Disease Registry, Atlanta, GA, USA*

<sup>3</sup>*Centers for Disease Control and Prevention, Atlanta, GA, USA*

Environmental health research (EHR) relied on in-vivo, in-vitro and ex-vivo toxicology studies and epidemiology studies of exposed human populations. This paradigm, built in the 60's, served EHR well. New techniques in molecular biology and epidemiology have opened exciting avenues for EHR. This tutorial reviews progress in systems biology and EHR. We discuss types of studies being done, the complex analytical techniques for evaluating data and the insights being gained from the research.

**Session: P2**

**Plenary Session 2: Thermal and non-Thermal Mechanisms**

**June 11, 2013 • 09:30 - 10:30**

**A. Riadis**

**Chairs: Gerard van Rhoon & Carmela Marino**

**P2-1 [09:30]**

**The role of modulation in the biological effects of RF fields ..... 525**

Jukka Juutilainen<sup>1</sup>, Hiie Hinrikus<sup>2</sup>, Anne Hoyto<sup>1</sup> & Jonne Naarala<sup>1</sup>

<sup>1</sup>*Department of Environmental Science, University of Eastern Finland, Kuopio, Finland, 70211*

<sup>2</sup>*Department of Biomedical Engineering, Tallinn University of Technology, Tallinn, Estonia*

Possible existence of modulation-dependent biological effects of weak radiofrequency (RF) electromagnetic fields have been debated for decades. This presentation reports the findings of a review on such effects. Although the majority of the studies were negative, a limited number of studies indicated that the human central nervous system might be specifically affected by pulse-modulated RF fields. Possible mechanisms for modulation-specific effects will be discussed.

**P2-2 [10:00]**

**Heating biological tissues: mechanisms and thresholds of thermal effects and damage ..... 526**

Pavel Yarmolenko<sup>1, 2</sup>, Eui Jung Moon<sup>3, 4</sup>, Chelsea Landon<sup>3, 5</sup>, Ashley van Heteren<sup>5, 6</sup>, Daryl W. Hochman<sup>7</sup>, Benjamin L. Viglianti<sup>8</sup> & Mark W. Dewhirst<sup>3, 5</sup>

<sup>1</sup>*Department of Biomedical Engineering, Duke University, Durham, NC, USA*

<sup>2</sup>*Center for Interventional Oncology, Radiology and Imaging Sciences, Clinical Center, National Institutes of Health, Bethesda, MD, USA*

<sup>3</sup>*Department of Pathology, Duke University, Durham, NC, USA*

<sup>4</sup>*Department of Radiation Oncology, Stanford University, Stanford, CA, USA*

<sup>5</sup>*Department of Radiation Oncology, Duke University, Durham, NC, USA*

<sup>6</sup>*Medical Physics Program, Duke University, Durham, NC, USA*

<sup>7</sup>*Department of Surgery, Duke University, Durham, NC, USA*

<sup>8</sup>*Department of Radiology, University of Michigan, Ann Arbor, MI, USA*

Biological effects of heat range across all possible size scales - from cellular mechanisms to local vascular effects and changes in intercellular communication, to whole-body responses. Principles of thermal dosimetry may be applied to available data on biological effects of heat to balance risks of heat exposure with diagnostic and therapeutic benefits. We review published data, discuss the current state of understanding of biological effects of heat and suggest directions for future study.

**Session: 05**  
**In vitro studies**  
**June 11, 2013 • 11:00 - 12:40**  
**A. Riadis**  
**Chairs: Isabelle Lagroye & Zhengping Yu**

**05-1 [11:00]**

**Induction of Adaptive Response in Human Lymphocytes pre-Exposed to Radiofrequency Fields and challenged with Ionizing Radiation ..... 527**

Anna Sannino<sup>1</sup>, Olga Zeni<sup>1</sup>, Stefania Romeo<sup>1</sup>, Rita Massa<sup>1,2</sup>, Giancarlo Gialanella<sup>2</sup>, Gianfranco Grossi<sup>2</sup>, Lorenzo Manti<sup>2</sup>, Vijayalaxmi<sup>3</sup> & Maria Scarfi<sup>1</sup>

<sup>1</sup>CNR, Naples, Italy, 80131

<sup>2</sup>INFN, Section of Naples, University of Naples Federico II, Naples, Italy, 80131

<sup>3</sup>Radiology, University of San Antonio, San Antonio, TX, USA, TX 78229

In this study, we have pre-exposed human peripheral blood lymphocytes to non-ionizing radiofrequency fields (RF, 1950 MHz, UMTS signal, at 0.3 W/kg SAR) and then challenged them with ionizing radiation to examine the induction of adaptive response (AR). The results showed that 20 hours of pre-exposure of the cells to RF resulted in a significant reduction in the frequency of micronuclei induced by 1.0 and 1.5 Gy x-rays. Thus, the data indicated RF-induced AR.

**05-2 [11:20]**

**ELF effects on Parkinson's Disease in vitro models 529**

Barbara Benassi<sup>1</sup>, Claudia Consales<sup>1</sup>, Caterina Merla<sup>1</sup>, Rosanna Pinto<sup>1</sup>, Vanni Lopresto<sup>1</sup>, Giuseppe Filomeni<sup>1</sup> & Carmela Marino<sup>1</sup>

<sup>1</sup>ENEA: Italian National Agency for new Technologies, Energy and Sustainable, Italy

Aim: to investigate the possible effects of 50Hz (1mT) exposure on neuroblastoma cell line SH-SY5Y treated with the neurotoxic drug MPP+, the active metabolite of the neurotoxin MPTP.

Results: No effect of ELF exposure on cell death and oxidative stress induced by MPP+ when magnetic fields and the neurotoxin are simultaneously administered or the drug is dispensed before ELF exposure.

Additive effect on cell death and oxidative stress induced by MPP+ when cells are pre exposed to ELF.

**05-3 [11:40] - STUDENT PAPER**

**Differences in thermal characteristics of protein  $\beta$ -lactoglobulin exposed to RF electromagnetic fields 52:**

Christian Beyer<sup>1</sup> & Jürg Fröhlich<sup>1</sup>

<sup>1</sup>Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zürich, Zürich, Switzerland, 8092

This mechanism-oriented study addresses the potential effects of radio frequency electromagnetic fields (RF-EMF) on the conformational state and folding kinetics of  $\beta$ -lactoglobulin. Measurement results of different hypothesis driven protocols are shown using an EMF exposure setup, where the point of observation becomes identical with the potential EMF interaction site in space and time. The

**Session: 06**  
**Occupational and medical measurements**  
**June 11, 2013 • 11:00 - 12:40**  
**M. Saltiel**  
**Chairs: Jonna Wilen & Myles Capstick**

**06-1 [11:00]**

**The weighted-peak method in time and frequency domain: an operative application to the analysis on MRI gradient signals ..... 539**

Rosanna Pinto<sup>1</sup>, Nicola Zoppetti<sup>2</sup>, Caterina Merla<sup>1</sup>, Rossella Lodato<sup>1</sup>, Rosaria Falsaperla<sup>3</sup>, Vanni Lopresto<sup>1</sup>, Gian Marco Contessa<sup>3</sup> & Daniele Andreuccetti<sup>2</sup>

<sup>1</sup>UT BIORAD, ENEA Casaccia Research Centre, Rome, Italy, 00123

<sup>2</sup>IFAC, CNR, Florence, Italy, 50019

<sup>3</sup>INAIL, Rome, Italy, 00040

Occupational exposure to switched gradient magnetic fields was evaluated near 1.5 and a 3 T total body MRI scanners. Data were analysed according to the weighted-peak method in time and frequency domains. Generally, a good agreement between the two approaches was found. However, some differences were evidenced for input sequences with a prevalent spectral content in proximity of the ICNIRP filter knees, suggesting the need of a critical analysis on the guidelines' exposure assessment criteria.

**06-2 [11:20]**

**Static magnetic field exposure on magnetic resonance workers - inter-jobs variability between radiographers and nurses ..... 542**

Jolanta Karpowicz<sup>1</sup> & Krzysztof Gryz<sup>1</sup>

<sup>1</sup>Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Czerniakowska 16, Poland, PL-00-701

Radiographers and nurses SMF exposure was examined to analyze if both jobs are equal in the sense of occupational exposure. When nurses assist to radiographer by each patient, nurses' SMF exposure may be comparable to MRI technicians exposure or even higher. In the case of nurses involved only in contrast administration to a small number of MRI patients per day – they SMF exposure is much lower than the exposure to which radiographers are subjected.

**06-3 [11:40]**

**An assessment of limb current in surgeons and nurses using electro-surgical units ..... 544**

Jolanta Karpowicz<sup>1</sup>, Krzysztof Gryz<sup>1</sup>, Wiesław Leszko<sup>1</sup> & Patryk Zradziński<sup>1</sup>

<sup>1</sup>Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Czerniakowska 16, Poland, PL-00-701

The exposure of healthcare workers, surgeons and nurses to EMF from 268 electro-surgical units (ESUs) operated in CUT mode, has been studied using limb current measurements. Measured values of upper limb current

applied protocols allow to distinguish between thermal and non-thermal effects of EMF.

**05-4 [12:00] - STUDENT PAPER**  
**2 mT Extremely Low Frequency Magnetic Fields Could Induce cellular Autophagy in Mouse Embryonic Fibroblasts(MEFs) ..... 533**

Yanfeng Chen<sup>1</sup>, Ying Zeng<sup>1</sup>, Shen Yunyun<sup>1</sup>, Zhengping Xu<sup>1</sup> & Qunli Zeng<sup>1</sup>

<sup>1</sup>*School of Medicine, Bioelectromagnetics Laboratory, Hangzhou, China, 310058*

ELF-MFs exposure is known to increase the risk of cancer and neurodegenerative diseases which autophagy is related to, cellular autophagy may change after exposure to ELF-MFs. When the cells were exposed to 2mT ELF-MFs for 6h, we found the formation of autophagic vacuoles under TEM. In GFP-LC3 expressing MEFs, ELF-MFs stimulated the generation of GFP-LC3 positive puncta. There is an increase of the autophagic marker in cells exposure to ELF-MFs. Our data suggest that ELF-MFs exposure may induce cellular autophagy in MEFs.

**05-5 [12:20]**  
**WITHDRAWN**

were in the range (min-max/median values): 1-58/4 mA in the case of grasping the active electrode handle, and 1-100/5 mA in grasping the cable supplying electrode. Statistically significant differences were found between the old-fashioned and the modern subsets of investigated ESUs.

**06-4 [12:00]**  
**Method for assessing magnetic fields from welding against the coming EU directive ..... 546**

Yngve Hamnerius<sup>2</sup>, Tomas Nilsson<sup>2</sup> & Kjell Attback<sup>1</sup>

<sup>1</sup>*Support and Services, Saab AB, Ostersund, Sweden, SE-83125*

<sup>2</sup>*Signals & Systems, Chalmers University of Technology, Goteborg, Sweden, SE-41296*

Complex magnetic field can be assessed against the EU directive limits using weighting filters. The evaluation is performed in the time domain, which allows for arbitrary signal waveforms and can be applied for both action levels and exposure limit values. With this method the number of simulations required to calculate the induced electric field strength can be reduced for complex signals.

**06-5 [12:20]**  
**Exposure of Woman Models at Different Stages of Pregnancy to Uniform Magnetic Fields at 50 Hz ..... 548**

Ilaria Liorni<sup>1,2</sup>, Marta Parazzini<sup>2</sup>, Serena Fiocchi<sup>2</sup>, Valerio De Santis<sup>3</sup>, Mark Douglas<sup>3</sup>, Marie-Christine Gosselin<sup>3,4</sup>, Niels Kuster<sup>3,4</sup> & Paolo Ravazzani<sup>2</sup>

<sup>1</sup>*Dipartimento Elettronica, Informazione e Bioingegneria DEIB, Politecnico di Milano, Milano, Italy, 20133*

<sup>2</sup>*Istituto di Ingegneria Biomedica ISIB, CNR Consiglio Nazionale delle Ricerche, Milano, Italy, 20133*

<sup>3</sup>*Foundation for Research on Information Technologies in Society, IT'IS Foundation, Zurich, Switzerland, 8004*

<sup>4</sup>*Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland, 8092*

Extremely low frequency magnetic fields (ELF-MF) have been considered as a possible risk factor for childhood leukemia. In this study fetal exposure assessment to differently polarized uniform magnetic fields at 50 Hz is carried out. The computation was performed on pregnant woman high resolution numerical models at 3, 7 and 9 months of Gestational Age (GA). Fetal whole-body and tissue-specific induced electric fields are analyzed as a function of both incident ELF-MF polarization and GA.

**Session: M2**  
**EBEA General Assembly**  
**June 11, 2013 • 12:40 - 14:00**  
**M. Saltiel 1**

**Session: F1**  
**Topic in focus: National programs and European action**  
**June 11, 2013 • 14:00 - 16:00**  
**A. Riadis**  
**Chairs: Paolo Ravazzani & Joachim Schuz**

**F1-1 [14:00]**

**Results from the Dutch EMF Programme (2007-2013) ..... 553**

Fred Woudenberg<sup>1</sup>

<sup>1</sup>*Department of Environment, Municipal Health Service Amsterdam, the Netherlands*

In 2006 Dutch government launched a € 16,6 million research programme on EMF & Health. The aim is to enhance the knowledge infrastructure in The Netherlands, to contribute to the international research effort and to help clarify possible health effects. To date three chairs, 48 projects and the work of 45 staff members (29,8 fte.) at ten institutes and universities have been granted. It sprung 54 national and international collaborations. More information: [www.zonmw.nl/emf](http://www.zonmw.nl/emf)

**F1-2 [14:40]**

**Highlights in EMF Health Risk Research – Monte Verità Revisited ..... 553**

Maren Fedrowitz<sup>1</sup>

<sup>1</sup>*Department of Pharmacology, Toxicology, and Pharmacy, University of Veterinary Medicine, Hanover, Germany, 30559*

In October, 2012, the second Monte Verità workshop was convened to substantiate effects and identify interaction mechanisms of weak EMF, without regard to any impact on potential health hazards. Essential investigations and new approaches were introduced and discussed. This presentation will focus on the most exciting issues concerning the EMF impact on genome stability, brain physiology, neurodegenerative diseases, therapeutic EMF applications, and recommendations for future EMF research.

**F1-3 [15:20]**

**SCENIHR Opinions on Potential Health Effects of Exposure to Electromagnetic fields (EMF) ..... 554**

Mats-Olof Mattsson<sup>1</sup>

<sup>1</sup>*Department Health & Environment, AIT Austrian institute of Technology, Tulln, Austria, A-3430*

Possible health effects of exposure to electromagnetic fields are assessed by expert committees that take scientific studies into account. One such expert committee is the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). SCENIHR has so far published three opinions on electromagnetic fields. A fourth opinion is in preparation and will likely be adopted for public consultation in June 2013.

**Session: W2**

**Workshop 2: Comparison of RF absorption in heads of children and adults due to mobile phone exposures**

**June 11, 2013 • 16:30 - 18:00**

**A. Riadis**

**Chairs: C. K. Chou & Kenneth Foster**

**W2-1 [16:30]**

**WS2: COMPARISON OF RF ABSORPTION IN HEADS OF CHILDREN AND ADULTS DUE TO MOBILE PHONE EXPOSURES ..... 556**

C. K. Chou<sup>1</sup>

<sup>1</sup>*Motorola Solutions, Inc., Fort Lauderdale, FL, USA, 33322*

This workshop brings researchers with experience in this field to review the studies up to date and compare their results. A panel will interact with researchers in the audience to discuss the RF exposure differences and conclude whether there are significant differences in SAR or penetration depth in children compared to adults and to discuss whether the SAM phantom is conservative for compliance assessments, especially for children.

**W2-2 [16:35]**

**Workshop 2: Comparison of RF Absorption in Heads of Children and Adults due to Mobile Phone Exposure ..... 556**

L. Lloyd Morgan<sup>1</sup>

<sup>1</sup>*Environmental Health Trust, Teton Village, WY, USA, 83025*

The history of exposure limits from 1966 to the current United States exposure limits, studies documenting that children absorb more radiation than adults, exposure “hot spots”—particularly in children, a comparison of 2 dosimetry methodologies, the inverse risk by age of childhood cancers, brain tumor latency time distribution information, and conclusions will be presented.

#### **W2-3 [16:45]**

#### **Absorption of Cell Phone Radiation Considering Anatomical Differences between Adults and Children ..... 55:**

Niels Kuster<sup>1,2</sup> & Andreas Christ<sup>1</sup>

<sup>1</sup>*IT'IS Foundation for Research on Information Technologies in Society, Switzerland*

<sup>2</sup>*Swiss Federal Institute of Technology (ETH), Zurich, Switzerland*

The influence of age-dependent parameters – head size, tissue dielectrics, and pinna thickness and elasticity – on the specific absorption rate (SAR) of cell phone radiation in the head is discussed. No systematic age-dependent changes are found for the peak spatial average SAR in head tissues. The SAM phantom yields a conservative exposure estimate (90th percentile) independent of the phone used in the assessment. Significant age-dependent differences due to changes in skull proportions and tissue conductivity are observed for local exposure of the brain and of the bone marrow.

#### **W2-4 [16:55]**

#### **Comparison between children and adult head exposure ..... 563**

Joe Wiart<sup>1,2</sup>, Emmanuelle Conil<sup>1,2</sup>, Nadege Varsier<sup>1,2</sup> & Abdelhamid Hadjem<sup>1,2</sup>

<sup>1</sup>*France Telecom Orange Labs, France*

<sup>2</sup>*WHIST Lab, France*

Since 15 years Children are more and more using wireless communication systems. This growth has strengthened public concern and has highlighted the need to assess the RF exposure of children. Taking advantage of progress in image processing and in high performance computer, large Great efforts have been carried out to improve the numerical tools and human models used to assess the Children Specific Absorption Rate (SAR)

#### **W2-5 [17:05]**

#### **Comparison and Evaluation of Spatial Peak SAR in Adult and Child Heads for Mobile Phones ..... 564**

Jianqing Wang<sup>1</sup>

<sup>1</sup>*Department of Computer Science and Engineering, Nagoya Institute of Technology, Nagoya, Japan, 466-8555*

This talk summarizes the study in our group on comparison of the spatial peak SAR in children's heads for mobile phones. First, we demonstrated that a contradictory conclusion may be drawn by different calculation conditions. Then we derived an empirical formula for the complex permittivity as a function of the hydrated rate, and showed that the dielectric properties for children do not affect significantly the spatial peak SAR and penetration depth.

#### **W2-6 [17:15]**

#### **Effect of ageing on dielectric properties of tissues and its relevance in assessment of the exposure of children to EMF ..... 564**

Azadeh Peyman<sup>1</sup>

<sup>1</sup>*Physical Dosimetry, Health Protection Agency, UK*

This presentation summarises and reviews the state of knowledge on dielectric properties of tissues as a function of age. It also examines the impact of variation in dielectric data on the outcome of recent dosimetric studies in particular when single tissue exposures are considered.

#### **W2-7 [17:25]**

#### **Large Scale Study on Variation of the Realistic Exposure of Adults and Children to Cell Phones ..... 564**

Jafar Keshvari<sup>1</sup>, Mikko Kivento<sup>1</sup>, Andreas Christ<sup>2</sup> & Giorgi Bit-Babik<sup>3</sup>

<sup>1</sup>*Nokia Corporation, Espoo, Finland, 00240*

<sup>2</sup>*Research Consultant, Cabo Frio / RJ, Brazil*

<sup>3</sup>*Motorola Solutions, Inc, Plantation, FL, USA*

This study extends the previous work on the assessment of possible differences in exposure to cell phone radiation among adults and children with realistic exposure scenarios including also the hand. A large number of realistic exposure conditions is analyzed using nine anatomical head models and highly detailed CAD models of cell phones. Age dependent changes in the peak spatial average SAR are not observed for the different user groups. The presence of a hand model affects the exposure, but does not lead to age dependent differences, either.



**Session:**  
**Social Event and Sponsor Recognition Ceremony**  
**June 11, 2013 • 19:30 -**  
**POLIS Convention Center**

**June 12, 2013**

**Session: P3**  
**Plenary Session 3: Induced fields and Neuromodulation in Humans**  
**June 12, 2013 • 09:00 - 10:30**  
**A. Riadis**  
**Chairs: Shoogo Ueno & Micaela Liberti**

**P3-1 [09:00]**  
**Transcranial magnetic stimulation of the human brain ..... 568**

Fioravante Capone<sup>1</sup>

<sup>1</sup>*Institute of Neurology, Universita Campus Biomedico, Rome, Italy*

Transcranial magnetic stimulation (TMS) can influence brain activity by producing excitatory and inhibitory effects. The physiologic bases of these phenomena are still poorly understood because of the complexity of the interactions between the currents induced in the brain with an intricate arrangement of neural circuits in the cerebral cortex. Direct recording of the evoked corticospinal output has provided important insight into the mechanisms of TMS. An updated overview of human studies on the physiologic mechanisms of intact motor cortex stimulation will be presented.

**P3-2 [09:45]**  
**Extremely low frequency magnetic field exposure and neuromodulation in humans ..... 569**

Alexandre Legros<sup>1,2,3,4</sup>, Julien Modolo<sup>1,2,3</sup> & Alex Thomas<sup>1,2,3</sup>

<sup>1</sup>*Human Threshold Research Group, Lawson Health Research Institute, London, ON, Canada*

<sup>2</sup>*Department of Medical Biophysics, Western University, London, ON, Canada*

<sup>3</sup>*Department of Medical Imaging, Western University, London, ON, Canada*

<sup>4</sup>*School of Kinesiology, Western University, London, ON, Canada*

A sufficiently strong time-varying magnetic field (MF) can impact the electrical activity of neurons and neuronal assemblies. However, no consensus exists yet on the MF threshold in the Extremely Low Frequency Range (ELF, < 300 Hz) inducing neuromodulation in humans, and to what extent it translates into objective behavioral outcomes.

Here, we review results suggesting possible ELFMF-induced neuromodulation, and discuss them through the prism of possible synaptic mechanisms.

**Session: FB**  
**Student Flash Poster Session B**  
**June 12, 2013 • 11:00 - 11:40**  
**A. Riadis**  
**Chair: Niels Kuster**

**FB-1 [11:00] - STUDENT PAPER**  
**A Study on the Possible Effects of Electric Field Intensity of 2450 MHz Near by Different Cactus Astrophytum Ornatum Placements ..... 574**

Yasemin Karadana<sup>1</sup>, Selcuk Comlekci<sup>1</sup> & Onur Ari<sup>1</sup>

<sup>1</sup>*Engineering Faculty, Suleyman Demirel University, Isparta, Turkey*

Wi-Fi communications have been used widely at today's working areas. One of the ways to reduce the harmful effects of 2450 MHz Wi-Fi with uninterrupted communication have been suggested to have a small cactus on the working table. In this study, the accuracy of this method is investigated. Both simulation and measurement results show that this can be likely true to some extent. Cross-sectional geometry and dielectric parameter of the plant tissue are presented as a factor.

**FB-2 [11:03] - STUDENT PAPER**  
**Blood Perfusion Model for the Pennes Bio-Heat Equation ..... 574**

Veriko Jeladze<sup>1</sup>, Mikheil Prishvin<sup>1</sup>, Lali Bibilashvili<sup>1</sup> & Revaz Zaridze<sup>1</sup>

<sup>1</sup>Laboratory of Applied Electrodynamics and Radio Engineering, Iv. Javakhishvili Tbilisi State University, Tbilisi, Georgia, 0128

A novel numerical model to simulate thermal response of human body tissues exposed to RF energy is presented in this paper. It is based on the new algorithm for construction of realistic blood vessel network, new model of blood flow velocity distribution and an approach to solve bio-heat equation in tissue with variable and initially unknown blood temperature distribution. The obtained results show relative difference between new and conventional models. The future plans involve the blood perfusion study for the whole body exposure.

#### **FB-3 [11:06] - STUDENT PAPER**

**Real-time quantification of actin dynamics in stably expressing Lifeact-EGFP macrophages during LF-EMF exposure ..... 574**

Lieke Golbach<sup>1</sup>, Eline Verbon<sup>1</sup>, Tijs Ketelaar<sup>2</sup>, Huub Savelkoul<sup>1</sup> & Lidy Verburg-van Kemenade<sup>1</sup>

<sup>1</sup>CBI, Wageningen Universiteit, Wageningen, the Netherlands

<sup>2</sup>LCB, Wageningen Universiteit, Wageningen, the Netherlands

Actin filaments are responsible for cell shape and motility and thus crucial for immune cells, like macrophages, to capture invading microbes. It has been hypothesized that LF-EMF may influence F-actin in the filopodia and microvilli, by non-thermal interactions. Using a macrophage cell line that stably expresses Lifeact, we investigate a potential interaction of LF-EMF with actin dynamics. With ImageJ macros large datasets generated by spinning disk microscopy are analysed without user bias.

#### **FB-4 [11:09] - STUDENT PAPER**

**A New Method for the Assessment of Personal RF Exposure of Children ..... 574**

Viktoria Finta<sup>1</sup>, Levente Váradi<sup>1</sup>, Péter Juhász<sup>2</sup>, György Thuroczy<sup>2</sup> & Ádám Kiss<sup>1</sup>

<sup>1</sup>Atomic Physics, Eötvös Loránd University, Budapest, Hungary, 1117

<sup>2</sup>Non-ionizing Radiations, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary, 1221

It is apparently necessary to determine the RF exposure of children but for this, adults around them must be involved by all means. We have tried to find a good method which has the best accuracy with the least discomfort.

We used our formerly developed protocol modified for these goals. We applied two parallel PEMs during 24 hours, volunteers were chosen among the caretakers of kindergarten and parents.

It can be established many conclusions for the method and temporal and spatial features of the exposure.

#### **FB-5 [11:12] - STUDENT PAPER**

**Life Time Dosimetric Assessment for Mice and Rats Exposed to Cell Phone Radiation ..... 575**

Yijian Gong<sup>1</sup>, Myles Capstick<sup>1</sup>, Niels Kuster<sup>1,2</sup>, David L. McCormick<sup>3</sup>, Thomas Horn<sup>3</sup> & Perry Wilson<sup>4</sup>

<sup>1</sup>IT'IS Foundation, Zurich, Switzerland, CH-8004

<sup>2</sup>Information Technology and Electrical Engineering, ETHZ, Zurich, Switzerland, CH-8092

<sup>3</sup>IIT Research Institute, 10 West 35th Street, Chicago, USA, IL 60616

<sup>4</sup>NIST, 325 Broadway, Boulder, USA, CO 80305

This paper presents aspects of the detailed life time dosimetry analysis for the rodents exposed to radio frequency radiation within the National Toxicology Program of the NIEHS. This long term study exposes rodents in reverberation chambers, which necessitates an analysis of the uncertainty due to the exposure environment, postures and differential growth rates of rodents. These final dosimetry results provide a comprehensive reference for studies into long-term biological effects.

#### **FB-35 [11:15] - STUDENT PAPER**

**Sequential RF-EMF exposure modeling and hotspot localization ..... P IC**

Sam Aerts<sup>1</sup>, Dirk Deschrijver<sup>1</sup>, Leen Verloock<sup>1</sup>, Tom Dhaene<sup>1</sup>, Luc Martens<sup>1</sup> & Wout Joseph<sup>1</sup>

<sup>1</sup>Department of Information Technology, Ghent University / iMinds, Ghent, Belgium, 9000

We present a new methodology to create heat maps that accurately pinpoint the outdoor locations with elevated exposure to radio-frequency (RF) electromagnetic fields (EMF) in an extensive urban region. It comprises an interactive measurement and modeling scheme based on kriging interpolation, and allows local authorities and epidemiologists to efficiently assess the location and spectral composition of RF-EMF exposure hotspots, while at the same time developing a global picture of the exposure in the area.

#### **FB-8 [11:18] - STUDENT PAPER**

**Fast evaluation of the uncertainty in specific absorption rate calculations by applying the unscented transform ..... 575**

Xi Cheng<sup>1</sup> & Vikass Monebhurrin<sup>1</sup>

<sup>1</sup>*Department of Electromagnetics, SUPELEC, Gif-sur-Yvette, France, 91192*

Numerical simulations are increasingly being considered to tackle dosimetry problems. The uncertainty evaluation of the numerical simulation is a challenging task. Uncertainty analysis using traditional Monte Carlo simulation proves inappropriate. The unscented transformation (UT) offers an efficient alternative to handle uncertainty. A second order UT requiring only three simulations for a given configuration provides a good estimation of the mean and standard deviation of the peak spatial-average specific absorption rate.

**FB-9 [11:21] - STUDENT PAPER**

**Detailed study of EM exposure simulation ..... 575**

Lali Bibilashvili<sup>1</sup>, Mikheil Prishvin<sup>1</sup>, Veriko Jeladze<sup>1</sup> & Revaz Zaridze<sup>1</sup>

<sup>1</sup>*Laboratory of Applied Electrodynamics and Radio Engineering, Tbilisi State University (TSU), Tbilisi, Georgia, 0128*

After completing the research in terms of MMF II project, it appeared that the understanding of the EM exposure simulation problem is not complete. Some additional aspects such as the presence of a hand, and antenna matching has to be considered. The reactive field in the close vicinity of the head depends on the antenna matching with open space. This paper contains comparison of EM simulation results for a human head model only and a head model with a hand, holding the handset.

**FB-: [11:24] - STUDENT PAPER**

**The CNP Pulsed Magnetic signal is able to silence a feed-forward neuronal network model ..... 575**

Francesca Camera<sup>1</sup>, Alex Thomas<sup>2</sup>, Alessandra Paffi<sup>1</sup>, Guglielmo d'Inzeo<sup>1</sup>, Francesca Apollonio<sup>1</sup>, Frank Prato<sup>2</sup> & Micaela Liberti<sup>1</sup>

<sup>1</sup>*ICEmB@DIET, "Sapienza" University of Rome, Rome, Italy, 00184*

<sup>2</sup>*Bioelectromagnetics Group, Imaging Program, Lawson Health Research Institute, London, ON, Canada*

**SUMMARY**

Several experimental results published in the literature regarding the stimulation of the central nervous system with weak pulsed magnetic fields bring scientific interest in trying to understand what are the specific biological mechanisms that regulate observed behaviors.

In this presentation we will present the results of simulations performed on neuronal models exposed to a specific pulsed magnetic field signal that seems to be very effective in affecting brain activity.

**FB-; [11:27] - STUDENT PAPER**

**The effects of 50 Hz magnetic fields on DNA damage in ATM<sup>-/-</sup> and ATM<sup>+/+</sup> mouse embryonic fibroblasts ..... 576**

Chuan Sun<sup>1</sup>, Xinyuan Zhao<sup>1</sup>, Liling Su<sup>1</sup>, Guangdi Chen<sup>1</sup> & Zhengping Xu<sup>1</sup>

<sup>1</sup>*Bioelectromagnetics Laboratory, Zhejiang University School of Medicine, Hangzhou, China, 310058*

Ataxia telangiectasia mutated gene deficient (ATM<sup>-/-</sup>) and wide type (ATM<sup>+/+</sup>) mouse embryonic fibroblasts (MEF) were exposed to 50 Hz magnetic fields (MF). DNA damage was examined by  $\gamma$ H2AX foci formation. Exposure to MF did not change the  $\gamma$ H2AX foci formation in ATM<sup>-/-</sup> MEF; however, 2.0 mT MF exposure decreased the percentage of  $\gamma$ H2AX foci positive cells in ATM<sup>+/+</sup> MEF.

**keywords:** Magnetic field; DNA damage; mouse embryonic fibroblasts; ATM deficient

**FB-12 [11:30] - STUDENT PAPER**

**Possible effects of 30 min LTE mobile phone exposure on cognitive performance assessed by Stroop test in young healthy human vol ..... 576**

Zsuzsanna Vecsei<sup>1,2</sup>, Péter Juhász<sup>1</sup>, György Thurocz<sup>1</sup> & István Hernádi<sup>2</sup>

<sup>1</sup>*Department of Non-ionising Radiations, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary, 1221*

<sup>2</sup>*Department of Experimental Neurobiology, University of Pécs, Pécs, Hungary, 7624*

The effect of a single 30 min LTE mobile phone like EMF exposure or placebo treatment was examined on young healthy human volunteers' cognitive performance in a double blind, counterbalanced within-subject task design. No statistically significant effects of RF exposure were found on volunteers' Stroop performance thus we concluded that a single 30 min LTE exposure does not affect selective attention and executive function of healthy young volunteers measured by RTs of Stroop test.

**FB-13 [11:33] - STUDENT PAPER**

**Experimental validation of the SAROTA concept for the evaluation of the real-life exposure due to mobile phones**

576

Ashish Rojatkar<sup>1</sup> & Vikass Monebhurrun<sup>1</sup>

<sup>1</sup>*Department of Electromagnetics, SUPELEC, Gif-sur-Yvette, France, 91192*

The specific absorption rate (SAR) value obtained when the mobile phone emits at maximum power is not representative of the real-life exposure. The SAROTA concept accounts for both SAR and OTA (over-the-air) performance. The concept is herein experimentally validated using four mobile phones with embedded data logging software which provides the full uplink and downlink communication data. A mode-stirred reverberation chamber is used to evaluate the real-life exposure similar to an indoor scenario.

**FB-14 [11:36] - STUDENT PAPER**

**A Comparison of Accuracy-Efficiency Tradeoffs of FDTD and FFT-Accelerated Integral Equation Methods for Numerical Dosimetry ..... 576**

Jackson Massey<sup>1</sup>, Fangzhou Wei<sup>1</sup>, Cemil Geyik<sup>1</sup> & Ali Yilmaz<sup>1</sup>

<sup>1</sup>*Department of Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX, USA, 78712*

The performance of FDTD for numerical dosimetry is compared to two FFT-accelerated integral-equation solvers—one that is constrained to regular voxel meshes (GMRES-FFT) and one that can use irregular tetrahedral meshes (AIM). The three methods are used to compute the power absorbed by multilayered spherical phantoms at 900 MHz. The results show that GMRES-FFT accuracy and computational costs are comparable to FDTD while AIM is more accurate and expensive.

**Session: PB  
Plenary Poster Session B  
June 12, 2013 • 11:00 - 12:30  
Foyer**

**Session:  
Tour / Free Time  
June 12, 2013 • 12:30 -**

**June 13, 2013**

**Session: T2  
Tutorial 2: Cell Signaling and Genomic Stability  
June 13, 2013 • 08:30 - 09:30  
A. Riadis  
Chairs: Maria Scarfi & Eric Van Rongen**

**T2-1 [08:30]**

**Analysis of the DNA damage response in reaction to non-ionizing electro-magnetic fields**

7; :

Robert Kanaar<sup>1</sup>

<sup>1</sup>*Erasmus Medical Center*

To determine whether non-ionizing EMFs can induced DNA lesions, we developed ultra-sensitive DNA damage detection systems that rely on a collection of mutant cell lines with impaired DNA damage response pathways. Furthermore we applied semi-quantitative SILAC proteomics to cells exposed to ELF. We developed bioinformatics tools for reliable data management, protein identification and quantitation, and network-based analyses of system-wide (cellular) responses to EMFs.

**T2-2 [09:00]**

**MAPK activation as a readout for cellular response to non-ionizing radiation**

7; :

Rony Seger<sup>1</sup>

<sup>1</sup>*Weizmann Institute Science, Israel*

The effects of non-thermal, non-ionizing electromagnetic fields (EFs) on living cells are not fully understood. We used activation of the ERK cascade as a very sensitive readout for cellular responses. Indeed, ERK is rapidly activated in response to cellular phone-generated EMF. This is sensed by NADH oxidase, which produces free radicals to activate metalloproteinase and consequently EGF receptor and ERK. Recently, we found that ERK is slightly activated by extremely low frequency EF as well.

**Session: 07**  
**Public exposure (RF EMF)**  
**June 13, 2013 • 09:30 - 11:10**  
**A. Riadis**  
**Chairs: Georg Neubauer & Andrew Wood**

**07-1 [09:30]**  
**SAR Assessment in Human Models Exposed to UHF RFID Readers ..... 7;**

Serena Fiocchi<sup>1</sup>, Ioannis Markakis<sup>2,4</sup>, Ilaria Liorni<sup>1,3</sup>, Marta Parazzini<sup>1</sup>, Paolo Ravazzani<sup>1</sup> & Theodoros Samaras<sup>2</sup>

<sup>1</sup>Consiglio Nazionale delle Ricerche CNR, Istituto di Ingegneria Biomedica ISIB, Milan, Italy

<sup>2</sup>Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, 54124

<sup>3</sup>Dipartimento di Elettronica, Informazione e Bioingegneria DEIB, Politecnico di Milano, Milan, Italy

<sup>4</sup>THESS, Thessaloniki Software Solution S.A., Pylaia Thessaloniki, Greece, 57001

This paper addresses the exposure assessment of a generic RFID reader system operating in the Ultra-High Frequency. The exposure levels in different exposure scenarios and subjects (i.e. adult male and female, 5-, 6-, 8- and 14 years old child and pregnant woman at a gestational age of 7- and 9-month) were quantified in terms of specific absorption rate (SAR). Maximum peak SAR<sub>10g</sub> closed to the limits provided by the guidelines and considering 100% duty-cycle and 1 W antenna radiated power were found.

**07-2 [09:50]**  
**Analysis of exposure distribution around LTE base stations ..... 824**

Markus Schubert<sup>1</sup> & Christian Bornkessel<sup>1</sup>

<sup>1</sup>Test Center, IMST GmbH, Kamp-Lintfort, Germany, D-47475

German wide exposure measurements around 16 LTE stations were performed using novel code selective equipment. The median LTE exposure was 0.96 % of the ICNIPR's field strength levels; including GSM and UMTS a median of 1.9 % was measured. LTE exposures are very similar to GSM and UMTS exposures with regard to magnitude and field distribution. An exposure increase of about 40 % due to LTE was found. The LTE code selective measurement method has proven to be very suitable for exposure assessment.

**07-3 [10:10]**  
**Statistical whole-body averaged SAR in indoor microenvironments by cellular communication and indoor signals ..... 827**

Gunter Vermeeren<sup>1</sup>, Francis Goeminne<sup>1</sup>, Wout Joseph<sup>1</sup> & Luc Martens<sup>1</sup>

<sup>1</sup>iMinds / UGent-INTEC, Ghent, Belgium, B-9050

**Session: 08**  
**Anti-Cancer Clinical Applications of EMF**  
**June 13, 2013 • 09:30 - 11:10**  
**M. Saltiel**  
**Chairs: Richard Nuccitelli & Julie Gehl**

**08-1 [09:30] - STUDENT PAPER**  
**In vivo tumor growth is blocked by RF AM EMF and is associated with peritumoral fibrosis and activation of the DAG/IP3 pathway ..... 836**

Hugo Jimenez<sup>1</sup>, Jacquelyn Zimmerman<sup>1</sup>, Ivan Brezovich<sup>2</sup>, Dongquan Chen<sup>3</sup>, Niels Kuster<sup>4</sup>, Myles Capstick<sup>4</sup>, Yijian Gong<sup>4</sup>, Alexandre Barbault<sup>5</sup> & Boris Pasche<sup>1</sup>

<sup>1</sup>Medicine, University of Alabama at Birmingham & UAB Cancer Center, Birmingham, AL, USA, 35294

<sup>2</sup>Radiation Oncology, University of Alabama at Birmingham & UAB Cancer Center, Birmingham, AL, USA, 35294

<sup>3</sup>Medicine, University of Alabama at Birmingham & UAB Cancer Center, Birmingham, AL, USA, 35294

<sup>4</sup>IT'IS Foundation, Swiss Federal Institute of Technology, Zurich, Switzerland

<sup>5</sup>, Rue de Verdun 20, Colmar 68000, France

There is clinical evidence that radiofrequency electromagnetic fields, amplitude-modulated at discrete frequencies (RF AM EMF), elicits therapeutic responses in patients with cancer. Experiments suggest that RF AM EMF exposure increases intracellular calcium, which leads to downstream apoptosis and autophagy. *In vivo*, we have identified increased fibrotic deposition in the tumors of mice exposed to RF AM EMF. We hypothesize that this change impacted tumor growth by a mechanism yet to be identified.

**08-2 [09:50]**  
**Nanoelectroablation for Human Carcinoma Therapy ..... 838**

Richard Nuccitelli<sup>1</sup>, Mark Kreis<sup>1</sup>, Brian Athos<sup>1</sup>, Kaying Lui<sup>1</sup>, Casey Berridge<sup>1</sup> & Pamela Nuccitelli<sup>1</sup>

<sup>1</sup>R&D, BioElectroMed Corp., Burlingame, CA, USA, 94010

We have developed a low energy direct current pulsed electric field therapy for tissue ablation. This therapy applies 100 ns long 30 kV/cm pulses and triggers apoptosis in the treated tissue. This therapy also stimulates a systemic immune response with natural killer T cells inhibiting the growth of secondary tumors in B6 mice.

**08-3 [10:10] - STUDENT PAPER**  
**Amplitude-Modulated Radiofrequency Electromagnetic Fields Inhibit Ovarian Cancer cell Growth ..... 839**

Hugo Jimenez<sup>1</sup>, Jacquelyn Zimmerman<sup>1</sup>, Charles Landen<sup>2</sup>, Ivan Brezovich<sup>3</sup>, Dongquan Chen<sup>4</sup>, Niels Kuster<sup>5</sup>, Myles Capstick<sup>5</sup>, Yijian Gong<sup>5</sup>, Alexandre Barbault<sup>6</sup> & Boris Pasche<sup>1</sup>

<sup>1</sup>Medicine, University of Alabama at Birmingham & UAB

We calculated the statistics of the whole-body SAR induced by cellular communication systems and indoor wireless sources in homes, creches, schools, and offices. The 95th percentile of the whole-body SAR ranged from 15  $\mu\text{W/kg}$  to 33  $\mu\text{W/kg}$  in Belgium, and from 28  $\mu\text{W/kg}$  to 145  $\mu\text{W/kg}$  in Greece and were below the ICNIRP basic restrictions of 0.08 W/kg for general public. The whole-body absorption induced by indoor sources can become larger than the values induced by outdoor sources if the indoor wireless sources are approached.

#### 07-4 [10:30] - STUDENT PAPER

##### Personal Distributed Exposimeter for Radio Frequency Electromagnetic Field Assessment ..... 829

Arno Thielens<sup>1</sup>, Hans De Clercq<sup>2</sup>, Sam Agneessens<sup>3</sup>, Jeroen Lecoutere<sup>2</sup>, Leen Verloock<sup>1</sup>, Frederick Declercq<sup>3</sup>, Gunter Vermeeren<sup>1</sup>, Emmeric Tanghe<sup>1</sup>, Hendrik Rogier<sup>3</sup>, Robert Puers<sup>2</sup>, Luc Martens<sup>1</sup> & Wout Joseph<sup>1</sup>

<sup>1</sup>Department of Information Technology (INTEC), Ghent University / iMinds, Ghent, Belgium, 9050

<sup>2</sup>Microelectronics and Sensors Group, Department of Electrotechnical Engineering, Catholic University Leuven, Heverlee, Belgium

<sup>3</sup>Electromagnetics Group, Department of Information Technology, Ghent University, Ghent, Belgium

A personal distributed exposimeter (PDE) consisting of 3 radio frequency (RF) acquisition nodes is constructed using textile antennas and wearable electronics. Numerical simulations are used to design the PDE. Calibration measurements at 950 MHz, using a human subject, are performed in an anechoic chamber. Compared to conventional exposimeters, which only measure in 1 position on the body, an excellent 95% confidence interval of 7 dB on measured power (densities) and isotropy of 0.5 dB are measured.

#### 07-5 [10:50]

##### Comparison of child and adult Whole-Body SAR due to downlink sources in 5 Countries from Personal Exposure Measurements ..... 833

Wout Joseph<sup>1</sup>, Patrizia Frei<sup>2,3</sup>, Martin Roosli<sup>2,3</sup>, Gunter Vermeeren<sup>1</sup>, John Bolte<sup>6</sup>, György Thuroczy<sup>4,8</sup>, Peter Gajsek<sup>5</sup>, Tomaz Trček<sup>5</sup>, Evelyn Mohler<sup>2,3</sup>, Péter Juhász<sup>4</sup>, Viktoria Finta<sup>7</sup> & Luc Martens<sup>1</sup>

<sup>1</sup>Department of Information Technology, Ghent University / iMinds, Ghent, Belgium, B-9050

<sup>2</sup>Swiss Tropical and Public Health Institute, Basel, Switzerland, CH - 4002

Cancer Center, Birmingham, AL, USA, 35294

<sup>2</sup>Obstetrics and Gynecology, University of Alabama at Birmingham & UAB Cancer Center, Birmingham, AL, USA, 35294

<sup>3</sup>Radiation Oncology, University of Alabama at Birmingham & UAB Cancer Center, Birmingham, AL, USA, 35294

<sup>4</sup>Medicine, University of Alabama at Birmingham & UAB Cancer Center, Birmingham, AL, USA, 35294

<sup>5</sup>IT'IS Foundation, Swiss Federal Institute of Technology, Zurich, Switzerland

<sup>6</sup>Rue de Verdun 20, Colmar 68000, France

Ovarian cancer has the highest mortality of all cancers of the female reproductive system. Intrabuccal administration of very low and safe radiofrequency electromagnetic fields modulated at specific frequencies is a new therapeutic modality. Here we show that ovarian cancer-specific modulation frequencies inhibit the proliferation of two ovarian cancer cell lines and modify gene expression. These findings suggest that this therapeutic approach should be further studied in ovarian cancer.

#### 08-4 [10:30]

##### On the modelling of the temperature increase obtained in a microwave thermal ablation process ..... 842

Marta Cavagnaro<sup>1</sup>, Vanni Lopresto<sup>2</sup> & Rosanna Pinto<sup>2</sup>

<sup>1</sup>Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome, Rome, Italy, 00184

<sup>2</sup>UT BIORAD, ENEA Casaccia Research Centre, Rome, Italy, 00123

Thermal ablation procedures rely on very high temperature increases to remove un-healthy tissue. To model the complex phenomena associated with these high temperatures, a comparison between measurements and numerical simulations is needed.

In this work, temperature increases in an ex vivo tissue have been measured and compared with numerical data. Different models have been developed to characterize phenomena as water vaporization and changes of tissue dielectric properties with the temperature.

#### 08-5 [10:50] - STUDENT PAPER

##### Novel applicator for hyperthermia treatment of soft-tissue sarcomas ..... 845

Marie-Christine Gosselin<sup>1,2</sup>, Myles Capstick<sup>1</sup>, Esra Neufeld<sup>1</sup>, Sven Kuehn<sup>1,2</sup> & Niels Kuster<sup>1,2</sup>

<sup>1</sup>IT'IS Foundation, Zurich, Switzerland, 8004

<sup>2</sup>Swiss Federal Institute of Technology (ETH), Zurich, Switzerland, 8092

The presented applicator design shows great potential for the hyperthermia treatment of superficial tumors. In addition to cooling the skin surface and coupling the radiated energy into the body, the water bolus is used to focus the fields to the target region, hence minimizing the exposure of the

<sup>3</sup>University of Basel, Switzerland

<sup>4</sup>Department of Non-Ionizing Radiation, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary, 1775

<sup>5</sup>Institute of Non-ionizing Radiation, Ljubljana, Slovenia, 1000

<sup>6</sup>Laboratory for Radiation Research, National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands

<sup>7</sup>Institute of Physics, Department of Atomic Physics, Eötvös Loránd University, Faculty of Science, Budapest, Hungary

<sup>8</sup>French National Institute for Industrial Environment and Risks (INERIS), Verneuil en Halatte, France

Our study compares mean whole-body absorptions in child and adult phantoms and contributions of RF sources in five relevant microenvironments in five European countries (Belgium, Switzerland, Slovenia, Hungary, and the Netherlands). Mean absorptions were of the same order for the different countries and the ranking of mean absorptions was very similar to that of the mean power densities measured by exposimeters.

**Session: 09**

**Electric and Magnetic Stimulation of the Brain**

**June 13, 2013 • 11:30 - 12:50**

**A. Riadis**

**Chairs: Alexandre Legros & Marta Parazzini**

**09-1 [11:30]**

**Transcranial magnetic stimulation to the motor cortex using an eccentric figure-eight coil ..... 848**

Masaki Sekino<sup>1</sup>, Hiroyuki Ohsaki<sup>1</sup>, Taiga Matsuzaki<sup>2</sup>, Atsushi Nishikawa<sup>3</sup>, Tomoyuki Maruo<sup>4</sup> & Youichi Saitoh<sup>4</sup>

<sup>1</sup>Graduate School of Engineering, The University of Tokyo, Tokyo, Japan, 113-8656

<sup>2</sup>Home Healthcare Research & Development Department, Teijin Pharma Limited, Tokyo, Japan, 100-8585

<sup>3</sup>Faculty of Textile Science and Technology, Shinshu University, Nagano, Japan, 386-8567

<sup>4</sup>Office for University-Industry Collaboration, Osaka University, Osaka, Japan, 565-0871

Previously we proposed an eccentric figure-eight coil that can cause threshold stimulation in the brain at lower driving currents. We fabricated a prototype eccentric coil and then used it to provide magnetic stimulation to healthy subjects; among our results, we found that the current slew rate corresponding to motor threshold values for the concentric and eccentric coils were 86 A/μs and 78 A/μs, respectively. Future development of compact magnetic stimulators will enable the treatment of some intractable neurological diseases at home.

**09-2 [11:50]**

**Cerebellar Transcranial Direct Current Stimulation: Numerical Modelling of Electric Fields and Current Densities Distributions ..... 849**

surrounding healthy tissues. Results show that the suggested sensors geometry will allow on-the-fly monitoring, enhancing the confidence that the applied treatment corresponds to the planned treatment.

**Session: 10**

**Mechanisms and Theoretical Modeling**

**June 13, 2013 • 11:30 - 12:50**

**M. Saltiel**

**Chairs: Frank Prato & Guglielmo d'Inzeo**

**10-1 [11:30]**

**Biophysical Mechanism of Detection of Weak Extremely Low Frequency Magnetic Fields ..... 856**

Frank Prato<sup>1, 2, 3</sup>, Denis Henshaw<sup>4, 5</sup> & Vladimir Binhi<sup>6, 7</sup>

<sup>1</sup>Bioelectromagnetics Group, Lawson Health Research Institute, London, ON, Canada, N6A 4V2

<sup>2</sup>Diagnostic Imaging, St. Joseph's Health Care, London, ON, Canada, N6A 4V2

<sup>3</sup>Medical Biophysics, University of Western Ontario, London, ON, Canada

<sup>4</sup>School of Chemistry, University of Bristol, Bristol, UK

<sup>5</sup>Children with Cancer UK, Great Ormond Street, London, UK

<sup>6</sup>Russian Academy of Sciences, Moscow, Russian Federation

<sup>7</sup>Moscow State University, Moscow, Russian Federation

The animal literature provides strong evidence that animals and perhaps humans are affected by exposure to weak Extremely Low Frequency Magnetic Fields (wELFMF). Due to signal-to-noise considerations no convincing initial transduction target has been identified. Here we propose a novel target i.e. Super Paramagnetic Iron Oxide (SPIO) particles as the initial transduction site that may explain almost all magnetoreception data associated with wELFMF.

**10-2 [11:50]**

**A Transition in Transduction Mechanisms for Amoeba Galvanotaxis from Electromechanical to Voltage-Gated Channels ..... 858**

Marta Parazzini<sup>1</sup>, Elena Rossi<sup>2</sup>, Roberta Ferrucci<sup>3,4</sup>, Serena Fiocchi<sup>1</sup>, Ilaria Liorni<sup>1,2</sup>, Alberto Priori<sup>3,4</sup> & Paolo Ravazzani<sup>1</sup>

<sup>1</sup>*Istituto di Ingegneria Biomedica ISIB CNR, Consiglio Nazionale delle Ricerche, Milan, Italy, 20133*

<sup>2</sup>*Dipartimento di Elettronica, Informazione e Bioingegneria DEIB, Politecnico di Milano, Milan, Italy, 20133*

<sup>3</sup>*Dipartimento di Fisiopatologia Medico-Chirurgica e dei Trapianti, Università degli studi di Milano, Milan, Italy, 20133*

<sup>4</sup>*Centro Clinico per la Neurostimolazione, le Neurotecnologie ed i Disordini del Movimento, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy, 20133*

This work estimates the distribution of the electric field and current density in the brain tissues, due to cerebellar tDCS, in human models of different ages and gender. Data show that the stronger electric field occurs mainly in the cerebellar cortex, with a spread toward the occipital region of the cortex, while the spread to other structures is negligible. Changes of about 1 cm in the position of the scalp electrode delivering tDCS did not influence the field distributions in the cerebellum.

#### 09-3 [12:10]

#### Calculating the Induced Electric Fields in Realistic Head Model by Square Coil Array in Transcranial Magnetic Stimulation ..... 84:

Mai Lu<sup>1</sup> & Shoogo Ueno<sup>2</sup>

<sup>1</sup>*Key Lab. of Opt-Electronic Technology and Intelligent Control of Ministry of Education, Lanzhou Jiaotong University, Lanzhou, China, 730070*

<sup>2</sup>*Department of Applied Quantum Physics, Kyushu University, Fukuoka, Japan, 812-8581*

We presented a numerical simulation of the induced electric fields in realistic head model by applying multiple coil array. The obtained induced electric fields have been compared to that of standard figure-of-eight coil. It was observed that the field focality in superficial cortical regions can be sharply improved by the coil array. Results in this work potentially provide a new method for expanding the use of TMS for focused deep brain stimulation.

#### 09-4 [12:30]

#### Electric fields inside a realistic head model for tDCS using the 10/20 EEG system electrodes ..... 852

Zoi Manoli<sup>1,2</sup>, Andreas Karampatzakis<sup>1,2</sup>, George Tsanidis<sup>2</sup> & Theodoros Samaras<sup>1</sup>

<sup>1</sup>*Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, 54124*

<sup>2</sup>*THESS S.A., Thessaloniki, Greece, 57001*

In this study we present a model of an anatomically correct human head undergoing transcranial direct current stimulation (tDCS). Different electrode pairs of the 10/20 EEG international system are excited and key measures (such as the affected volume and the maximum electric field) in five brain tissues/regions of interest are estimated, in order to quantify the efficiency, focality and penetration ability of the different pairs.

Francis Hart<sup>1</sup>, Adian Cook<sup>1</sup> & John Palisano<sup>2</sup>

<sup>1</sup>*Department of Physics, The University of the South, Sewanee, TN, USA, 37383*

<sup>2</sup>*Department of Biology, The University of the South, Sewanee, TN, USA, 37383*

Time-lapse movies of amoeba galvanotaxis in which each amoeba served as its own control indicated that for DC fields below 200 V/m, the increase in speed and directionality can be explained by an electromechanical transduction mechanism. In larger fields a voltage-gated channel mechanism is more applicable.

#### 10-3 [12:10]

#### High Intensity Electric Field Pulses Technology: a Way to Control Protein Unfolding ..... 85;

Paolo Marracino<sup>1</sup>, Alessandra Paffi<sup>1</sup>, Micaela Liberti<sup>1</sup>, Guglielmo d'Inzeo<sup>1</sup> & Francesca Apollonio<sup>1</sup>

<sup>1</sup>*ICEmB@DIET, University Sapienza of Rome, Rome, Italy, 00184*

Protein functions and characteristics can highly differ from physiological conditions in presence of chemical, mechanical or electromagnetic stimuli. In this work we provide a rigorous picture of electric field effects on protein behavior, investigating, at atomistic details, the possible ways in which a high intensity electric field pulse can be transduced into biophysical effects mainly related to protein unfolding.

#### 10-4 [12:30]

#### Medium Geometry: The Dominant Factor of In Vitro Exposure ..... 864

Quirino Balzano<sup>1</sup>, Asher Sheppard<sup>2</sup> & Giorgi Bit-Babik<sup>3</sup>

<sup>1</sup>*Department of Electrical and Computer Engineering, University of Maryland, College Park, MD, USA, 20742*

<sup>2</sup>*Asher Sheppard Consulting, Santa Rosa, CA, USA, 95405*

<sup>3</sup>*Motorola Solutions, Ft. Lauderdale, FL, USA, 33304*

During in vitro RF exposures the shape of the medium in a Petri dish or tissue culture flask (shallow depths) or test tube (up to several cm deep) functions as a receiving antenna. We modeled RF current densities at 837 MHz and 1.8 GHz to demonstrate effects of the meniscus (shallow media) on SAR, and temperature gradients (deep media, strong incident power density). Convection in the latter case may affect cellular microenvironments of test samples, but not controls.



**Session: M3**  
**BEMS Annual Business Meeting**  
**June 13, 2013 • 13:00 - 14:00**  
**M. Saltiel 1**

**Session: 11**  
**Epidemiology II - RF EMF**  
**June 13, 2013 • 14:00 - 16:20**  
**A. Riadis**  
**Chairs: Martin Roosli & David Black**

**Session: 12**  
**Electroporation II**  
**June 13, 2013 • 14:00 - 16:00**  
**M. Saltiel**  
**Chairs: Andrei Pakhomov & P. Thomas Vernier**

**11-1 [14:00]**  
**Mobile phone use and risk of intracranial tumors: a consistency analysis ..... 866**

Susanna Lagorio<sup>1</sup> & Martin Roosli<sup>2</sup>

<sup>1</sup>*National Centre for Epidemiology, Surveillance and Public Health, National Institute of Health, Rome, Italy*

<sup>2</sup>*Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland*

We performed a meta-analysis of studies on mobile phone use and incidence of intracranial tumors published by 2012. There was a high level of across studies heterogeneity in the glioma and acoustic neuroma, but not in the meningioma, data-sets. No tendency for the combined relative risk estimates to increase with increasing time since start use was observed in any meta-regression, while most of the overall heterogeneity in results was explained by methodological differences between studies.

**11-2 [14:20]**  
**Validation of self-reported mobile phone use in a Swedish case-control study of radiofrequency fields and acoustic neuroma risk ..... 86:**

David Pettersson<sup>1</sup>, Matteo Bottai<sup>1</sup>, Michaela Prochazka<sup>1</sup> & Maria Feychting<sup>1</sup>

<sup>1</sup>*Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden*

Scarcity of information concerning the size and character of recall errors in the self-reported data used in case-control studies of mobile phone use and cancer risk limits their interpretation. We used operator data as gold standard to validate postal questionnaire information on start year of mobile phone use for cases and controls. The systematic errors found were small and did not differ between cases and controls while random errors were considerable.

**11-3 [14:40]**  
**Acoustic neuroma risk in relation to mobile telephone use: Results of the INTERPHONE international case-control study ..... 872**

Isabelle Deltour<sup>1</sup>, Elisabeth Cardis<sup>2</sup>, Joachim Schuz<sup>1</sup> & For-the-Interphone Study-Group

**12-1 [14:00] - STUDENT PAPER**  
**Microdosimetric model of a single cell for nanosecond pulsed electric fields: an experimental method of validation..... 877**

Agnese Denzi<sup>1</sup>, Caterina Merla<sup>2,3</sup>, Cristiano Palego<sup>3</sup>, Yaqing Ning<sup>3</sup>, Francesca Apollonio<sup>1</sup>, James M.C. Hwang<sup>3</sup> & Micaela Liberti<sup>1</sup>

<sup>1</sup>*ICEmB@DIET, "Sapienza" University of Rome, Rome, Italy, 00184*

<sup>2</sup>*ICEmB@UtiBioRad, ENEA, Rome, Italy, 00123*

<sup>3</sup>*Lehigh University, Bethlehem, PA, USA, 18015*

**SUMMARY**

The use of pulses with short duration and high intensity is an emerging field for promising biomedical applications. Here, a comparison in the time domain is reported between the current densities computed using an electrical cell model and the experimental current extracted from S parameter measurements (up to 2 GHz) performed on a microfluidic micro-chamber. The data comparison demonstrates the possibility to validate dielectric models for the cell cytoplasm in term of its conductivity.

**12-2 [14:20] - STUDENT PAPER**  
**Electric field and temperature measurements for in vitro exposures to high-intensity nanosecond pulsed electric fields ..... 87;**

Sophie Kohler<sup>1</sup>, Rodney P. O'Connor<sup>1</sup>, Delia Arnaud-Cormos<sup>1</sup> & Philippe Leveque<sup>1</sup>

<sup>1</sup>*XLIM Research Institute, C.N.R.S., Limoges, France, 87060*

Experimental setups have been reported to expose biological cells to intense nanosecond electric pulses and simultaneously observe the biological effects. However, there is a lack of techniques for characterizing the macroscopic electric field and microscopic temperature changes induced inside the exposed sample. We report here dosimetry measurements at macroscopic and microscopic scales inside a Petri dish containing biological cells and exposed to nanosecond electrical stimuli within a transverse electromagnetic cell.

**12-3 [14:40] - STUDENT PAPER**  
**Applied treatment planning of electroporation-based medical interventions ..... 884**

Bor Kos<sup>1</sup>, Denis Pavliha<sup>1</sup>, Anže Županič<sup>2</sup>, Marija Marčan<sup>1</sup>, Gregor Serša<sup>3</sup> & Damijan Miklavcic<sup>1</sup>

<sup>1</sup>Section of Environment and Radiation, International Agency for Research on Cancer, Lyon, France, 69372

<sup>2</sup>Centre for Research in Environmental Epidemiology, Barcelona, Spain, 08003

Acoustic neuroma (AN) is a benign slow growing tumour of cranial nerves. The INTERPHONE case-control study of AN was conducted in 13 countries including 1105 cases and 2145 controls. Past mobile phone use was assessed by personal interview. Estimates of association with time since first exposure and ever using a mobile phone were below unity. For persons with 1640 hours or more of use the OR was 1.32 (0.88–1.97) and 2.79 with 5 years latency, reflecting true association, chance or recall bias.

#### 11-4 [15:00]

##### **Systematic review of the epidemiology of the effects of mobile phones on the occurrence of tumours in brain, head or neck ..... 873**

Eric Van Rongen<sup>1</sup>, Gerard van Rhoon<sup>2</sup>, André Aleman<sup>3</sup>, Hans Kromhout<sup>4</sup>, Flora van Leeuwen<sup>5</sup>, Huub Savelkoul<sup>6</sup>, Wytse Wadman<sup>7</sup>, Rik van de Weerd<sup>8</sup>, Peter Zwamborn<sup>9</sup>, Gert Kelfkens<sup>10</sup> & Irene Kreis<sup>1</sup>

<sup>1</sup>Health Council of the Netherlands, The Hague, the Netherlands

<sup>2</sup>Erasmus University Medical Center, Rotterdam, the Netherlands

<sup>3</sup>University of Groningen, Groningen, the Netherlands

<sup>4</sup>Institute for Risk Assessment Sciences, Utrecht, the Netherlands

<sup>5</sup>Netherlands Cancer Institute, Amsterdam, the Netherlands

<sup>6</sup>Wageningen University, Wageningen, the Netherlands

<sup>7</sup>University of Amsterdam, Amsterdam, the Netherlands

<sup>8</sup>Central Gelderland Municipal Health Services (GGD), Arnhem, the Netherlands

<sup>9</sup>Netherlands Organisation for Applied Scientific Research, The Hague, the Netherlands

<sup>10</sup>Netherlands Institute for Public Health and the Environment, Bilthoven, the Netherlands

The Electromagnetic Fields Committee of the Health Council of the Netherlands has performed a systematic review of the epidemiological evidence on the association between use of mobile phones and tumours in the brain and other structures of the head. The methods used, the results and conclusions will be discussed.

#### 11-5 [15:20]

##### **How do Swiss adolescents use their mobile phones? 874**

Anna Schoeni<sup>1,2</sup>, Katharina Roser<sup>1,2</sup> & Martin Roosli<sup>1,2</sup>

<sup>1</sup>Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland

<sup>2</sup>University of Basel, Basel, Switzerland

Calls on the UMTS (Universal Mobile Telecommunications System) network cause less exposure than on the GSM (Global System for Mobile Communications) network.

<sup>1</sup>Laboratory of Biocybernetics, University of Ljubljana, Ljubljana, Slovenia, 1000

<sup>2</sup>Institute for Ageing and Health, University of Newcastle upon Tyne, Newcastle upon Tyne, UK

<sup>3</sup>Institute of Oncology, Ljubljana, Slovenia, 1000

In recent years, electrochemotherapy (ECT) has entered clinical practice in oncology, mostly for treatment of cutaneous metastases, but first clinical studies on treatment of deep seated tumors are already in progress with encouraging results. We present here a method of treatment planning for ECT, based on medical image analysis, numerical modeling of electroporation, and several visualization tools for treatment plan assessment, and illustrate the methods with an example treatment plan for ECT.

#### 12-4 [15:00]

##### **Stimulation and permeabilization of cultured hippocampus neurons by 10-ns electric pulses 887**

Andrei Pakhomov<sup>1</sup>, Iurii Semenov<sup>1</sup>, Shu Xiao<sup>1,2</sup> & Olga Pakhomova<sup>1</sup>

<sup>1</sup>Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA

<sup>2</sup>Dept. of Electrical and Computer Engineering, Old Dominion University, Norfolk, VA, USA

We demonstrated diverse effects of 10-ns electric pulses in cultured rat hippocampal neurons. Mild exposures reduced membrane resistance, triggered action potentials, and elevated cytosolic calcium. More intense treatments triggered the uptake of membrane permeabilization marker dyes (Yo-PRO-1 and propidium), and cause cell swelling and restructuring. A significant gap between stimulatory and pathological effects suggests that 10-ns pulses can be used for neurostimulation.

#### 12-5 [15:20]

##### **Bleomycin cytotoxicity induced by simultaneous application of electroporation and sonoporation ..... 888**

Mindaugas Tamošiūnas<sup>1</sup>, Lluís M. Mir<sup>2,3,4</sup>, Mindaugas Venslauskas<sup>1</sup> & Saulius Šatkauskas<sup>1</sup>

<sup>1</sup>Biophysical Research Group, Vytautas Magnus University, Kaunas, Lithuania, LT-44404

<sup>2</sup>Laboratoire de Vectorologie et Thérapeutiques Anticancéreuses, Université Paris-Sud, Orsay, France, F-91405

Analysis of mobile phone usage behaviour of 191 adolescents using objective mobile phone traffic data shows considerable interindividual differences in the network being used. This enables us to derive an exposure metric which does not only depend on usage duration in order to differentiate between radiation and mobile phone training effects.

#### 11-6 [15:40]

**Environmental radiofrequency electromagnetic fields exposure, cognitive function and behaviour problems in 5-6 year old children ..... 876**

Mònica Guxens<sup>1</sup>, Manon van Eijsden<sup>2</sup>, Johan Beekhuizen<sup>1</sup>, Eva Loomans<sup>2,3</sup>, Tanja G.M. Vrijkotte<sup>4</sup>, Rob T. van Strien<sup>2</sup>, Hans Kromhout<sup>1</sup>, Roel Vermeulen<sup>1,5</sup> & Anke Huss<sup>1</sup>

<sup>1</sup>*Institute for Risk Assessment Sciences, Utrecht University, the Netherlands*

<sup>2</sup>*Department of Epidemiology, Public Health Service of Amsterdam (GGD), the Netherlands*

<sup>3</sup>*Department of Developmental Psychology, Tilburg University, the Netherlands*

<sup>4</sup>*Department of Public Health, University of Amsterdam, the Netherlands*

<sup>5</sup>*Julius Centre for Public Health Sciences and Primary Care, University Medical Centre, Utrecht, the Netherlands*

We analysed the association between exposure to environmental radiofrequency electromagnetic fields from mobile phone base stations at home and cognition and behaviour outcomes in a group of around 2000 5-6 year old children in Amsterdam, The Netherlands.

#### 11-7 [16:00]

**Adult Cancers Near High-voltage Overhead Power Lines ..... 877**

Paul Elliott<sup>1</sup>, Gavin Shaddick<sup>2</sup>, Margaret Douglass<sup>1</sup>, Kees De Hoogh<sup>1</sup>, David Briggs<sup>1</sup> & Mireille Toledano<sup>1</sup>

<sup>1</sup>*Small Area Health Statistics Unit, MRC-HPA Center for Environment and Health, Imperial College London, London, UK, W2 1PG*

<sup>2</sup>*Department of Mathematical Sciences, University of Bath, Bath, UK, BA2 7AY*

In a national case control study we did not find evidence to support an epidemiologic association of adult cancers with residential magnetic fields in proximity to high-voltage overhead-power lines.

<sup>3</sup>*Laboratoire de Vectorologie et Thérapeutiques Anticancéreuses, CNRS, Orsay, France, F-91405*

<sup>4</sup>*Laboratoire de Vectorologie et Thérapeutiques Anticancéreuses, Institut Gustave Roussy, Villejuif, France, F-94805*

We have investigated the combination of electroporation and sonoporation to increase the effectiveness of antitumor drug bleomycin transfer in vitro. At the optimized experimental conditions, cell viability remained basically unaffected by electroporation and sonoporation. CHO cells that received electrosonoporation demonstrated an increase in bleomycin cytotoxicity caused by reversible permeabilization, in comparison to the cells that underwent electroporation or sonoporation alone.

#### 12-6 [15:40]

**Manipulation of the cell death pathways after treatment with nanosecond electric pulses ..... 889**

Olga Pakhomova<sup>1</sup>, Betsy Gregory<sup>1</sup> & Andrei Pakhomov<sup>1</sup>

<sup>1</sup>*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA, 23508*

In this study we demonstrate that cell swelling and membrane rupture are the predominant mechanisms of early cell death following exposure to 60- and 300-ns pulses. This necrotic death is an early event which prevents the development and observation of apoptosis in nsPEF-treated cells. However, the suppression of the primary necrosis reveals much higher incidence of apoptosis and delayed cell death, so that the long-term survival remains unchanged.

**Session: W3**  
**Workshop 3: Occupational EMF Exposure**  
**June 13, 2013 • 16:30 - 18:30**  
**A. Riadis**  
**Chairs: Philip Chadwick & Maila Hietanen**

**W3-1 [16:30]**

**Development of Procedures and Instrumentation for Demonstration of Worker's EM Safety ..... 88:**

Mark Douglas<sup>1</sup>, Valerio De Santis<sup>1</sup>, Myles Capstick<sup>1</sup> & Niels Kuster<sup>1</sup>

<sup>1</sup>*IT'IS Foundation, Zurich, Switzerland, 8004*

Simple and reliable procedures and instrumentation are described for the evaluation of workplace compliance with EU Directive 2004/40/EC. The implementation of the Directive poses a challenge to employers, particularly in industries where workers use high-voltage or high-current equipment. The instrumentation and procedures presented are demonstrated to significantly improve the exposure evaluation compared to the assessment of reference levels, particularly for localized sources.

**W3-2 [16:50]**

**Interference of occupational EMF with electronic implants: Scientific internet information platform and human provocation study ..... 893**

Frank Gollnick<sup>1</sup>, Dominik Stunder<sup>1</sup>, Sarah Driessen<sup>1</sup>, Dagmar Dechent<sup>1</sup>, Tobias Seckler<sup>1</sup>, Stephan Joosten<sup>2</sup> & Thomas Kraus<sup>3</sup>

<sup>1</sup>*Research Center for Bioelectromagnetic Interaction (femu), University Hospital Aachen, Aachen, Germany, 52074*

<sup>2</sup>*Energy, textile, electrical and media products sector (BG ETEM), German Social Accident Insurance Institution, Köln, Germany, 50968*

<sup>3</sup>*Institute of Occupational and Social Medicine, RWTH Aachen / University Hospital Aachen, Aachen, Germany, 52074*

In occupational surroundings, the electromagnetic compatibility of electronic implants is an important question. In an interdisciplinary approach, *femu* addresses everyday life and occupational EMF interference with electronic implants. The research center offers scientific information on this subject in its free internet information platform "EMF-Portal". Provocation studies in our lab with wearers of active cardiac implants provide information on electromagnetic interference with the devices.

**W3-3 [17:10]**

**Worker exposure in various 'problem sectors' in relation to the EMF Directive ..... 897**

Rianne Stam<sup>1</sup>

<sup>1</sup>*National Institute for Public Health and the Environment, Bilthoven, the Netherlands*

A new European Directive sets limits to worker exposure to EMF. These are largely based on ICNIRP recommendations. Worker exposure to magnetic fields in the literature was compared to the relevant limits in the Directive. The results show that these limits may be exceeded for some workers involved in welding, induction heating, transcranial magnetic stimulation and magnetic resonance imaging. Measures to reduce exposure may be necessary for some workers with these occupations.

**W3-4 [17:30]**

**Topical issues in occupational EMF exposure to MRI ..... 897**

Maila Hietanen<sup>1</sup>

<sup>1</sup>*Safe new technologies, Finnish Institute of Occupational Health, Helsinki, Finland, 00250*

ICNIRP has published a statement on the protection of patients during magnetic resonance imaging, and an amendment focusing on exposure to static magnetic fields during MR procedures. However, exposure during movement in high magnetic fields is of concern. Recently, the ICNIRP guidelines for limiting exposure to electric fields induced by movement in static magnetic fields have been under public consultation, and will be published in the near future.

**W3-5 [17:50]**

**Occupational EMF exposure assessment - the situation in Japan ..... 898**

Sachiko Yamaguchi-Sekino<sup>1</sup>

<sup>1</sup>*National Institute of Occupational Safety and Health, Japan, Kawasaki, Japan, 2148585*

Current situation of occupational EMF exposure assessment in Japan and results of EMF measurements at the specified work environments (MR workers and welders) will be presented.

## June 14, 2013

**Session: DA**  
**D' Arsonval Presentation and Lecture**  
**June 14, 2013 • 08:30 - 09:30**  
**A. Riadis**

**Session: SA**  
**Student Awards Presentation**  
**June 14, 2013 • 09:30 - 10:00**  
**A. Riadis**

**Session: H**  
**Hot Topic - The Occupational EMF Directive (Debate format)**  
**June 14, 2013 • 10:00 - 11:30**  
**A. Riadis**  
**Chairs: Philip Chadwick & Mark Douglas**

**H-1 [10:00]**  
**Hot Topic - The Occupational EMF Directive ..... P IC**

Ralf Bodemann<sup>1</sup>  
<sup>1</sup>*Siemens, Germany*  
No abstract available

**H-2 [10:20]**  
**Hot Topic – The EMF Directive, from a workers' perspective ..... 899**

Roland Gauthy<sup>1</sup>  
<sup>1</sup>*European Trade Union Institute (ETUI), Belgium*

This directive is welcome: its delay gave an impression that EMF had no impact on workers' health. This presentation describes how the directive protects against short-term risk and also the derogations that will allow many work activities to continue. It also includes a safeguard clause to cover potential long-term effects if they are confirmed. In fact, the directive is sparse; it is via its implementation framework that it will live or die and this presentation covers that aspect also.

**Session: CC**  
**Rapporteur's Reports and Closing Ceremony**  
**June 14, 2013 • 12:00 - 13:00**  
**A. Riadis**

**Session: M4**  
**BEMS Board and EBEA Council Meetings**  
**June 14, 2013 • 13:00 - 16:00**  
**CR1 and CR2**

**Session: PA**  
**Plenary Poster Session A**  
**June 10, 2013 • 11:00 - 12:30**  
**Foyer**

**PA-1 [11:00]**

**Intended electromagnetic threats and possible risks for humans ..... :**

Georg Neubauer<sup>1</sup>, Andreas Weinfurter<sup>1</sup>, Kurt Lamedschwandner<sup>2</sup>, Thomas Gruber<sup>1</sup>, Alexander Preinerstorfer<sup>1</sup> & Stefan Cecil<sup>2</sup>

<sup>1</sup>*Safety & Security Department, AIT Austrian Institute of Technology GmbH, Seibersdorf, Austria, 2444*

<sup>2</sup>*EMC & Optics, Seibersdorf Laboratories GmbH, Seibersdorf, Austria, 2444*

The proper function of critical infrastructures such as energy supply is a predominant requirement of nowadays societies. To ensure functionality of their infrastructures providers are requested to analyze potential risks including threats arising from intended electromagnetic attacks. So far the focus was set on electric and electronic components of infrastructures, but no attempts are known to analyze potential risk for employees of infrastructures and the public in general.

**PA-3 [11:00]**

**Comparison of 50-Hz electric and magnetic fields of Ukrainian urban high voltage power substations with exposure regulations ..... 32**

Oleksandr Okun<sup>1</sup>, Sergii Shevchenko<sup>1</sup> & Leena Korpinen<sup>2</sup>

<sup>1</sup>*Department of Electrical Energy, National Technical University "Kharkiv Polytechnic Institute" (NTU "KhPI"), Kharkiv, Ukraine, 61002*

<sup>2</sup>*Department of Electronics and Communications Engineering, Tampere University of Technology, Tampere, Finland, P.O. Box 692*

This work is devoted to the comparison of low frequency electric and magnetic fields generated by high voltage power substations located in city areas and existing exposure regulations. Electromagnetic field studies were performed on examples of several common 110 kV substations in Ukraine. Results have shown that the electric and magnetic field levels do not reach exposure limits specified by Ukrainian regulations, international guidelines ICNIRP 2010, as well as the proposed European Union Directive.

**PA-5 [11:00]**

**Risk Communication of Korea Electric Power Corporation for a correct understanding of ELF EMF ..... 34**

Tai-young Kim<sup>1</sup>, Tae-yong Kim<sup>1</sup> & Yoo-cheon Kim<sup>1</sup>

<sup>1</sup>*Transmission Project Department, Korea Electric Power Corporation(KEPCO), Seoul, Korea, 135-791*

It is necessary to construct new power lines, but the construction of power facilities has been delayed by various public complaints. The major factor of complaints is EMF of power equipment.

In the paper, describes about the risk communication conducted by a power company KEPCO ; the program to interact with the residents before the construction of power facilities, the Advisory Committee on the EMF ELF to summarize the opinions of the various fields, etc.

**PA-7 [11:00]**

**Examples of characterisation of 50 Hz magnetic field exposure ..... 35**

Martine Souques<sup>2</sup>, Stéphanie Billot<sup>2</sup>, Isabelle Magne<sup>1</sup> & Jacques Lambrozo<sup>2</sup>

<sup>1</sup>*EDF R&D, EDF, Moret sur Loing, 77818*

<sup>2</sup>*Service of Medical Studies, EDF, Levallois-Perret, 92300*

Assessing the exposure in an epidemiological study as realistically as possible is a complex task. During 24 h, 3 young volunteers in different exposure conditions wore an EMDEX II. Another EMDEX II was placed in their bedroom over the same period. The results show differences of classification as "exposed" or "non exposed", depending on the indicator used. This paper, limited in scope, shows that the exposure of a child or an adult cannot be resumed by measurements at home.

**PA-9 [11:00] - STUDENT PAPER**

**An Ultra Broadband Measurement System for Electromagnetic Field Exposure Monitoring ..... 37**

Marco Zahner<sup>1</sup>, Patrick Leidenberger<sup>1</sup>, Fabian Schneider<sup>1</sup>, Philipp Bachmann<sup>1</sup> & Jürg Fröhlich<sup>1</sup>

<sup>1</sup>*Laboratory for Electromagnetic Fields and Microwave Electronics, D-ITET, ETH Zürich, Zurich, Switzerland, 8092*

A low frequency magnetic field meter is presented as part of a versatile smartphone based personal exposure assessment platform developed during the last years. The proposed magnetometer operates in the frequency range of 5 Hz up to 2 kHz and features a measurement range of 100 nT to 130  $\mu$ T. Time domain signal sampling enables an unprecedented level of flexibility for the analysis of the magnetic fields generated by electric power transfer and conversion systems.

**PA-11 [11:00]**

**Induced electric field computations in the MAXWEL human phantom from exposure during 50 Hz live-line working situations ..... 3:**

Richard Findlay<sup>1</sup>

<sup>1</sup>*EMFcomp, Wantage, UK, OX12 8HG*

Scalar potential finite difference (SPFD) calculations of induced electric field have been performed in the MAXWEL (MALE flexible Whole-body modEL) anatomically realistic human model for representative cases of exposure during 50 Hz live-line working.

The dosimetric quantities were computed over an extended range of distances to examine the relationship of induced electric field with distance and to compare with values in the proposed EU EMF Directive and ICNIRP Guidelines.

**PA-13 [11:00]**

**A dosimetric study to compare stimulations by intra-operative microelectrodes and chronic macroelectrodes in the DBS technique ..... 3;**

Alessandra Paffi<sup>1</sup>, Maria Grazia Puxeddu<sup>1</sup>, Francesca Apollonio<sup>1</sup>, Marta Parazzini<sup>2</sup>, Guglielmo d'Inzeo<sup>1</sup>, Paolo Ravazzani<sup>2</sup> & Micaela Liberti<sup>1</sup>

<sup>1</sup>*ICeMB at Department of Information Engineering, Electronics and Telecommunication (DIET), Sapienza University of Rome, Rome, 00184*

<sup>2</sup>*CNR Consiglio Nazionale delle Ricerche, Istituto di Ingegneria Biomedica, Milano*

To identify the target of Deep Brain Stimulation (DBS) and to choose the optimal parameters for the stimulating signal, intra-operative micro-electrodes are generally used. However, when they are replaced with the chronic macro-electrode, the effect of the stimulation is often very different. Here, we use numerical simulations to predict the stimulation of neuronal fibers induced by micro-electrodes and macro-electrodes placed in different positions with respect to each other.

**PA-15 [11:00]**

**Measurement of the magnetic fields in cars running at constant speeds ..... 43**

Hiroomi Kato<sup>1</sup>, Chiyoji Ohkubo<sup>1</sup> & Katsuo Isaka<sup>2</sup>

<sup>1</sup>*Japan EMF Information Center, Japan Electrical Safety & Environment Technology Laboratories, Tokyo, Japan, 105-0014*

<sup>2</sup>*The University of Tokushima, Tokushima, Japan, 770-8506*

The magnetic fields and their frequencies were measured in the three types of cars including a hybrid vehicle, an electric vehicle, and an internal combustion engine vehicle in an indoor test facility. It is found from the analyzed results for the cars running at speeds of 0km/h, 10km/h, 40km/h and 80 km/h that the magnetic fields inside the cars do not exceed the general public reference levels of the ICNIRP guidelines.

**PA-17 [11:00]**

**Examples of magnetic field exposure in cable room under gas insulated substation (GIS) ..... 47**

Rauno Pääkkönen<sup>1</sup>, Harri Kuisti<sup>2</sup>, Hiroo Tarao<sup>3,4</sup>, Fabriziomaria Gobba<sup>5</sup> & Leena Korpinen<sup>3</sup>

<sup>1</sup>*Finnish Institute of Occupational Health, Helsinki, Finland*

<sup>2</sup>*Fingrid Oyj, Helsinki, Finland*

<sup>3</sup>*ELT, Environmental Health, Tampere University of Technology, Tampere, Finland*

<sup>4</sup>*Department of Electrical and Computer Engineering, Kagawa National College of Technology, Takamatsu, Japan*

<sup>5</sup>*Department of Public Health Sciences, University of Modena and Reggio Emilia, Modena, Italy*

The aim of this work is to present examples of magnetic field exposure in a cable room under a gas insulated substation. The action values of the EU Directive (2004/40/EC) were not exceeded while walking in the cable room. However, exposure in the cable room was higher than in other places near the GIS substation.

**PA-19 [11:00]**

**Impact of skin properties on the averaged internal electric field according to the ICNIRP 2010 in a hand-model ..... 4:**

Stefan Cecil<sup>1</sup>, Gernot Schmid<sup>1</sup> & Richard Überbacher<sup>1</sup>

<sup>1</sup>*EMC&Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

Preliminary investigations showed that the properties of the skin have a big impact on the level of exposition determined according to ICNIRP 2010. A generic scenario with an exposed hand on a metallic object was calculated with numerical simulations and the parameters of the skin are changed. The results show, that the variation of the skin parameters brings a span of 18dB in averaged internal electric field. Some undesired effects because of the application of the 99<sup>th</sup> percentile are shown.

**PA-21 [11:00]**

**Improving the quality of computational phantoms by using a surface subdivision method: effect on the computational results ..... 53**

Thomas Lelong<sup>1</sup>, Pierre Thomas<sup>1</sup>, Riccardo Scorretti<sup>3</sup>, Francis Piriou<sup>2</sup>, Noël Burais<sup>3</sup> & Isabelle Magne<sup>4</sup>

<sup>1</sup>THEMIS, EDF R&D, Clamart, France, 92141

<sup>2</sup>Laboratoire Ampère UMR 5005 CNRS, Villeurbanne, France, 69622

<sup>3</sup>L2EP, Villeneuve d'Ascq, France, 59 655

<sup>4</sup>LME, EDF R&D, Moret sur Loing, France, 77818

Nowadays many tools exist for modelling electromagnetic fields in human body. However, the reliability of such a modelling is still an issue, due to the complexity of the human body and the uncertainty of many parameters. The accuracy of the Finite Element Method solution is linked to the quality of the mesh of the computational phantom. In this work we present a residual based error estimator to quantify the local numerical error which can be used with the classical  $\Phi$ -**A** formulation.

**PA-23 [11:00]**

**Preliminary Measurement of Human Body Impedances at Power Frequency - Dependence on BMI and Relative Distribution ..... 55**

Noriyuki Hayashi<sup>1</sup>, Hiroo Tarao<sup>2</sup>, Yusuke Iki<sup>3</sup> & Yo Sakamoto<sup>3</sup>

<sup>1</sup>Faculty of Engineering Education and Research, University of Miyazaki, 1-1, Nishi, Gakuen-Kibana-Dai, Miyazaki, Japan, 889-2192

<sup>2</sup>Electrical and Computer Engineering, Kagawa National College of Technology, 355, Chokushi-cho, Takamatsu, Japan, 761-8058

<sup>3</sup>Graduate School of Engineering, University of Miyazaki, 1-1, Nishi, Gakuen-Kibana-Dai, Miyazaki, Japan, 889-2192

For further understanding of contact current characterization, human body impedances R of adult male volunteers at power frequency were measured. Absolute values of R for various scenarios of contact, relationships between R and BMI, and distribution of R along the current path are compared with numerical ones obtained by using the numerical human models. It is found that the absolute values of R are in inverse proportion to BMI, and that the relative distributions of R are in good agreement with the numerical ones.

**PA-25 [11:00]**

**Calculation of Contact Currents in a Human Body in Contact with a Car in 60 Hz Electric Fields ..... 58**

Hiroo Tarao<sup>1</sup>, Noriyuki Hayashi<sup>2</sup>, Leena Korpinen<sup>3</sup>, Takashi Matsumoto<sup>4</sup> & Katsuo Isaka<sup>5</sup>

<sup>1</sup>Dept of Electrical & Computer Eng, Kagawa National College of Technology, Takamatsu-shi, Japan, 761-8058

<sup>2</sup>University of Miyazaki, Japan

<sup>3</sup>Tampere University of Technology, Finland

<sup>4</sup>Anan National College of Technology, Japan

<sup>5</sup>The University of Tokushima, Japan

When a human touches an ungrounded conductor such as a car in electric fields, contact currents flow into the human body. At the same, currents are also induced in the body by the external electric fields. In this presentation, numerical calculations of both currents are demonstrated using an anatomically numerical human model.

**PA-27 [11:00] - STUDENT PAPER**

**Analysis of gene expression modulation by exposure to low frequency (LF) electric fields ..... 59**

Tania Rescigno<sup>1</sup>, Mariella Caputo<sup>1</sup>, Hylde Zirpoli<sup>1</sup>, Maria Caterina De Rosa<sup>1</sup>, Francesco Chiadini<sup>2</sup>, Antonio Scaglione<sup>2</sup>, Claudia Stellato<sup>3</sup>, Giorgio Giurato<sup>3</sup>, Alessandro Weisz<sup>3</sup>, Mario Felice Tecce<sup>1</sup> & Bruno Bisceglia<sup>2</sup>

<sup>1</sup>Department of Pharmacy, University of Salerno, Fisciano (SA), Italy, 84084

<sup>2</sup>Department of Industrial Engineering, University of Salerno, Fisciano (SA), Italy, 84084

<sup>3</sup>Department of Medicine and Surgery, University of Salerno, Baronissi (SA), Italy, 84081

We analyzed the effects on gene expression of capacitively coupled electric signals (60 kHz, burst 12.5 Hz), produced by an apparatus used in bone disease therapy, by microarrays technology in human SaOS-2 cell line. After a 24 h exposure only



the expression of a small number of genes, mostly of transcription factors and DNA binding proteins, is affected. Since enzymatic variations can be observed earlier, we conclude that exposure affects only indirectly gene regulation mechanisms.

**PA-29 [11:00]**

**Temperature Variations in Biological Samples is a Potential Confounder for Experimental Variability and Reproducibility..... 64**

Lucas Portelli<sup>1</sup>, Aditya Kausik<sup>2</sup>, Hemal Semwal<sup>3</sup> & Frank Barnes<sup>1</sup>

<sup>1</sup>*Department of Electrical, Computer and Energy Engineering, University of Colorado, Boulder, CO, USA, 80309*

<sup>2</sup>*Department of Mechanical Engineering, University of Colorado, Boulder, CO, USA, 80309*

<sup>3</sup>*Department of Physics, University of Colorado, Boulder, CO, USA, 80309*

We have found spatial inhomogeneity in the order of several centigrade degrees which lasted from minutes to hours between identically treated biological samples under conventional culture conditions. These differences depend on the size of the incubator, location in the incubator, thermal capacity and placement modality of the cell container in the incubator. *In vitro* data obtained in our lab supporting the importance of such variability will be presented. Solutions for this issue will also be presented.

**PA-31 [11:00]**

**Exposure of the General Public in the Vicinity of Air Traffic Control Primary and Secondary Radar Systems ..... 67**

Nektarios Skamnakis<sup>1</sup>, Efthymia Kalampaliki<sup>1</sup>, Dimitris Koutounidis<sup>1</sup>, Panagiota Tsaprouni<sup>1</sup>, Christina Tzoumanika<sup>1</sup>, Agamemnon Yalofas<sup>1</sup> & Efthymios Karabetsos<sup>1</sup>

<sup>1</sup>*Non Ionizing Radiation Office, Greek Atomic Energy Commission, Agia Paraskevi, Athens, Greece, 15310*

Results of in situ measurements in the vicinity of 12 Air Traffic Control Primary and Secondary Radar systems, throughout Greece, carried out by the national competent authority which is the Greek Atomic Energy Commission, are presented in this paper. All the measurements were performed in order to determine compliance with the exposure limits for general public, as defined in the national legislation. The results show compliance with the limits, at all cases.

**PA-33 [11:00]**

**Enhancement of electric fields by conductors ..... 72**

John Lekner<sup>1</sup>

<sup>1</sup>*School of Chemical and Physical Sciences, MacDiarmid Institute, Wellington, New Zealand, 6015*

Electric fields are affected by the redistribution of charge on electrical conductors. The amplification can be large at sharp points of a conductor, and especially in the gap between two nearby conductors. Formulae are given for the amplification factor for spheres and cylinders.

**PA-35 [11:00]**

**Study of the effects of moderate-intensity static magnetic fields on human cell physiology using electrorotation ..... 73**

Amal El Gaddar<sup>1</sup>, Marie Frénéa-Robin<sup>2</sup>, Damien Voyer<sup>1</sup>, Naoufel Haddour<sup>1</sup> & Laurent Krahenbuhl<sup>1</sup>

<sup>1</sup>*EEA, Ampere Laboratory, Ecully, France, 69134*

<sup>2</sup>*EEA, Ampere Laboratory, Villeurbanne, France, 69100*

The present study aims to examine the influence of a static magnetic field (SMF) on Human Embryonic Kidney (HEK) 293 cell physiology. HEK cells have been exposed for 72 h to a 0.5 T uniform SMF. The potential effects were investigated by comparing the electrorotation spectrum and the electrical characteristics of exposed and unexposed cells. The results show no significant differences between control and exposed HEK cells.

**PA-37 [11:00]**

**Development of measurement system for motion and magnetic field – a potential safety training tool for MRI use ..... 76**

Sachiko Yamaguchi-Sekino<sup>1</sup>

<sup>1</sup>*National Institute of Occupational Safety and Health, Japan, Kawasaki, Japan, 2148585*

We constructed special equipment for magnetic field measurements at three positions and motion recording. Experiments were carried out in a 3T MRI room. Three healthy subjects were instructed to put on the test suit and to simulate the head MR examination process. The highest  $B_{max}$  and the average  $B_{max}$  were observed at the head position. The exposed magnetic fields at the breast and the lower abdomen were much lower than those at the head.

**PA-39 [11:00]**

**Design and Study of Very High Electric Field Exposure System for Human Cells Exposure ..... 79**

Masood Ur Rehman<sup>1,2</sup>, Yasir Alfadh<sup>2</sup>, Xiaodong Chen<sup>2</sup>, John Tattersall<sup>3</sup>, Iain Scott<sup>3</sup> & Warren Kitchen<sup>3</sup>

<sup>1</sup>*Centre for Wireless Research, University of Bedfordshire, Luton, UK, LU1 3JU*

<sup>2</sup>*School of Electronic Engineering and Computer Science, Queen Mary University of London, London, UK, E1 4NS*

<sup>3</sup>*Biomedical Science Department, Dstl Porton Down, Salisbury, UK*

A novel system has been designed for the exposure of human body cells to very high electric fields in 1000MHz to 2000MHz frequency range based on a cylindrical re-entrant resonant cavity. Performance is evaluated in terms of reflection coefficient, electric field and Q-factor in unloaded and loaded with cell culture (contained in a 55mm diameter Petri dish) conditions. Simulated results are verified through measurements. This system can well support electric field strengths of 120kV/m with an input power of 200W in unloaded condition.

**PA-41 [11:00]**

**Microwave treatment of mold on travertine. Evaluation of structural effects ..... 7;**

Bruno Bisceglia<sup>1</sup> & Francesco Marra<sup>1</sup>

<sup>1</sup>*Department of Industrial Engineering, University of Salerno, Fisciano (SA), Italy, 84084*

Stone decay takes many different forms. Living organisms contribute to the decay of stone and similar materials.

MW treatment is a promising technology for disinfestation of architectural remains. In this work, the coupled thermal and electromagnetic effects on a travertine sample in WR340 waveguide were analyzed by means of numeric simulation, including also the mathematical description of disinfestations effects on a target microorganism.

**PA-43 [11:00]**

**Health effects from cell phone radiations. The verdict of the Court of Cassation of Italy ..... 84**

Bruno Bisceglia<sup>1</sup>

<sup>1</sup>*Department of Industrial Engineering, University of Salerno, Fisciano (SA), Italy, 84084*

The effect of mobile phone radiation on human health is the subject of recent interest and study. The Supreme Court of Cassation of Italy has recently recognized the occupational origin of a trigeminal schwannoma in a user of mobile telephones. We describe and discuss the salient aspects of this unprecedented ruling as a case-study in the framework of the use (and misuse) of scientific evidences in toxic-tort litigation.

**PA-45 [11:00]**

**Duty Cycles of Wireless Applications and Activities for WiFi Exposure Assessment ..... 85**

Wout Joseph<sup>1</sup>, Daan Pareit<sup>1</sup>, Dries Naudts<sup>1</sup>, Gunter Vermeeren<sup>1</sup>, Ingrid Moerman<sup>1</sup> & Luc Martens<sup>1</sup>

<sup>1</sup>*Information Technology, Ghent University/iMinds, Ghent, Belgium, 9050*

Duty cycles of WLANs using WiFi technology are determined for applications such as voice over IP (VoIP), file transfer, video streaming, audio, surfing, etc. These duty cycles can be used for assessment of realistic WLAN exposure. File transfer at maximum and minimum data rate results in median duty cycles of 47.6% and 91.5%, respectively. The worse the connection, i.e., when only low physical data rates are possible, the higher the duty cycle and the resulting exposure can be.

**PA-47 [11:00]**

**Test of Toms Pocket for Measuring RF Exposure ..... 87**

Bjorn Tollefsrud<sup>1</sup> & Ake Bergvall<sup>2</sup>

<sup>1</sup>*Technology, Telenor Norway, Fåberg, Norway, 26225*

<sup>2</sup>*Site and projects, Telenor Sweden AB, Karlskrona, Sweden, 37180*

If there are many *mobile* operators whose operations are the source of "radiation" in one area, it can be interesting and/or necessary to document what a single antenna, – for example, one of Telenor's UMTS (3G) antennas - contributes to the total measured radiation registered through use of the broadband instrument EMR 300.

**PA-49 [11:00]**

**Estimation of Compliance Height of Structures Surrounding a Base Station Under Worst Case Conditions (Maximum EIRP) ..... 89**

Ashish Kumar Shrivastava<sup>1</sup>

<sup>1</sup>*Radio Frequency Department, TATA Teleservices Ltd., JAIPUR, India, 302021*

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

**PA-51 [11:00]**

**Application of a Novel Quality Control Procedure for Micro-wave Diathermy in Physiotherapy Unit ..... 89**

Constantinos Koutsojannis<sup>1</sup>

<sup>1</sup>*Department Of Physiotherapy, Technological Educational Institute of Patras, Patras, Greece, 26334*

Micro-wave diathermy (MWD) is a form of radiofrequency (RF) radiation, that is used by physiotherapists for rehabilitation. Although this form of therapy is widely available, the management of the equipment is not often addressed by either physiotherapists or by medical physics/clinical engineering. A quality control protocol for MWD units, examining power output, was recently developed and applied to units used in clinical practice.

**PA-53 [11:00] - STUDENT PAPER**

**Whole-Body SAR Simulation of Growing Rodents Employing Anatomical and Homogeneous Voxel Models and Geometrical Structures ..... 93**

Thomas Fiedler<sup>1</sup>, Joachim Streckert<sup>2</sup>, Markus Clemens<sup>2</sup> & Stefan Dickmann<sup>1</sup>

<sup>1</sup>*Chair of Fundamentals of Electrical Engineering, Helmut Schmidt University, Hamburg, Germany, 22043*

<sup>2</sup>*Chair of Electromagnetic Theory, University of Wuppertal, Wuppertal, Germany, 42119*

In order to reduce simulation time, anatomical rat models are substituted by homogeneously filled models of rat or ellipsoidal shape. In the range from 1 to 30 g body mass, the absorbed power and SAR will be compared. It is shown that a time-saving worst-case assessment is possible with the ellipsoid models from 3 to 21 g with a maximum overexposure of 42%. With the homogeneous models of rat shape a worst-case assessment is achieved throughout the considered body mass range with a maximum overexposure of 22%.

**PA-55 [11:00] - STUDENT PAPER**

**Protective effects of traditional Chinese medicine Kangfuling against microwave-induced cognitive impairment through antioxidant ..... 97**

Rui-yun Peng<sup>1</sup>, Shao-hua Hu<sup>1</sup>, Guo-shan Yang<sup>2</sup> & Lin Wang<sup>3</sup>

<sup>1</sup>*Dept. of Experimental Pathology, Beijing Institute of Radiation Medicine, Beijing, China, 100850*

<sup>2</sup>*Division of Radiation Protection and Health Physics, Beijing Institute of Radiation Medicine, Beijing, China, 100850*

<sup>3</sup>*Department of Pharmaceutical Chemistry, Beijing Institute of Radiation Medicine, Beijing, China, 100850*

To evaluate the potential protective effects of a traditional Chinese medicine KFL on cognitive ability and oxidative stress induced by microwave. Behavioral parameters, histopathology, amino acid neurotransmitters level, and biochemical parameters in hippocampus were assessed at the end of the administration. We also examined free radical scavenging activity and antioxidant effect in PC12 cells induced by microwave of the extracts of KFL.

**PA-57 [11:00]**

**Brain tissue-specific exposure to small helical antenna radiation ..... 98**

Maria Christopoulou<sup>1</sup>, Vasileios Papavasileiou<sup>1</sup> & Konstantina Nikita<sup>1</sup>

<sup>1</sup>*School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece*

Adult and six child head models are exposed to a small helical antenna, operating at 1800 MHz. Mobile terminal model is positioned at IEEE standardized 'touch' and 'tilted' positions. Peak averaged Specific Absorption Rate (SAR) values are calculated in head, grey matter, white matter and averaged brain. SAR reference mass is calculated as cubical and contiguous, as respectively defined by IEEE and ICNIRP standards. Age-dependent variation of tissues dielectric properties is considered.

**PA-59 [11:00]**

**EMI evaluation of implanted cardiac pacemaker using realistic mobile radio terminal model ..... 9:**

Kazuyuki Saito<sup>1,2</sup>, Endo Yuta<sup>2</sup>, Sota Kojima<sup>2</sup>, Soichi Watanabe<sup>1</sup>, Masaharu Takahashi<sup>2</sup> & Koichi Ito<sup>2</sup>

<sup>1</sup>*National Institute of Information and Communications Technology, Koganei, Japan, 1848795*

<sup>2</sup>*Chiba University, Chiba, Japan, 2638522*

Recently, electromagnetic interference (EMI) of an implanted cardiac pacemaker with a mobile radio terminal has been investigated. In previous numerical computation of the EMI, half-wavelength dipole antenna has been employed as radiator of electromagnetic waves. However, actual mobile radio terminals equipped antennas of complex structure. In this study, a realistic model of mobile radio terminal was constructed and was employed for EMI evaluation of the implanted cardiac pacemaker.

**PA-61 [11:00] - STUDENT PAPER****Sequential RF-EMF exposure modeling and hotspot localization ..... : 3**

Sam Aerts<sup>1</sup>, Dirk Deschrijver<sup>1</sup>, Leen Verloock<sup>1</sup>, Tom Dhaene<sup>1</sup>, Luc Martens<sup>1</sup> & Wout Joseph<sup>1</sup>

<sup>1</sup>*Department of Information Technology, Ghent University / iMinds, Ghent, Belgium, 9000*

We present a new methodology to create heat maps that accurately pinpoint the outdoor locations with elevated exposure to radio-frequency (RF) electromagnetic fields (EMF) in an extensive urban region. It comprises an interactive measurement and modeling scheme based on kriging interpolation, and allows local authorities and epidemiologists to efficiently assess the location and spectral composition of RF-EMF exposure hotspots, while at the same time developing a global picture of the exposure in the area.

**PA-63 [11:00]****Towards a Uniform Exposure at Millimeter Waves: Design and Optimization of an Advanced Feed for a 60-GHz Exposure System ..... : 5**

Artem Boriskin<sup>1</sup>, Maxim Zhadobov<sup>1</sup>, Ronan Sauleau<sup>1</sup> & Yves Le Dréan<sup>2</sup>

<sup>1</sup>*Institute of Electronics and Telecommunications of Rennes (IETR), Rennes, France*

<sup>2</sup>*Institute for Research on Environmental and Occupational Health (IRSET), Rennes, France*

An advanced feed for a mm-wave exposure system is developed based on the choke ring antenna (CRA) concept. Its performance is optimized to provide a -0.5 dB (W/m<sup>2</sup>) exposure uniformity of a 35mm Petri dish with an exposure efficiency of 55%. Compared to standard waveguides and horn antennas, a twofold efficiency improvement is demonstrated. The reported CRA is an excellent solution for in vitro bioelectromagnetic studies at 60 GHz.

**PA-65 [11:00]****Experimental Set-up for Exposure of Cell Cultures in vitro to Pulse-Modulated RF Signals of Ultra High Field MRI ..... : 8**

Maxim Zhadobov<sup>1</sup>, Guillaume Ferrand<sup>2</sup>, Michel Luong<sup>2</sup>, Yonis Soubere Mahamoud<sup>3</sup>, Pierre-Henri Carton<sup>2</sup>, Yves Piret<sup>2</sup>, Ronan Sauleau<sup>1</sup> & Yves Le Dréan<sup>3</sup>

<sup>1</sup>*Institute of Electronics and Telecommunications of Rennes (IETR), Rennes, France*

<sup>2</sup>*French Alternative Energies and Atomic Energy Commission (CEA Saclay), Gif sur Yvette, France*

<sup>3</sup>*Institute for Research on Environmental and Occupational Health (IRSET), Rennes, France*

A set-up for exposure of cell cultures in vitro to pulse-modulated 300 MHz and 500 MHz signals of future magnetic resonance imaging (MRI) systems is presented. Dipole antennas, specifically designed for ultra high field MRI, are used as radiating structures. The exposure of cells located in standard tissue culture plates is quantified from the electromagnetic and thermal viewpoints.

**PA-67 [11:00]****A New Technique to Evaluate the Specific Absorption Rate of Multi-Antenna Systems in Mobile Communications ..... : :**

Dinh Thanh Le<sup>1</sup>, Lira Hamada<sup>1</sup>, Soichi Watanabe<sup>1</sup> & Teruo Onishi<sup>2</sup>

<sup>1</sup>*National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795*

<sup>2</sup>*NTT DOCOMO INC., Tokyo, Japan, 239-8536*

In mobile communication utilizing MIMO techniques, there are several transmitting antennas working at a same frequency in a device. The amplitudes and phase differences of radiated signals changes randomly during a communication. The proposed technique is to measure the time-averaged SAR of such devices by activating all of the antennas at the same time and averaging the measured SAR in a certain averaging time. Several typical MIMO signals, modeled in MATLAB, are investigated to find suitable averaging time for stable SAR measurement.

**PA-69 [11:00]****SAR Estimations in Fetuses at 13th, 18th and 26th Gestation Ages Exposed to the EM Wave from a Flip Phone ..... : 3**

Akihiro Tateno<sup>1</sup>, Kensuke Tanaka<sup>1</sup>, Tomoaki Nagaoka<sup>2</sup>, Kazuyuki Saito<sup>1</sup>, Soichi Watanabe<sup>2</sup>, Masaharu Takahashi<sup>1</sup>, Joe Wiat<sup>3</sup> & Koichi Ito<sup>1</sup>

<sup>1</sup>*Chiba University, Chiba, Japan, 263-8522*

<sup>2</sup>*National Institute of Information and Communications Technology, Koganei, Japan, 184-8795*

<sup>3</sup>*Orange Labs and Whist Lab, Issy-Les-Moulineaux, France, 92794*

Recently, as the electromagnetic (EM) environment becomes diverse, it is essential to estimate the exposure by EM waves in pregnant females and their fetuses under various situations. Therefore, we have calculated specific absorption rate (SAR) in a fetus. However, the structure of the wireless radio terminal was simple as like a planar inverted-F antenna. Therefore, we present the calculated SAR in a fetus exposed to EM waves from high-definition EM source model using the pregnant female models of 13th, 18th and 26th week gestation.

**PA-71 [11:00]**

**SAR Measurement in Long Term Evolution (LTE) Wireless Devices ..... ; 6**

Teruo Onishi<sup>1</sup>

<sup>1</sup>*Research Laboratories, NTT DOCOMO, INC., Yokosuka, Japan, 239-8536*

This paper describes SAR measurement of Long Term Evolution (LTE) handsets. One point that should be considered regarding this technology for SAR measurement is some parameters compared to these technologies, e.g., Resource block (RB). There exist LTE SAR measurement procedures based on RF conducted power. However since this has not been clarified so far, the correlation between RF conducted power and SAR is investigated. SAR measurements according to existing procedures are conducted and compared results.

**PA-73 [11:00]**

**An assessment of direct and indirect electromagnetic hazards near radiofrequency physiotherapeutic devices ..... ; 8**

Krzysztof Gryz<sup>1</sup> & Jolanta Karpowicz<sup>1</sup>

<sup>1</sup>*Laboratory of Electromagnetic Hazards, Central Institute For Labour Protection - National Reserach Institute, Warszawa, Poland, 00-701*

EMF emitted by physiotherapeutic devices and capacitive currents in the upper limb of operators were measured in near short-wave and long-wave diathermies and sonotherapy units. Short-wave diathermies create the highest EMF hazards, no near sonotherapy hazards were found – according to requirements on workers and general public exposure (e.g. patients who do not undergo treatment) and on the protection of active implantable medical devices against dysfunctions caused by EMF interactions.

**PA-75 [11:00] - STUDENT PAPER**

**Wireless Device 10g SAR Calculation from 3D MRI Temperature Measurements ..... ; ;**

Leeor Alon<sup>1,2</sup>, Gene Y. Cho<sup>1,2</sup>, Daniel K. Sodickson<sup>1,2</sup> & Cem M. Deniz<sup>1,2</sup>

<sup>1</sup>*Department of Radiology, New York University, New York, NY, USA, 10016*

<sup>2</sup>*Sackler Institute of Graduate Biomedical Sciences, New York University School of Medicine, New York, NY, USA, 10016*

Deposition of RF energy can be quantified via local SAR and temperature-change measurements. MRI provides a tool to measure small temperature changes in phantoms being exposed to RF radiation. Conversion from temperature-change to SAR is nontrivial when heating duration is long, since the heat-diffusion effect is prominent. In this work, a method for 3D calculation of 10g SAR is shown via inversion of the heat equation using high-resolution 3D temperature maps and measured thermal properties.

**PA-77 [11:00]**

**Assessments of realistic output power levels for LTE devices ..... 324**

Paramananda Joshi<sup>1</sup>, Björn Thors<sup>1</sup>, Tomas Persson<sup>1</sup>, Christer Tornevik<sup>1</sup> & Davide Colombi<sup>1</sup>

<sup>1</sup>*Ericsson Research, Ericsson AB, Stockholm, Sweden, 16480*

Drive and walk test measurements have been carried out in different environments and for real applications utilizing a wide range of data rates, to assess uplink output power levels in an LTE network. The LTE uplink output power was found to be substantially below the maximum available power for all cases considered. In urban and suburban environments, the mean output power for voice applications was 25 dB below maximum available output power. For continuous file upload the corresponding value was 9 dB.

**PA-79 [11:00]**

**Temporal and spatial distribution of radiofrequency electromagnetic fields in the city of Basel ..... 327**

Damiano Urbinello<sup>1</sup> & Martin Roosli<sup>1</sup>

<sup>1</sup>*University of Basel, Basel, Switzerland, 4002*

This study investigated spatial variability and temporal trends of RF-EMF exposure levels in Basel, Switzerland. Data was collected using exposimeters in outdoor areas, public transports and indoor settings between 2010 and 2012.

We found exposure levels for total RF-EMF exposure between 0.09 V/m (residential area) and 0.72 V/m (trains), increasing yearly by up to 48% (outdoor).

**PA-81 [11:00]****Home measurements of RF exposure in the French Comop programm ..... 32;**

Rene De Seze<sup>1,2</sup>, Patrice Cagnon<sup>3</sup>, György Thuroczy<sup>1,2</sup>, Samuel Mauger<sup>3</sup>, Paul Mazet<sup>4</sup>, Jean-Benoit Agnani<sup>5</sup>, François Gaudaire<sup>6</sup>, Julien Caudeville<sup>7</sup> & Brahim Selmaoui<sup>1,2</sup>

<sup>1</sup>*Experimental Toxicology - PeriTox EA 4285 UMI 01, INERIS, Verneuil-en-Halatte, France, 60550*

<sup>2</sup>*PeriTox EA 4285 UMI 01, UPJV, Amiens, France, 80000*

<sup>3</sup>*Technical Barriers and Safety Systems, INERIS, Verneuil-en-Halatte, France, 60550*

<sup>4</sup>*CETIM, Senlis, France, 60300*

<sup>5</sup>*ANFR, Maisons-Alfort, France, 94704*

<sup>6</sup>*CSTB, Saint-Martin-d'Hères, France, 38400*

<sup>7</sup>*Health Impact and Exposure, INERIS, Verneuil-en-Halatte, France, 60550*

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-83 [11:00]****Application of measurement standards to large scale measurement of public EMF exposure from mobile communications base stations ..... 334**

Marthinus Van Wyk<sup>1</sup>, Wessel van Brakel<sup>1</sup> & Christo Visser<sup>1</sup>

<sup>1</sup>*EMSS Consulting, Stellenbosch, South Africa, 7600*

Complex standards exist that specify measurement equipment and methodologies for the measurements of electromagnetic fields (EMF) around broadcast infrastructure. The IEC 62232 standard is specifically of interest when considering cellular base stations.

Simplification of a standard to a set of guidelines which can be easily understood by more general engineering staff members and measurement and reporting automation for improved accuracy is reported on in this poster.

**PA-85 [11:00]****Evaluation of the disturbances caused by the sensor of the SARmeter ..... 337**

Dominique Picard<sup>1</sup>

<sup>1</sup>*Electromagnétisme - DRE, Supélec, Gif sur Yvette, France, 91192*

The measurement of the power radiated by a mobile phone allows the evaluation of the user exposure. The SARmeter is a device which measures this radiated power. This device uses a sensor placed near the phone antenna. This study estimates the perturbation caused by the presence of the sensor on the radiated power and the radiation pattern of the phone antenna.

**PA-87 [11:00]****Individual indicator of the power emitted by a mobile phone ..... 33:**

Dominique Picard<sup>1</sup> & Joël Legrand<sup>1</sup>

<sup>1</sup>*Electromagnétisme - DRE, Supélec, Gif sur Yvette, France, 91192*

The exposure of the user of a mobile phone is proportional to the power radiated by the phone. The power radiated by a mobile phone depends on the propagation conditions and can be modified at the request of the base station by means of the power control on a large dynamic range which is of 30dB for GSM and of 70dB for UMTS. This study allowed to design and to realize a simple, cheap and light device which displays the level of the power radiated by a mobile phone.

**PA-89 [11:00]****EMF risk assessment near mobile base stations using Rice-K parameter estimation by GTD/UTD propagation prediction ..... 33;**

Richard Überbacher<sup>1</sup>, Georg Neubauer<sup>2</sup> & Stefan Cecil<sup>1</sup>

<sup>1</sup>*EMC&Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

<sup>2</sup>*Safety and Security Department, Austrian Institute of Technology, Seibersdorf, Austria, 2444*

In this work we compare data from former measurement campaigns near mobile base stations with results obtained from numerical GTD/UTD simulations. While the field strength prediction for single points can lead to considerable uncertainties (i.e. unknown material parameters, low realistic modeling) in a volumetric approach the Rice-K factor produces good reliable results as descriptor for the spatial field variations. For the EMF assessment a known Rice-K factor may lead to a more accurate site validation.

**PA-91 [11:00]****Design and dosimetric analysis of a novel 1,950 MHz head exposure system for provocation studies concerning mucosa cells ..... 343**Gernot Schmid<sup>1</sup>, Stefan Cecil<sup>1</sup>, Richard Überbacher<sup>1</sup>, David Sainitzer<sup>1</sup> & Hamid Molla-Djafari<sup>2</sup><sup>1</sup>*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444*<sup>2</sup>*Austrian Workers Compensation Board AUVA, Vienna, Austria, A-1200*

The exposure system is based on 2 small patch antennas located in the cheek region, mounted on a headset worn by the test subject. Exposure of the left or right cheek at 2 different exposure levels and sham can be randomly controlled in a double-blind manner. Exposure of mucosa was numerically analyzed in the area where oral swabs are taken. System efficiency in terms of average mucosa-SAR in the swab area is 12.8 (W/kg)/W. SAR homogeneity was 76% within  $\pm 3$ dB. Uncertainty was less than  $\pm 2$ dB.

**PA-93 [11:00]****A Statistical Approach for the Assessment of the Fetal Brain Exposure to Radio Frequency Electromagnetic Fields ..... 346**Marjorie Jala<sup>1,3</sup>, Emmanuelle Conil<sup>1</sup>, Joe Wiart<sup>1</sup>, Céline Lévy-Leduc<sup>2</sup> & Éric Moulines<sup>3</sup><sup>1</sup>*Orange Labs, Issy-les-Moulineaux, France, 92130*<sup>2</sup>*AgroParisTech, Paris, France, 75005*<sup>3</sup>*Télécom ParisTech, Paris, France, 75013*

In this paper, we discuss the issue of the assessment of the fetal brain exposure to radio frequency electromagnetic fields. We consider that the Specific Absorption Rate (SAR) in the brain of a 26-week-old fetus from a Japanese pregnant woman model is a function of two parameters, the azimuth and the elevation of the incident plane wave. We propose to apply a methodology to build a sequential design of experiments in order to estimate the 95% quantile of the SAR distribution by performing as few SAR calculations as possible.

**PA-95 [11:00]****The Impact of Input Data Accuracy on the Validity of Modelled Electromagnetic Fields from Mobile Phone Base Stations ..... 348**Johan Beekhuizen<sup>1</sup>, Hans Kromhout<sup>1</sup>, Alfred Bürgi<sup>2</sup>, Anke Huss<sup>1</sup> & Roel Vermeulen<sup>1</sup><sup>1</sup>*Environmental Epidemiology, Institute for Risk Assessment Sciences, Utrecht, the Netherlands, 3584CK*<sup>2</sup>*ARIAS umwelt.forschung.beratung, Bern, the Netherlands, CH-3011*

Different prediction models have been applied to assess population exposure to radio frequency electromagnetic fields (RF-EMF) from mobile phone base stations. We evaluated the impact of input data accuracy on the validity of model output, as detailed input data is not always available for epidemiological studies. Our results show that a reliable model output can be obtained when 3D building data and information on the antenna height, frequency, location and direction are available.

**PA-97 [11:00]****Public RF exposure around radio and television broadcast stations ..... 349**Peter Necz<sup>1</sup>, Noemi Nagy<sup>1</sup>, Jozsef Bakos<sup>1</sup>, Gábor Jánossy<sup>1</sup> & György Thuroczy<sup>1</sup><sup>1</sup>*Department of Radiohygiene - Non-ionizing Radiations, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary, 1221*

The aim of this study is to re-evaluate the public exposure to RF caused by TV and radio broadcast stations, in order to classify exposure categories for further cohort studies. The measured RF fields around these stations were below the ICNIRP reference levels for general public. There have been found a slight difference of RF field strength between the urban and rural areas. The results suggest that it is not possible to assign exposure zones around broadcast towers for the purposes of epidemiological studies.

**PA-99 [11:00]****Rational Chemical Design of Broadband Tissue-Simulating Liquids ..... 34;**Kristell Quelever<sup>1,2,3</sup>, Benoit Derat<sup>3</sup>, Olivier Meyer<sup>2</sup>, Thibaud Coradin<sup>1</sup> & Christian Bonhomme<sup>1</sup><sup>1</sup>*Chimie de la Matière Condensée de Paris (LCMCP), UMR 7574, UPMC Université Paris 06, CNRS, Paris, France, 75005*<sup>2</sup>*Laboratoire de Génie Electrique de Paris (LGEPE), UMR 8507, Gif-sur-Yvette, France, 91192*<sup>3</sup>*Art-Fi SAS, Orsay, France, 91400*

SAR measurement methods are highly time consuming. Changing between a number of biological tissue simulating fluids is one of the tedious aspects in radiofrequency dosimetric assessment. Materials capable of broadband matching with standard target dielectric parameters are hence of great utility. This paper illustrates how the application of basic physical chemistry

principles can be used to define a straightforward methodology for deriving new broadband and stable tissue-simulating liquids.

**PA-101 [11:00]**

**Extensive radiofrequency measurements in outdoor environments in Sweden ..... 353**

Jimmy Estenberg<sup>1</sup> & Torsten Augustsson<sup>1</sup>

<sup>1</sup>*Swedish Radiation Safety Authority, Stockholm, Sweden, 171 16*

We have developed a car based system for fast, large area, spectral radiofrequency power density estimation. The system was presented at the BEMS meeting in 2012. Since then, more than 80'000 measurements covering the frequency range 30 MHz to 3 GHz have been carried out. It is possible to perform a complete mapping of a town with 15'000 inhabitants and a path length of 115 kilometers within one day. Detailed frequency analysis of power densities from urban and rural areas will be presented.

**PA-103 [11:00]**

**Fast SAR Assessment using spherical modes ..... 355**

Aycine Bellaouel<sup>1,2</sup>, Azeddine Gati<sup>1</sup>, Abdelhamid Hadjem<sup>1</sup>, David Lautru<sup>2</sup>, Joe Wiart<sup>1</sup> & Victor Fouad<sup>2</sup>

<sup>1</sup>*Orange, Issy-Ies-Moulineaux, France, 92130*

<sup>2</sup>*L2E, Orange, Paris, France, 75005*

This paper focuses on the exposure assessment using a non-invasive method. We propose to calculate the SAR from the radiated fields and to identify their signature from a data base of measurements. The method is demonstrated through a set of simulations using the Finite-Difference-Time-Domain method. We introduce a Correlation Factor (CF) for comparing the spherical traces. We found a high correlation between the SAR and the propagated fields outside the head. For high CFs, the SAR obtained for the compared mobile phones are similar.

**PA-105 [11:00]**

**Exposure analysis of children reproductive organs to EMF emitted by a mobile phone placed nearby ..... 357**

Amal Ghanmi<sup>1,2</sup>, Nadege Varsier<sup>1,2</sup>, Abdelhamid Hadjem<sup>1,2</sup>, Emmanuelle Conil<sup>1,2</sup>, Joe Wiart<sup>1,2</sup>, Odile Picon<sup>3</sup> & Christian Person<sup>2,4</sup>

<sup>1</sup>*Orange Labs, Issy les Moulineaux, France, 92130*

<sup>2</sup>*WHIST Lab common laboratory of Orange Labs and Institut Telecom, France*

<sup>3</sup>*Esycom Université Paris-Est Marne la Vallée, Marne la Vallée, France*

<sup>4</sup>*Institut Telecom Telecom Bretagne, Brest, France*

The last twenty years have seen an unprecedented increase in the use of wireless communication systems, particularly by children and young people. The goal of this study is to analyze the exposure of child genitals associated with the use of mobile phones nearby. A statistical analysis of the results obtained for 100 different positions of a phone shows that the SAR induced in the genitals is very sensitive to the position of the phone and that male genitals are more exposed than females ones.

**PA-107 [11:00]**

**Lipid Membrane Reorganization under Combined Action of Antibiotics and Radiofrequency Field ..... 35:**

Maria-Minodora Iordache<sup>1</sup>, Mihaela-Georgeta Moisescu<sup>1</sup>, Eugenia Kovacs<sup>1</sup> & Tudor Savopol<sup>1</sup>

<sup>1</sup>*Carol Davila Medical and Pharmaceutical University, Bucharest, Romania*

The liposomes behavior in physical and chemical environment which simulates conditions often encountered by patients under clinical investigation and treatment was studied. The General Polarization of Laurdan labeled DMPC vesicles was recorded in presence of gentamicine and radiofrequency field under thermal stress induced by consecutive heating and cooling. Knowing the behavior of lipid vesicles in this special environment is important for a proper formulation design of liposome drug carriers.

**PA-109 [11:00]**

**A versatile system for cell cultures exposures to multiple RF signals ..... 362**

Stefania Romeo<sup>1</sup>, Claudio D'Avino<sup>1</sup>, Daniele Pinchera<sup>2</sup>, Olga Zeni<sup>1</sup>, Maria Scarfi<sup>1</sup> & Rita Massa<sup>1,3</sup>

<sup>1</sup>*CNR, Institute for Electromagnetic Sensing of the Environment, Naples, Italy, 80124*

<sup>2</sup>*Electric and Information Engineering "Maurizio Scarano", University of Cassino and Southern Lazio, Cassino, Italy, 03043*

<sup>3</sup>*INFN Section of Naples, University of Naples Federico II, Naples, Italy, 80126*



A versatile exposure device has been realized and characterized for exposing cell cultures to single or multiple frequencies used by ICT. The applicator consists of a customized WR-430 waveguide, and exposures can be performed at 1.8, 1.95 and 2.45 GHz. Both single and multiple frequency scenarios have been characterized obtaining high efficiency and acceptable non-uniformity degree. Numerical dosimetry was validated by measurements, and a very satisfying agreement has been found between simulations and experimental data.

**PA-111 [11:00]**

**Repetitive exposure to a static magnetic field: cytotoxicity investigations on human fetal lung fibroblasts ..... 364**

Stefania Romeo<sup>1</sup>, Anna Sannino<sup>1</sup>, Olga Zeni<sup>1</sup>, Rita Massa<sup>1,2</sup>, Maria Scarfi<sup>1</sup>, Paolo Bifulco<sup>3</sup>, Mario Cesarelli<sup>3</sup> & Raffaele d'Angelo<sup>4</sup>

<sup>1</sup>*Institute for Electromagnetic Sensing of Environment (IREA), Italian National Research Council (CNR), Naples, Italy, 80124*

<sup>2</sup>*Department of Physics, University of Naples Federico II, Naples, Italy, 80126*

<sup>3</sup>*Department of Electric Eng. and Information Technologies, University of Naples Federico II, Naples, Italy, 80125*

<sup>4</sup>*Italian Workers' Compensation Authority (INAIL), Naples, Italy, 80143*

In this study human fetal lung fibroblasts were subjected to repetitive exposure (1h/day for 4 days) of 0.4 T static magnetic field to assess possible cytotoxic effects. A well characterized exposure device has been employed, and preliminary results indicate absence of effects on cell viability in terms of metabolic activity.

**PA-113 [11:00]**

**An assessment of SAR in numerical male and female phantoms through the use of professional wireless communication handsets ..... 367**

Patryk Zradziński<sup>1</sup>, Jolanta Karpowicz<sup>1</sup>, Krzysztof Gryz<sup>1</sup> & Wiesław Leszko<sup>1</sup>

<sup>1</sup>*Laboratory of Electromagnetic Hazards, Central Institute For Labour Protection - National Research Institute, Warszawa, Poland, 00-701*

Professional wireless communication handsets in common use by workers of public services as the Fire Service or the Police are sources of radiofrequency EMF. Numerical simulations of SAR inside male and female human body phantoms in exposure cases involved various handsets, operating frequencies (150 & 450 MHz) and locations by the worker's body (near the ear, chest or hip). The results showed up to five times higher localised SAR at 150 MHz exposure, and the highest SAR in the chest location.

**PA-115 [11:00]**

**Static and Extremely Low Frequency Magnetic Fields Measurements in Various Types and Models of Hybrid Technology Cars ..... 36:**

Efthymios Karabetos<sup>1</sup>, Efthymia Kalampaliki<sup>1</sup> & Dimitris Koutounidis<sup>1</sup>

<sup>1</sup>*Non-Ionizing Radiation Office, Greek Atomic Energy Commission, Agia Paraskevi, Athens, Greece, 15310*

In order to determine the levels of the magnetic fields - produced due to the currents flowing through the circuits in the passenger compartment - measurements were conducted in all 4 seats, at 3 heights (feet, chest, head) in various types (full/mild) of hybrid cars. Measurements were performed in 4 driving conditions: stationary, during 20-40, 80-120 and over 120 km/h. The results showed that the higher values were found in the feet area of the passenger's seats, during braking and accelerating.

**PA-117 [11:00]**

**Investigation of Magnetic Field Exposure in the Vicinity of Residential Areas around 154/345kV Power Transmission Lines ..... 373**

Sung Ho Myung<sup>1</sup>, Byeongyoon Lee<sup>1</sup>, Yeungyu Cho<sup>1</sup>, Sangbeom Kim<sup>2</sup>, Yunseog Lim<sup>2</sup>, Yoo-cheon Kim<sup>3</sup>, Tae-yong Kim<sup>3</sup>, Yoon-Ok Ahn<sup>4</sup>, Yoon-Myoung Gimm<sup>5</sup> & Seung-Cheol Hong<sup>6</sup>

<sup>1</sup>*Advanced Power Grid Research Division, Korea Electrotechnology Research Institute, Changwon, Korea, 642-120*

<sup>2</sup>*Power System Lab., Korea Electric Power Research Institute, Daejeon, Korea, 305-380*

<sup>3</sup>*Korea Electric Power Corporation, Seoul, Korea, 135-791*

<sup>4</sup>*Department of Preventive Medicine, Seoul National University, Seoul, Korea*

<sup>5</sup>*School of Electronics and Electrical Engineering, DanKook University, Korea*

<sup>6</sup>*Dept. of Occupational Health & Safety Engineering, Inje University, Korea*

In this paper, the analysis results of magnetic field exposure data measured in the vicinity of residential areas around 154kV/345kV overhead electric power transmission lines from 2009 to 2011 were presented. The number of measurement areas was 301 in total (192 for 154kV and 109 for 345kV). The results will be used to establish electric and magnetic fields management planning in the Republic of Korea.

**PA-119 [11:00]**  
**Magnetic field distortion of helmholtz coil by incubator ..... 376**

Jong Gun Lee<sup>1</sup>

<sup>1</sup>*School of Electrical Engineering, Pusan National University, Busan, Korea, 609-735*

We demonstrate why the magnetic field is distorted by Incubator. And we propose the incubator condition and surrounding environment to be applied a uniform magnetic field for the cell. Currently, a variety of devices have been used to see the changes in human cells that are exposed to uniform magnetic fields. However, in the actual environment, magnetic field is generated a non-uniform because it is susceptible. So, how the incubator of the material and the surrounding environment make up to applied to the cells in a uniform magnetic field.

**PA-121 [11:00]**  
**Field Uniformity Measurements in a GTEM Cell for in Vitro Experiments at Mobile Communication Frequencies ..... 378**

Vasileios Papavasileiou<sup>1</sup>, Nektarios Moraitis<sup>2</sup>, Maria Christopoulou<sup>1</sup> & Konstantina Nikita<sup>1</sup>

<sup>1</sup>*Biomedical Simulations and Imaging Laboratory, National Technical University of Athens, Greece*

<sup>2</sup>*Mobile Radiocommunications Laboratory, National Technical University of Athens, Greece*

In this paper we present preliminary field uniformity measurements inside a GTEM cell at mobile communication frequencies and specific stress level. Two measurement scenarios are examined and compared. In the first scenario, the field uniformity in an empty chamber is evaluated, whereas in the second scenario, ten dielectric tubes filled with blood simulating liquid are placed inside the cell. The field uniformity is assessed in both scenarios and useful conclusions are drawn.

**PA-123 [11:00]**  
**Patch antenna configuration for pneumothorax diagnosis ..... 37;**

Maria Christopoulou<sup>1</sup> & Stavros Koulouridis<sup>1</sup>

<sup>1</sup>*Department of Electrical and Computer Engineering, University of Patras, Rio Campus, Greece*

Two configurations of patch antennas are proposed, in order to non-invasively diagnose the collection of air into the pleural cavity of lung area (i.e. pneumothorax). Two- and five-patch antennas set-ups are placed in contact with a layered planar tissue thorax model. The frequency range of operation is set to 1 - 4 GHz. Comparison to corresponding healthy case (absence of air) of S-parameters reveals that detection of air layer as thin as 1 cm is possible.

**PA-125 [11:00]**  
**Analysis of the human exposure and channel modeling for wireless devices near war-fighter ..... 383**

Woo-Geun Kang<sup>1</sup>, Jeung-Won Choi<sup>2</sup>, Jong-Hwan Ko<sup>2</sup>, Ju-Man Park<sup>2</sup>, Hyun-Sung Lee<sup>2</sup> & Jeong-Ki Park<sup>1</sup>

<sup>1</sup>*Radio Science and Engineering, Daejeon, Korea*

<sup>2</sup>*Agency for Defense Development, Daejeon, Korea*

In this paper, we analyzed the SAR values and the on-body channel characteristics for 3 postures of Korean standard human model to investigate the effects of wireless devices near war-fighters, operating at 2.45 GHz. It turns out that the maximum allowed input power of the device, compared to the Korean SAR limit for worker, is about 70 mW and human body can cause about 8 – 42 dB extra loss at 1 m depending on the transmitter and receiver locations.

**PA-127 [11:00]**  
**Confidence by Evidence - Putting LTE to the Test ..... 385**

Dagmar Wiebusch<sup>1</sup> & Karsten Menzel<sup>1</sup>

<sup>1</sup>*Informationszentrum Mobilfunk e. V., Berlin, Germany, 10117*

Under the slogan "Confidence by Evidence – Putting LTE to the test" the Informationszentrum Mobilfunk e. V. (IZMF) commissioned the first nationwide series of measurements at LTE base stations in regular operation. Based on the study, IZMF realized communication activities for public, politicians and local authorities. Thus IZMF developed an useful tool for risk communication and fulfilled WHO's research agenda, that recommends exposure monitoring of new RF technologies with high priority.

**PA-129 [11:00]**  
**Prenatal Exposure of a 900 MHz Electromagnetic Field Decreases the Number of Dentate Gyrus Cells in the Hippocampus ..... 387**

Ersan Odaci<sup>1</sup>, Orhan Bas<sup>2</sup> & Süleyman Kaplan<sup>3</sup>

<sup>1</sup>*Department of Histology and Embryology, Karadeniz Technical University, Trabzon, Turkey*

<sup>2</sup>*Department of Anatomy, Ordu University, Ordu, Turkey*

<sup>3</sup>*Department of Histology and Embryology, University of Ondokuz Mayıs, Samsun, Turkey, 55139*

The effects of prenatal exposure to EMF on the number of granule cells in the dentate gyrus were investigated. The dentate gyrus cell number was estimated using the unbiased stereological techniques. These results show that prenatal exposure of EMF cause a decrease in the number of granule cells in the dentate gyrus of the rats. Cell loss might be caused by an inhibition of granule cell neurogenesis in the dentate gyrus.

**PA-131 [11:00]**

**Survey of RF Exposure Levels from Electromagnetic Sources in Frequency Range of 27 MHz to 6 GHz in Tehran, Iran ..... 388**

Vahid Nayyeri<sup>1</sup>, Hamid-Reza Jalilian-Khaleghi<sup>1</sup>, Maryam Borna<sup>1</sup> & Mohammad Soleimani<sup>1</sup>

<sup>1</sup>*Antenna Research Laboratory, Iran University of Science and Technology, Tehran, Iran*

A survey of radio-frequency radiation from EMF sources laid in frequency band of 27 MHz to 6 GHz has been carried out in Tehran, Iran at 1000 positions mostly located in crowded areas and near major medical centers. Results were compared to the relevant guideline of ICNIRP and that of Iran, confirming radiation exposure levels being satisfactorily below defined limits and to be non-detrimental.

**PA-133 [11:00] - STUDENT PAPER**

**Are children more vulnerable than adults to RF? Different physiology, different vulnerabilities ..... 38;**

Mary Redmayne<sup>1</sup>

<sup>1</sup>*School of Geography, Environment and Earth Sciences, Victoria University of Wellington, Wellington, New Zealand, 6012*

The difference in responses of young and old to RF exposure are more numerous and complex than those generally proffered. This paper explores relevant changes that occur physiologically from child to adulthood. These include development of the CNS/brain, alpha activity, melatonin levels, ear and skull thickness, dielectric tissue values, water and ions in tissues, weight, and size. It will then review research indicating age-dependent effects from RF exposure under the same conditions.

**PA-135 [11:00]**

**Simulation and testing of THz metamaterial antenna for biomedical imaging ..... 393**

Maria Koutsoupidou<sup>1</sup>, Irene Karanasiou<sup>2</sup> & Nikolaos Uzunoglu<sup>1</sup>

<sup>1</sup>*National Technical University of Athens, Athens, Greece, 15773*

<sup>2</sup>*Institute of Communications and Computer Systems, Athens, Greece, 15773*

Biomolecules exhibit distinct signatures in the THz spectral domain, introducing THz technology as a promising option for biological imaging, as it can be used to provide biochemical profiling of biological agents and proteins. In this work, we present a THz patch antenna as emitting component of a novel 2-D THz imaging system for characterization of biosamples associated to brain functionality. Also, the results from measurements of the scaled antenna at the microwave regime are presented.

**PA-137 [11:00]**

**Nanosecond pulsed electric fields abolish orthotopic rat hepatocellular carcinoma and bypass cancer mutations that evade apoptosis ..... 396**

Stephen J. Beebe<sup>1</sup> & Ru Chen<sup>1</sup>

<sup>1</sup>*Frank Reidy Research Center for Bioelectronics, Old Dominion University, Norfolk, VA, USA, 23508*

Pulse power has been used for unique applications in environmental sciences, basic medical sciences and medicine. In this report, pulse power using nanosecond pulsed electric fields (nsPEFs) was successfully applied to treat rat N1-S1 hepatocellular carcinoma (HCC). Using N1-S1 HCC and Jurkat clones with modified apoptosis-related proteins, mechanisms of actions reveal how nsPEFs bypass common oncogenic mutations that protect mitochondria and evade caspase activation at multiple sites.

**PA-139 [11:00]**

**A Functionalized High-Resolution Head Model for EM-Tissue Interaction Modeling ..... 397**

Esra Neufeld<sup>1</sup>, Johanna Wolf<sup>1,2</sup>, Maria Iacono<sup>3</sup>, Leonardo Angelone<sup>3</sup>, Ethan Cohen<sup>3</sup>, Eugene Civillico<sup>3</sup>, Esther Akinagbe<sup>3</sup>, Bertram Wilm<sup>4</sup>, Michael Wyss<sup>4</sup>, Klaas Pruessmann<sup>4</sup>, Wolfgang Kainz<sup>3</sup> & Niels Kuster<sup>1,2</sup>

<sup>1</sup>*Foundation for Research on Information Technologies in Society (IT'IS), Zurich, Switzerland, 8004*

<sup>2</sup>*Swiss Federal Institute of Technology (ETH) Zurich, Zurich, Switzerland, 8092*

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

<sup>4</sup>Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland, 8092

A functionalized high-resolution head model able to simulate EM-neuron interactions in complex anatomical geometries is being developed. MR images were acquired together with DTI data to guide neuron model placement and inform about tissue anisotropy. A dedicated EM solver was implemented and coupled with dynamic models of neuronal activity. The platform was validated with literature data and used to implement a SENN [1] model accounting for local thermal effects.

**PA-141 [11:00]**

**On the question of the biological significance of electromagnetic radiation neuroeffects short exposure and non-thermal intensit ..... 39:**

Svetlana Lukyanova<sup>1</sup>, Vladimir Stepanov<sup>1</sup>, Felix S. Torubarov<sup>1</sup> & Viktorya A. Alekseeva<sup>1</sup>

<sup>1</sup>Burnazyan Federal Medical Centre, FMBA of Russia, Moscow, Russian Federation

Studies by Russian scientists have shown, that electromagnetic radiation a non- thermal intensity (EMR in the continuous regime or impulse <500mkVt /cm<sup>2</sup>) and a short exposure (<30 min.) should be considered as a nonspecific irritant tu the central nervous system. This is evidenced by the presence of the reacnions of individual neurons, brain structures in general, and - the possibility of a conditioned reflex to EMR.

**PA-143 [11:00]**

**Cation selectivity and size of electric-field induced membrane pores in tobacco protoplasts ..... 39;**

Lars Wegner<sup>1</sup>

<sup>1</sup>Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany, 76344

The ion selectivity of the outer membrane of tobacco cells (cell line 'bright yellow-2') exposed to ms PEFs was studied in the whole cell configuration of the patch clamp technique. Voltage ramps were imposed at various combinations of solutions before/during poration. Permeabilities calculated from reversal potentials with a modified Goldmann equation depended on the ionic diameter (Selectivity sequence Ca<sup>2+</sup>>Li<sup>+</sup>>Rb<sup>+</sup>≈K<sup>+</sup>≈Na<sup>+</sup>>TEA<sup>+</sup>≈TBA<sup>+</sup>>Cl<sup>-</sup>). A simple model was used to estimate the mean pore diameter (~1.8nm).

**PA-145 [11:00]**

**Electrotransfer of large plasmids ..... 3: 3**

Léa L. Lesueur<sup>1</sup>, Lluís M. Mir<sup>1</sup> & Franck André<sup>1</sup>

<sup>1</sup>UMR 8203, CNRS, Villejuif, France, 94805

DNA electrotransfer is a promising alternative to the use of viral vectors for gene therapy. The electrotransfer is safer, enables nonpermanent expression of transgenes and allows transfection of large plasmids.

We report here that increasing the plasmid size reduces expressions and survivals after electrotransfer. We present strategies to improve electrotransfer of large plasmids as well as keys for understanding the specific mechanisms involved in large plasmid electrotransfer.

**PA-147 [11:00]**

**Occupational Exposure to Extremely Low-Frequency Electromagnetic Fields and Neurodegenerative Disease ..... 3: 3**

Ximena Vergara<sup>1</sup>, Leeka Kheifets<sup>1</sup>, Sander Greenland<sup>1</sup>, Sona Oksuzyan<sup>1</sup>, Yong-Sung Cho<sup>1</sup> & Gabor Mezei<sup>2</sup>

<sup>1</sup>Epidemiology, UCLA, Los Angeles, USA, 90095

<sup>2</sup>EPRI, Palo Alto, USA, 94022

We conducted a meta-analysis of occupational MF NDD, primarily Alzheimer disease (AD), and motor neuron diseases (MNDs) studies.

**PA-149 [11:00]**

**Unexplained patterns of brain tumors in the USA; some speculations ..... 3: 3**

Devra Davis<sup>1</sup>, Yueh Ying Han<sup>2</sup>, Annie J. Sasco<sup>3</sup> & L. Lloyd Morgan<sup>1</sup>

<sup>1</sup>Research Section, Environmental Health Trust, Teton Village, WY, USA, 83025

<sup>2</sup>Department of Epidemiology, University of Pittsburgh, Pittsburgh, PA, USA, 15213

<sup>3</sup>Epidemiology for Cancer Prevention, INSERM, Bordeaux, France

This study evaluates temporal trends in age & sex-specific incidence of malignant brain tumors by anatomical sites and histological subtypes in the United States to hypothesize about potential avoidable factors. Increased use of diagnostic radiation through computed tomography has been projected to induce excess cancers. Unexplained recent increases in malignant brain cancer is a matter that merits serious investigation.

**PA-151 [11:00]****Exposure to RF-EMF from broadcast transmitters and risk of childhood cancer: a nation-wide cohort study from Switzerland ..... 3: 4**

Dimitri Hauri<sup>1</sup>, Ben Spycher<sup>2</sup>, Michael Grotzer<sup>3</sup>, Nicolas von der Weid<sup>4</sup>, Claudia Kuehni<sup>2</sup> & Martin Roosli<sup>1</sup>

<sup>1</sup>Swiss TPH, Basel, Switzerland

<sup>2</sup>ISPM Bern, Bern, Switzerland

<sup>3</sup>University Children's Hospital Basel, Basel, Switzerland

<sup>4</sup>University Children's Hospital Zürich, Zürich, Switzerland

RF-EMF from broadcast transmitters have been hypothesized to cause childhood cancer. The aim of this nation-wide cohort was to investigate the association between RF-EMF exposure and childhood cancer in Switzerland. The study included 999 cases diagnosed between 2000 and 2008. RF-EMF exposure was modeled and potential confounding factors were considered. RF-EMF exposure was not related to childhood leukemia but some indications for an association with central nervous system tumors were obtained.

**PA-153 [11:00]****Mobile Phone Use and Risk of Glioma ..... 3: 7**

Siegal Sadetzki<sup>1,2</sup>, Angela Chetrit<sup>1</sup>, Galit Hirsh-Yechezkel<sup>1</sup>, Revital Bruchim<sup>1</sup>, Arnona Ziv<sup>3</sup>, Lili Aslanov<sup>1</sup> & Tehila Ben-Tal<sup>1</sup>

<sup>1</sup>Cancer & Radiation Epidemiology Unit, The Gertner Institute for Epidemiology and Health Policy Research, Chaim Sheba Medical Center, Ramat-Gan, Israel, 52621

<sup>2</sup>Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel

<sup>3</sup>Information and Computerization Unit, The Gertner Institute for Epidemiology and Health Policy Research, Chaim Sheba Medical Center, Ramat-Gan, Israel, 52621

To evaluate the possible association between exposure to RF emitted by mobile phone and risk for glioma a nationwide case-control study was conducted. Incident cases of glioma diagnosed in 3/2008-10/2010 (n=529) and individually matched controls were interviewed. Detailed information on mobile phone use was obtained. The association between mobile phone use indices and gliomas will be presented. The relatively long latency period (24y) in this study, may help to shed more light on this important issue.

**PA-155 [11:00]****Evaluation on Electromagnetic Field Individual Exposure of Radio Frequency of 11-15 ages in Large Cities of Korea ..... 3: 7**

Seung-Cheol Hong<sup>1</sup>, Yun Jin Lee<sup>1</sup>, Gi Young Kim<sup>1</sup>, Yeonjun Jeong<sup>1</sup>, Hi Hye Han<sup>1</sup>, Hyun Joo<sup>1</sup> & Yoon-Shin Kim<sup>1</sup>

<sup>1</sup>Occupational Health & Safety Engineering, Inje University, GimHae, Korea, reohong@inje.ac.

To figure out the individual exposure level of radio frequency electromagnetic field of the population of ages 11-15 residing in large cities of Korea, where the age of starting to use cellular phones is relatively early. The level of individual exposure has been measured for 24 hours using SPY-100, and the activity phases by times have been figures out through daily activity patterns records. Currently, this research is ongoing until the first half of year 2013.

**PA-157 [11:00]****WITHDRAWN****PA-159 [11:00]****Antiadipogenic effects of a 50 Hz MF: an approach to the etiology of semicircular lipoatrophy ..... 3: 9**

Maria Martinez<sup>1</sup>, Carlos Paino<sup>2</sup>, Maria Trillo<sup>1</sup> & Alejandro Ubeda<sup>1</sup>

<sup>1</sup>Investigación-BEM, Hospital Ramón y Cajal - IRYCIS, Madrid, Spain, 28034

<sup>2</sup>Investigación-Neurobiología, Hosp. Ramón y Cajal-IRYCIS, Madrid, Spain, 28034

Adipose derived stem cells (ADSC) from human donors were exposed intermittently to a 50 Hz, 100  $\mu$ T MF. The results show that MF exposure prevents the synthesis and storage of lipids in the ADSC cytoplasm. This response seems to be mediated by altered expression/activation of factors like PPAR $\gamma$ , ERK1/2 and Sox9, involved in the regulation of adipogenesis.

**PA-161 [11:00]****Influence of Extremely Low Frequency Electromagnetic Field on Functional State of Muscle Tissue ..... 3: :**

Yu.V. Tseyslyer<sup>1</sup>, O.V. Tsymbalyuk<sup>1</sup>, Olga V. Shelyuk<sup>1</sup>, N.E. Nurishenko<sup>1</sup> & Victor Martynyuk<sup>1</sup>

<sup>1</sup>Department of Biophysics, Taras Shevchenko National University of Kyiv, Kyiv, Ukraine, 01601

ELF EMF influences both the contractile activity of smooth muscle and ATPase of myosin *in vitro*. The direction and magnitude of the EMF-induced changes depends on the chemical agents induced contraction and also on time of exposure. The Ca<sup>2+</sup>, Mg<sup>2+</sup>-independent effects of the EMF ELF open the prospect of learning a new primary mechanisms of action of this physical factor.

**PA-163 [11:00] - STUDENT PAPER**

**Systems approach to study cellular responses to non-ionizing electro-magnetic fields ..... 3; 3**

Arnold Kuzniar<sup>1</sup>, Berina Eppink<sup>1</sup>, Charlie Laffeber<sup>1</sup>, David Schuermann<sup>4</sup>, Manuel Murbach<sup>5</sup>, Mascha Schoonakker<sup>1</sup>, Alex Zelensky<sup>1</sup>, Jeroen Demmers<sup>2</sup>, Primo Schär<sup>4</sup> & Robert Kanaar<sup>1, 3</sup>

<sup>1</sup>*Department of Genetics, Erasmus Medical Center, Rotterdam, the Netherlands, 3000 CA*

<sup>2</sup>*Proteomics Center, Erasmus Medical Center, Rotterdam, the Netherlands, 3000 CA*

<sup>3</sup>*Department of Radiation Oncology, Erasmus Medical Center, Rotterdam, the Netherlands, 3000 CA*

<sup>4</sup>*Department of Biomedicine, University of Basel, Basel, Switzerland, 4058*

<sup>5</sup>*Foundation for Research on Information Technologies in Society, Swiss Federal Institute of Technology, Zürich, Switzerland, CH-8092*

There is a public health concern about the influence of non-ionizing electromagnetic fields (EMFs), such as those produced by power lines, mobile or wireless devices, on the development of cancer. We are interested in whether exposure to EMFs can indirectly cause DNA damage. For this, we developed ultra-sensitive DNA damage detection systems based on a collection of mutant cell lines, as well as implemented a semi-quantitative proteomics approach coupled with bioinformatics analyses.

**PA-165 [11:00] - STUDENT PAPER**

**Ex vivo neutrophil extracellular trap (NET) formation during Low Frequency Electromagnetic Fields (LF-EMF) exposure ..... 3; 3**

Lieke Golbach<sup>1</sup>, Jan Cuppen<sup>2, 3</sup>, Huub Savelkoul<sup>1</sup> & Lidy Verburg-van Kemenade<sup>1</sup>

<sup>1</sup>*CBI, Wageningen University, the Netherlands*

<sup>2</sup>*Eindhoven University of Technology, the Netherlands*

<sup>3</sup>*Neiding BV, the Netherlands*

Neutrophil extracellular traps (NETs) are extracellular DNA structures released by neutrophils upon infection. NETs contain antimicrobial proteins that capture and kill microbes. An *ex vivo* NET formation assay with human neutrophils indicates a yet unknown correlation between EMF and NETosis. LF-EMF (Immune, 300 µT) increased the amount of NET released by an unknown mechanism. We are currently investigating a possible interaction of LF-EMF with actin dynamics and ROS dependant NETosis

**PA-167 [11:00]**

**Influence of exposure to IF magnetic fields on migration potency in neutrophil-like differentiated HL-60 Cells ..... 3; 6**

Junji Miyakoshi<sup>1</sup>, Eijiro Narita<sup>1</sup> & Naoki Shinohara<sup>1</sup>

<sup>1</sup>*Division of Creative Research and Development of Humanosphere, Kyoto University, Uji, Japan, 611-0011*

The immune defence system against foreign substances maintains homeostasis in humans, and a weakened immune system makes an individual prone to infections and is potentially harmful to health. In this study, we investigated the influence of a 23 kHz magnetic field at 2 mT, which is approximately 74 times higher than the reference level in the ICNIRP-2010 guidelines, on migration potency in neutrophil-like cells differentiated from human HL-60 cells (dHL60).

**PA-169 [11:00]**

**A specific EMF exposure affects Beclin1 expression by acting on miR30a in SH-SY5Y human neuroblastoma cells ..... P IC**

Nicoletta Marchesi<sup>1</sup>, Cecilia Osera<sup>1</sup>, Lorenzo Fassina<sup>2, 3</sup>, Marialaura Amadio<sup>1</sup>, Letizia Venturini<sup>4</sup>, Giovanni Magenes<sup>2, 3</sup>, Giovanni Ricevuti<sup>4</sup>, Sergio Comincini<sup>5</sup>, Alessia Pascale<sup>1</sup>, Stefano Govoni<sup>1</sup> & Salvatore Caorsi<sup>2, 6</sup>

<sup>1</sup>*Dipartimento di Scienze del Farmaco, Università di Pavia, Pavia, Italy, 27100*

<sup>2</sup>*Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Pavia, Italy, 27100*

<sup>3</sup>*Centro di Ingegneria Tissutale (C.I.T.), Università di Pavia, Pavia, Italy, 27100*

<sup>4</sup>*Dipartimento di Medicina Interna e Terapia Medica-IDR S. Margherita, Università di Pavia, Pavia, Italy, 27100*

<sup>5</sup>*Dipartimento di Biologia e Biotecnologie, Università di Pavia, Pavia, Italy, 27100*

<sup>6</sup>*Unità di Ricerca ICEmB (National Interuniversity Centre on Interaction between Electromagnetic Fields and Biosystems), Università di Pavia, Pavia, Italy, 27100*

Our results indicated that the specific EMF treatment determined a significant down-regulation of miR30a expression and, consequently, an increase in Beclin1 expression in SHSY-5Y neuroblastoma cells. This EMF-induced molecular change might contribute to the activation of the autophagy process, in particular making available Beclin1 for the initial stages of nucleation process of autophagy, particularly important in Beta-amiloid accumulation in Alzheimers's patients.

**PA-171 [11:00]**

**Prolonged Pulsed Electromagnetic Stimulation induces a cytoprotective response on SH-SY5Y Neuroblastoma Cell Line ..... 3; 8**

Cecilia Osera<sup>1</sup>, Lorenzo Fassina<sup>2,3</sup>, Marialaura Amadio<sup>1</sup>, Letizia Venturini<sup>4,5</sup>, Nicoletta Marchesi<sup>1</sup>, Giovanni Magenes<sup>2,3</sup>, Stefano Govoni<sup>1</sup>, Giovanni Ricevuti<sup>4,5</sup> & Alessia Pascale<sup>1</sup>

<sup>1</sup>*Dipartimento di Scienze del Farmaco, Università di Pavia, Pavia, Italy, 27100*

<sup>2</sup>*Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Pavia, Italy, 27100*

<sup>3</sup>*Centro di Ingegneria Tissutale (C.I.T.), Università di Pavia, Pavia, Italy, 27100*

<sup>4</sup>*Laboratorio di Fisiopatologia Cellulare e Immunologia Clinica - IRCCS S. Matteo, Università di Pavia, Pavia, Italy, 27100*

<sup>5</sup>*Dipartimento di Medicina Interna e Terapia Medica - IDR S. Margherita, Università di Pavia, Pavia, Italy, 27100*

We investigated the effects of a prolonged (72 hours) pulsed electromagnetic field (PEMF; magnetic field intensity, 2mT; frequency, 75 Hz) on a neuronal cellular model characterized by the overexpression of the amyloid precursor protein (APP). Focusing on the stress pathways, we found an increase of HSP70 and SOD-1 proteins. The PEMF treatment promoted the non-amyloidogenic processing of APP and the release of the neurotrophic factor sAPP $\alpha$ , thus suggesting a cytoprotective response.

**PA-173 [11:00] - STUDENT PAPER**

**Investigation of potential effects of ELF pulsed magnetic fields on the interaction of Calcium with proteins Calmodulin & STIM1 ..... 3; ;**

Christian Beyer<sup>1</sup>, Jürg Fröhlich<sup>1</sup>, Marcel Egli<sup>2</sup> & Fabian Ille<sup>2</sup>

<sup>1</sup>*Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zürich, Zürich, Switzerland, 8092*

<sup>2</sup>*Center of Competence in Aerospace Biomedical Science and Technology, Lucerne University of applied Science and Arts, Lucerne, Switzerland, 6052*

This study addresses the possible effects of extremely low frequency pulsed magnetic fields (pMF) on potential target proteins in biological systems. A novel experimental exposure unit that can be directly placed into the measurement compartment of a circular dichroism spectrophotometer was used to investigate pMF induced conformational changes, altered protein folding kinetics as well as changes in the rate of calcium binding in solutions of highly purified Calmodulin (CaM) and STIM1.

**PA-175 [11:00]**

**Effect of electromagnetic radiation (EMR) emitted from 3G mobile phone on nociceptive behavior in Wistar rat: Role of magnetic field ..... 423**

Rashmi Mathur<sup>1</sup>, Amrendra Jha<sup>1</sup>, Suman Jain<sup>1</sup> & Jitendra Behari<sup>2</sup>

<sup>1</sup>*Department of Physiology, All India Institute of Medical Science, New Delhi, India, 110029*

<sup>2</sup>*Department of environmental Science, Jawaharlal Nehru University, New Delhi, India, 110067*

Wistar rats were exposed to magnetic field and 3G frequency band for 2h/day x 45 days. Tail flick latency and nociceptive behavior were performed at different time point (Basal, 15, 30 and 45 days) of exposure. Decreased forepaw lick-latency was observed at 45 days of 3G frequency band exposure. Effect of magnetic field, temporal pattern of nociceptive behavior and tonic pain rating of rat will be presented.

**PA-177 [11:00]**

**Influence of Low Power Millimeter and Decimeter Waves on the Stability of Bilayer Lipid Membranes ..... 424**

Vitaly Kalantaryan<sup>1</sup> & Valeri Arakelyan<sup>2</sup>

<sup>1</sup>*Microwave Radiophysics, Yerevan State University, Yerevan, Armenia, 0025*

<sup>2</sup>*Molecular Physics, Yerevan State University, Yerevan, Armenia, 0025*

The action of electromagnetic waves leads to a decrease in the bilayer lipid membrane (BLM) stability in an electric field. The experiments indicate that the effect of millimeter waves(MMW) leads to an increase in the number of pores in the BLM. Decrease in the BLM-average lifetime is more pronounced under the action of non-resonant frequency MMW. It is also shown that the effect of decimeter waves is connected both with increase in the number of pores in the BLM and with decrease of the pore formation work.

**PA-179 [11:00]**

**Comparison of genotoxic effects of 1800 MHz radiofrequency electromagnetic fields and extremely-low-frequency electromagnetic field ..... 426**

Chuan Liu<sup>1</sup>, Wei-Xia Duan<sup>1</sup>, Lei Zhang<sup>1</sup>, Zhou Zhou<sup>1</sup> & Zhengping Yu

<sup>1</sup>*Department of Occupational Health, Third Military Medical University, Chongqing, China, 400038*

In this study, we conducted a comparison of exposure to 1800 MHz RF-EMF and to 50 Hz ELF-EMF. The FPG sensitive sites and the 8-oxoG levels were increased after RF-EMF exposure at a SAR of 4 W/kg, as well as an increase of ROS. However, no detectable DNA strand breakage was observed following both RF-EMF and ELF-EMF exposure. These findings may imply the possibility that RF-EMR but not ELF-EMF may produce genotoxicity through oxidative DNA base damage in male germ cells.

**PA-181 [11:00]**

**Characteristics of new in vitro exposure system using resonant coupling wireless power transfer ..... 427**

Junji Miyakoshi<sup>1</sup>, Kohei Mizuno<sup>1</sup> & Naoki Shinohara<sup>1</sup>

<sup>1</sup>*Research Institute for Sustainable humanosphere, Kyoto University, Uji, Kyoto, Japan, 611-0011*

The wireless power transfer technology using resonant coupling phenomenon has been studied by many researchers. However, there are very few studies concerning the possible relationship between electromagnetic field from wireless power transfer and human health. We manufactured the new in vitro exposure system for evaluation of biological effects. In this paper, we introduced characteristics of our exposure system for in vitro study.

**PA-183 [11:00]**

**Analysis of 60-GHz millimeter-wave exposure on chemokines signaling by an original cell-to-cell approach ..... 428**

Yann Le Page<sup>1</sup>, Rémy Le Guével<sup>2</sup>, Catherine Le Quément<sup>1</sup>, Denis Habauzit<sup>1</sup>, Maxim Zhadobov<sup>3</sup>, Ronan Sauleau<sup>3</sup> & Yves Le Dréan<sup>1</sup>

<sup>1</sup>*IRSET - INSERM U1085, Rennes, France, 35042*

<sup>2</sup>*ImPACcell - SFR Biosit, Rennes, France, 35042*

<sup>3</sup>*IETR - UMR CNRS 6164, Rennes, France, 35042*

An effect on the inflammatory response was previously observed in human keratinocytes exposed to 60.4 GHz millimeter wave (MMW). To go deeper into analysis, we used the Cellomics technology to assess the expression of 3 cytokines (CXCL-1, CCL2 and CXCL-8). Large scale cell-to-cell data on protein expression and localization were obtained, and the heterogeneity of the cellular response was evaluated in order to determine if a more MMW-sensitive subpopulation of cells exists or not.

**PA-185 [11:00]**

**2.1 GHz Microwave Radiation Induces Apoptosis and  $\Delta\Psi_m$  Depolarization in Human Breast Fibroblast Cells ..... 42:**

Nesrin Seyhan<sup>1</sup>, Meric Arda Esmekaya<sup>1</sup>, Handan Kayhan<sup>2</sup>, Mehmet Zahid Tuysuz<sup>1</sup>, Ayse Canseven Kursun<sup>1</sup> & Munci Yagci<sup>2</sup>

<sup>1</sup>*Department of Biophysics, Gazi University, Ankara, Turkey*

<sup>2</sup>*Department of Internal Medicine, Gazi University, Ankara, Turkey*

In the present study we aimed to investigate the effects of 2.1 GHz Wideband Code Division Multiple Access (W-CDMA) modulated Microwave (MW) Radiation on cell survival and apoptotic activity of human breast fibroblast cells. 2.1 GHz MW radiation was shown to be able to induce cell proliferation inhibition and apoptosis induction in human breast fibroblast cells. The results of this study showed that 2.1 GHz W-CDMA modulated MW radiation induced apoptotic cell death via the mitochondrial pathway.

**PA-187 [11:00]**

**DNA Integrity of Human Leukocytes after 3T Magnetic Resonance Imaging ..... 42:**

Agnes Szerencsi<sup>1</sup>, Györgyi Kubinyi<sup>1</sup>, Éva Váliczkó<sup>1</sup>, Péter Juhász<sup>1</sup>, Gábor Jánossy<sup>1</sup>, Jozsef Bakos<sup>1</sup>, István Hernádi<sup>2</sup> & György Thuroczy<sup>1</sup>

<sup>1</sup>*Frédéric Joliot-Curie, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary*

<sup>2</sup>*University of Pécs, Faculty of Sciences, Institute of Biology, Department of Experimental Zoology and Neurobiology, Pécs, Hungary*

This study focuses on the effects of high-field (3T) magnetic resonance imaging scans on the DNA integrity of human leukocytes in vitro in order to replicate the study where genotoxic effects were obtained published by Lee et al (1). The scanning protocol were the same as those used for a routine clinical brain scan. DNA damage in leukocytes were detected by comet assay and micronucleus test. The applied exposure of MRI does not appear to produce breaks in the DNA and has no significant effect on DNA integrity.



**PA-189 [11:00]**

**Transfer of Electronic Copies of Pharmaceuticals through a Distance – Challenge to the Future ..... 432**

Evgeny Germanov<sup>1</sup>, Vladimir Voeikov<sup>2</sup> & Vitaly Kalantaryan<sup>3</sup>

<sup>1</sup>*DST-Foundation, Moscow, Russian Federation*

<sup>2</sup>*Biochemistry, Lomonosov Moscow State University, Moscow, Russian Federation*

<sup>3</sup>*Microwave Radiophysics, Yerevan State University, Yerevan, Armenia*

*Current short review presents experimental results and theoretical works, which confirm the possibility of transfer of informational electronic copies of pharmaceutical through a distance using modern means of communication.*

**PA-191 [11:00]**

**Design of a study to investigate possible effects of the TETRA radio signal on cognitive functions of volunteers. .... 434**

Heidi Danker-Hopfe<sup>1</sup>, Torsten Eggert<sup>1</sup>, Hans Dorn<sup>1</sup>, Gernot Schmid<sup>2</sup>, Richard Überbacher<sup>2</sup>, Thomas Bolz<sup>3</sup>, Achim Bahr<sup>3</sup>,  
Blanka Pophof<sup>4</sup> & Cornelia Sauter<sup>1</sup>

<sup>1</sup>*Competence Center of Sleep Medicine, Charité - University Medicine Berlin, Berlin, Germany, 14050*

<sup>2</sup>*Seibersdorf Laboratories, Seibersdorf, Austria*

<sup>3</sup>*IMST, Kamp-Lintfort, Germany*

<sup>4</sup>*German Federal Office for Radiation Protection (BfS), Oberschleissheim/Neuherberg, Germany*

Possible effects of an exposure with TETRA signals (Sham, 1.5 W/kg and 6 W/kg) on brain activity during sleep and wake are investigated in this double-blind, randomized, cross-over study. A custom-made flat antenna, positioned at the left side of the head, was used for up to eight hours in 30 healthy young men. During wake several psychophysiological tests were applied. Event-related potentials and behavioural outcomes are considered. Sleep will be analysed at the macro- and microstructural level.

**PA-193 [11:00] - STUDENT PAPER**

**Electromagnetic fields and cardiac pacemakers/ICDs – is there a risk of electromagnetic interference in occupational environment ..... 436**

Maria Tiikkaja<sup>1</sup>, Tommi Alanko<sup>1</sup>, Harri Lindholm<sup>1</sup> & Maila Hietanen<sup>1</sup>

<sup>1</sup>*Finnish Institute of Occupational Health, Helsinki, Finland*

This *in vivo*- study investigated electromagnetic interference (EMI) of pacemakers and implantable cardioverter-defibrillators (ICDs) with external electromagnetic fields (EMFs). Various common sources of EMFs were used to expose 35 volunteers bearing a pacemaker or an ICD. None of the pacemakers with bipolar programming and none of the ICDs experienced EMI in the exposure situations, whereas three pacemakers tested also with unipolar programming were seriously disturbed during the exposures.

**PA-195 [11:00]**

**Magnetic Signal and Cellular Perceptive Psychology ..... 437**

Pierre Le Chapellier<sup>1</sup> & Badri Matta<sup>1</sup>

<sup>1</sup>*Algology, Centre Hospitalier de Soissons, (Soissons General Hospital), Soissons, France, 02209*

Because any organism has an extension property, cell's process from one state to the next can depend less on molecules making up then on the qualitative structure of the medium. So the applied magnetic signal, acting on the perceived extracellular aqueous topological structure, can drive bioeffects due to a Relational Energetics: If cells' perception includes a biomagnetic advance L, a bioelectric delay C and a bioresistance R, the MF waveform can cause a psychical resonance of a RLC type.

**PA-197 [11:00]**

**Study on Electromagnetic Fields from Smart Meters ..... 439**

Chris Zombolas<sup>1</sup>

<sup>1</sup>*EMC Technologies Pty Ltd, Melbourne, Australia, 3042*

In response to a state government commission in Australia, the electromagnetic emissions from Smart Meters at 16 locations were measured and compared against relevant ELF and RF exposure standards. For RF, when adjusted for estimated worst case duty cycle and possible reflections, the emissions from the meters were found to be less than 1% of the limit. Computer predictions and SAR measurements also confirmed that the EMF was very low.

**PA-199 [11:00]**

**On a Hypothetical Mechanism of Endogenous Magnetic Field Generation ..... 43;**

Alexander Axelrod<sup>1</sup>

<sup>1</sup>EMC Engineer, Israel, 42865

The proposed model associates endogenous magnetic field generation with mechanical vibrations of polarized cell membranes. The model assumes that magnetic fields are initiated by cells as an integral part of their living activities, including selective ion transport and intercellular communications. The vibrations are tuned to cyclotron resonance frequency of specific ion type, to facilitate this ion type energy-lossless transport.

**PA-201 [11:00]**

**Magnetic Field in Combined Treatment for Breast Cancer T<sub>2,3</sub>N<sub>0</sub>M<sub>0</sub> ..... 442**

Nicolay Bakhmutsky<sup>1</sup>, Vladimir Porhanov<sup>1</sup>, Vadim Bodnya<sup>1</sup> & Igor Vasilenko<sup>1</sup>

<sup>1</sup>Kuban State Medical University, Krasnodar, Russian Federation, 350063

The results of combined treatment and post operational morphological study of breast cancer using vorticity magnetic field generated by the unit "Magnitoturbotron" are presented.

Adjusted 5-year survival after of treatment in the groups of T<sub>2,3</sub>N<sub>0</sub>M<sub>0</sub> patients was 95.44% and 92.31%. The mean life span in these groups was 8.75 years and 7.88 years.

The morphological study has shown the induction of apoptosis in tumor cells.

**PA-203 [11:00]**

**Clinical Applications of Wireless Microcurrent Stimulation ..... 444**

George Lagoumintzis<sup>1</sup>, Manousos E. Kambouris<sup>1</sup>, Ilias Boltsis<sup>1</sup>, Adisaputra Ramadhinar<sup>2</sup>, Sotirios Koureleas<sup>1</sup>, Constantinos Koutsojannis<sup>3</sup> & Konstantinos Poulas<sup>1</sup>

<sup>1</sup>Department of Pharmacy, University of Patras, Patras, Greece, 26500

<sup>2</sup>Department of Medicine, University of Jakarta, Jakarta, Indonesia

<sup>3</sup>Department of Physiotherapy, Technological Educational Institute of Patras, Patras, Greece

Applications of Wireless Microcurrent Stimulation, an electrical stimulation therapy spinoff, are presented, for faster wound healing. One 70-year-old male with chronic diabetic ulcer at the amputated right leg and one 80-year-old female, with chronic ulcer at right tibia on diabetes, rheumatoid arthritis and chronic venous insufficiency background, were subjected to 1.5  $\mu$ A treatment for 60min every 24 or 48 hours for 45 and 15 days respectively. Ulcers are healing with no reported discomfort.

**PA-205 [11:00]**

**Magnetotherapy Should Use Analytically Designed Signals ..... 446**

Richard Parker<sup>1</sup> & Marko Markov<sup>2</sup>

<sup>1</sup>Cytowave LLC, Ft Lauderdale, FL, USA, 33484

<sup>2</sup>Research International, Williamsville, NY, USA, 14221

The paper presents our continuing efforts to design and engineer signals and devices for magnetic field therapy based upon analytical approach. The paper uses recording of the magnetic fields from normal and injured soft tissues and tendons performed with SQUID magnetometers. Based upon the objective data, and applying analytical approach, therapeutic signals have been identified.

**PA-207 [11:00]**

**Preliminary report of breast carcinomas arising in women following chronic exposure to cell phones carried in their brassieres ..... 447**

Robert Nagourney<sup>1</sup>, John West<sup>2</sup>, Elizabeth Ridgway<sup>3</sup>, Elizabeth Bailey<sup>4</sup>, Ronald Balassanian<sup>5</sup> & Devra Davis<sup>3</sup>

<sup>1</sup>Rational Therapeutics, Long Beach, CA, USA, 90806

<sup>2</sup>Breast Care & Imaging Center, Breast Link, Orange, CA, USA, 92868

<sup>3</sup>Research Section, Environmental Health Trust, Teton Village, CA, USA, 83025

<sup>4</sup>Carol Ann Read Breast Health Center, Alta Bates Summit Medical Center, Oakland, CA, USA, 94609

<sup>5</sup>Department of Pathology, UCSF School of Medicine, San Francisco, CA, USA, 94143

We report a case series of women with multi-focal synchronous breast cancers that arose following exposure to cellphone antennae in patients who habitually carried their cellphones in their brassieres. The patients presented with palpable masses, confirmed by abnormal mammograms. Patients A and B are negative for known genetic or environmental risk factors. Patient C is in an age group where breast cancer is more common, but had an atypical presentation of her tumors.

**PA-209 [11:00]**

**The effect of electromagnetic radiation on the activity of succinate dehydrogenase in rabbits' cardiac and skeletal muscles ..... 448**

Hamaspyur Hovhannisyanyan<sup>1</sup> & Vitaly Kalantaryan<sup>2</sup>

<sup>1</sup>*Human Physiology, Yerevan State University, Yerevan, Armenia, 0025*

<sup>2</sup>*Microwave Radiophysics, Yerevan State University, Yerevan, Armenia, 0025*

A key anaerobic metabolic enzyme - succinate dehydrogenase (SDH), having an important function in supplying tissues with energy, is a very sensitive characteristic of the cell pressure in case of changing the physiological state of the body under the impact of various environmental factors. The purpose of presented paper is the experimental study of the effects of sixfold treatment by electromagnetic radiation on the activity of anaerobic metabolism of rabbits' cardiac and skeletal muscles.

**PA-211 [11:00]**

**The impact of vibration and electromagnetic fields on activity changes of proline biosynthesis enzymes ..... 449**

Tsovinar Adamyan<sup>1</sup>, Emma Gevorkyan<sup>1</sup> & Vitaly Kalantaryan<sup>2</sup>

<sup>1</sup>*Human Physiology, Yerevan State University, Yerevan, Armenia, 0025*

<sup>2</sup>*Microwave Radiophysics, Yerevan State University, Yerevan, Armenia, 0025*

The activity of ornithine aminotransferase and pyrroline-5-carboxylate reductase enzymes, participating in the biosynthesis of proline, in various organs of animals subjected to vibration, electromagnetic radiation in millimeter range and their combined influence was studied. It is assumed that the elevation of the amount of proline caused by the influence of physical factors has adaptive nature.

**PA-213 [11:00]**

**Investigating short-term exposure to electromagnetic fields on reproductive capacity of invertebrates in the field situation ..... 44:**

John Bolte<sup>2</sup>, Martina Vijver<sup>1</sup>, Tracy Evans<sup>3</sup>, Wil Tamis<sup>1</sup>, Willie Peijnenburg<sup>2</sup>, Kees Musters<sup>1</sup> & Geert de Snoo<sup>1</sup>

<sup>1</sup>*Institute of Environmental Sciences (CML), Leiden University, Leiden, the Netherlands*

<sup>2</sup>*Centre for Sustainability, Environment and Health, National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands*

<sup>3</sup>*Illinois Department of Natural Resources, Springfield, IL, USA*

We examined the impact of exposure to the fields from mobile phone base stations (GSM 900 MHz) on the reproductive capacity of small, virgin, invertebrates. A field experiment was performed exposing four different invertebrates species at different distances from a RF EMF transmitter for a 48 hour period. The response variables as measured in the laboratory were fecundity and number of offspring. No significant association between exposure to electromagnetic fields and reproductive endpoints was found.

**PA-215 [11:00]**

**Lack of Effect by High Power Microwave Radiation on Rat Passive Avoidance ..... 452**

Ronald Seaman<sup>1</sup> & Jeffrey Whitmore<sup>2</sup>

<sup>1</sup>*General Dynamics Information Technology, JBSA Fort Sam Houston, TX, USA, 78234*

<sup>2</sup>*Radio Frequency Bioeffects Branch, 711th Human Performance Wing, JBSA Fort Sam Houston, TX, USA, 78234*

A passive avoidance experiment with rats was conducted with high power microwave (HPM) pulses. During a training trial, rats were exposed to ten HPM pulses with 1.36 to 1.58 MV/m peak electric field while in the dark chamber of a shuttle box. The latency to go from the light chamber to the dark chamber on a later trial was not different from the first trial. The absence of change in latency provides evidence that an exposure limit of 100 or 200 kV/m is conservative.

**PA-217 [11:00]**

**Neuroinflammation and mobile phone exposure: the NIMPHE project ..... 455**

Marion Jany<sup>1</sup>, Florence Poulletier De Gannes<sup>1</sup>, Murielle Taxile<sup>1</sup>, Annabelle Hurtier<sup>2</sup>, Emmanuelle Haro<sup>2</sup>, Gilles Ruffie<sup>2</sup>, Bernard Veyret<sup>1,2</sup> & Isabelle Lagroye<sup>1,2</sup>

<sup>1</sup>*Bioelectromagnetics laboratory, Ecole Pratique des Hautes Etudes, Talence, France, 33405*

<sup>2</sup>*IMS laboratory, Bordeaux 1 University, Talence, France, 33405*

There are some controversial findings related to neuroinflammation following wireless communication signals exposure. The NIMPHE project aims at providing extensive information on neuroinflammation under repeated exposures to two types of mobile phone signals (GSM-900 and UMTS) through the investigation of a panel of neuroinflammation markers in rat brains. A total of 24 rats per group were exposed 2 hrs/day, 5 days/week, for 4 weeks at BASAR of 0, 0.5, 5, and 15 W/kg.

**PA-219 [11:00]****The influence of 1800 MHz GSM-like signals on hepatic oxidative DNA and lipid damage in pregnant and newborn rabbits ..... 456**Arin Tomruk<sup>1</sup>, Goknur Guler<sup>1</sup>, Aylin Sepici<sup>2</sup> & Nesrin Seyhan<sup>1</sup><sup>1</sup>*Department of Biophysics, Gazi University, Ankara, Turkey, 06500*<sup>2</sup>*Department of Biochemistry, Gazi University, Ankara, Turkey, 06500*

1800 MHz RF radiation exposure on liver oxidative DNA damage and lipid peroxidation levels in nonpregnant, pregnant New Zealand White rabbits, and in their newborns. 8 OHdG/106 dG, malondialdehyde (MDA) and ferrous oxidation in xylenol orange (FOX) levels were analyzed.

**PA-221 [11:00]****Effects of weak combined magnetic fields tuned resonance for nuclear spins on the regeneration of planaria. .... 456**Natalia Belova<sup>1</sup>, Artem Ermakov<sup>1</sup> & Valery Lednev<sup>1</sup><sup>1</sup>*Institute of Theoretical and Experimental Biophysics, Pushchino, Russian Federation, 142290*

We have shown that weak combined magnetic fields tuned to Larmor precession frequency of <sup>23</sup>Na, <sup>39</sup>K, <sup>31</sup>P, <sup>63</sup>Cu, <sup>55</sup>Mn, <sup>59</sup>Co, <sup>35</sup>Cl nuclear spins significantly change the regeneration level of planaria. The effect depends on the frequency of the alternating component and has a resonant-like character.

**PA-223 [11:00]****Extra-low frequency electromagnetic field modifies electromagnetic shielding-induced changes in nociception in *Helix albescens* ..... 458**Natalia Temuryants<sup>1</sup>, Alexandra Kostyuk<sup>1</sup> & Karine Tumanyants<sup>1</sup><sup>1</sup>*Department of Human Physiology and Biophysics, Taurida National V.I. Vernadsky University, Simferopol, Ukraine, 95007*

We found that weak electromagnetic shielding (EMS), 8 Hz and 50 nT variable magnetic field (VMF) cause phase changes in nociception in snails. Under shielding, phase I is the most prominent, where coefficient of efficiency decreases up to 14.74%. Hypoalgesia is most prominent under the exposure to 8 Hz VMF (coefficient of efficiency increased up to 20%, whereas under EMS in increased only up to 11.25%). Exposure to 8Hz VMF decreases the extent of hyperalgesia effect of shielding.

**PA-225 [11:00]****The effectiveness of magnetically aligned collagen for nerve regeneration ..... 45:**Yawara Eguchi<sup>1</sup> & Shoogo Ueno<sup>2</sup><sup>1</sup>*Department of Orthopedic surgery, Shimoshizu National Hospital, Yotsukaido, Japan, 284-0003*<sup>2</sup>*Department of Applied Quantum Physics, Kyushu University, Fukuoka, Japan, 812-8581*

In this study, we investigated the usefulness for nerve regeneration using the magnetically aligned collagen by an 8-T magnetic field exposure using the in vivo rat sciatic nerve model. Histological and functional evaluation indicated that the magnetically orientated collagen promoted nerve regeneration. We could control organization in the microstructure such as extracellular matrix including the artificial nerve, which may translate into potentially viable treatments for nerve regeneration.

**PA-227 [11:00]****The effects of moderate-intensity gradient static magnetic fields on neuromuscular junction ..... 45;**Hideyuki Okano<sup>1,2</sup>, Yuuki Ansei<sup>1</sup>, Yoshitaka Hattori<sup>1</sup>, Toshiaki Osuga<sup>1</sup> & Hozumi Tatsuoka<sup>1</sup><sup>1</sup>*Research Center for Frontier Medical Engineering, Chiba, Japan, 263-8522*<sup>2</sup>*Research Section for Magnetics, Department of Products, Product Development Division, PIP Co., Ltd., Osaka, Japan, 540-0011*

This study focuses on the effect of static magnetic fields (SMF) on the rat neuromuscular junction. We found that the compound motor action potential (CMAP) decrement was significantly increased by 0.7 T SMF exposure for 1–2 h compared with the unexposed control group.

**PA-229 [11:00]****Lack of teratological effects in pregnant rats being locally exposed to their abdomen of intermediate frequency magnetic fields ..... 462**Akira Ushiyama<sup>1</sup>, Shin Ohtani<sup>1,2</sup>, Machiko Maeda<sup>1,2</sup>, Yukihisa Suzuki<sup>3</sup>, Keiji Wada<sup>3</sup>, Naoki Kunugita<sup>1</sup> & Chiyoji Ohkubo<sup>4</sup>

<sup>1</sup>*Department of Environmental Health, National Institute of Public Health, Wako, Japan, 351-0197*

<sup>2</sup>*Meiji Pharmaceutical University, Kiyose, Japan, 204-8588*

<sup>3</sup>*Tokyo Metropolitan University, Hachioji, Japan, 192-0397*

<sup>4</sup>*Japan EMF Information Center, Minato-ku, Japan, 105-0014*

Sparse investigations have been conducted to assess the exposure effects of intermediate frequency magnetic fields (IF-MFs).

In this study, we teratologically evaluated them in the pregnant rats using exposure apparatus which can locally expose high intensity of IF-MFs to the abdomen. Abdominal exposure to high intensity of IF-MFs during organogenesis did not show any significant reproducible teratogenicity under this experimental condition.

**PA-231 [11:00] - STUDENT PAPER**

**Patient exposure in MRI environments ..... 463**

Henrik Sundström<sup>1</sup>, Kjell Hansson Mild<sup>1</sup> & Jonna Wilen<sup>1</sup>

<sup>1</sup>*Department of Radiation Sciences, Umeå University, Umeå, Sweden, S-90713*

During MRI procedures, patients are exposed to switched gradient magnetic fields as well as radiofrequency magnetic fields. The complex nature of both exposures makes it difficult to apply common methods such as rms values, spatial averaging etc. In this project the gradient field exposure has been evaluated by the use of dedicated measurement technique to understand the exposure in more detail. The aim is to assess if the gradient current, which is well defined and available, is a good proxy for the gradient field exposure.

**PA-233 [11:00]**

**The challenge of a population exposure index linked to a wireless communication network ..... 465**

Joe Wiart<sup>1,2</sup>, Emmanuelle Conil<sup>1,2</sup>, Nadege Varsier<sup>1,2</sup>, Abdelhamid Hadjem<sup>1,2</sup> & Azeddine Gati<sup>1,2</sup>

<sup>1</sup>*France telecom Orange Labs, Issy les Moulineaux, France*

<sup>2</sup>*WHIST Lab, Issy les Moulineaux, France*

The wireless communications systems are increasingly used. This paper analyse the contribution of up- and down link to the global exposure. In particular the global exposure induced by a UMTS network is studied using emitted power and received power measurements. The exposure induced by the base stations is weak compared to those induced by the mobile phone except when the handset is very close to the access point. This analysis emphasizes the need for an exposure index representing the day-to-day exposure to a network

**PA-235 [11:00]**

**Initiating a network on interdisciplinary research on the causes of childhood leukemia ..... 467**

Gunde Ziegelberger<sup>1</sup>, Monika Asmuss<sup>1</sup>, Anne Dehos<sup>1</sup>, Bernd Grosche<sup>1</sup> & Sabine Hornhardt<sup>1</sup>

<sup>1</sup>*Federal Office for Radiation Protection, Oberschleissheim, Germany, 85764*

The consistently observed association of an increased risk for childhood leukaemia (CL) with exposure to low-level magnetic fields and the increased incidence of CL near nuclear power plants prompted the German Federal Office for Radiation Protection (BfS) to define a long-term strategic research agenda towards a better understanding of the main causes of this rare disease. BfS is currently on the way to implement an interdisciplinary research programme and five pilot projects have been initiated.

**Session: PB**  
**Plenary Poster Session B**  
**June 12, 2013 • 11:00 - 12:30**  
**Foyer**

**PB-2 [11:00]**

**Exposure Level Analysis of EMF Strength on Human around Base Station in Korea ..... 577**

Hyun-Bong Kim<sup>1</sup>, Wan-Ki Kim<sup>1</sup>, Yeong-Su Lee<sup>1</sup>, Wan-Pyo Jun<sup>1</sup> & Gi-Tae Lee<sup>1</sup>

<sup>1</sup>*Radio Environment Business Department, Korea Communications Agency, Seoul, Korea*

The paper analyzes the results of EMF measurement for 5 years in Korea. First, Mobile stations measured by Radio Wave Act [1] analyze trend on quantitative change. Second, the paper analyzed radio environment in Korea as verify annual distribution ratio on ICNIRP guidelines. The results of EMF strength measurement on base stations indicated that most of measurement levels are much lower than ICNIRP guidelines of human exposure. But the paper is indicated that EMF exposure levels are rising every year.

**PB-4 [11:00] - STUDENT PAPER**

**A Study on the Possible Effects of Electric Field Intensity of 2450 MHz Near by Different Cactus *Astrophytum Ornatum* Placements ..... 578**

Yasemin Karadana<sup>1</sup>, Selcuk Comlekci<sup>1</sup> & Onur Ari<sup>1</sup>

<sup>1</sup>*Engineering Faculty, Suleyman Demirel University, Isparta, Turkey*

Wi-Fi communications have been used widely at today's working areas. One of the ways to reduce the harmful effects of 2450 MHz Wi-Fi with uninterrupted communication have been suggested to have a small cactus on the working table. In this study, the accuracy of this method is investigated. Both simulation and measurement results show that this can be likely true to some extent. Cross-sectional geometry and dielectric parameter of the plant tissue are presented as a factor.

**PB-6 [11:00]**

**Radiofrequency exposure policies relevant to mobile communication devices and antenna sites ..... 578**

Jack Rowley<sup>1</sup>, Ken Joyner<sup>2</sup>, Peter Zollman<sup>3</sup> & Lars-Eric Larsson<sup>4</sup>

<sup>1</sup>*GSMA, Hong Kong, Hong Kong*

<sup>2</sup>*Joyner & Associates (Telecommunications Industry Consultants), Melbourne, Australia*

<sup>3</sup>*Vodafone Group Research and Development, Newbury, UK*

<sup>4</sup>*TeliaSonera, Karlstad, Sweden*

We used publicly available sources to update the current situation in regard to RF exposure limits for both mobile communication antenna sites and devices. The majority of countries have based their RF exposure limits on the ICNIRP recommendations. There is greater harmonisation in respect of the mobile device limits. While the same technical mobile communication standards are used in most countries there is greater variability in the RF exposure limits applicable to antenna sites.

**PB-8 [11:00]**

**Influences of TETRA fields emitted by handsets on cognitive function and psychological basic activity ..... 57:**

Hannelore Neuschulz<sup>1</sup>, Klaus Hentschel<sup>1</sup> & Norbert Kersten<sup>1</sup>

<sup>1</sup>*Federal Institute for Occupational Safety and Health, Berlin, Germany, 10317*

In two studies (generic antennas, modified handsets) the health risk during professional use of TETRA was assessed by investigating volunteers in a Faraday room. Conditions: Frequency 380.25 MHz, RF power 2 W peak, maximum value of SAR 1.35 W/kg. According to a cross-over design volunteers fulfilled computer-based visual demands as well as a test known as the "autokinetic illusion". No statistically significant differences ( $P < 0.05$ ) were found between TETRA exposures and the sham condition.

**PB-10 [11:00]**

**ELF measurements and evaluation of occupational exposure at four power plants in Greece ..... 582**

Maria Christopoulou<sup>1</sup>, Chrysa Govari<sup>1</sup>, Panagiota Tsaprouni<sup>1</sup>, Dimitris Koutounidis<sup>1</sup>, Nektarios Skamnakis<sup>1</sup>, Agamemnon Yalofas<sup>1</sup>, Efthymia Kalampaliki<sup>1</sup>, Christina Tzoumanika<sup>1</sup> & Efthymios Karabetzos<sup>1</sup>

<sup>1</sup>*Non Ionizing Radiation Office, Greek Atomic Energy Commission (GAEC), Agia Paraskevi, Greece, 15310*

The scope of the paper is to comparatively present the ELF measurements performed at four power plants in Greece, focusing into: a) the worst-case exposure conditions, b) the existence of magnetic field harmonic components, c) the

topology similarities among the power plants, comparing the measured percentages of occupational exposure action values at typical working areas in the power plants. The study aims to map the working areas of power plants into certain zones and to propose preventive protective measures.

**PB-12 [11:00]**

**Comparing simulated body currents in 50 Hz electrical fields with analytical methods (EN 62226-3-1 and Deno) and proband studies ..... 586**

Tobias Seckler<sup>1</sup>, Dominik Stunder<sup>1</sup>, Thomas Kraus<sup>2</sup> & Stephan Joosten<sup>3</sup>

<sup>1</sup>Research Center for Bioelectromagnetic Interaction (femu), University Hospital Aachen, Aachen, 52074

<sup>2</sup>Institute of Occupational and Social Medicine, RWTH Aachen / University Hospital Aachen, Aachen, 52074

<sup>3</sup>Energy, textile, electrical and media products sector (BG ETEM), German Social Accident Insurance Institution, Köln, 50968

There are 3 ways to determine short circuit currents induced by electric fields ( $I_{sc}$ ): Analytic methods, simulations and measurements. All of those have limitations in accuracy, approximation method and variance. We scrutinised analytic methods in comparison to a ANSYS simulation model to determine errors and limitations especially in a geometrical/anatomical manner. Our research shows how analytical methods and proband measurements can be used to verify simulations of body current distributions.

**PB-14 [11:00]**

**Choice of an exposure indicator in the environmental health field: the case of 50/60 Hz magnetic field ..... 589**

Isabelle Magne<sup>1</sup> & Martine Souques<sup>2</sup>

<sup>1</sup>EDF R&D, Moret sur Loing

<sup>2</sup>Service of Medical Studies, EDF, Levallois-Perret

The different methods of exposure assessment, their advantages and disadvantages have been reviewed. These methods result in a single value when using wiring code, distance or calculation, in several values when using measurements in space or time. It is then necessary to choose a single indicator representing the exposure of the subject. The last choice is the definition of the threshold for exposed subjects: it is a crucial choice because everybody is exposed to magnetic field.

**PB-16 [11:00]**

**Study of SAR in a human body model in a non-radiate wireless power transmission system ..... 58:**

Minhyuk Kim<sup>1</sup>, SangWook Park<sup>2</sup> & Hyun-Kyo Jung<sup>1</sup>

<sup>1</sup>Department of Electrical and Computer Engineering, Seoul National University, Seoul, Korea, 151-744

<sup>2</sup>Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795

Many studies are underway in order to develop wireless power transmission (WPT) system with the development of non-radiative WPT technique. The novel WPT technology can affect the human body since the energy transmission medium is an electromagnetic wave. In this paper, hazard assessment is investigated in the human body in the WPT system which is essentially considered prior to the commercialization of the product.

**PB-18 [11:00]**

**Low Frequency Electromagnetic Field Therapy in Equine Industry ..... 593**

Richard Parker<sup>1</sup> & Marko Markov<sup>2</sup>

<sup>1</sup>CytoWave LLC, Ft. Lauderdale, FL, USA, 33484

<sup>2</sup>Research International, Williamsville, NY, USA, 14221

*This paper is a continuation of the efforts of CytoWave LLC to design and engineer signals and equipments for magnetotherapy. It demonstrates the efficiency of magnetotherapy in treatment of large animals – especially superficial digital flexor tendon (SDF) in horses, which is analogical to the Achilles tendon in humans.*

**PB-20 [11:00]**

**A Study on evaluation of EMF human exposure from electric vehicle ..... 595**

Kihwea Kim<sup>1</sup> & Dong-geun Choi<sup>1</sup>

<sup>1</sup>EMF Safety, National Radio Research Agency, Seoul, Korea, 140-848

In this study, the evaluation method of magnetic fields generated by electric vehicle (OLEV) using the wireless power transfer technology is considered in area accessible to the public. The electric power lines of OLEV are considered as a field source, in which resonance frequency of 20 kHz and output power 75 kW. From the numerical analysis, the three-point (at

the three heights, 0.5 m, 1.0 m, and 1.5 m above the ground) average exposure level represents the average exposure level over the entire human body.

**PB-22 [11:00]**

**A new dynamic and flexible approach to evaluate exposure to electromagnetic fields (EMF) with the Evaluation Platform EMES ..... 596**

Hamid Molla-Djafari<sup>1</sup>, Andreas Weinfurter<sup>2</sup>, David Sainitzer<sup>3</sup>, Doris Leopold<sup>2</sup>, Stefan Kampusch<sup>2</sup>, Gernot Schmid<sup>3</sup> & Georg Neubauer<sup>2</sup>

<sup>1</sup>*Austrian Workers Compensation Board (AUVA), Vienna, Austria, 1200*

<sup>2</sup>*Safety & Security Department, AIT Austrian Institute of Technology, Seibersdorf, Austria, 2444*

<sup>3</sup>*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

The EU-Directive 2004/40/EC on the exposure of workers to EMFs obligates employers to evaluate their workplaces. The platform EMES makes such evaluation for several environments like the crafting industry possible. The platform allows the selection of different exposure limits from organizations such as ICNIRP. EMES is based on a repository with exposure data of more than thousand EMF sources and offers an open interface allowing qualified experts to provide exposure data.

**PB-24 [11:00]**

**Characteristics of Magnetic Field Distribution Under EHV and HV Double-Circuit Power Lines Which Cross Paths ..... 59:**

Takashi Matsumoto<sup>1</sup>, Hitoshi Hirata<sup>1</sup>, Hiroo Tarao<sup>2</sup>, Noriyuki Hayashi<sup>3</sup> & Katsuo Isaka<sup>4</sup>

<sup>1</sup>*Dept. of Electrical and Electronic Engineering, Anan National College of Technology, Anan-shi, Japan, 774-0017*

<sup>2</sup>*Kagawa National College of Technology, Takamatsu-shi, Japan*

<sup>3</sup>*University of Miyazaki, Miyazaki-shi, Japan*

<sup>4</sup>*The University of Tokushima, Tokushima-shi, Japan*

The transmission power lines are the typical facility which generates ELF magnetic fields. There are few analyses which considered the phase order configuration of EHV and HV double-circuit line conductors to decrease magnetic fields in the vicinity of the ground. In this paper, a special emphasis is placed on EHV and HV double-circuit crossing paths and the effect on the total magnetic field distribution.

**PB-26 [11:00] - STUDENT PAPER**

**The effects of 50 Hz magnetic fields on DNA damage in ATM<sup>-/-</sup> and ATM<sup>+/+</sup> mouse embryonic fibroblasts ..... 5: 2**

Chuan Sun<sup>1</sup>, Xinyuan Zhao<sup>1</sup>, Liling Su<sup>1</sup>, Guangdi Chen<sup>1</sup> & Zhengping Xu<sup>1</sup>

<sup>1</sup>*Bioelectromagnetics Laboratory, Zhejiang University School of Medicine, Hangzhou, China, 310058*

Ataxia telangiectasia mutated gene deficient (ATM<sup>-/-</sup>) and wide type (ATM<sup>+/+</sup>) mouse embryonic fibroblasts (MEF) were exposed to 50 Hz magnetic fields (MF). DNA damage was examined by  $\gamma$ H2AX foci formation. Exposure to MF did not change the  $\gamma$ H2AX foci formation in ATM<sup>-/-</sup> MEF; however, 2.0 mT MF exposure decreased the percentage of  $\gamma$ H2AX foci positive cells in ATM<sup>+/+</sup> MEF.

**keywords:** Magnetic field; DNA damage; mouse embryonic fibroblasts; ATM deficient

**PB-28 [11:00]**

**SECOND INTERLABORATORY COMPARISON PROGRAMME ON ELF EMF MEASUREMENTS PERFORMED IN GREECE ..... 5: 5**

Ioannis Ztoupis<sup>1</sup>, Eleni Nikolopoulou<sup>1</sup>, Efthymios Karabetsos<sup>2</sup>, Ioannis Gonos<sup>1</sup> & Ioannis Stathopoulos<sup>1</sup>

<sup>1</sup>*High Voltage Laboratory, National Technical University of Athens, Athens, Greece*

<sup>2</sup>*Non-Ionizing Radiation Office, Greek Atomic Energy Commission, Athens, Greece*

Three years after the first interlaboratory comparison programme (ILC) for extremely low frequency electromagnetic fields (ELF EMF), twelve participating laboratories measured the values of electric and magnetic fields including frequency at specified positions and distances from the field sources. This paper presents the measurements procedure, the results and their evaluation calculating the z-scores, as well as proposals for the improvement on the implementation of the ELF ILC scheme.

**PB-30 [11:00]**

**Exposure to 50 Hz magnetic fields in residential apartment building close to Transformer Substation – worst case scenario ..... P IC**

Peter Gajsek<sup>1</sup>, Bor Kos<sup>1,2</sup> & Blaz Valic<sup>1</sup>



<sup>1</sup>*Institute of Non-ionizing radiation, Ljubljana, Slovenia, 1000*

<sup>2</sup>*Laboratory of Biocybernetics, University of Ljubljana, Ljubljana, Slovenia, 1000*

Transformer substations located close to the living areas have been identified as a source of high long-term exposures to extremely low frequency magnetic fields. In the study we analyzed a worst case exposure to 50 Hz magnetic fields in residential apartment building close to transformer substation in Slovenia. In addition we have used numerical dosimetry models of the adult male, pregnant female and 6 years old child to assess in situ electric field strength according to ICNIRP guidelines from 2010.

**PB-32 [11:00]**

**Numerical SAR and Temperature Analysis in RF EM Fields Exposed Vial Set-ups of Peripheral Blood Lymphocytes ..... 5: 9**

Sofia Bakogianni<sup>1</sup> & Stavros Koulouridis<sup>1</sup>

<sup>1</sup>*Electrical and Computer Engineering, University of Patras, Patras, Greece*

Numerical electromagnetic and thermal dosimetry is carried out in order to characterize the exposure conditions of blood cells in a GTEM cell. Blood cell suspension stored in 15 ml test tubes is subjected to radiofrequency electromagnetic waves. Specific absorption rate calculations are performed for tubes being E-, H-, and K-polarized at 900MHz, 1800MHz and 2450MHz. For a selected arrangement that shows satisfactory SAR uniformity, SAR and temperature distributions inside cell medium are presented and discussed.

**PB-34 [11:00]**

**The application of the phantom, MAXWEL, to calculating ICNIRP localised SAR values over a 10 g contiguous region ..... 5; 4**

Richard Findlay<sup>1</sup>

<sup>1</sup>*EMFcomp, Wantage, UK, OX12 8HG*

The MAXWEL (MAle flexible Whole-body modEL) human phantom has been used to calculate whole-body and localised SAR values for plane wave exposure from 20 MHz to 5 GHz.

The localised SAR calculations demonstrated that the averaging region (10 g contiguous or cube) can significantly affect the SAR value calculated.

**PB-36 [11:00]**

**Development of Three Computational Human Models of Pregnant Females with Different Gestational Age ..... 5; 6**

Tomoaki Nagaoka<sup>1</sup>, Tetsu Niwa<sup>2</sup> & Soichi Watanabe<sup>1</sup>

<sup>1</sup>*Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795*

<sup>2</sup>*Tokai University School of Medicine, Japan*

Recently, there has been increasing concern regarding the safety of exposure to RF-EMFs in pregnant females and their fetuses. Anatomical structures of gestational tissues including fetal tissues are different depending on the pregnancy stage. Therefore, the pregnant female models at various gestational ages are required. This paper outlines the development of new pregnant female models with anatomically realistic fetal models with fine resolution at various gestational ages.

**PB-38 [11:00]**

**Applicability of Basic Formula to Assess RF Exposure to 220-MHz Band ..... 5; 8**

Junji Higashiyama<sup>1</sup>, Yoshiaki Tarusawa<sup>1</sup> & Teruo Onishi<sup>1</sup>

<sup>1</sup>*Research Laboratories, NTT DOCOMO, INC., Yokosuka, Japan, 239-8536*

This paper shows that the basic formula given in IEC 62232 is effective in reducing the cost and time for assessing human exposure to an electric field from a base station for mobile digital broadcasting services in the 220-MHz frequency band considering the main-beam direction and the opposite direction of the base station antenna. Results are based on a comparison of the calculated electric fields using the basic formula and the moment method as full wave analysis.

**PB-40 [11:00]**

**Analysis on Korean Mobile Phones for Epidemiological Study ..... 5; :**

Ae-kyoung Lee<sup>1</sup>, Hyunho Wi<sup>2</sup>, Byungje Lee<sup>2</sup> & Hyung-Do Choi<sup>1</sup>

<sup>1</sup>*Radio Technology Research Department, ETRI, Daejeon, Korea, 305-700*

<sup>2</sup>*Dept. of Wireless Communications Engineering, Kwangwoon University, Seoul, Korea, 139-701*

Frequency band, opening type, and antenna type of about 800 mobile phones released by main manufacturers were investigated and classified into 15 groups for case-control study. In order to estimate numerically SAR distribution in individual head of the case and control groups, the representative phone models should be developed. A few phone models were designed with important components influencing SAR pattern.

**PB-42 [11:00]**

**Thermographic SAR Measurements in a Rubber Phantom Implanted with Metallic Plates ..... 622**

Takashi Hikage<sup>1</sup>, Yoshifumi Kawamura<sup>1</sup>, Toshio Nojima<sup>1</sup>, Tomoaki Nagaoka<sup>2</sup> & Soichi Watanabe<sup>2</sup>

<sup>1</sup>*Hokkaido University, Sapporo, Japan, 0600814*

<sup>2</sup>*National Institute of Information and Communications Technology, Tokyo, Japan, 1848795*

In this study, the effect of implanting metallic osteosynthesis plates in the human body is examined by using FDTD analysis and measurement. The effect of combination of two metallic implants aligned closely in parallel, using a phantom implanted with plates, are simulated under far- and near-field exposure conditions at 2 GHz. In order to validate the simulation results, SAR distribution of a physical phantom implanted with two metallic plates are measured by thermographic method.

**PB-44 [11:00]**

**Reduction of SAR due to FPU for Marathon Races Considering Its Operations ..... 624**

Naoto Kogo<sup>1</sup> & Tetsuomi Ikeda<sup>1</sup>

<sup>1</sup>*Science & Technology Research Laboratories, NHK, Tokyo, Japan*

During live outside broadcasting (OB) of marathon races, video images are transmitted by FPU. The frequency band for the FPU is planned to migrate from 700 MHz band to 1.2 and 2.3 GHz bands in Japan. After the frequency migration, the transmission power will be higher than that of 700MHz band to compensate the propagation loss; however, few studies have been performed concerning the SAR on the human body due to the FPU. In this paper, we propose to use a conductive sheet on the window near human body to reduce the SAR due to the FPU.

**PB-46 [11:00]**

**New Method for Determining Dielectric Properties of High Water Content Materials at Millimeter Waves Based on Heating Kinetics ..... 627**

Maxim Zhadobov<sup>1</sup>, Nacer Chahat<sup>1</sup>, Ronan Sauleau<sup>1</sup> & Stanislav Alekseev<sup>2</sup>

<sup>1</sup>*Institute of Electronics and Telecommunications of Rennes (IETR), Rennes, France*

<sup>2</sup>*Institute of Cell Biophysics, Pushchino, Russian Federation*

In this study we show that the heating kinetics resulting from the millimeter-wave exposure can be used for the accurate determination of the penetration depth and power density in different materials, including 1% and 4% agar phantoms, 20% and 25% polyethylene powder phantoms, and human skin. Compared to the most of the existing techniques, this method is remote and it allows performing non-destructive measurements of high water content materials *in situ*.

**PB-48 [11:00]**

**GSM mobile phones exposure: turning on and extinction of the phone ..... 629**

Dominique Picard<sup>1</sup>

<sup>1</sup>*Electromagnétisme, Supélec, Gif sur Yvette, France, 91192*

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 turning on and the extinction of the phone. This study is the characterization of the user exposure to GSM mobile phones during these two steps.

**PB-50 [11:00]**

**Influence of the dielectric properties of the tissue equivalent liquid on the probe sensitivity for SAR measurements ..... 62;**

Hamidou Balde<sup>1</sup>, Mohammed Serhir<sup>1</sup> & Dominique Picard<sup>1</sup>

<sup>1</sup>*Electromagnétisme, Supélec, Gif sur Yvette, France, 91192*

The dielectric properties of the biological tissue equivalent liquid are a cause of error on SAR measurements. Three different parameters are modified by the dielectric properties of the tissue equivalent liquid: 1) the adaptation of the radiating antenna, 2) the coupling between this antenna and the liquid and 3) the sensitivity of the probe in the liquid. This study is devoted to the third aspect for the GSM900 and GSM1800 frequency bands.

**PB-52 [11:00] - STUDENT PAPER**

**Blood Perfusion Model for the Pennes Bio-Heat Equation ..... 633**

Veriko Jeladze<sup>1</sup>, Mikheil Prishvin<sup>1</sup>, Lali Bibilashvili<sup>1</sup> & Revaz Zaridze<sup>1</sup>

<sup>1</sup>*Laboratory of Applied Electrodynamics and Radio Engineering, Iv. Javakhishvili Tbilisi State University, Tbilisi, Georgia, 0128*

A novel numerical model to simulate thermal response of human body tissues exposed to RF energy is presented in this paper. It is based on the new algorithm for construction of realistic blood vessel network, new model of blood flow velocity distribution and an approach to solve bio-heat equation in tissue with variable and initially unknown blood temperature distribution. The obtained results show relative difference between new and conventional models. The future plans involve the blood perfusion study for the whole body exposure.

**PB-54 [11:00]**

**Dependence of Specific Absorption Rate on the Size of the Head Model in Mobile Phone Dosimetry ..... 635**

Mai Lu<sup>1</sup> & Shoogo Ueno<sup>2</sup>

<sup>1</sup>*Key Lab. of Opt-Electronic Technology and Intelligent Control of Ministry of Education, Lanzhou Jiaotong University, Lanzhou, China, 730070*

<sup>2</sup>*Department of Applied Quantum Physics, Kyushu University, Fukuoka, Japan, 812-8581*

In this work, SAR deposition in realistic head model with different sizes has been analyzed by finite-difference time-domain method. It was found that the SAR distribution in human brain is dependent on model size. The induced SAR in a head model with smaller size allows deeper electromagnetic penetration than that in big one. In mobile phone dosimetric analysis, simulation with a head model always overestimates the brain exposure compared to the practical situation that the whole-body exposed to the fields radiated by the mobile phone.

**PB-56 [11:00]**

**Safety Distance Concept for LTE-Base Stations at 2.6 GHz ..... 638**

Stefan Cecil<sup>1</sup> & Gernot Schmid<sup>1</sup>

<sup>1</sup>*EMC&Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

In this study the extension of the currently applied safety distance concept of the German standard BGR B11 for LTE-antennas at 2.6 GHz was analyzed. With numerical simulations the exposure of human body models in front of LTE-antennas was evaluated. The results showed that the current safety distance concept cannot ensure the compliance with the ICNIRP-guidelines, mostly because of high values of the 10g-SAR-maximum. The safety distance concept needs to be adapted for the frequency of 2.6 GHz.

**PB-58 [11:00]**

**Preliminary study: Classification of workplaces concerning potential electromagnetic exposure of pregnant women 63;**

Gernot Schmid<sup>1</sup>, David Sainitzer<sup>1</sup>, Tobias Jhala<sup>1</sup> & Christian Troger<sup>2</sup>

<sup>1</sup>*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444*

<sup>2</sup>*Austrian Workers Compensation Board AUVA, Vienna, Austria, A-1200*

The upcoming directive 2004/40/EC of the European Union specifies that employers have to pay special attention to the electromagnetic exposure of pregnant workers. Based on literature reviews regarding possible adverse effects of electromagnetic fields on the unborn, reports on work place specific exposure, available statistical data and supplementary numerical estimations, a preliminary classification of workplaces concerning the potentially expected exposure of the fetus was carried out.

**PB-60 [11:00]**

**Fast Estimation of MR Safety Based on Thermal Dose ..... 644**

Esra Neufeld<sup>1</sup>, Maximilian Fuetterer<sup>1,2</sup>, Manuel Murbach<sup>1,2</sup> & Niels Kuster<sup>1,2</sup>

<sup>1</sup>*Foundation for Research on Information Technologies in Society (IT<sup>2</sup>S), Zurich, Switzerland, 8004*

<sup>2</sup>*Swiss Federal Institute of Technology (ETH) Zurich, Zurich, Switzerland, 8092*

A method to rapidly evaluate magnetic resonance (MR) safety for any scan sequence – based on specific absorption rate (SAR) data and takes local hot-spots, exposure duration, tissue sensitivity, heating history, and thermoregulation into consideration – is presented. Data for the model, such as the characteristic time of temperature changes, has been extracted from simulations made with detailed anatomical models in different MR scan scenarios, and such simulations have also been used to validate the model.

**PB-62 [11:00]**

**RF-EMF exposure in schools in Central Switzerland ..... 646**

Katharina Roser<sup>1,2</sup>, Anna Schoeni<sup>1,2</sup> & Martin Roosli<sup>1,2</sup>

<sup>1</sup>*Department of Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland*

<sup>2</sup>*University of Basel, Basel, Switzerland*

In the framework of the HERMES (Health Effects Related to Mobile PhonE use in adolescentS) study, a prospective cohort study, measurements of radiofrequency electromagnetic fields (RF-EMF) were conducted. Summary statistics were calculated using the robust regression on order statistics (ROS) method to account for values below the detection limit. Preliminary results show an average RF-EMF exposure of 0.13 V/m in schools. Presence or absence of W-LAN networks influenced the exposure levels.

**PB-64 [11:00]**

**Dosimetric Comparison for Supine and Stance Human Models Generated by Different Methods ..... 64:**

Tongning Wu<sup>1</sup> & Lei Yang<sup>1</sup>

<sup>1</sup>*China Academy of Telecommunication Research of Ministry of Industry and Inf, BeiJing, China, wutongning@emcit*

Supine and stance are two possible postures in evaluating the EMF exposure especially for some clinical purposes. In this study, we generated the stance models from the supine models by two approaches. These models were numerically evaluated in the cases of wide-band plane wave and the 3T MRI birdcage exposure. The results were that the stance and the supine models were equivalent for plane wave exposure evaluation. However, during MRI, the significant variation has been observed.

**PB-66 [11:00]**

**A measurement campaign in urban environment for risk assessment of co-exposure to radon and electromagnetic fields of children ..... 653**

Rita Massa<sup>1,2</sup>, Maria Gabriella Pugliese<sup>1</sup>, Maria Quarto<sup>1</sup>, Vincenzo Roca<sup>1</sup>, Stefania Romeo<sup>2</sup> & Olga Zeni<sup>2</sup>

<sup>1</sup>*INFN Section of Naples, University of Naples Federico II, Naples, Italy, 80126*

<sup>2</sup>*Institute for Electromagnetic Sensing of the Environment, National Research Council, Naples, Italy, 80124*

A monitoring campaign of both electromagnetic field background and radon concentrations has been carried out in schools in some towns near Naples (Italy), an area with a high density of both population and electromagnetic sources, as well as rich in rocks of tuffs and pyroclastics that are major source of radon. The aim of the activity is to evaluate combined exposures to ubiquitous radiation sources in sites where prolonged presence of children and teenagers is foreseen.

**PB-68 [11:00] - STUDENT PAPER**

**A New Method for the Assessment of Personal RF Exposure of Children ..... 655**

Viktoria Finta<sup>1</sup>, Levente Váradi<sup>1</sup>, Péter Juhász<sup>2</sup>, György Thuroczy<sup>2</sup> & Ádám Kiss<sup>1</sup>

<sup>1</sup>*Atomic Physics, Eötvös Loránd University, Budapest, Hungary, 1117*

<sup>2</sup>*Non-ionizing Radiations, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary, 1221*

It is apparently necessary to determine the RF exposure of children but for this, adults around them must be involved by all means. We have tried to find a good method which has the best accuracy with the least discomfort.

We used our formerly developed protocol modified for these goals. We applied two parallel PEMs during 24 hours, volunteers were chosen among the caretakers of kindergarten and parents.

It can be established many conclusions for the method and temporal and spatial features of the exposure.

**PB-70 [11:00]**

**The sensitivity of radiofrequency electric and magnetic field meters to the ambient electric field of power frequency ..... 658**

Jolanta Karpowicz<sup>1</sup>, Krzysztof Gryz<sup>1</sup> & Wiesław Leszko<sup>1</sup>

<sup>1</sup>*Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Czerniakowska 16, Poland, PL-00-701*

The results of laboratory studies on the sensitivity of radiofrequency electromagnetic radiation measurement devices, of measurement ranges from the 1 kHz – 38 GHz range, to the influence of sinusoidal time-varying 50 Hz ambient electric field with a strength of 5-30 kV/m are presented. In the E-field of 5 kV/m (ICNIRP general public limit), false indications of E-field of 1.5-900 V/m and 0.001-0.5 A/m may be identified, and in 10 kV/m (ICNIRP workers' limit) 3-1800 V/m and 0.002-1 A/m.

**PB-72 [11:00]**

**On the worst-case whole-body SAR assessment due to far-field exposure ..... 65:**

Achilles Boursianis<sup>1</sup>, Ioannis Markakis<sup>1</sup>, Sotirios K. Goudos<sup>1</sup> & Theodoros Samaras<sup>1</sup>

<sup>1</sup>*Radiocommunications Laboratory, Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, GR-54124*

In this study we report a deterministic approach to evaluate the worst-case whole-body SAR due to far-field exposure. The approach is validated against a statistical approach (Monte Carlo) and the Self-Adaptive Differential Evolution optimization method, for two human numerical models and two frequencies under illumination from twelve plane-waves. It appears that the statistical approach performs worse than the other two methods, because it predicts lower values for the SAR.

**PB-74 [11:00]**

**Frequency Selective Spot Measurements in Greek Indoor Environments ..... 663**

Ioannis Markakis<sup>1,2</sup> & Theodoros Samaras<sup>1</sup>

<sup>1</sup>*Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, 54124*

<sup>2</sup>*THESS, Thessaloniki Software Solutions S.A., Pylaia - Thessaloniki, Greece, 57001*

Public concern has recently shifted from base stations radiation to devices operating in wireless networks and short range communications systems ubiquitous by now in indoor environments. In this study, frequency selective measurements were performed in 42 rooms, both at urban and suburban locations in Thessaloniki, Greece, to assess exposure. The results show that power density at places with indoor sources is twice as high compared to places where no WiFi or DECT transmitters are present.

**PB-76 [11:00]**

**Dosimetric study on the exposure of cell cultures: the effect of the meniscus at the solid-liquid interface ..... 665**

Alessandra Paffi<sup>1</sup>, Agnese Grosso<sup>1</sup>, Quirino Balzano<sup>2</sup>, Francesca Apollonio<sup>1</sup> & Micaela Liberti<sup>1</sup>

<sup>1</sup>*ICEmB at Department of Information Engineering, Electronics and Telecommunication (DIET), Sapienza University of Rome, Rome, Italy, 00184*

<sup>2</sup>*University of Maryland, College Park, MD, USA, 20742*

In this study, numerical simulations have been carried out to evidence the importance of modeling the meniscus for *in vitro* dosimetry. A plane wave has been considered impinging from different directions on a Petri dish filled with 2 or 4 mL of water, at 0.9, 1.8, and 2.5 GHz. Results indicate that the meniscus has a significant effect on the distributions of power loss density and current density inside the medium; thus it has to be accounted for a correct dosimetric evaluation.

**PB-78 [11:00] - STUDENT PAPER**

**Life Time Dosimetric Assessment for Mice and Rats Exposed to Cell Phone Radiation ..... 667**

Yijian Gong<sup>1</sup>, Myles Capstick<sup>1</sup>, Niels Kuster<sup>1,2</sup>, David L. McCormick<sup>3</sup>, Thomas Horn<sup>3</sup> & Perry Wilson<sup>4</sup>

<sup>1</sup>*IT'IS Foundation, Zurich, Switzerland, CH-8004*

<sup>2</sup>*Information Technology and Electrical Engineering, ETHZ, Zurich, Switzerland, CH-8092*

<sup>3</sup>*IIT Research Institute, 10 West 35th Street, Chicago, USA, IL 60616*

<sup>4</sup>*NIST, 325 Broadway, Boulder, USA, CO 80305*

This paper presents aspects of the detailed life time dosimetry analysis for the rodents exposed to radio frequency radiation within the National Toxicology Program of the NIEHS. This long term study exposes rodents in reverberation chambers, which necessitates an analysis of the uncertainty due to the exposure environment, postures and differential growth rates of rodents. These final dosimetry results provide a comprehensive reference for studies into long-term biological effects.

**PB-80 [11:00]**

**Assessing the on-body performance of EMF dosimeters ..... 66:**

Benjamin Loader<sup>1</sup>, Mohammed Khalid<sup>2</sup>, Darren Addison<sup>2</sup>, Myron Maslanyj<sup>2</sup> & Terry Mee<sup>2</sup>

<sup>1</sup>*Electromagnetics Group, National Physical Laboratory, Teddington, UK, TW11 0LW*

<sup>2</sup>*EMF Dosimetry Group, Health Protection Agency, Didcot, UK, OX11 0RQ*

This paper evaluates the isotropy of the Maschek EMS-140 and SATIMO EME-Spy 140 personal EMF dosimeters in free-space and when body-mounted. Results show additional corrections should be applied to the readings when body-mounted and that the dosimeter should be removed when the subject is stationary for long periods to avoid significant errors. Additionally, an EMC problem is apparent with the Maschek device at 0.65 GHz.

**PB-82 [11:00]**

**The study on the SAR evaluation technique for 150 MHz frequency ..... 673**

Dong-geun Choi<sup>1</sup>, Kihwea Kim<sup>1</sup> & Jaehoon Choi<sup>2</sup>

<sup>1</sup>EMF Safety, National Radio Research Agency, Seoul, Korea, 140-848

<sup>2</sup>Department of Electrical and Computer Engineering, Hanyang university, Seoul, Korea, 133-791

Currently, International SAR standard includes the evaluation method of above 300 MHz frequency. and commercial SAR measurement system can also measure only it. In this paper, we were obtained the SAR reference values of the system validation and the reference dipole antenna standard on 150 MHz frequency using numerical analysis, also verified the measurement results by measuring the SAR probe calibration using it. and it was already reflected the SAR measurement method notification in Korea.

**PB-84 [11:00]**

**An assessment of the influence of the human body on RF EMF measurement results in the numerically modelled use of exposimeters ..... 675**

Krzysztof Gryz<sup>1</sup>, Jolanta Karpowicz<sup>1</sup> & Patryk Zradziński<sup>1</sup>

<sup>1</sup>Laboratory of Electromagnetic Hazards, Central Institute For Labour Protection - National Reserach Institute, Warszawa, Poland, 00-701

The use of radiofrequency personal exposimeters was modelled numerically on the human body model Gustav using FIT CST Suite Studio software. The results obtained revealed a significant influence of the human body on the results of RF EMF measurements, through the use of exposimeters worn on the body. The location, at the waist on the side of the human body, or in front of chest, helped reduce the range of uncertainty when assessing RF E-field exposure using exposimeters.

**PB-86 [11:00] - STUDENT PAPER**

**Fast evaluation of the uncertainty in specific absorption rate calculations by applying the unscented transform ..... 677**

Xi Cheng<sup>1</sup> & Vikass Monebhurrin<sup>1</sup>

<sup>1</sup>Department of Electromagnetics, SUPELEC, Gif-sur-Yvette, France, 91192

Numerical simulations are increasingly being considered to tackle dosimetry problems. The uncertainty evaluation of the numerical simulation is a challenging task. Uncertainty analysis using traditional Monte Carlo simulation proves inappropriate. The unscented transformation (UT) offers an efficient alternative to handle uncertainty. A second order UT requiring only three simulations for a given configuration provides a good estimation of the mean and standard deviation of the peak spatial-average specific absorption rate.

**PB-88 [11:00] - STUDENT PAPER**

**Detailed study of EM exposure simulation ..... 679**

Lali Bibilashvili<sup>1</sup>, Mikheil Prishvin<sup>1</sup>, Veriko Jeladze<sup>1</sup> & Revaz Zaridze<sup>1</sup>

<sup>1</sup>Laboratory of Applied Electrodynamics and Radio Engineering, Tbilisi State University (TSU), Tbilisi, Georgia, 0128

After completing the research in terms of MMF II project, it appeared that the understanding of the EM exposure simulation problem is not complete. Some additional aspects such as the presence of a hand, and antenna matching has to be considered. The reactive field in the close vicinity of the head depends on the antenna matching with open space. This paper contains comparison of EM simulation results for a human head model only and a head model with a hand, holding the handset.

**PB-90 [11:00]**

**Low Exposure Network . A new EU project ..... 682**

Joe Wiart<sup>1,5</sup>, Emmanuelle Conil<sup>1,5</sup>, Yann Toutain<sup>2</sup>, Serge Bories<sup>3</sup>, Milos Tesanovic<sup>4</sup>, Yves Lostanlen<sup>7</sup> & Luis Correia<sup>6</sup>

<sup>1</sup>France Telecom Orange, France

<sup>2</sup>Satimo, France

<sup>3</sup>CEA, France

<sup>4</sup>Fujitsu, UK

<sup>5</sup>Whist lab, France

<sup>6</sup>INOV, Portugal

<sup>7</sup>SIRADEL, France

LEXNET ([www.lexnet-project.eu](http://www.lexnet-project.eu) (<http://www.lexnet-project.eu>)) is an Integrated Project in the EC's 7th Framework Programme, gathering 17 partners to develop effective mechanisms to reduce the Electromagnetic Electromagnetic Fields (EMF) exposure, without compromising the quality of service

**PB-92 [11:00]**

**Influence of grounding on SAR inside various anthropometric human body phantoms exposed to RF EMF from a dielectric sealer..... 683**

Patryk Zradziński<sup>1</sup>, Jolanta Karpowicz<sup>1</sup>, Krzysztof Gryz<sup>1</sup> & Wiesław Leszko<sup>1</sup>

<sup>1</sup>Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection – National Research Institute, Warszawa, Poland, 00-701

Differences in SAR in workers' body phantoms with various anthropometric properties (homogeneous cylinder, Hugo and CIOP-MAN) and grounding conditions (freestanding, insulated by rubber and grounded) exposed to EMF generated by dielectric sealers (E-field of 27 MHz) have been examined by numerical simulations. The results reveal that the grounding conditions of phantoms significantly influence on SAR evaluation results up to 23-times differences among results for various grounded condition.

**PB-94 [11:00]**

**Evaluation of Uncertainty in the Measurement of Environmental Electromagnetic Fields ..... 684**

Branislav Vulevic<sup>1</sup>

<sup>1</sup>Non-Ionizing Radiation Protection, PC Nuclear Facilities of Serbia, Belgrade, Serbia, 11351

This work is based on practice and on previous attempts to make a simple approach to analysis of measurement uncertainty in the area of measurement of electromagnetic fields. A systematic approach to estimating measurement uncertainty of operative EMF measurements forced a mandatory distinction between measuring electromagnetic fields of low (up to 100kHz) as opposed to those of high frequencies (100kHz to 300GHz).

**PB-96 [11:00] - STUDENT PAPER**

**Experimental validation of the SAROTA concept for the evaluation of the real-life exposure due to mobile phones**

684

Ashish Rojatkari<sup>1</sup> & Vikass Monebhurrani<sup>1</sup>

<sup>1</sup>Department of Electromagnetics, SUPELEC, Gif-sur-Yvette, France, 91192

The specific absorption rate (SAR) value obtained when the mobile phone emits at maximum power is not representative of the real-life exposure. The SAROTA concept accounts for both SAR and OTA (over-the-air) performance. The concept is herein experimentally validated using four mobile phones with embedded data logging software which provides the full uplink and downlink communication data. A mode-stirred reverberation chamber is used to evaluate the real-life exposure similar to an indoor scenario.

**PB-98 [11:00]**

**Typical Exposure of Children to EMF ..... P IC**

Blaz Valic<sup>1</sup>, Bor Kos<sup>1,2</sup> & Peter Gajsek<sup>1</sup>

<sup>1</sup>Institute of Non-ionizing radiation, Ljubljana, Slovenia, 1000

<sup>2</sup>Laboratory of Biocybernetics, University of Ljubljana, Ljubljana, Slovenia, 1000

Typical everyday exposure of children to EMF, determined by survey study with portable exposimeters was used calculate the *in-situ* electric field and SAR values. The average exposure of participants was 0.29  $\mu$ T for low-frequency magnetic field and 0.09 V/m for GSM base stations, 0.11 V/m for DECT and 0.10 V/m for WiFi; other contribution could be neglected. Calculated values of the *in-situ* electric field and SAR values were below 0.2 % of the basic restrictions.

**PB-100 [11:00]**

**Computational Study of Temperature Elevation in Fetal Tissues Due to UHF RFID Exposure ..... 686**

Serena Focchi<sup>1</sup>, Marta Parazzini<sup>1</sup>, Ioannis Markakis<sup>2,3</sup>, Ilaria Liorni<sup>1,4</sup>, Theodoros Samaras<sup>2</sup> & Paolo Ravazzani<sup>1</sup>

<sup>1</sup>Consiglio Nazionale delle Ricerche CNR, Istituto di Ingegneria Biomedica ISIB, Milan, Italy

<sup>2</sup>Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, 54124

<sup>3</sup>THESS, Thessaloniki Software Solution S.A., Pylaia Thessaloniki, Greece, 57001

<sup>4</sup>Dipartimento di Elettronica, Informazione e Bioingegneria DEIB, Politecnico di Milano, Milan, Italy

New technologies which make use of electromagnetic fields (EMF) are essential in many aspects of everyday life. Among them, radiofrequency identification (RFID) is going to be used in several applications which can unselectively expose groups of general population who are more sensitive to thermal effects produced by EM exposure, such as pregnant women. This paper aims to assess the temperature rise in two pregnant women models exposed to radiation from a UHF RFID reader antenna.

**PB-102 [11:00]**

**Exposure set up for cellular studies of MRI exposure ..... 689**

Jonna Wilen<sup>1</sup>, Kjell Hansson Mild<sup>1</sup>, Bor Kos<sup>2</sup> & Peter Gajsek<sup>2</sup>

<sup>1</sup>*Department of Radiation Sciences, Umeå University, Umeå, Sweden, S-90187*

<sup>2</sup>*Institute of Non-ionizing Radiation, Ljubljana, Slovenia*

Magnetic resonance imaging is often used as a diagnostic tool in medical health care. More recently, it has been demonstrated an increased prevalence of micronuclei in lymphocytes after exposure to clinical MRI procedures. To achieve relatively homogenous gradient and radiofrequency fields, we have designed a custom exposure system. This work aims to discuss the different possible exposure scenarios with respect to exposure homogeneity, induced E-field/SAR homogeneity and similarity with real life exposure inside an MRI bore.

**PB-104 [11:00]**

**Variation in Neuromuscular Excitability Induced by the Biomagnetic Pair on Spots of Dermic Biosoma. First Essays 68;**

I. Goiz<sup>1</sup>, E. de Juan & JL Arranz

<sup>1</sup>*Department of Medical Specialties, University of Alcalá, Alcalá de Henares, Spain*

The present study is geared towards validation of Biomagnetic Pair as useful therapy. For this purpose, Reotomo equipment from Lapicque and Laborit was used for measuring neuromuscular excitability in a random sample of 20 subjects from different age groups.

**PB-106 [11:00]**

**Assessment of Dielectric Material Properties for Near-Surface Body Tissues in the THz-Frequency Range ..... 68;**

Oliver Spathmann<sup>1</sup>, Volkert Hansen<sup>1</sup>, Mehrdad Saviz<sup>2</sup>, Joachim Streckert<sup>1</sup>, Martin Zang<sup>1</sup> & Markus Clemens<sup>1</sup>

<sup>1</sup>*Bergische Universität Wuppertal, Wuppertal, Germany*

<sup>2</sup>*University of Tehran, Tehran, Iran*

Due to the increasing number of applications in the THz-Frequency range the need for determining the exposure risk is continuously growing. Literature is only providing sparse information concerning dielectric material properties for frequencies above 100 GHz. Here, the effective medium theory based on anatomical tissue data is applied to estimate the material properties needed for numerical simulations in the frequency range between 0.1 and 10 THz, which is demonstrated here for the example of the skin.

**PB-108 [11:00]**

**Modelling the absorption of THz radiation in skin capillary red cells: determining appropriate dielectric values ..... 694**

Andrew Wood<sup>1</sup>, Robert McIntosh<sup>1</sup>, Steve Iskra<sup>1</sup> & Ray McKenzie<sup>1</sup>

<sup>1</sup>*BPsyC, Swinburne University of Technology, Melbourne, Australia, Vic 3122*

In order to accurately predict THz energy absorption in cellular structures, accurate values of cell component dielectric properties are needed for the range 0.1 – 100 THz. Although data are freely available for pure water for this range, selection of appropriate values for membrane and cellular fluids is not straightforward. This presentation will discuss approaches based on mechanistic descriptions of water behaviour and their modifications to other materials.

**PB-110 [11:00]**

**Development and Application of Electromagnetic Field Excitation Models for Dosimetry Studies in the THz Range 698**

Martin Zang<sup>1</sup>, Volkert Hansen<sup>1</sup>, Ullrich Pfeiffer<sup>2</sup>, Oliver Spathmann<sup>1</sup>, Konstantin Statnikov<sup>2</sup>, Joachim Streckert<sup>1</sup> & Markus Clemens<sup>1</sup>

<sup>1</sup>*Bergische Universität Wuppertal, Chair of Electromagnetic Theory, Wuppertal, Germany, 42119*

<sup>2</sup>*Bergische Universität Wuppertal, Chair of High-Frequency and Communication Technology, Wuppertal, Germany, 42119*

To assure human safety when using THz technologies, dosimetry studies based upon computer simulations must be performed. Here excitation models for the proper representation of THz fields striking the body are developed using Huygens' principle. By implementing this method into the software CST Studio Suite 2012™ [1], the realistic exposure of biological systems can be modeled in order to compute the distributions of electromagnetic fields inside the tissues.

**PB-112 [11:00]**

**Electromagnetic field sources and typical exposure characteristics: a new feature on EMF-Portal ..... 69:**

Sarah Driessen<sup>1</sup>, Dagmar Dechent<sup>1</sup>, Frank Gollnick<sup>1</sup>, Andrea Scholl<sup>1</sup>, David Graefrath<sup>1</sup> & Thomas Kraus<sup>1</sup>

<sup>1</sup>*Research Center for Bioelectromagnetic Interaction, University Hospital, Aachen, Germany, 52074*

The EMF-Portal is the worldwide most comprehensive scientific database on bioelectromagnetic interaction providing more than 16,700 studies, a glossary with more than 2,800 technical terms and detailed summaries of more than 2,900 articles. A new feature provides free access to exposure parameters of everyday electromagnetic exposure sources and thus, enables the user to better understand the existing data on the effects of electromagnetic fields of the studies and place them correctly in context of real-life exposure values.



**PB-114 [11:00]****Research on SAR Reduction of Mobile phone with Wifi Antenna by using AMC Reflector ..... 6: 3**

Seungwoo Lee<sup>1</sup>, Nam Kim<sup>1</sup> & Seung-Yeop Rhee<sup>2</sup>

<sup>1</sup>*College of Electrical and Computer Engineering, Chungbuk National University, Cheongju-si, Korea, 361-763*

<sup>2</sup>*College of Engineering Science, Chonnam National University, Yeosu-si, Korea, 550-749*

A trapezoidal antenna for 2.4 GHz WLAN(Wifi) is designed. The antenna has a broad bandwidth and an omnidirectional radiation pattern. SAR values are 0.529 W/kg(1g) and 0.273 W/kg(10g). Although the antenna is satisfied by guidelines, the reflector using the AMC structure is designed and applied for reducing SAR values. As the result, SAR values are dramatically suppressed by the reflector, and the performance is increased by two times.

**PB-116 [11:00]****Histopathological Examination of the Purkinje Cells in the Cerebellum of Newborn Rats Following Prenatal Exposure to 900 MHz EMF ..... 6: 4**

Bülent Ayas<sup>1</sup>, Berrin Zuhail Altunkaynak<sup>1</sup>, Gülünar Erdem<sup>1</sup>, Ö. Gülsüm Deniz<sup>1</sup>, Elif Kayhan<sup>1</sup>, M. Eyüp Altunkaynak<sup>1</sup> & Süleyman Kaplan<sup>1</sup>

<sup>1</sup>*Department of Histology and Embryology, Ondokuz Mayıs University, Samsun, Turkey, 55139*

In this study, we investigated the effect of EMF on the cerebellum. According to the results we found that prenatal exposure to 900 MHz EMF could not only cause to decrease of the Purkinje cell number but also destroy the structure of it's in the newborn rat cerebellum.

**PB-118 [11:00]****Histopathological Examination of Glomerulus in the Kidney of Newborn Rats Following Prenatal Exposure to 900 MHz EMF ..... 6: 5**

Mahmut Ulubay<sup>1</sup>, Ahmad Yahyazadeh<sup>2</sup>, Ö. Gülsüm Deniz<sup>2</sup>, Elvide Gizem Kivrak<sup>2</sup>, Berrin Zuhail Altunkaynak<sup>2</sup>, Bülent Ayas<sup>2</sup>, Gülünar Erdem<sup>2</sup> & Süleyman Kaplan<sup>2</sup>

<sup>1</sup>*Department of Urology, Medical Park Hospital, Samsun, Turkey*

<sup>2</sup>*Histology and Embryology, Ondokuz Mayıs University, Samsun, Turkey, 55139*

In this study, we investigated the effect of prenatal exposure to 900 MHz EMF on the glomeruli in the kidney of the 4-week male rats. According to statistical analysis there were significant differences between the Cont and EMF groups in terms of numerical density of glomeruli. As a result of the study, we suggest that 900 MHz EMF may cause to decrease of the glomeruli density in the rat kidney.

**PB-120 [11:00]****Improved lipid extraction performance from microalgae after pulsed electric field treatment ..... 6: 5**

Christian Eing<sup>1</sup>, Martina Goettel<sup>1</sup>, Christian Gusbeth<sup>1</sup>, Ralf Straessner<sup>1</sup> & Wolfgang Frey<sup>1</sup>

<sup>1</sup>*Institute for Pulsed Power and Microwave Technology, Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany, 76344*

Pre-treatment of the microalgae *Auxenochlorella protothecoides* with pulsed electric fields allows efficient extraction of the algal lipids, using ethanol as solvent. Our results show a clear dependence of the lipid yield from the applied treatment energy. A maximum lipid yield could be obtained for treatment energies of 1.5 MJ and higher per kg of dry algae biomass. The Sulpho-Phospho-Vanillin method was used as additional method for the screening of lipid content in solvent extracts.

**PB-122 [11:00]****Manipulation of internal calcium concentration by PEFs and reproduction of the spontaneous calcium oscillations of haMSCs..... 6: 7**

Marie-Amelie de Menorval<sup>1,2,3</sup>, Franck Andre<sup>1,2,3</sup>, Delong Zhou<sup>1,2,3</sup>, Aude Silve<sup>4</sup> & Lluís M. Mir<sup>1,2,3</sup>

<sup>1</sup>*Laboratoire de vectorologie et thérapeutiques anticancéreuses, UMR 8203, Université Paris Sud, Orsay, France, 91405*

<sup>2</sup>*Laboratoire de vectorologie et thérapeutiques anticancéreuses, UMR 8203, CNRS, Villejuif, France, 94805*

<sup>3</sup>*Laboratoire de vectorologie et thérapeutiques anticancéreuses, UMR 8203, Institut Gustave Roussy, Villejuif, France, 94805*

<sup>4</sup>*Institut für Hochleistungsimpuls- und Mikrowellentechnik, Karlsruher Institut für Technologie, Eggenstein-Leopoldshafen, Germany, 76344*

Human adipose-derived mesenchymal stem cells (haMSCs) present spontaneous calcium oscillations controlled by the inositol 1,4,5-trisphosphate receptor and linked to their state of differentiation. We showed that it is possible to manipulate cytosolic calcium concentrations using one single 100 microsecond or one single 10 nanosecond pulsed electric field in

order to reproduce artificially the spontaneous calcium oscillations of haMSCs by permeabilizing plasma membrane and organelles membranes.

**PB-124 [11:00]**

**High voltage, ns electric pulse exposure of liquid media for evaluation of metal release from electrodes ..... 6: 8**

Stefania Romeo<sup>1</sup>, Gianpiero Pataro<sup>2</sup>, Anna Sannino<sup>1</sup>, Olga Zeni<sup>1</sup>, Giovanna Ferrari<sup>2,3</sup>, Maria Scarfi<sup>1</sup> & Luigi Zeni<sup>1,4</sup>

<sup>1</sup>*Institute for Electromagnetic Sensing of the Environment, National Research Council, Naples, Italy, 80124*

<sup>2</sup>*Department of Industrial Engineering, University of Salerno, Fisciano, Italy, 81084*

<sup>3</sup>*ProdAI scarl, University of Salerno, Fisciano, Italy, 81084*

<sup>4</sup>*Dept. of Industrial and Information Engineering, Second University of Naples, Aversa, Italy, 81031*

A ns, high-voltage pulse generator based on the Blumlein pulse forming network concept has been realized for *in vitro* application of pulsed electric fields (PEF) on liquid media. The pulse generator has been suited for pulse application to high impedance loads, by employing microstrip transmission lines. The system will be used to apply PEF to liquid media placed in batch treatment chamber, in order to evaluate the possible metal release from the electrodes into the liquids.

**PB-126 [11:00]**

**A Numerical Study of Electroporation Dynamics in Mammalian Cells Under Multiple Nanosecond Electric Pulses ..... 6: :**

Patrizia Lamberti<sup>1</sup>, Stefania Romeo<sup>2</sup>, Anna Sannino<sup>2</sup>, Maria Scarfi<sup>2</sup>, Vincenzo Tucci<sup>1</sup>, Luigi Zeni<sup>2,3</sup> & Olga Zeni<sup>2</sup>

<sup>1</sup>*Electrical and Computer Engineering and Applied Mathematics (DIEM), University of Salerno, Fisciano (SA), Italy, I-84084*

<sup>2</sup>*Institute for Electromagnetic Sensing of the Environment (IREA), National Research Council of Italy, Napoli, Italy, I-80124*

<sup>3</sup>*Industrial and Information Engineering, Second University of Naples, Aversa (CE), Italy, I-81031*

A numerical study is used to analyze the electroporation phenomenon (EP) in cells exposed to nanosecond pulsed electric fields (nsPEFs). The effect of multiple pulse exposure with variable repetition rate on the dynamics of pore is studied by using a Finite Element Model of the equations describing the EP. The results are correlated to the behavior of T-cells exposed to 2.5MV/m, 60ns pulses. The model gives information about the EP on a time scale where available experimental methods fail.

**PB-128 [11:00]**

**Modulation of cellular and mitochondrial reactive oxygen species production by external magnetic fields ..... 6; 2**

Pablo Castello<sup>1,4</sup>, Josette Zaklit<sup>2</sup>, Robert Usselman<sup>3</sup> & Carlos Martino<sup>4</sup>

<sup>1</sup>*IQUIFIB Facultad de Farmacia y Bioquímica, Buenos Aires, Argentina*

<sup>2</sup>*Biomedical Engineering, University of Nevada Reno, Reno, NV, USA, 89557*

<sup>3</sup>*Biomagnetic Imaging Standards and Microsystems, NIST, Boulder, CO, USA, 80303*

<sup>4</sup>*Mechanical Engineering, University of Nevada Reno, Reno, NV, USA, 89557*

This work studied the modulation of production of extracellular, intracellular, and mitochondrial superoxide and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) in cultured yeast and isolated mitochondria exposed to external static and weak radio frequency magnetic fields. H<sub>2</sub>O<sub>2</sub> production was measured by fluorometric technique. The production of H<sub>2</sub>O<sub>2</sub> was evaluated in the presence of inhibitors of the mitochondria respiratory chain. Superoxide production was measured by a set of hydroxylamine spin probes with EPR technique.

**PB-130 [11:00] - STUDENT PAPER**

**A Comparison of Accuracy-Efficiency Tradeoffs of FDTD and FFT-Accelerated Integral Equation Methods for Numerical Dosimetry ..... 6; 3**

Jackson Massey<sup>1</sup>, Fangzhou Wei<sup>1</sup>, Cemil Geyik<sup>1</sup> & Ali Yilmaz<sup>1</sup>

<sup>1</sup>*Department of Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX, USA, 78712*

The performance of FDTD for numerical dosimetry is compared to two FFT-accelerated integral-equation solvers—one that is constrained to regular voxel meshes (GMRES-FFT) and one that can use irregular tetrahedral meshes (AIM). The three methods are used to compute the power absorbed by multilayered spherical phantoms at 900 MHz. The results show that GMRES-FFT accuracy and computational costs are comparable to FDTD while AIM is more accurate and expensive.

**PB-132 [11:00]**

**Influence of the mRNA Degradation Rate on the Circadian Rhythm in Humans due to Weak Electromagnetic Exposure ..... P IC**

Malka Halgamuge<sup>1</sup>, Vijayalaxmi<sup>2</sup>, Leeka Kheifets<sup>3</sup>, Andrew Wood<sup>4</sup>, Jonathan White<sup>5</sup> & Efstratios Skafidas<sup>1</sup>

<sup>1</sup>*Department of Electrical and Electronic Engineering, The University of Melbourne, Melbourne, Australia, 3010*

<sup>2</sup>University of Texas Health Science Center, San Antonio, TX, USA, 78229

<sup>3</sup>UCLA School of Public Health, University of California, Los Angeles, CA, USA, 90095

<sup>4</sup>Brain Sciences Institute, Faculty of Life & Social Sciences, Swinburne University of Technology, Melbourne, Australia

<sup>5</sup>School of Chemistry, The University of Melbourne, Victoria, Australia, 3010

Changes in the circadian rhythm and the melatonin concentration are observed due to the external perturbation of chemical reaction rates. Substantial melatonin interruption and changes to the circadian rhythm occur due to the perturbation of chemical reaction rates are found, as also described in previous findings. Results indicate the influence of the mRNA degradation rate on the circadian rhythm's critical time delay. This support the belief that exposure to weak electromagnetic fields via melatonin disruption can adversely affects on human.

#### **PB-134 [11:00] - STUDENT PAPER**

**The CNP Pulsed Magnetic signal is able to silence a feed-forward neuronal network model ..... 6; 6**

Francesca Camera<sup>1</sup>, Alex Thomas<sup>2</sup>, Alessandra Paffi<sup>1</sup>, Guglielmo d'Inzeo<sup>1</sup>, Francesca Apollonio<sup>1</sup>, Frank Prato<sup>2</sup> & Micaela Liberti<sup>1</sup>

<sup>1</sup>ICEmB@DIET, "Sapienza" University of Rome, Rome, Italy, 00184

<sup>2</sup>Bioelectromagnetics Group, Imaging Program, Lawson Health Research Institute, London, ON, Canada

#### **SUMMARY**

Several experimental results published in the literature regarding the stimulation of the central nervous system with weak pulsed magnetic fields bring scientific interest in trying to understand what are the specific biological mechanisms that regulate observed behaviors.

In this presentation we will present the results of simulations performed on neuronal models exposed to a specific pulsed magnetic field signal that seems to be very effective in affecting brain activity.

#### **PB-136 [11:00]**

**Cryptochrome-dependent magnetic sensitivity of Arabidopsis thaliana is maximal in the geomagnetic range and occurs by a radical ..... 6; 9**

Carlos Martino<sup>1</sup>, Thorsten Ritz<sup>2</sup> & Margaret Ahmad<sup>3</sup>

<sup>1</sup>Mechanical Engineering, University of Nevada Reno, Reno, NV, USA, 89557

<sup>2</sup>Physics and Astronomy, University of California Irvine, Irvine, CA, USA, 92697

<sup>3</sup>PHYSIOLOGIE CELLULAIRE et MOLECULAIRE des PLANTES, University of Paris VI, Paris, France, 75252

Here we report for the first time a dose response curve for magnetic sensitivity in plants, at incremental static field strengths (from 0 to 500 microTessla) which is consistent with response to weak fields in the geomagnetic range. We further characterize the magnetic sensitivity as a function of light quality including wavelength sensitivity, fluence response characteristics, and effects of temperature and stress.

#### **PB-138 [11:00]**

**Theoretical modeling of interradical dipolar interaction: triplet to singlet magnetic transition in flavin-indole radical pairs ..... 6; :**

Paolo Marracino<sup>1</sup>, Laura Zanetti<sup>3</sup>, Francesca Apollonio<sup>1</sup>, Micaela Liberti<sup>1</sup>, Andrea Amadei<sup>2</sup> & Guglielmo d'Inzeo<sup>1</sup>

<sup>1</sup>Department of Information Engineering, Electronics and Telecommunications, La Sapienza Università di Roma, Rome, Italy, 00184

<sup>2</sup>Dipartimento di Scienze e Tecnologie Chimiche, University of Rome "Tor Vergata", Rome, Italy, 00133

<sup>3</sup>Dipartimento di Chimica Ingegneria Chimica e Materiali, University of L'Aquila, L'Aquila, Italy, 67010

A benchmark biochemical reaction is here theoretically investigated by means of a perturbative approach in order to model the spin state relaxation of the radical pairs complex. The dipolar interaction between the two radicals is explicitly considered during the dynamic evolution of the system in order to investigate the proper conditions for the triplet to singlet transition to occur.

#### **PB-140 [11:00]**

**Review and Evaluation of Beneficial Low-Level EMF Effects on Cancer Cells in with Respect to Potential Interaction Mechanisms ..... 723**

Davnah Payne<sup>1</sup> & Niels Kuster<sup>1,2</sup>

<sup>1</sup>Foundation for Research on Information Technologies in Society (IT<sup>2</sup>S), Zurich, Switzerland, 8004

<sup>2</sup>Swiss Federal Institute of Technology (ETH) Zurich, 8092 Zurich, Switzerland, Zurich, Switzerland, 8092

Ninety-six *in vitro*, *in vivo*, and human studies on the beneficial effects of low-level EMF exposure on cancer cells and tissues were reviewed for common exposure patterns, efficient and replicable exposure conditions, and information on interaction mechanisms. Biological systems, exposure conditions, and study quality were highly heterogeneous and little information was provided about mechanisms. Future studies should replicate existing ones and be designed to challenge mechanistic hypotheses.

**PB-142 [11:00]**  
**Represent UV-A sterilization by model equation ..... 725**

Masachika Ishizaki<sup>1</sup> & Masatake Akutagawa<sup>1</sup>  
<sup>1</sup>*Tokushima University, Tokushima City, Japan, 770-8502*

Ultraviolet (UV) light has a different sterilization effect by UV wavelength is changed. Among them, we conduct a research focused on sterilization of UV-A. But, sterilization power of UV-A is weak. So, our purpose is the practical application of sterilization by UV-A LED. Therefore, my research is deriving a model equation that can expect the result of sterilization by fitting the sterilization conditions. Predicting the sterilization effect is useful in making sterilization equipment.

**PB-144 [11:00]**  
**Pearliness: reflection by natural nearly-periodic structures ..... 727**

John Lekner<sup>1</sup>  
<sup>1</sup>*MacDiarmid Institute, Victoria University, Wellington, New Zealand, 6015*

Many natural substances, for example mother-of-pearl, are almost-periodic layered structures. We give a theoretical treatment of the optics of periodic layered structures, and show that the reflection properties closely correspond with that of many biominerals. In particular, we show that high reflection at almost all angles of incidence is to be expected.

**PB-146 [11:00]**  
**Assessment of implantable defibrillator exposure to low frequency magnetic fields ..... 727**

Isabelle Magne<sup>2</sup>, Juliano Katrib<sup>1</sup>, Djilali Kourtiche<sup>1</sup>, Pierre Schmitt<sup>1</sup>, Patrice Roth<sup>1</sup>, Mustapha Nadi<sup>1</sup> & Martine Souques<sup>3</sup>  
<sup>1</sup>*Institut Jean Lamour ; UMR 7198, Université de Lorraine-CNRS, Nancy, France*  
<sup>2</sup>*EDF R&D, EDF, Moret sur Loing, France, 77818*  
<sup>3</sup>*Service of Medical Studies, EDF, Levallois-Perret, France, 92300*

Assessment of human exposure to electromagnetic fields in the workplace, for persons wearing active implantable medical devices, is a current challenge. This paper gives the experimental results for *in vitro* magnetic field characterization of Implantable Cardioverter Defibrillator (ICD) immunity. To be closer to the real conditions of exposure, the implant was placed in simulated human body and electrical appropriated signals have been applied, in order to simulate cardiac activity.

**PB-148 [11:00]**  
**Controlled release from magnetoliposomes solutions exposed to a low intensity magnetic field ..... 729**

Francesca Ceccarelli<sup>1</sup>, Romina Spera<sup>2</sup>, Caterina Merla<sup>3</sup>, Rosanna Pinto<sup>3</sup>, Micaela Liberti<sup>1</sup>, Guglielmo d'Inzeo<sup>1</sup>, Stefania Petralito<sup>2</sup> & Francesca Apollonio<sup>1</sup>  
<sup>1</sup>*ICEmB@DIET, University Sapienza of Rome, Rome, Italy, 00184*  
<sup>2</sup>*Dep. of Drug Chemistry and Technology, University Sapienza of Rome, Rome, Italy*  
<sup>3</sup>*ICEmB @ Radiation Biology and Human Health Unit, RC Casaccia, ENEA, Rome, Italy*

Magnetoliposomes (liposomes loading magnetic nanoparticles) have been intensely growing recently, as new drug delivery systems. With the use of alternating magnetic fields it is possible to remotely control the delivery of a drug or any other macromolecule loaded inside the vesicle. Here the release of a fluorescent dye from a magnetoliposome is achieved through a 20 kHz magnetic field, with amplitude below 100 A/m, demonstrating that the coupling of the field with the nanoparticles modifies the permeability of the liposome membrane.

**PB-150 [11:00]**  
**Analysis of Absorption Properties and Behavior of Collagen Fibers in Terahertz Band ..... 732**

Maya Mizuno<sup>1</sup>, Akira Yamada<sup>1</sup> & Kaori Fukunaga<sup>1</sup>  
<sup>1</sup>*National Institute of Information and Communications Technology, Koganei, Japan, 184-8795*

The absorption spectra of type I collagen samples were measured in a terahertz band and simulated by molecular orbital method. Comparison between the measurement and simulation was carried out in the spectral shape related to vibrations of ethylene and amino groups. When salts were added to the collagen sample, its spectrum significantly differed from that in the simulation. We speculated that the absorption feature reflected contraction and condensation of collagen fibers.

**PB-152 [11:00]**  
**Superficial Neurostimulation for Craniomandibular Disorder (Bruxism) ..... 733**

José Luis Bardasano<sup>1</sup>, Pilar Rico<sup>1</sup>, Helena Alvarez-Ude<sup>1</sup> & J. Carrion<sup>1</sup>

<sup>1</sup>*Department of Medical Specialties, University of Alcalá, Alcalá de Henares, Spain, 28801*

Bruxism patient condition improves considerably as neuromuscular and occlusal balance is restored. Superficial neurostimulation has been shown useful for the treatment of this ailment. Changes in intensity and the number of overnight episodes of bruxism after superficial neurostimulation of bruxism-diagnosed patients are observed. Eleven patients out of the fifteen showed either improvement to a mild intensity range or absence of bruxism

**PB-154 [11:00]**  
**Influence of PEMF Therapy on Gene Expression in Muscle Cells, Peripheral Circulation, and Metabolic Factors In Aging Overweight ..... 734**

János Rikk<sup>1</sup> & Sándor Sandra<sup>1</sup>

<sup>1</sup>*Impulser International AG, Győr, Hungary*

This double-blind study tested the effects of PEMF therapy. The treatment was provided five days per week for a total of 60 sessions. Fifty-five older adult completed the entire treatment while six subjects consented to muscle biopsies. The results indicate no change in mRNA content of Ku70 during the single PEMF session however mRNA levels of IL-6 and c-Fos increased. The chronic effects of PEMF treatment include significant reductions in blood pressure, and increases in skin temperature.

**PB-156 [11:00]**  
**Central nervous system effects of the exposure to low intensity extremely low frequency electromagnetic fields ..... 736**

Vincenzo Di Lazzaro<sup>1</sup>, Fioravante Capone<sup>1</sup>, Francesca Apollonio<sup>2</sup>, Micaela Liberti<sup>2</sup>, Alessandra Paffi<sup>2</sup>, Katia Varani<sup>3</sup>, Ruggero Cadossi<sup>4</sup>, Pier Andrea Borea<sup>4</sup>, Claudio Grassi<sup>5</sup>, Marta Parazzini<sup>6</sup>, Lorenzo Fassina<sup>7</sup> & Paolo Ravazzani<sup>6</sup>

<sup>1</sup>*Institute of Neurology, Università Campus Biomedico, Rome, Italy*

<sup>2</sup>*ICEmB at Department of Information Engineering, Electronics and Telecommunication (DIET), Sapienza University of Rome, Rome, Italy, 00184*

<sup>3</sup>*Dipartimento di Medicina Clinica e Sperimentale, Istituto di Farmacologia, Università di Ferrara, Ferrara, Italy*

<sup>4</sup>*IGEA Biophysics Laboratory, Carpi, Italy*

<sup>5</sup>*Institute of Human Physiology, Università Cattolica S. Cuore, Rome, Italy*

<sup>6</sup>*CNR Consiglio Nazionale delle Ricerche, Istituto di Ingegneria Biomedica, Milano, Italy*

<sup>7</sup>*Dipartimento di Informatica e Sistemistica, Università di Pavia, Pavia, Italy*

Several studies reported functional changes on nervous system induced by extremely low frequency magnetic fields (ELF-MFs). However, the outcomes are variable and the mechanisms of action are still unknown. In this work, a review of methodological, experimental and clinical studies is provided. The aim is to give a deeper knowledge of the effects of ELF-MFs on the human brain for a controlled modulation of the brain activity, useful in the treatment of neurologic and neuropsychiatric disorders

**PB-158 [11:00]**  
**Apparatus for Human ELF Exposure at 50mT ..... 738**

Lynn Keenlside<sup>1</sup>, Alexandre Legros<sup>1, 2, 3, 4</sup>, Julien Modolo<sup>1, 2, 3</sup> & Alex Thomas<sup>1, 2, 3</sup>

<sup>1</sup>*Human Threshold Research Group, Imaging Program, Lawson Health Research Institute, London, ON, Canada, N6A 4V2*

<sup>2</sup>*Dept. of Medical Biophysics, Western University, London, ON, Canada, N6A 5C1*

<sup>3</sup>*Dept. of Medical Imaging, Western University, London, ON, Canada, N6A 5W9*

<sup>4</sup>*School of Kinesiology, Western University, London, ON, Canada, N6A 5B9*

OBJECTIVE: Design and production of an up to 50mT ELF MF exposure system inducing detectable effects in humans (e.g., magnetophosphenes).

METHODS: We have developed a custom exposure system including a water-cooled coil utilizing a MRI gradient amplifier.

RESULTS: The system is able to generate a MF flux density over 50 mT from 20 to 100 Hz.

CONCLUSIONS: We have designed an exposure system minimizing heating and vibration, producing ELF MF at levels reported to induce biological effects in humans.

**PB-160 [11:00]**  
**Preliminary data on human central nervous system exposed to 50 and 60 Hz magnetic fields of up to 50 mT and magnetophosphenes ..... 739**

Alexandre Legros<sup>1,2,3,4</sup>, Julien Modolo<sup>1,2,3</sup>, Daniel Goulet<sup>5</sup>, Michel Plante<sup>5</sup>, Martine Souques<sup>6</sup>, François Deshamps<sup>7</sup>, Genevieve Ostiguy<sup>5</sup>, Gabor Mezei<sup>8</sup>, Jacques Lambrozo<sup>6</sup> & Alex Thomas<sup>1,2,3</sup>

<sup>1</sup>Human Threshold Research Group, Lawson Health Research Institute, London, ON, Canada

<sup>2</sup>Department of Medical Biophysics, Western University, London, ON, Canada

<sup>3</sup>Department of Medical Imaging, Western University, London, ON, Canada

<sup>4</sup>School of Kinesiology, Western University, London, ON, Canada

<sup>5</sup>Hydro-Québec, Montréal, QC, Canada

<sup>6</sup>Service des Études Médicales, EDF, Paris, France

<sup>7</sup>Service Environnement Réseaux, RTE, Paris, France

<sup>8</sup>Electric Power Research Institute, Palo Alto, CA, USA

OBJECTIVE: Establishing magnetic flux density thresholds for systematic neurophysiological responses at 50 and 60 Hz.

METHODS: Magnetophosphene perception, electroencephalography, tremor are tested between 0 and 50 mT.

RESULTS: Preliminary data including tremor recordings and repeated reports of magnetophosphenes with corresponding EEG activity will be presented.

CONCLUSIONS: Our protocol allows the detection of systematic effects related to 50 and 60 Hz exposures between 0 and 50 mT.

#### **PB-162 [11:00]**

**Non-thermal effect of mobile phone radiofrequency waves on human skin perfusion ..... 742**

Nathalie Loos<sup>1</sup>, Brahim Selmaoui<sup>2</sup>, Jean-Pierre Libert<sup>1</sup> & Rene De Seze<sup>2</sup>

<sup>1</sup>Laboratory PERITOX, EA 4285 UMI-INERIS, Jules Verne University of Picardy, Amiens, France, 80036 Cedex 1

<sup>2</sup>EA 4285 UMI-INERIS, INERIS, Verneuil-en-Halatte, France, 60550

In this study, variations in skin micro blood flow and temperature were simultaneously recorded in 20 adults with a thermostatic laser Doppler system during "radiofrequency" and "sham" mobil phone's exposure for 20 minutes. These findings show the existence of a vasodilatory effect on skin perfusion of MP radiofrequency emission, which was non-thermal.

#### **PB-164 [11:00] - STUDENT PAPER**

**Possible effects of 30 min LTE mobile phone exposure on cognitive performance assessed by Stroop test in young healthy human vol ..... 744**

Zsuzsanna Vecsei<sup>1,2</sup>, Péter Juhász<sup>1</sup>, György Thuroczky<sup>1</sup> & István Hernádi<sup>2</sup>

<sup>1</sup>Department of Non-ionising Radiations, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary, 1221

<sup>2</sup>Department of Experimental Neurobiology, University of Pécs, Pécs, Hungary, 7624

The effect of a single 30 min LTE mobile phone like EMF exposure or placebo treatment was examined on young healthy human volunteers' cognitive performance in a double blind, counterbalanced within-subject task design. No statistically significant effects of RF exposure were found on volunteers' Stroop performance thus we concluded that a single 30 min LTE exposure does not affect selective attention and executive function of healthy young volunteers measured by RTs of Stroop test.

#### **PB-166 [11:00]**

**Investigation of possible synergistic effects of caffeine intake and UMTS mobile phone-like exposure on predictive coding in the ..... 745**

Attila Trunk<sup>1</sup>, Gábor Stefanics<sup>2,3</sup>, Norbert Zentai<sup>1</sup>, Ivett Bacskay<sup>4</sup>, Attila Felinger<sup>4</sup>, György Thuroczky<sup>5</sup> & István Hernádi<sup>1</sup>

<sup>1</sup>Department of Experimental Neurobiology, University of Pécs, Pécs, Hungary, H-7624

<sup>2</sup>Translational Neuromodeling Unit (TNU), Institute for Biomedical Engineering, University of Zürich, Zürich, Switzerland, CH-8092

<sup>3</sup>Laboratory for Social and Neural Systems Research, Department of Economics, University of Zürich, Zürich, Switzerland, CH-8091

<sup>4</sup>Department of Analytical and Environmental Chemistry, University of Pécs, Pécs, Hungary, H-7624

<sup>5</sup>National Institute for Radiobiology and Radiohygiene (NIRR), Budapest, Hungary, H-1221

We investigated combined effects of 3 mg per kg body weight caffeine and 15 min UMTS EMF exposure examined on human reaction time and predictive coding indexed by cortical oscillatory activity. Although the alpha band oscillation

changes indicate that the subjects more efficiently anticipated the target stimuli in the caffeine compared to the control condition no synergistic effects of caffeine and UMTS EMF exposure were found either on RTs or on oscillations.

**PB-168 [11:00]**

**Change of physical-chemical characteristics of tumoral and healthy DNA irradiated by low power millimeter waves ..... 747**

Vitaly Kalantaryan<sup>1</sup>, Radik Martirosyan<sup>1</sup>, Lusine Nersesyan<sup>2</sup> & Hrachya Stepanyan<sup>2</sup>

<sup>1</sup>*Microwave Radiophysics, Yerevan State University, Yerevan, Armenia, 0025*

<sup>2</sup>*Science Technical Centre of Organic and Pharmaceutical Chemistry, Yerevan, Armenia, 0025*

Thermostability and density of water-salt solutions of tumoral and healthy DNA, irradiated by electromagnetic waves with frequency 42.2GHz and 64.5 GHz have been investigated. It is shown that depend on time of irradiation the thermostability of DNA and density of its solutions are increased. It is expected that under influence of radiation the hydration of DNA and being present in solution ions of Na<sup>+</sup> increase owing to what physicochemical characteristics of DNA are changed.

**PB-170 [11:00]**

**Effects of semi-chronic radar type exposure (3 GHz) on cognitive performance in rats ..... 74:**

Celine Cretallaz<sup>1</sup>, Ioannis Lamproglou<sup>2</sup>, Christine Amourette<sup>1</sup>, Michel Diserbo<sup>1</sup>, William Fauquette<sup>1</sup>, Patrick Martigne<sup>1</sup>, Alice Collin<sup>1,3</sup>, Philippe Leveque<sup>3</sup> & Anne Perrin<sup>1</sup>

<sup>1</sup>*Radiobiology Department, Biomedical Research Institute of the Army -CRSSA, La Tronche, France, 38700*

<sup>2</sup>*Oncology and Radiotherapy Unit, La Pitié-Salpêtrière Hospital, Paris, France, 75651*

<sup>3</sup>*XLIM, UMR CNRS n°7252, University of Limoges, Limoges, France, 87060*

The purpose of this work was to investigate the possible effects of pulse-modulated 3 GHz microwave exposure (8 weeks, 45min/day, 5 days/week, mean SAR 5 W/kg) on memory and learning capacities of adult Wistar rats. Different exposure conditions were studied differing by the repetition time and pulse duration. Water-Maze tests were carried out for 16 months following a semi-chronic exposure period. No behavioral effect of microwave was observed.

**PB-172 [11:00]**

**Low-intensity extremely high frequencies electromagnetic field irradiated antibiotics effects on Escherichia coli ..... 74;**

Heghine Torgomyan<sup>1</sup> & Armen Trchounian<sup>1,2</sup>

<sup>1</sup>*Department of Biophysics, Yerevan State University, Yerevan, Armenia, 0025*

<sup>2</sup>*Department of Microbiology & Plants and Microbes Biotechnology, Yerevan State University, Yerevan, Armenia, 0025*

Bacterial sensitivity against antibiotics can be enhanced by electromagnetic irradiation. In this work irradiation of antibiotics from different groups then adding into growth medium has been shown to have more effective antibacterial action on *E. coli* compared with non-irradiated antibiotics. The growth characteristics – lag phase duration and specific growth rate were changed. The effects of electromagnetic irradiation and antibiotics may create new opportunities for applications.

**PB-174 [11:00]**

**2450 MHz Wi-Fi router electromagnetic radiation effects on mice motor coordination, anxiety, learning and memory 753**

Adamantia Fragopoulou<sup>1</sup>, Antonis Stamatakis<sup>2</sup>, Despoina Mina<sup>1</sup>, Katerina Skouroliakou<sup>3</sup>, Nikolaos Kostomitsopoulos<sup>4</sup>, Fotini Stylianopoulou<sup>2</sup> & Lukas Margaritis<sup>1</sup>

<sup>1</sup>*Department of Cell Biology and Biophysics, Faculty of Biology, University of Athens, Athens, Greece, 15784*

<sup>2</sup>*Biology – Biochemistry Laboratory, Faculty of Nursing, School of Health Sciences, University of Athens, Athens, Greece, 11527*

<sup>3</sup>*Department of Physics and Chemistry & Material Technology, Technical Educational Institute of Athens, Athens, Greece, 12210*

<sup>4</sup>*Laboratory Animal Facilities & Centre of Experimental Surgery, Biomedical Research Foundation, Academy of Athens, Athens, Greece, 11527*

Whole body exposure of C57BL/6 mice to the Wi-Fi router 2440-2480 MHz frequency band at 381 mV/m average electrical field intensity and SAR 0.1 mW/kg for 14 h/day x 2 months is associated with elevated anxiety in a time dependent manner, but no motor coordination, balance, motor learning or recognition memory deficits.

**PB-176 [11:00]**

**Comparative effects of CW and FM signals on apoptosis and oxidative stress in Drosophila ..... 757**

Areti Manta<sup>1</sup>, Niki Sagioglou<sup>1</sup>, Giannis Giannarakis<sup>1</sup>, Katerina Skouroliakou<sup>2</sup>, Dimitrios Stravopodis<sup>1</sup> & Lukas Margaritis<sup>1</sup>

<sup>1</sup>*Dept. of Cell Biology and Biophysics, National and Kapodistrian University of Athens, Athens, Greece, 15784*

<sup>2</sup>*Department of Physics and Chemistry & Material Technology, Technical Educational Institute of Athens, Athens, Greece, 12210*

Differential impact of CW vs. FM signals in various frequencies (100-900 MHz) on the ovaries of *D. melanogaster* revealed a clear difference in apoptosis and reactive oxygen species formation after exposing newly emerged flies for 60 min daily for 5 days. Thus, apoptosis and ROS seem to be early events of EMF/living matter interaction, not necessarily related with the modulated signals to be more bioactive.

**PB-178 [11:00]**

**The influence of 1800 MHz GSM-like signals on blood chemistry and oxidative stress in non-pregnant and pregnant rabbits ..... 75;**

Nesrin Seyhan<sup>1</sup>, Gorkem Kismali<sup>2</sup>, Elcin Ozgur<sup>1</sup>, Goknur Guler<sup>1</sup>, Aytac Akcay<sup>3</sup> & Tevhide Sel<sup>2</sup>

<sup>1</sup>*Department of Biophysics, Gazi University, Ankara, Turkey, 06500*

<sup>2</sup>*Department of Biochemistry, Ankara University, Ankara, Turkey, 06500*

<sup>3</sup>*Department of Biometry, Erciyes University, Kayseri, Turkey*

1800 MHz GSM-like RFR exposure for 15 min/day for seven days on blood chemistry and lipid peroxidation levels in both non-pregnant and pregnant rabbits were investigated. Blood chemistry parameters, such as cholesterol, total protein, albumin, uric acid, creatinin and creatine kinase (CK) and creatine kinase-myocardial band isoenzyme (CK-MB) changed in both pregnant and RFR-exposed pregnant animals. No indication for oxidative stress was detected in the blood of pregnant rabbits upon RFR exposure.

**PB-180 [11:00]**

**New Non-invasive Medical Technology for Express-Diagnostics and Extra High Frequency Therapy ..... 762**

Sergey Kostylev<sup>1</sup>, Vladimir Kamkov<sup>2</sup>, Vladimir Grinyuk<sup>2</sup>, Sergey Yatsunenko<sup>3</sup> & Anatoly Yatsunenko<sup>2</sup>

<sup>1</sup>*Onyx International Consulting, LLC, Bloomfield Hills, MI, USA, 48304*

<sup>2</sup>*RAMED, LLC, Dnepropetrovsk, Ukraine, 49005*

<sup>3</sup>*Institute of Physics Polish Academy of Sciences, Warsaw, Poland*

Includes the techniques for puncture express-diagnostics and therapy using electromagnetic waves of sub-low intensity (EMW SLI). Biophysical parameters of biologically active points (BAP) characterize processes both on intracellular and on extracellular levels. Data received are interpreted with biomedical model of human body to form the healing strategy and tactics. Results of corrective therapy by impact on BAPs by EMW SLI tuned to a normal cells' resonant frequency are presented.

**PB-182 [11:00]**

**Effect of radiofrequency electromagnetic radiation (RF-EMR) on neurotransmitters in rat brain ..... 765**

Kanu Megha<sup>1</sup>

<sup>1</sup>*Department of Biochemistry, University of Delhi, Delhi, India*

The present study aimed to investigate the effects of radiofrequency electromagnetic radiation (RF-EMR) exposure (30 days) from mobile phones on brain neurotransmitters (epinephrine, nor epinephrine, dopamine and serotonin) and expression of their key regulating enzymes (tyrosine hydroxylase and tryptophan hydroxylase) in brain of Fischer rats. The results of the present study suggest that RF-EMR exposure impairs learning and memory by altering these neurotransmitters in brain.

**PB-184 [11:00]**

**Anticancer Effect of Low Frequency Magneto-Sonodynamic Therapy with Chlorine E6 in Experiment ..... 766**

Sergei Pletnev<sup>1</sup>, Andrei Pletnev<sup>2</sup> & Yury Istomin<sup>2</sup>

<sup>1</sup>*Magnomed, Minsk, Belarus, 220037*

<sup>2</sup>*N. N. Alexandrov National Cancer Center of Belarus, Minsk, Belarus, 223040*

At the time when media and general public raise concern about possible role of magnetic field in initiation of cancer, current research investigated the possibility of a selected magnetic field in combination with ultrasound and photosensitizer to inhibit cancer growth. The aim of the current study is to develop a novel method of combined low frequency magneto-sonodynamic therapy with Chlorin E6 for achieving anticancer effect in experiment.

**PB-186 [11:00]**

**Comparative Analysis of Microvasculatory and Arterial Pulsing Pressure Modulations by ELF-EMF Exposure In Vivo 767**

Lubomir Traikov<sup>1</sup>, Ivan Antonov<sup>1</sup>, Julia Petrova<sup>1</sup> & Liubina Vesselinova<sup>1</sup>

<sup>1</sup>*Medical Physics and Biophysics, Medical University-Sofia, Sofia, Bulgaria, 1431*



This work reports results obtained by comparative analysis of data, obtained after ELF-EMF exposure, by using combined novel and classical techniques for simultaneous registration of blood pressure and vascular diameter changes, registered in animals at real time measurements *in vivo*.

Complex regulatory mechanisms need complex analysis of the ELF-EMF action. Through the intra arterial (*Arteria Femoralis*) catheterization we succeed to measure accurately enough acute changes in blood pressure at ELF-EMF exposure.

**PB-188 [11:00]**

**Effects of *in vivo* ELF-MF exposure (50 Hz) for 2 weeks on the hematopoietic system in two different inbred rat strains ..... 769**

Maren Fedrowitz<sup>1</sup> & Wolfgang Loscher<sup>1</sup>

<sup>1</sup>*Dept of Pharmacology, Toxicology, and Pharmacy, University of Veterinary Medicine, Hannover, Germany, 30559*

Lewis and Fischer 344 rats, strains with different sensitivities towards stress, carcinogens, and ELF-MF exposure, were used to examine the ELF-MF effects on the hematopoietic system. After *in vivo* exposure, differential blood counts revealed changes in F344. The *ex vivo* mitogen stimulation of primary lymphocytes from spleen and bone marrow revealed alterations in the proliferative activity. Differences between Lewis and F344 as well as distinct results in males and females were observed.

**PB-190 [11:00]**

**Nociceptive Behaviour in 'Blind' Mice is Not Affected by Magnetic Field Shielding as are Laboratory Mice with Normal Vision ..... 76;**

Frank Prato<sup>1,2,3</sup>, Dawn Desjardins-Holmes<sup>1</sup>, Lynn Keenlside<sup>1</sup> & Alex Thomas<sup>1,2,3</sup>

<sup>1</sup>*Bioelectromagnetics Group, Lawson Health Research Institute, London, ON, Canada, N6A 4V2*

<sup>2</sup>*Diagnostic Imaging, St. Joseph's Health Care, London, ON, Canada, N6A 4V2*

<sup>3</sup>*Department of Medical Biophysics, University of Western Ontario, London, ON, Canada*

Daily repeated exposure within a magnetic field shielded enclosure induces opioid-like antinociception (analgesia) in mice. This effect is caused by the elimination of the ambient time changing magnetic field. Re-introduction of light of appropriate wavelength and intensity eliminates this effect. Here we report that "FVB/NJ blind" mice are not affected by magnetic field shielding suggesting a role of the retina or visual system in the biophysical detection mechanism.

**PB-192 [11:00]**

**The Changes of Erythrocyte Membranes of White Outbred Rats Exposed to Electrostatic Field with the Tension Exceeding the Natura ..... 773**

Gohar Sahakyan<sup>1</sup>, Gagik Artsruni<sup>1</sup> & Gayane Poghosyan<sup>1</sup>

<sup>1</sup>*Laboratory of Biochemistry and Biophysics, Yerevan State Medical University, Yerevan, Armenia, 0025*

The viscosity, microviscosity and the immersion degree of membrane proteins in lipid bilayer of rat erythrocyte ghosts after 1-hour *in vivo* exposure of animals to the 200 kV/m field have investigated. It has shown that the field influence leads to the lipid-protein intermolecular reconstructions on the membrane surface and increases the membrane viscosity and the strength of relation between peripheral proteins and lipid bilayer.

**PB-194 [11:00]**

**Microwave treatment of *Streptomyces coelicolor*. Preliminary results ..... 774**

Bruno Bisceglia<sup>1</sup>, Francesco Chiadini<sup>1</sup>, Simona Matrella<sup>2</sup>, Antonio Scaglione<sup>1</sup> & Giovanni Vigliotta<sup>2</sup>

<sup>1</sup>*Department of Industrial Engineering, University of Salerno, Fisciano (SA), Italy, 84084*

<sup>2</sup>*Department of Chemistry and Biology, University of Salerno, Fisciano (SA), Italy, 84084*

Actinomycetes and fungi represent a source of emission of immunologically reactive propagules and toxic molecules into the air. They are responsible of allergic reactions, infections, toxic responses and "sick building syndrome". The main goal of this study was to test the capacity of microwave radiations of affect the viability of actinomycetes spores (*Streptomyces coelicolor*).

**PB-196 [11:00]**

**The effect of electromagnetic waves with extremely high frequencies and low intensity on surface charge density of rat blood ery ..... 776**

Poghos Vardevanyan<sup>1</sup>, Vitaly Kalantaryan<sup>2</sup>, Anahit Nerkararyan<sup>1</sup> & Mariam Shahinyan<sup>1</sup>

<sup>1</sup>*Department of Biophysics, Yerevan State University, Yerevan, Armenia, 0025*

<sup>2</sup>*Department of Microwave Radiophysics and Telecommunication, Yerevan State University, Yerevan, Armenia, 0025*

The effect of electromagnetic waves with extremely high frequencies (EMW EHF) and low intensity on surface charge density of rat blood erythrocytes has been investigated. It has been shown that the effect of EMW EHF on biological systems depends on irradiation frequency. The role of water in biological system response reaction formation to external physical field has been discussed.

**PB-198 [11:00]**

**HFEMF at 2.45 GHz does not affect T cell dependent antibody responses in mouse hybridoma cell line (SRBC-P20-13-13) ..... 778**

Eijiro Narita<sup>1</sup>, Yukihisa Suzuki<sup>2</sup>, Masao Taki<sup>2</sup> & Junji Miyakoshi<sup>1</sup>

<sup>1</sup>Research Institute for Sustainable Humanosphere, Kyoto University, Uji, Japan, 611-0011

<sup>2</sup>Department of Electrical Engineering, Tokyo Metropolitan University, Hachioji, Japan, 192-0397

The immune defence system against foreign substances maintains homeostasis in humans. Plaque forming cell assay is a method which is able to evaluate the immune response from the recognition of antigen to the production of antibody by counting the antibody-forming cells in the spleen following immunization with sheep red blood cells. In this study, we investigated the effects of a high-frequency electromagnetic field at 2.45 GHz on T cell dependent antibody responses in mouse splenic hybridoma cell line (SRBC-P20-13-13).

**PB-200 [11:00]**

**Investigations of the genotoxic potential of wireless communication electromagnetic fields ..... 779**

David Schuermann<sup>1</sup>, Christina Ziemann<sup>2</sup>, Myles Capstick<sup>3</sup>, Antje Oertel<sup>2</sup>, Zeinab Barekati<sup>1</sup>, Frauke Focke<sup>1</sup>, Manuel Murbach<sup>3</sup>, Niels Kuster<sup>3</sup>, Clemens Dasenbrock<sup>2</sup> & Primo Schär<sup>1</sup>

<sup>1</sup>Department of Biomedicine, University of Basel, Basel, Switzerland, 4058

<sup>2</sup>Department of Toxicology and Environmental Hygiene, Fraunhofer ITEM, Hannover, Germany, 30625

<sup>3</sup>IT'IS Foundation, Swiss Federal Institute of Technology (ETHZ), Zürich, Switzerland, 8092

The impact on the genome integrity of signal-modulated electromagnetic fields (EMF) emitted by wireless data transfer devices was revisited and systematically evaluated in *in vitro* cultured human cells. This revealed no evidence for a direct DNA-damaging potential of wEMF exposure. Nevertheless, using newly developed tools, we found indications for modulation-specific multifactorial functional interference with cellular homeostasis, requiring further experimentations.

**PB-202 [11:00]**

**Microwave measurements of dielectric properties of biological tissues ..... 77:**

Lourdes Abdilla<sup>1</sup>, Charles Sammut<sup>1</sup> & Louis Zammit Mangion<sup>1</sup>

<sup>1</sup>Department of Physics, University of Malta, Msida, Malta, MSD 2080

This study presents the dielectric properties of muscle, liver, kidney and fat from 500MHz up to 40GHz. A single Cole-Cole model was used to fit the data as a function of frequency at 37°C. This allowed the estimation of dielectric properties at the frequency of interest and extended the current models up to 40GHz. Precision reflection measurements were made on 0.1N Sodium Chloride prior to measurements on biological tissues and wideband temperature-dependent properties extending up to 50°C are presented.

**PB-204 [11:00]**

**Millimeter-Wave Exposure Apparatus with Disc-Shaped Post-Wall Waveguide for *in vitro* Experiments ..... 77:**

Takeo Shina<sup>1</sup>, Yukihisa Suzuki<sup>1</sup>, Kanako Wake<sup>2</sup> & Masao Taki<sup>1</sup>

<sup>1</sup>Electrical and Electronic Engineering, Tokyo Metropolitan University, Hachioji-shi, Japan, 192-0397

<sup>2</sup>National Institute of Information and Communications Technology, Koganei-shi, Japan, 184-8795

We developed an *in vitro* millimeter-wave exposure apparatus with disc-shaped post-wall waveguide to obtain reproducible results in the investigation of non-thermal effects. The apparatus achieved exposure of a sufficient number of cells with improved uniformity of incident wave intensity. The exposure condition was characterized by numerical analysis, and the results were validated by experiment. The feasibility of the exposure apparatus was demonstrated by *in vitro* experiments.

**PB-206 [11:00]**

**Study of Potential Biological Effects of Pulse-Modulated RF Signals of Ultra High Field MRI ..... 783**

Yonis Soubere Mahamoud<sup>1</sup>, Catherine Le Quément<sup>1</sup>, Maxim Zhadobov<sup>2</sup>, Guillaume Ferrand<sup>3</sup>, Rémy Le Guével<sup>4</sup>, Michel Luong<sup>3</sup>, Pierre-Henri Carton<sup>3</sup>, Yves Piret<sup>3</sup>, Ronan Sauleau<sup>2</sup> & Yves Le Dréan<sup>1</sup>

<sup>1</sup>Institute for Research on Environmental and Occupational Health (IRSET), Rennes, France

<sup>2</sup>Institute of Electronics and Telecommunications of Rennes (IETR), Rennes, France

<sup>3</sup>*French Alternative Energies and Atomic Energy Commission (CEA Saclay), Gif sur Yvette, France*

<sup>4</sup>*Plate-forme ImpACcell (Imagerie Pour Analyse du Contenu cellulaire), Rennes, France*

We studied potential cytotoxic effects of pulse-modulated 300 MHz and 500 MHz signals of future magnetic resonance imaging (MRI) apparatus. The human U251-MG glioma cell line was used as a model and the cellular integrity and gene expression of stress-related markers were analyzed.

**PB-208 [11:00]**

**Induced movement of giant vesicles by millimeter wave radiation ..... 784**

Alfonsina Ramundo-Orlando<sup>1</sup>, Martina Albini<sup>1</sup>, Simone Dinarelli<sup>2</sup>, Stefania Romeo<sup>3</sup>, Emiliano Zampetti<sup>4</sup>, Marco Girasole<sup>2</sup>, Umberto Morbiducci<sup>5</sup> & Rita Massa<sup>3,6</sup>

<sup>1</sup>*Institute of Translational Pharmacology, National Research Council, Rome, Italy, 00133*

<sup>2</sup>*Institute of Structural Matter, National Research Council, Rome, Italy, 00133*

<sup>3</sup>*Institute for Electromagnetic Sensing of the Environment, National Research Council, Naples, Italy, 80124*

<sup>4</sup>*Institute for Microelectronics and Microsystems, National Research Council, Rome, Italy, 00133*

<sup>5</sup>*Department of Mechanical and Aerospace Engineering, Polytechnic University of Turin, Turin, Italy, 10129*

<sup>6</sup>*Department of Physics, University of Naples Federico II, Naples, Italy, 80126*

Due to the increasing interest in medical applications using millimetre waves the investigation of their effects on the physical properties of cellular systems is of the utmost importance. Here we report preliminary results on the vectorial movement induced by low intensity radiation at 53.37 GHz in a cell-size system, i.e. giant vesicles.

**PB-210 [11:00]**

**Effect of extremely low frequency magnetic field on cell proliferation ..... 787**

Mi-Na Hong<sup>1</sup>, Hyung-Chul Lee<sup>1</sup>, Yun-Sil Lee<sup>2</sup>, Yoon-Myoung Gimm<sup>3</sup>, Sung Ho Myung<sup>4</sup>, Young-Gyu Ko<sup>5</sup> & Jae-Seon Lee<sup>1</sup>

<sup>1</sup>*Radiation Molecular Cancer Biology, Korea Institute of Radiological and Medical Sciences, Seoul, Korea, 139-706*

<sup>2</sup>*Life Science and Pharmaceuticals, Ewha Woman's University, Seoul, Korea, 120-750*

<sup>3</sup>*EMF safety, Dankook University, Gyeonggi-do, Korea, 448-701*

<sup>4</sup>*Smart Grid Research, Korea Electrotechnology Research Institute, Gyeongsang-namdo, Korea, 641-120*

<sup>5</sup>*Life Sciences and Biotechnology, Korea University, Seoul, Korea, 136-713*

In this study, we investigated the effects of ELF-MF on cell proliferation in various cell lines. ELF-MF with a magnetic flux density of 1~2 mT at 60 Hz was employed to stimulate various cell types for 4 or 16 hours. We assessed the effect of ELF-MF on cell growth and viability. We concluded that ELF-MF could induce delay of cell cycle progression in a cell context-specific manner.

**PB-212 [11:00]**

**Design and characterization of microwave exposure setups for fluorescence measurements on biological systems ..... 788**

Mihaela-Georgeta Moiescu<sup>1</sup>, Sophie Kohler<sup>2</sup>, Nicolas Ticaud<sup>2</sup>, Maria-Minodora Iordache<sup>1</sup>, Mohamad Kenaan<sup>2</sup>, Delia Arnaud-Cormos<sup>2</sup>, Philippe Leveque<sup>2</sup> & Tudor Savopol<sup>1</sup>

<sup>1</sup>*Dept. of Biophysics and Cell Biotechnologies, Davila University of Medicine and Pharmacy, Bucharest, Romania, 050474*

<sup>2</sup>*UMR 6172 CNRS, XLIM Research Institute, Limoges, France, 87060*

Two setups for measurements of parameters quantified by fluorescence methods (e.g., generalized polarization GP) while a biological sample (cells or artificial vesicles) is simultaneously exposed to 2.45 GHz fields are presented. The setups consist in either an open coaxial applicator or an open transverse electromagnetic cell combined with a spectrofluorometer. Experimental and numerical dosimetry, temperature distribution within the sample and setup validation by GP measurements are presented.

**PB-214 [11:00]**

**ERK1/2 and p38 MAPKs mediate in the proliferative response to a weak 50 Hz MF. Potential implication of free radicals ..... 78;**

Maria Martinez<sup>1</sup>, Alejandro Ubeda<sup>1</sup>, Maria Cid<sup>1</sup> & Maria Trillo<sup>1</sup>

<sup>1</sup>*Investigación-BEM, Hospital Ramón y Cajal - IRYCIS, Madrid, Spain, 28034*

This study investigates: 1) the potential involvement of ERK1/2, MAPK-p38 and JNK in the proliferative response of NB69 to intermittent exposure to a 50 Hz, 100 µT MF; 2) the potential involvement of free radicals in the MF effects on the signalling. Data show that the cytoproliferative response is mediated by early, transient and simultaneous activation of ERK1/2 and p38 signalling pathways. The results also indicate that free radicals intervene in the MF-induced activation of MAPK-p38.

**PB-216 [11:00]****Biomolecular effects of EMF studied in living cells ..... 792**

Yann Percherancier<sup>1</sup>, Bertrand Goudeau<sup>2</sup>, Stéphane Arbault<sup>2</sup>, Florence Poullétier De Gannes<sup>1</sup>, Emmanuelle Haro<sup>1</sup>, Annabelle Hurtier<sup>1</sup>, Renaud Charlet De Sauvage<sup>1</sup>, Daniela Moretti<sup>1</sup>, Hiroshi Masuda<sup>1</sup>, Neso Sojic<sup>2</sup>, Isabelle Lagroye<sup>1</sup> & Bernard Veyret<sup>1</sup>

<sup>1</sup>*IMS laboratory / CNRS UMR 5218, C.N.R.S., Talence, France, 33400*

<sup>2</sup>*Institut des Sciences Moléculaires (CNRS UMR 5255), C.N.R.S., Pessac, France, 33607*

Surprisingly, bioelectromagnetics research has not yet fully benefited from biotechnological innovations that allow a real-time investigation of molecular events in living cells. Using Bioluminescence Resonant Energy Transfer (BRET) and Fluorescence Recovery after photobleaching (FRAP), we address the effects of radiofrequency fields (RF) and Extremely Low frequency fields (ELF) on transient receptor channels activation and GAP junction functions.

**PB-218 [11:00] - STUDENT PAPER****Real-time quantification of actin dynamics in stably expressing Lifeact-EGFP macrophages during LF-EMF exposure ..... 793**

Lieke Golbach<sup>1</sup>, Eline Verbon<sup>1</sup>, Tijs Ketelaar<sup>2</sup>, Huub Savelkoul<sup>1</sup> & Lidy Verburg-van Kemenade<sup>1</sup>

<sup>1</sup>*CBI, Wageningen, the Netherlands*

<sup>2</sup>*LCB, Wageningen, the Netherlands*

Actin filaments are responsible for cell shape and motility and thus crucial for immune cells, like macrophages, to capture invading microbes. It has been hypothesized that LF-EMF may influence F-actin in the filopodia and microvilli, by non-thermal interactions. Using a macrophage cell line that stably expresses Lifeact, we investigate a potential interaction of LF-EMF with actin dynamics. With ImageJ macros large datasets generated by spinning disk microscopy are analysed without user bias.

**PB-220 [11:00]****Cell response to oxidative stress under ELF-pulsed magnetic field exposure: is the effect due to magnetic or electric fields? ..... 796**

Brunella Del Re<sup>1</sup>, Mariangela Lecciso<sup>2</sup>, Ferdinando Bersani<sup>3</sup>, Entelè Gavoçi<sup>3</sup> & Gianfranco Giorgi<sup>2</sup>

<sup>1</sup>*Department of Pharmacy and Biotechnology, University of Bologna, Bologna, Italy, 40126*

<sup>2</sup>*Department of Biological Geological and Environmental Sciences, University of Bologna, Bologna, Italy, 40126*

<sup>3</sup>*Department of Physics and Astronomy, University of Bologna, Bologna, Italy, 40126*

Human cells were exposed to PMF, to Sham counter-wrapped coils and also kept outside the coils (Control). The oxidative stress was obtained by H<sub>2</sub>O<sub>2</sub> treatment. Surprisingly, no difference was found between Sham and PMF exposed cells, while a difference in term of G2/M arrest was found between these conditions and Control. These suggest that the effect was due to the electric field associated with the voltage drop across the coil resistance rather than to the magnetic field.

**PB-222 [11:00]****Genotoxic effect of exposure to intermediate frequency magnetic field ..... 796**

Györgyi Kubinyi<sup>1</sup>, Agnes Szerencsi<sup>1</sup>, Jozsef Bakos<sup>1</sup>, István Hernádi<sup>1</sup> & György Thuroczy<sup>1</sup>

<sup>1</sup>*Department of Non-ionising Radiations, National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary*

The genotoxic effect of exposure to intermediate frequency magnetic field was studied. Two magnetic field strengths were applied at 250 kHz frequency: 1 kA/m with exposure durations of 4, 5, 20, 24h and 10 kA/m with exposure durations of 1,2,3,4 and 5h. The single and double strand breaks of DNA in white blood cells were determined by alkaline one cell gel electrophoresis method. It was found that the exposure to 250 kHz frequency magnetic field did not result in DNA damage either in case of 1 kA/m or 10 kA/m MF exposure.

**PB-224 [11:00]****Destructive Effects of Pulsed Electric Fields on Cancer Cells: The Microtubules Mechanical Resonance Clue ..... 798**

Gerard Dubost<sup>1</sup>, James Bare<sup>2</sup>, Anthony Holland<sup>3</sup> & Frederic Bellossi<sup>4</sup>

<sup>1</sup>*Emeritus Professor of Physics, University of Rennes 1, France*

<sup>2</sup>*DC, Albuquerque, NM, USA*

<sup>3</sup>*Associate Professor, Skidmore College, New-York, USA*

<sup>4</sup>*ESE Engineer, Bordeaux, France*

Non-thermal pulsed electrical fields generated by a confined plasma antenna showed destructive effects on cancerous cells. The destruction of the cells can be explained by the mechanical resonances of their microtubules (MT) and by the energy

accumulated over the exposure time. The proposed model, based on the characterization of the plasma antenna electric field and on the MT mechanical characteristics, is compliant with the fact that the active frequencies are tumor specific and temperature dependent.

**PB-226 [11:00]**

**Gene expression analysis of *Vibrio parahaemolyticus* for UV irradiation ..... 79;**

Teppei Hohshiyama<sup>1</sup>, Masatake Akutagawa<sup>1</sup>, Mutsumi Aihara<sup>1</sup>, Mario Hayashida<sup>1</sup>, Akira Takahashi<sup>1</sup>, Takahiro Emoto<sup>1</sup>, Shinsuke Konaka<sup>1</sup> & Yohsuke Kinouchi<sup>1</sup>

<sup>1</sup>*Tokushima University, Tokushima, Japan, 770-8502*

In sterilization technology, Ultraviolet (UV) sterilization using UV-A have been proposed because it's environmentally friendly. However, mechanism of sterilization using UV-A is still unknown. In this study, in order to elucidate which wavelength is effective for sterilization in UV-A, gene expression analysis was performed against *Vibrio parahaemolyticus* irradiated UV-A.

**PB-228 [11:00]**

**Exposure of Flies to DECT or Wi-Fi Radiation Affects their Learning and Memory and Induces Oxidative Stress ..... 7: 2**

Lukas Margaritis<sup>1</sup>, Alexandros Kanellopoulos<sup>2</sup>, Areti Manta<sup>1</sup> & Maria Ntzouni<sup>1</sup>

<sup>1</sup>*Dept. of Cell Biology and Biophysics, National and Kapodistrian University of Athens, Athens, Greece, 15784*

<sup>2</sup>*Institute of Cellular and Developmental Biology, BSRC "Alexander Fleming", Vari, Athens, Greece, 16 672*

This work was designed, to explore basic responses and effects of wireless radiation emitted from a DECT phone and a Wi-Fi router on young adult *D. melanogaster* flies (4-6 days old). It was found that a) odor-based memory performance was disturbed and b) reactive oxygen species (ROS) levels increased in the heads of the flies, suggesting that free radical formation may be an early event affecting memory

**PB-230 [11:00]**

**Effect of electromagnetic radiation from GSM mobile phones, Wi-Fi routers and DECT wireless phones on the model *Caenorhabditis elegans* ..... 7: 6**

Michael Fasseas<sup>1</sup>, Popi Syntichaki<sup>1</sup>, Adamantia Fragopoulou<sup>2</sup>, Katerina Skouroliakou<sup>3</sup> & Lukas Margaritis<sup>2</sup>

<sup>1</sup>*Basic Research II, Biomedical Research Foundation of the Academy of Athens, Athens, Greece, 11527*

<sup>2</sup>*Department of Cell Biology and Biophysics, National and Kapodistrian University of Athens, Athens, Greece, 15784*

<sup>3</sup>*Department of Physics, Chemistry & Material Technology, Technical Educational Institute of Athens, Athens, Greece, 12210*

We exposed synchronized populations of *C. elegans*, at different developmental stages, to electromagnetic radiation for various lengths of time. Wild-type and aging-or stress-sensitive mutant worms were examined for changes in growth, fertility, lifespan, chemotaxis, short-term memory, increased ROS and apoptosis by using fluorescent marker genes or qRT-PCR. The results so far indicate that although gene expression is affected in some cases, overall, the worm is not significantly affected by the radiation.

**PB-232 [11:00]**

**Effects of UV-A irradiation on growth of cultured RAW 264.7 cells ..... 7: 9**

Toshitaka Ikehara, Mutsumi Aihara, Zehong Su, Koichiro Tsuchiya, Akira Takahashi, Masatake Akutagawa & Yohsuke Kinouchi

<sup>1</sup>*Department of Human Welfare, Tokushima Bunri University, Tokushima, Japan, 770-8514*

<sup>2</sup>*Institute of Health BioSciences, The University of Tokushima, Tokushima, Japan, 770-8503*

<sup>3</sup>*Institute of Technology and Science, The University of Tokushima, Tokushima, Japan, 770-8503*

We tested effects of UV-A irradiation on RAW 264.7 cells. Cells were cultured and irradiated with 365 nm light at 156 mW/cm<sup>2</sup>. 2 min irradiation inhibited the cell growth, but N-acetyl L-cysteine recovered from the inhibition. It was demonstrated that ROS induced in the medium with the irradiation is mainly singlet oxygen by EPR spectrometer. These results suggest that inhibition of cell proliferation is caused by singlet oxygen induced by the UV-A irradiation.

**PB-234 [11:00]**

**No variation of p53 expression and activation is induced in human amniotic cells exposed to GSM-900 RF ..... 7: :**

Sylvie Bourthoumieu<sup>1</sup>, Philippe Leveque<sup>2</sup>, Amandine Magnaudeix<sup>1</sup>, Faraj Terro<sup>1</sup> & Catherine Yardin<sup>1</sup>

<sup>1</sup>*Department of Histology and Cytogenetics, Limoges University Hospital, LIMOGES, France, 87025*

<sup>2</sup>*XLIM Department OSA, UMR CNRS 6172, LIMOGES, France, 87060*

Human amniotic cells were exposed to GSM-900 for 24 h to average-specific absorption rates (SAR) of 0.25, 1, 2 and 4 W/kg in a wire-patch cell (WPC). Expression and activation of p53 by phosphorylation at serine 15 and 37 were studied

using western blot assay. Bleomycin exposed cells were used as positive controls. According to our results, no significant change in expression and activation of protein p53 by phosphorylation at serine 15 and 37 was found following exposure.

**PB-236 [11:00]**

**Nocturnal exposure to the 915MHz RFID-induced suppression of melatonin production in rat pineal gland ..... 7; 3**

Young Hwan Ahn<sup>1</sup>, Hae Sun Kim<sup>1</sup>, You Hee Lee<sup>1</sup>, Man Jeung Paik<sup>2</sup>, Yun-Sil Lee<sup>3</sup>, Hyung-Do Choi<sup>4</sup>, Jeong-Ki Pack<sup>5</sup> & Nam Kim<sup>6</sup>

<sup>1</sup>*Department of Neurosurgery, Ajou University School of Medicine, Suwon, Korea, 443-749*

<sup>2</sup>*College of Pharmacy, Suncheon National University, Suncheon, Korea, 540-742*

<sup>3</sup>*Division of Life Science and Pharmaceuticals, Ewha Woman's University, Seoul, Korea, 120-750*

<sup>4</sup>*Department of Radio Technology Research, Electronics and Telecommunications Research Institute, Daejeon, Korea, 305-700*

<sup>5</sup>*Department of Radio Sciences and Engineering, Choongnam National University, Daejeon, Korea, 305-764*

<sup>6</sup>*School of Electrical and Computer Engineering, Chungbuk National University, Cheongju, Korea, 361-763*

We investigated the effects of whole body exposure to the 915MHz RFID on rat pineal melatonin biosynthesis. Rats were exposed to the 915MHz RFID (whole body SAR 4 W/kg) for 8 h/day, 5 days a week, for 2 weeks during night time. Activity, protein level and mRNA expression of AANAT were suppressed by exposure to the RFID. These findings suggest that nocturnal exposure to the strong RFID cause reduction of melatonin biosynthesis as a consequent result.

**PB-238 [11:00]**

**Effect of electromagnetic irradiation produced by 3G mobile phone on rat reproductive system ..... 7; 4**

Sanjay Kumar<sup>1</sup>, Jitendra Behari<sup>1</sup>, Jay Prakash Nirala<sup>1</sup> & Rajamani Paulraj<sup>1</sup>

<sup>1</sup>*Bioelectromagnetic Laboratory, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India, 110067*

The present investigation was carried out on 70 days old adult male albino rats exposed to 3 G mobile phone frequency. Results showed a significant decrease in sperm count. EMF exposure also increases the lipid peroxidation, damage in sperm cell in the exposed groups. A reduction in seminiferous tubules and testicular weight of rat exposed to EMF was observed. These changes may adversely affect the male fertility.

**PB-240 [11:00]**

**Effects of Combined Radiofrequency Radiation Exposure on Levels of Reactive Oxygen Species in Neuronal Cells**

**7; 7**

Kyung Ah Kang<sup>1</sup>, Hyung-Chul Lee<sup>1</sup>, Je-Jung Lee<sup>1</sup>, Mi-Na Hong<sup>1</sup>, Myung-Jin Park<sup>1</sup>, Yun-Sil Lee<sup>2</sup>, Hyung-Do Choi<sup>3</sup>, Nam Kim<sup>4</sup>, Young-Gyu Ko<sup>5</sup> & Jae-Seon Lee<sup>1</sup>

<sup>1</sup>*Radiation Cancer Research, Korea Institute of Radiological and Medical Sciences, Seoul, Korea, 139-706*

<sup>2</sup>*Life Science and Pharmaceuticals, Ewha womans University, Seoul, Korea, 120-750*

<sup>3</sup>*EM Environment Research Team, Electronics and Telecommunications Research Institute, Daejeon, Korea, 305-700*

<sup>4</sup>*Electrical and Computer Engineering, Chungbuk National University, Cheongju, Korea, 361-763*

<sup>5</sup>*Life Sciences and Biotechnology, Korea University, Seoul, Korea, 136-713*

The objective of the study was to investigate the effects of the combined RF radiation on levels of intracellular reactive oxygen species (ROS) in neuronal cells. Exposure of combined RF signal was conducted at SAR values of 2 W/kg of CDMA plus 2 W/kg of WCDMA for 2 hours. Co-exposure to combined RF radiation with ROS inducers was also performed. Our results indicate that neither combined RF radiation alone nor combined RF radiation with menadione or H<sub>2</sub>O<sub>2</sub> influences intracellular ROS level in neuronal cells.

**PB-242 [11:00]**

**Nanosecond Pulsed Electric Fields Promote the Activation of Pro-Survival Signaling in U937 Cells ..... 7; 8**

Larry Estlack<sup>1</sup>

<sup>1</sup>*General Dynamics Information Technology, Fort Sam Houston, TX, USA, 78234*

We hypothesize that nsPEF activate pro-survival signaling through the stimulation of the cell membrane receptor Fas/CD95. Results show that the inhibition of death receptor signals by cellular FLICE-like inhibitory protein (FLIP) decreases the sensitivity of cells to nsPEF and protects the cells from Fas ligand-induced death signals. The results of the current study suggest that nsPEFs can promote the activation of pro-survival signaling in U937 cells.