

The Bioelectromagnetics Society

33rd Annual Meeting

Technical Program and General Information

June 12, 2011 - June 17, 2011

Dalhousie University

Halifax, Canada



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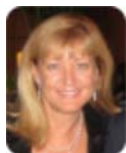


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Marvin Ziskin

From the Co-chairs of the Technical Program Committee

Welcome to Halifax Canada for the 33rd Annual Meeting of The Bioelectromagnetics Society.

Building upon the positive feedback from the 2010 meeting held in Seoul Korea, we have organized the technical program into seven Plenary Sessions, one of which includes the d'Arsonval lecture to be given by Dr. Marvin Ziskin, two Tutorial Sessions, sixteen Platform Sessions, and two Poster Sessions.

The first plenary is dedicated to an update of recent research – key papers on EMF health effects that appeared last year are summarized for three lines of evidence, namely human (including epidemiology), in vivo and in vitro. Other plenary sessions developed with input from the Technical Program Committee highlight under-researched areas or emerging topics such as WiFi or THz applications, another one re-visits the development of exposure standards. We have two tutorials. The first has presentations on science and news media with viewpoints from research or communication specialists. The second tutorial provides guidance on how to navigate the EMF literature database run by the Technical University of Aachen in Germany. A highlight will be the “Hot Topic” as we are the first to provide meeting attendees the possibility to discuss the outcome of the evaluation of the carcinogenicity of radiofrequency electromagnetic fields by the International Agency for Research on Cancer (IARC) with the responsible Scientific Officer of the evaluation; the outcome of the evaluation will be publicly available only two weeks before the BEMS meeting.

This year marks a significant departure from the way the program has been constructed in the past. Normally, the abstract submission deadline has been very early in the year to accommodate the organization of the program and construction of the program booklet. This year we utilized new tools available through our redesigned website, www.bems.org, to reduce dramatically the time to build the technical program and the program booklet.

Abstracts were submitted through our website directly. The TPC was then able to review and score each abstract from within the website. Abstracts were assigned for review automatically by matching the research area and frequency range specified by the author to reviewers with expertise in these areas based on user profiles. The website also automatically cross-checked authorship to prevent potential conflicts of interest. When the reviews were complete, the average reviewer score for each abstract was calculated and abstracts were ranked. Abstracts with the highest scores were assigned to sessions according to the author preference (e.g. platform or poster, session topic and frequency range). The platform sessions were then filled by the TPC Chairs with the remaining abstracts using average score, research area, and frequency range as the main criteria.

The program that you see on the BEMS website is constructed dynamically utilizing the outcome of the reviews and the session assignments by the TPC chairs. This entirely new capability enabled us to make last minute changes to the program even as abstracts were received long after the deadline. We were even in a position to create new sessions on timely topics such as a focus on the Dutch EMF research program and a Joint session with the Society for Thermal Medicine (STM). These last minute program modifications were never possible in the past, but thanks to the new website we now have organizational capabilities that go well beyond much larger societies.

Another feature that we hope you will come to appreciate is the highly linked meeting program. Rather than browse through a static PDF, you now are able to browse the abstracts dynamically in a variety of contexts and link out to authors easily. In addition, you can navigate to the Author list, browse for an author, then link through to a session or abstract containing the particular author with a single click.

We hope that you enjoy the meeting and the ancillary events such as the traditional Sunday Workshop sponsored by the U.S. Air Force. This year's the workshop will focus on Terahertz technologies and biological applications.

This meeting would not be possible without the efforts of many individuals. We thank all who have been involved, but would like to mention in particular:

- All the Members of the Technical Program Committee;
- Art Thansandote LOC Co-Chair for input and help with the technical program especially in relation to Plenary Session P3 (Emerging Dosimetry, compliance and interaction mechanisms of WiFi), Plenary Session P4 (Exposure Standards), and his help with securing funds from Health Canada;
- Gloria Parsley (BEMS Executive Director) and Lynn Plitt for organizing the many ancillary events and providing helpful feedback on the overall program;

Finally, The Bioelectromagnetics Society is most grateful to our sponsors for their generous support.

Jeffrey Carson and Joachim Schüz
Co-Chairs of the Technical Program Committee

Local Organizing Committee



Jeffrey Carson
Co-chairs



Art
Thansandote
Co-chairs



Zhizhang Chen
Canada



Colleen
Rodgerson
Canada

From the Co-chairs of the Local Organizing Committee

It is a privilege and pleasure to express to all of you our warmest welcome to Halifax, Nova Scotia, Canada, and the 33rd Annual Meeting of The Bioelectromagnetics Society. Halifax is a great conference venue. It is a modern port city with a population of almost 400,000 people that is filled with historic sites, museums and galleries, pubs and fine restaurants, lively night life, shopping, outdoor adventures and summer festivals.

In conjunction with Executive Director Gloria Parsley, the Local Organizing Committee worked with Dalhousie University to fulfill needs in terms of accommodation, meeting venue, meal service, wireless Internet access, and audiovisual requirements. We also worked with Destination Halifax and other organizations to provide participants with useful information about local transportation and excursions. This information is available on the BEMS website www.bems.org.

Both platform and poster sessions will be held at the Studley Campus of Dalhousie University (DAL), about 15 min walk to/from downtown Halifax. During the meeting, complimentary wireless Internet access will be available in the Scotiabank and Ondaatje Auditoriums of the Marion McCain Arts and Social Sciences Building and in the McInnes Room of the Student Union Building. Please feel free to bring your laptop and/or iPad device.

We are pleased to gratefully acknowledge financial support from the sponsors listed in this booklet and on the meeting website. We would also like to thank Zhizhang (David) Chen and Colleen Rodgerson, our LOC members in Halifax, for their advice and help with the local arrangements. The efforts of Gloria Parsley and her team in dealing with the meeting venue, accommodations, the social event and optional tours are gratefully acknowledged. Thanks also go to a number of DAL students who volunteered to help with this scientific meeting.

We hope that you will take time to enjoy some of the many attractions that Halifax has to offer, including the magnificent Public Gardens, tours of Halifax Harbour and Halifax Citadel National Historic Sites, and that you will have the opportunity to explore the surrounding areas, as well as other towns and natural wonders in Atlantic Canada.

Jeffrey Carson and Art Thansandote
Co-Chairs of the Local Organizing Committee

Schedule at a Glance

Thursday, June 9, 2011

Time	Session	Name	Location
09:00 - 12:00	SC1	ICES/TC95/Subcommittee 1: Techniques, Procedures, Instrumentation and Computation	University Club
13:30 - 16:30	SC2	ICES/TC95/Subcommittee 2: Terminology, Units of Measurements and Hazard Communication	University Club
17:00 - 19:00	CMR	Committee on Man and Radiation	University Club

Friday, June 10, 2011

Time	Session	Name	Location
09:00 - 16:30	SC3	ICES/TC95/Subcommittee 3: Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 - 3 kHz	University Club
09:00 - 16:30	SC4	ICES/TC95/Subcommittee 4: Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 3 kHz – 300 GHz	University Club
17:00 - 19:00	SCC	IEEE/ICES/SCC39 Administrative Committee (AdCom members only)	University Club

Saturday, June 11, 2011

Time	Session	Name	Location
08:00 - 17:00	M1	BEMS Board of Directors Meeting	University Club
09:00 - 12:00	IC	IEEE/ICES/TC95 (Main Committee)	University Club
17:30 -	PR	BEMS Presidents' Reception (by invitation only)	University Club

Sunday, June 12, 2011

Time	Session	Name	Location
08:00 - 17:00		Speaker Ready Room	McCain Bldg: 2190
08:00 - 17:00		Poster Setup	Student Union Bldg: McInnes Room
08:00 - 09:30	M2	BEMS/EBEA Task Force	McCain Bldg: 2021
09:00 - 10:55	AFI	US AIRFORCE WORKSHOP SESSION I: Terahertz technologies and biological applications	McCain Bldg: Scotiabank Auditorium
10:55 - 12:15	AF Lunch	USAF Lunch/Discussions in Cafeteria	
11:00 - 13:00		Lunch	Howe Hall
11:00 - 13:00	M3	BioEM 2013 Planning Committee	McCain Bldg: 2021

12:15 - 13:55	AF2	US AIRFORCE WORKSHOP SESSION 2: Terahertz technologies and biological applications (cont'd)	McCain Bldg: Scotiabank Auditorium
13:00 - 19:00		BEMS Registration	Student Union Bldg: McInnes Room
13:55 - 14:30	AF Break	USAF Refreshment Break/Discussions	
14:30 - 16:20	AF3	US AIRFORCE WORKSHOP SESSION 3: Terahertz technologies and biological applications (cont'd)	McCain Bldg: Scotiabank Auditorium
17:00 - 19:00		Welcome Reception	Student Union Bldg: McInnes Room
19:00 -	Student I	Student Ice Breaker	Maxwell's Plum English Pub

Monday, June 13, 2011

Time	Session	Name	Location
09:00 - 09:30	OC	Opening Ceremony	Ondaatje Auditorium
09:30 - 11:00	PI	Plenary I: Update of EMF risk research in three lines of evidence	Ondaatje Auditorium
11:00 - 11:30	CI	Coffee Break	Student Union Bldg: McInnes Room
11:30 - 12:50	O1	Epidemiology	Ondaatje Auditorium
11:30 - 12:50	O2	Electroporation: BES-BEMS Special Session	Scotiabank Auditorium
12:50 - 14:00	LI	Lunch	Howe Hall
14:00 - 16:00	O3	Dosimetry - RF I	Ondaatje Auditorium
14:00 - 16:00	O4	In Vitro Studies I	Scotiabank Auditorium
16:00 - 16:30	C2	Coffee Break	Student Union Bldg: McInnes Rm
16:30 - 18:30	TI	Tutorial I: Science and News Media	Scotiabank Auditorium
19:00 -	M4	Editorial Board Dinner	Chives Canadian Bistro

Tuesday, June 14, 2011

Time	Session	Name	Location
08:00 - 09:30	P2	Plenary 2: Under-researched areas	Ondaatje Auditorium
09:30 - 10:30	DA	d'Arsonval Award & Lecture: "Millimeter Waves: Acoustic And Electromagnetic"	Ondaatje Auditorium
10:30 - 12:30	PA	Poster Session A	Student Union Bldg: McInnes Room

12:30 - 13:30	L2	Lunch	Howe Hall
13:30 - 15:30	05	Human & Clinical Studies	Ondaatje Auditorium
13:30 - 15:30	06	Dosimetry - RF II	Scotiabank Auditorium
15:30 - 16:00	C3	Coffee Break	McInnes Room
16:00 - 17:20	07	In Vivo Studies	Ondaatje Auditorium
16:00 - 17:20	08	Dosimetry - MRI & EAS	Scotiabank Auditorium
17:30 -		Social Event & Sponsor Recognition: Pier 21 Immigration Museum	Buses depart DAL

Wednesday, June 15, 2011

Time	Session	Name	Location
08:30 - 10:00	P3	Plenary 3: Emerging Dosimetry, compliance and interaction mechanisms of WiFi	Ondaatje Auditorium
10:00 - 12:00	PB	Poster Session B	McInnes Room
12:30 -		Free Afternoon Optional Tour: Whale Watch & Historical Harbour Tour	Buses depart DAL
13:00 - 17:00	M5	Long Range Planning Committee	University Club

Thursday, June 16, 2011

Time	Session	Name	Location
09:00 - 10:30	P4	Plenary 4: Exposure Standards	Ondaatje Auditorium
10:30 - 11:00	C4	Coffee Break	McInnes Room
11:00 - 12:40	09	Dosimetry - ELF/IF/Pulsed	Ondaatje Auditorium
11:00 - 12:40	10	In Vitro Studies II	Scotiabank Auditorium
12:40 - 14:00	L3	Lunch & Annual BEMS Business Meeting	Ondaatje Auditorium
14:00 - 16:00	11	Dosimetry - RF III	Ondaatje Auditorium
14:00 - 16:00	12	Special Session: ZonMw	Scotiabank Auditorium
16:00 - 16:30	C5	Coffee Break	McInnes Room
16:30 - 18:30	13	Mechanisms/Theory	Ondaatje Auditorium
16:30 - 17:50	14a	Exposure Assessment	Scotiabank Auditorium
17:50 - 19:00	14b	Hyperthermia: STM-BEMS Special Session	Scotiabank Auditorium

Friday, June 17, 2011

Time	Session	Name	Location
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08:30 - 09:15	P5	Plenary 5: Emerging technologies: Terahertz radiation	Ondaatje Auditorium
09:30 - 10:30	I5	Policy & Risk	Ondaatje Auditorium
09:30 - 10:30	T2	Tutorial II: Introduction to EMF-Portal	Scotiabank Auditorium
10:30 - 10:45	C6	Coffee Break	Auditorium Foyer
10:45 - 12:20	P6	Plenary 6: Hot Topic: IARC Monograph on Non-Ionizing radiation (RF)	Ondaatje Auditorium
12:30 - 13:00	SA	Student Awards & Closing Ceremony	Ondaatje Auditorium
13:00 - 19:00	M6	BEMS BOD Meeting	University Club

General Information

ANNUAL MEETING LOCATION:

Dalhousie University (DAL)'s Studley Campus (<http://campusmap.dal.ca/>)

Platform Sessions will be held in the Marion McCain Arts and Social Sciences Building's Scotiabank and Ondaatje Auditoriums, located at 6135 University Ave., Halifax NS B3H 4P9

The Welcome Reception, Poster Sessions and Coffee Breaks will all be held directly across the street in the Student Union Building's McInnes Room, 6136 University Avenue, Halifax NS B3H 4J2.

If you buy the conference meal plans for the hall you can eat breakfast and lunch buffets, they will be served in the Howe Hall dining hall.

DAL is an integral part of city life in Halifax. A coastal city with a population of almost 400,000, Halifax boasts a youthful spirit, rich history and scenic waterfront. Combine that with our legendary Maritime charm and it's no wonder that Nova Scotia's capital city quickly becomes a second home to our students.

Halifax offers a vibrant cultural and athletic scene that features world-class events. Though smaller in size than many of Canada's urban centres, Halifax offers all the amenities of a big city: art galleries, museums, concerts, restaurants, multicultural celebrations, live theatre, sports events, a symphony and beautiful public gardens.

It takes just 20 minutes to walk from Dalhousie's main campus to downtown Halifax. The ocean is part of life here – Dalhousie is just 300 meters from the Atlantic – so sailing and water sports are enjoyed through spring, summer and fall, with surfing being popular year-round. Average temperatures range from a comfortable 10 degrees C in fall to -5 degrees C in winter; from 4 degrees C in early spring to 18 degrees C and warmer in summer.

ACCOMODATION INFORMATION

Dalhousie University has a block of single traditional student rooms in Risley Hall, 1233 LeMarchant St, Halifax, NS B3H 3P6 Canada (<http://dal.ca/confserv/>); For Risley Hall Accomodations, call 1-888-271-9222, 1-902-494-3832, or 1-902-494-8840. CAD\$26.62/night or CAN\$159.75 per week (minimum 7 nights).

The **Lord Nelson Hotel** is also offering rooms at CAD\$175 single/double plus tax. It is approximately a 10-15 minute walk past the Public Gardens to the university campus. For reservations call: 1-800-565-2020 or 1-902-423-5130 Group ID#: 19259 Group Password: 37009714 (www.LordNelsonHotel.com)

AWARDS

The following Awards will be presented:

- **d'Arsonval Award to Marvin Ziskin:** Millimeter Waves: Acoustic and Electromagnetic.
- **Bioelectromagnetics Most Cited Paper Award:** Exposure of rat brain to 915 MHz GSM microwaves induces changes in gene expression but not double stranded DNA breaks or effects on chromatin conformation; *I.Y. Belyaev, C.B. Koch, O. Terenius, K. Roxstrom-Lindquist, L.O.G. Malmgren, W.H. Sommer, L.G. Salford B.R.R. Persson.* Bioelectromagnetics Vol 27(4): 295-306.
- **Student awards:** Joseph James Morrissey Memorial Award for the Best Platform presentation (sponsored by MMF); and the Curtis Carl Johnson Memorial Award for the Best Poster presentation.

TRAVEL INFORMATION

A taxi or airport shuttle may be arranged at the Airport Exit from the Arrivals Area. A taxi will cost in the vicinity of \$50.00. The Airporter Shuttle will bring you to the Public Gardens stop across the street from the Lord Nelson Hotel for \$21 (or you may purchase a discounted round trip fee). You can either take a taxi or walk for approximately 15 minutes to Dalhousie's Risley Hall residences.

DRIVING DIRECTIONS

Airport to Howe Hall Cafeteria (6230 Coburg Road)

When leaving the airport, follow the signs that say Halifax and you will find yourself on a divided highway. Continue on this highway for about 25 minutes until you see an overhead sign indicating the Mackay Bridge (Robie St.) and keep to the right. The MacKay is a toll bridge which costs \$0.75. After crossing this bridge, stay on the same road which will eventually turn into Robie St. Continue on Robie. Landmarks to watch for are: a Shell station on your right at the intersection with North St.; a Holiday Inn & Blockbuster on your right when you cross Quinpool (this is a fairly large intersection). You will then pass the hospitals on your left. Turn right on Coburg Road. At the corner of Coburg and LeMarchant Streets you will see a large stone building; this is Howe Hall.

Airport to Risley Hall Residences (1233 LeMarchant Street)

Follow the directions above turning left at LeMarchant Street. Continue down LeMarchant Street, past University Avenue, and Risley Hall is on the left (large red brick building).

MEALS

Registrants will receive complimentary:

- Welcome Reception on Sunday evening;
- Daily mid-morning and afternoon coffee breaks;
- Tuesday evening Social Event at Pier 21: Canada's Immigration Museum

Registrants can purchase two conference meal packages: full service breakfast buffets and full service lunch buffets. The cafeteria is in Dalhousie University's Howe Dining Hall. *For attendees staying in the dorms, paid meals will be loaded onto their room key card. For attendees staying in the Lord Nelson Hotel, meal vouchers will be provided.*

- \$42 Breakfast package: Buffets open daily Sunday - Friday
- \$62 Lunch package: Buffets offered Sunday, Monday, Tuesday and Friday; box lunches will be provided on Wednesday (for the free afternoon/boat tour) and on Thursday (for the Annual Business Meeting).

PLATFORM (ORAL) SESSIONS

Simultaneous sessions will be held in Dalhousie University in the Ondaatje and Scotiabank Auditoriums at the times indicated in the Program schedule. Each session will have an LCD projector for computer presentations.

Speakers must provide the AV technician with their presentation **the day before their session**, on either a CD ROM, USB memory stick or jump drive. *Under no circumstances will presenters be allowed to use their own computers for presentation.*

The total presentation time for each platform paper will be 20 minutes: 15 minutes for presentation and 5 minutes for questions and discussion, unless otherwise noted.

POSTER SESSIONS

Please create your poster smaller than the mounting area of 43" high x 45" wide. This year in Halifax, the poster boards are 44" high x 92" wide in a horizontal landscape format. Since they are such wide boards, we will mount two posters side by side onto each board's face (both front

and back). Materials for mounting your poster will be provided. Poster setup is Sunday, June 12th from 13:00-19:00 in the Student Union Bldg's McInnes Room. **AUTHORS MUST REMOVE THEIR POSTERS BY THURSDAY, JUNE 16 AT 7:00pm.** Neither BEMS nor the University are liable for any poster materials.

Authors are asked to be present at their poster on the day and time scheduled in the Program. There will be two Poster Sessions:

Poster Session A: Tuesday, June 14th

Odd numbered posters will be presented from 10:30am to 12:30 in McInnes Room.

Poster Session B: Wednesday, June 15th

Even numbered posters will be presented from 10:00am to 12:00pm in McInnes Room.

RECORDING/PHOTOGRAPHY

Video and audio recording (including flash photography) of any presentation in any technical session is prohibited. No photography of poster or slides is permitted unless explicitly authorized beforehand by the presenter. Access to scientific sessions by the media for the purposes of recording must be authorized in advance by the President of the Society.

ABSTRACT COLLECTION

The Abstract Collection will be available on the BEMS website two weeks prior to the Annual Meeting. Attendees may wish to download and print out the abstracts prior to attending the meeting.

Technical Program

June 12, 2011

Session:
Welcome Reception
June 12, 2011 • 17:00 - 19:00
Student Union Bldg: McInnes Room

Session: Student I
Student Ice Breaker
June 12, 2011 • 19:00 -
Maxwell's Plum English Pub

June 13, 2011

Session: OC
Opening Ceremony
June 13, 2011 • 09:00 - 09:30
Ondaatje Auditorium
Chairs: Jeffrey Carson, Joachim Schuz & Art Thansandote

Session: PI
Plenary I: Update of EMF risk research in three lines of evidence
June 13, 2011 • 09:30 - 11:00
Ondaatje Auditorium
Chairs: Philip Chadwick & Jonna Wilen

PI-1 [09:30]

EPIDEMIOLOGICAL AND EXPERIMENTAL HUMAN STUDIES – WHAT'S NEW?

Kerstin Hug¹

¹*Swiss Tropical and Public Health Institute, Basel, Switzerland*

This presentation will highlight important findings of epidemiological and experimental human studies since last year's BEMS meeting. The research update will cover static, extremely-low frequency (ELF), intermediate and radiofrequency (RF) electromagnetic fields. While the majority of recent RF studies have focused on brain physiology and health-related quality of life, several meta-analyses on ELF magnetic fields and cancer risks in children and adults have been published.

PI-2 [10:00]

In Vivo EMF studies – Did last year's animal studies provide any gain in knowledge?

Maren Fedrowitz¹

¹*Department of Pharmacology, Toxicology, and Pharmacy, University of Veterinary Medicine, Hannover, Germany, 30559*

A review of *in vivo* EMF studies published from March 2010 until June 2011 revealed that during this period, about 60 publications from 17 countries were published in 30 peer-reviewed journals. Half of them deal with the effects of radiofrequency EMF, but there are also several contributions about the response to ELF-MF, PEMF, and static fields. In summary, including all the different frequencies, animals, methods, and endpoints, some studies reported that there were no effects, but the majority of studies found alterations after *in vivo* EMF exposure.

PI-3 [10:30]

Update on EMF risk research in three lines of evidence “In Vitro Studies and Mechanisms”

Isabelle LaGroye¹

¹*BioElectromagnetics Laboratory, EPHE, France, 33607*

Update on EMF risk research in three lines of evidence: “In Vitro Studies and Mechanisms”

Session: CI
Coffee Break
June 13, 2011 • 11:00 - 11:30
Student Union Bldg: McInnes Room

Session: 01
Epidemiology
June 13, 2011 • 11:30 - 12:50
Ondaatje Auditorium
Chairs: Mats-Olof Mattsson & Frank Prato

01-1 [11:30] - STUDENT PAPER

Risk for neurological diseases among survivors of electric shocks: A nationwide cohort study, Denmark, 1968-2008

Kathrine Grell¹, Andrea Meersohn¹, Joachim Schuz^{1, 2} & Christoffer Johansen¹

¹*Institute of Cancer Epidemiology, Danish Cancer Society, Copenhagen, Denmark*

²*Section of Environment and Radiation, International Agency for Cancer Research, Lyon, France*

We conducted a retrospective cohort study of the incidences of a number of neurological diseases among all people in Denmark who had survived an accident involving exposure to electric current in the period 1968–2008. We observed significantly increased risks for peripheral nerve diseases, migraine, vertigo and epilepsy. Only small numbers of cases of other neurological diseases were found, making the risk estimates unstable.

01-2 [11:50] - STUDENT PAPER

Cellular telephones and Skin Cancer - a nationwide cohort study in Denmark

Aslak Poulsen¹, Patrizia Frei¹, Christoffer Johansen¹ & Joachim Schuz²

¹*Institute of Cancer Epidemiology, Danish Cancer Society, Copenhagen, Denmark, 2100*

²*Section of Environment and Radiation, International Agency for Research on Cancer (IARC), Lyon, France*

A large proportion of the energy emitted by cellular telephones is deposited in the outer tissues, yet there are no epidemiological studies on the risk of tumors of the skin in users. Danish registers allows analysis of this association both for melanoma and non-melanoma skin cancer. By calculating and comparing separate rate ratios for the head where exposure is localized and for parts of the body not significantly exposed general confounding factors are eliminated. Preliminary results.

01-3 [12:10] - STUDENT PAPER

Psychological aspects of recalling the extent of cellphone use

Mary Redmayne¹, Euan Smith¹ & Michael Abramson²

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

²*Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia, 3004*

We carried out a survey of adolescent cellphone use in New Zealand, obtaining both recalled and actual SMS rates. During analysis, we identified several psychologically based patterns in how people estimate numbers. One is a tendency to estimate

Session: 02
Electroporation: BES-BEMS Special Session
June 13, 2011 • 11:30 - 12:50
Scotiabank Auditorium
Chairs: Lluís M. Mir & James Weaver

02-1 [11:30]

Potential of the cytotoxic effects of electric pulses by electrosensitization.

Olga Pakhomova¹, Betsy Gregory¹, Angela Bowman¹, Vera Khorokhorina¹ & Andrei Pakhomov¹

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

In this study we introduce a novel phenomenon of electrosensitization, which is manifested by a profound and delayed increase of electric pulse (EP) sensitivity in EP-pretreated cells. Electrosensitization can be induced by splitting a single EP treatment into properly separated fractions, resulting in a marked increase of the overall treatment efficiency. Possible mechanisms and applications of this phenomenon will be discussed.

02-2 [11:50]

Nanoelectropore Expansion by Exposure to Multiple Nanosecond-Duration Electric Pulses

Andrei Pakhomov¹, Angela Bowman¹ & Olga Pakhomova¹

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

We provide experimental evidence that nanopores created in cell plasma membrane by intense nanosecond-duration electric pulses can increase in size when the electroporated cell is subjected to additional pulses.

02-3 [12:10]

Thresholds for Nanopore Formation in Excitable Cells by Nanosecond Electric Pulses

Caleb Roth¹, Jason Payne², Gerald Wilink² & Bennett Ibey²

¹*General Dynamics Information Technology, Brooks City-Base, TX, USA, 78235*

²*Bioeffects Division, Air Force Research Laboratory, Brooks City-Base, TX, USA, 78235*

Nanosecond electric pulse (nsEP) exposure of cells causes nanopore formation in the plasma membrane. In this paper, we determined the thresholds for nsEP-induced nanoporation in NG108-15 and hippocampal neurons by measuring calcium

in ratios using a logarithmic mental number-line. We also found that a maximum monthly allowance had a calibrating influence. If these are not taken into account, they could bias risk analysis. We will present these factors and their influence.

01-4 [12:30]

Electromagnetic fields: perceptions and understanding among French general practitioners

Jacques Lambrozo¹, Martine Souques¹ & Anne Perrin²

¹Medical Studies Department, Electricité de France, Levallois, France, 92302

²CRESSA, Biomedical Institute of the Army, La Tronche, France, 38

The aim of our study was:

- to assess general practitioners' overall perceptions of the risks possibly associated with EMFs and their knowledge
- to generate a picture of how much and how often GPs are asked by their patients about the risks of EMFs

influx through nanopores using fluorescent microscopy. We independently determined the nanoporation thresholds for single nsEP amplitude and width. Measurement of these thresholds will guide future studies to determine if nsEP can inhibit action potential propagation.

02-4 [12:30]

Exposition of cells in suspension to nanosecond electric pulses: detection of permeabilisation using bleomycin

Aude Silve¹ & Lluís M. Mir¹

¹UMR 8203, CNRS, Villejuif, France, 94805

Nanosecond duration electric pulses with a large magnitude (several MV/cm) can induce damages on cells external membrane. One possible way of detecting and quantifying those damages is to detect the uptake of non permeant molecules. The use of a cytotoxic drug like bleomycin is a very sensitive method as a limited number of molecules inside the cell is able to kill it. We detail the methodology to carry out those experiments, drawing the attention to exposure artifacts. We also report results of preliminary experiments.

Session: LI
Lunch
June 13, 2011 • 12:50 - 14:00
Howe Hall

Session: 03
Dosimetry - RF I
June 13, 2011 • 14:00 - 16:00
Ondaatje Auditorium
Chairs: James Lin & Niels Kuster

Session: 04
In Vitro Studies I
June 13, 2011 • 14:00 - 16:00
Scotiabank Auditorium
Chairs: Myrtill Simko & Gabi Waite

03-1 [14:00]

Experimental specific energy absorption rate assessment from absorption cross section measurement for far-field exposure at 2-3 GHz

Aliou Bamba¹, Jorgen Andersen², Wout Joseph¹, David Plets¹, Emmeric Tanghe¹, Gunter Vermeeren¹, Jesper Ø. Nielsen² & Luc Martens¹

¹Department of Information Technology, Ghent University/IBBT, Ghent, Belgium, 9000

²Department of Electronic Systems, Aalborg University, Aalborg, Denmark, 9220

Rather than using numerical computations method, a measurement-based method is readily developed in this paper to assess the Absorption Cross Section (ACS) of humans in a realistic closed environment. From the ACS, it is hence easy to derive the whole body SAR [1].

03-2 [14:20]

Experimental Whole-body SAR Assessments by Means of Surface Scan with No Phase Information

Davide Colombi¹, Björn Thors¹ & Lars Jonsson²

¹EMF Health and Safety, Ericsson Research, Stockholm, Sweden, 16480

²School of Electrical Engineering, Royal Institute of Technology, Stockholm, Sweden, 10044

A fast method for experimental whole-body SAR assessments, suited for integration with commercially available SAR measurement systems, has been investigated. The method is based on surface amplitude measurements of the electric field components and an integral equation technique. It has been

04-1 [14:00]

Imaging Processing and Fast Multiple Scales Complexity Analysis for Erythrocyte Cell's Flickering with 50Hz EMF Exposure

Chen Zhang¹ & Tongning Wu¹

¹Telecommunication Metrology Center of Ministry of Industry and Information, Beijing, China, 100191

Flickering of Erythrocyte reflects dynamic properties of cytoskeleton and membrane. Improved multi-scale sample entropy method is applied to analyze flickering of erythrocyte. The method substantially increase computation efficiency and provide possibility for large quantity of data. Results confirm that the multi-scale sample entropy degrades with aging. With aging to the forth day, exposure of ELF of 50Hz distinguished exposed group and sham group with statistic significance.

04-2 [14:20]

Pulsed Electromagnetic Fields Activate Mechanosensitive Developmental Programs in the Absence of Mechanical Input

Alfredo Franco-Obregon¹, Tatiana Benavides Damm¹, Silvio Unternährer¹, Jack Traxler², Christian Beyer² & Jürg Fröhlich²

¹Institute of Biomedical Engineering, ETH Zurich, Zurich, Switzerland, 8092

²Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zurich, Zurich, Switzerland, 8092

We have shown that pulsed electromagnetic fields (PEMFs) in the extremely low frequency (ELF) range instigate

found that only the amplitude of the tangential field components over the phantom boundary is needed to accurately assess whole-body SAR. The method has been validated with simulations and measurements.

03-3 [14:40]

Electrical dosimetry: A new analytic tool for evaluation of electrostimulation effectiveness

J. Patrick Reilly^{1, 2}

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²Metatec Associates, Silver Spring, MD, USA, 20904

A Threshold Factor, F_T numerically rates a stimulus waveform by its effectiveness to excite nerve or muscle. It is a multiple by which the waveform exceeds or falls below the threshold of excitation of a reference-case neuron. A digital record of the waveform is applied to a model of a myelinated neuron. We illustrate F_T for various waveforms from electrical stun weapons, and discuss its correlation to the biological reactions of laboratory animals.

03-4 [15:00]

A statistical assessment to the multiple exposures in a truncated pregnant woman and her fetus and Visible Human induced by multiple plane waves

Thierry Kientega¹, Emmanuelle Conil¹, Abdelhamid Hadjem¹, Azeddine Gati¹, Elodie Richalot², Man-Fai Wong¹, Isabelle Bloch^{1, 3}, Jeremie Anquez^{1, 3}, Odile Picon² & Joe Wiart^{1, 3}

¹Resawave, Whist Lab Common Lab of Orange Labs and Institut Telecom, 92300, France, Paris

²Esycom, Université Paris-Est Marne-la-Vallée, Paris, France

³Telecom Paris Tech, Paris, France

In real environment, the human are exposed to random multiple plane waves coming from different directions. In this study, we apply a new method to analyze statistically the multiple exposure of a 34 weeks pregnancy fetus obtained by segmentation of RMI images of the abdomen of the mother and also the exposure of an adult the Visible Human. An experiment plan is designed to obtain the precise distribution of the exposures.

03-5 [15:20] - STUDENT PAPER

Implementation and Experimental Validation of a Brain-Region Specific Exposure Estimation in SAR Measurement Systems

Marie-Christine Gosselin¹, Pedro Crespo-Valero², Sven Kuehn^{1, 2} & Niels Kuster¹

¹ITIS Foundation, ETH Zurich, Zurich, Switzerland, 8004

²SPEAG, Zurich, Switzerland, 8004

mechanosensitive tissue regeneration by opening TRPC1 calcium-permeable channels. PEMF-induced calcium entry then stimulates stem cell proliferation. The most effective field strengths at promoting myoblast proliferation are within the 100s of mT range, field strengths greater than 1.5 mT instead inhibit proliferation. PEMF-based therapies thus offer possibility to activate mechanically-regulated developmental programs that would be otherwise muted.

04-3 [14:40] - STUDENT PAPER

CELL SWELLING AFTER NANOSECOND PULSED ELECTRIC FIELD EXPOSURE

Yu-Hsuan Wu¹, Stefania Romeo², Zachary Levine^{3, 4} & P. Thomas Vernier^{4, 5}

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⁴MOSIS, Information Sciences Institute, University of Southern California, Marina del Rey, CA, USA, 90292

⁵Ming Hsieh Department of Electrical Engineering, University of Southern California, Los Angeles, CA, USA, 90089

Electric field-driven pore formation in cells has been widely studied, but the underlying mechanisms are not well understood. We describe small changes in cell volume due to water influx induced by exposure to 5 ns electric pulses. We report the effects of lanthanide and mercury ions (Gd³⁺, La³⁺, and Hg²⁺) on nanoelectropore formation, and we provide complementary analyses from computer simulations of electroporation.

04-4 [15:00]

2.45GHz In-vitro Exposure System for Use During Live Cell Imaging

Myles Capstick¹, Yijian Gong¹, Niels Kuster¹ & Primo Schär²

¹ITIS Foundation, Zurich, Switzerland, CH-8004

²Department of Biomedicine, University of Basel, Basel, Switzerland, CH-4058

This paper describes a 2450MHz exposure system for use during live cell imaging that provides excellent exposure control and homogeneity. The system comprises a dual mode cylindrical cavity with quadrature feed and a computer controlled excitation system. To achieve excellent SAR homogeneity and control the system developed has control settings that are objective lens specific to compensate for the close interaction of the exposure field and lens.

04-5 [15:20]

Temperature modulation of nanoelectropulse excitation of adrenal chromaffin cells

Gale Craviso¹, Sophie Choe¹, Indira Chatterjee² & P. Thomas Vernier³

¹Department of Pharmacology, University of Nevada, Reno, Reno, NV, USA, 89557

²Department of Electrical and Biomedical Engineering, University of

An automated technique to assess the head tissue and brain-region specific SAR in anatomical human heads based on SAR measurements in the homogeneous SAM phantom was implemented in a commercial SAR scanner. Its applicability was validated using realistic mobile phones. The uncertainties and limitations were determined using the comparison of the experimental and numerical evaluations in anatomical head models and in the SAM phantom.

03-6 [15:40]

Calculation of the electromagnetic fields and SAR distribution around the human body and transmission loss related with the human body communication

Yoon-Myoung Gimm¹, Dong-Yeol Lee¹, Yu Ri Lee¹ & Young-Jun Ju¹

¹*Department of Electronics and Electrical Engineering, Dankook University, Yong-in, Korea, 448-701*

Electric field distributions around the human body with the transmitter at right hand and the receiver at left hand were calculated at five different frequencies with 5 MHz interval between 10 MHz and 30 MHz. Electric field intensities near both hands were integrated along the straight line between the nearby electrodes for the terminal voltages whose ratio was defined as channel loss. The calculated channel losses were about 75 dB and showed nearly flat all through the evaluated frequencies.

Nevada, Reno, Reno, NV, USA, 89557

³*Viterbi School of Engineering, MOSIS, Information Science Institute/ University of Southern California, Marina del Rey, CA, USA, 90292*

Exposing adrenal chromaffin cells to a single 5 ns, 5 MV/m electric pulse activates multiple types of voltage-gated calcium channels, causing calcium influx and catecholamine release. We have begun exposing cells to nanosecond pulses at 37 °C rather than at room temperature to obtain more physiologically relevant data. Clear temperature-related differences were observed with respect to the changes in intracellular calcium evoked by single or multiple pulses delivered at low repetition rates, but not when multiple pulses were delivered at higher repetition rates.

04-6 [15:40]

NON-THERMAL PULSE-MODULATED RF SIGNALS INDUCE DIFFERENTIATION AND NEURITE OUTGROWTH IN THE MN9D DOPAMINERGIC CELL LINE

Rukmani Lekhraj¹, Deborah Cynamon², Stephanie DeLuca¹, Michele Yeung¹, Shahla Powell¹, Eric Taub¹, Arthur Pilla³ & Diana Casper¹

¹*Department of Neurological Surgery, Montefiore Medical Center, Bronx, NY, USA, 10467*

²*Touro College, New York, NY, USA, 10010*

³*Columbia University, New York, NY, USA, 10027*

This study shows that non-thermal pulse-modulated RF, applied to the murine MN9D dopaminergic neuronal cell line, increases cAMP levels several fold ($P < 0.01$) with a single 15-minute exposure. The same signal, applied for three days, increased the number of differentiated cells by 47% ($P = 0.02$) and neurite length by 43% ($P = 0.03$). These results are consistent with a PEMF effect on CaM-dependent NO/cAMP signaling and suggest that this PEMF signal can be used to increase neuronal plasticity.

Session: C2
Coffee Break
June 13, 2011 • 16:00 - 16:30
Student Union Bldg: McInnes Rm

Session: T1
Tutorial I: Science and News Media
June 13, 2011 • 16:30 - 18:30
Scotiabank Auditorium
Chairs: Andrew Wood & Janie Page

TI-1 [16:30]

Science and the Media: Finding a Common Ground

Bruce Stutz¹

¹*Science Writer/Editor, Brooklyn, NY, NY, USA, 11215*

When scientists report their results they recognize that their findings are part of a research continuum. When journalists report on a scientist's work this context often goes missing--or it's buried deep in the story, far below the attention-grabbing headline. The "takeaway" message for readers and policy-makers who often lack scientific literacy can often be a distorted version of the science. Scientists, journalists, and the public all have a stake in finding a better way.

TI-2 [17:00]

Guidelines for scientists to inform the media: The ABCs of Communicating Science to the press

Jennifer Loukissas¹

¹*Division of Cancer Epidemiology and Genetics, National Cancer Institute, Bethesda, MD, USA, 20892*

Science advances when researchers disseminate their findings widely. Media coverage of science helps to inform public policy, aid in clinical decision making, bolster financial support from lawmakers and philanthropists, and inspire the next generation of researchers. Media coverage can vary widely in both accuracy and impact, in part because of variation in interviews with scientists and their ability to adapt to this format. Successful interviews share common elements. This presentation will review the ABCs of communicating science.

TI-3 [17:30]

“The Good, The Bad and The Ugly” and The Scientist: discussing science with the main-stream media

Dariusz Leszczynski¹

¹*STUK – Radiation and Nuclear Safety Authority, Helsinki, Finland*

In presentation, using some examples from my personal experience of over 10 years , I will discuss the love-and-hate relationship between journalists and scientists.

Session: M4
Editorial Board Dinner
June 13, 2011 • 19:00 -
Chives Canadian Bistro

June 14, 2011

Session: P2
Plenary 2: Under-researched areas
June 14, 2011 • 08:00 - 09:30
Ondaatje Auditorium
Chairs: Meike Mevissen & Koichi Ito

P2-1 [08:00]

NEURODEGENERATIVE DISEASES AND ELECTROMAGNETIC FIELDS – DO WE KNOW THE ANSWER?

Mats-Olof Mattsson¹

¹*Health and Environment Department , AIT Austrian Institute of Technology, Seibersdorf, Austria, AT-2444*

Besides genetic factors, it has been suggested that e.g. life style factors and environmental factors are contributing to development of neurodegenerative diseases. This lecture will critically assess the studies (in vitro studies, animal experiments, epidemiological studies) that have investigated the possible effects of exposures to electromagnetic fields (EMF) on the development of these pathologic conditions.

P2-2 [08:45]

Light-dependent magnetic compass: A fundamental role in mammalian spatial cognition?

John Phillips¹

¹Dept. of Biological Sciences, Virginia Tech, Blacksburg, VA, USA, 24061-0406

email: jphillip@vt.edu

Session: DA
d'Arsonval Award & Lecture: "Millimeter Waves: Acoustic And Electromagnetic"
June 14, 2011 • 09:30 - 10:30
Ondaatje Auditorium
Chair: Andrew Wood

DA-1 [09:30]

Millimeter Waves: Acoustic and Electromagnetic

Marvin Ziskin¹

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Millimeter waves are waves with wavelengths ranging from 1 to 10 millimeters. Both acoustic and electromagnetic millimeter waves are useful in medicine. Whereas the major use of acoustic millimeter waves (ultrasound) has been for diagnostic applications, electromagnetic millimeter waves (MMW) are used for therapy. Ultrasound has been remarkably safe in clinical practice. However, if its intensity is sufficiently high it can cause tissue damage. MMW therapy has been successfully used in the treatment of a large variety of diseases.

Session: PA
Poster Session A
June 14, 2011 • 10:30 - 12:30
Student Union Bldg: McInnes Room

Session: L2
Lunch
June 14, 2011 • 12:30 - 13:30
Howe Hall

Session: 05
Human & Clinical Studies
June 14, 2011 • 13:30 - 15:30
Ondaatje Auditorium
Chairs: Dariusz Leszczynski & Frank Barnes

Session: 06
Dosimetry - RF II
June 14, 2011 • 13:30 - 15:30
Scotiabank Auditorium
Chairs: Myles Capstick & Joe Wiart

05-1 [13:30]

Exposure to a 60 Hz 3000 μ T magnetic field has an effect on resting brain blood flow: A functional magnetic resonance imaging study

Jodi Miller^{1, 2}, Julien Modolo^{1, 2}, Michael Corbacio^{1, 2}, Daniel Goulet³, Jacques Lambrozo⁴, Michel Plante³, Martine Souques⁴, Frank Prato^{1, 2}, Alex Thomas^{1, 2} & Alexandre Legros^{1, 2}

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³Hydro-Québec, Montréal, QC, Canada

⁴Service des Études Médicales, Électricité de France, Paris, France

The effects of a 60 minute 60 Hz 3000 μ T MF exposure on resting brain blood flow were investigated using arterial spin labeling, a functional magnetic resonance imaging technique. Fourteen subjects participated in this study; seven were exposed to the MF, which they were unable to detect. Significant changes were found in resting brain blood flow in the exposed and sham group. These changes were consistent with previous EEG studies of MF exposure. Additional subjects are

06-1 [13:30] - STUDENT PAPER

Organ specific averaged SAR in a realistic environment at 950 MHz

Arno Thielens¹, Gunter Vermeeren¹, Wout Joseph¹ & Luc Martens¹

¹Departement of Information Technology, Ghent University/ IBBT, Ghent, Belgium, 9050

A method to determine the organ specific averaged (OSA) SAR statistically in a realistic environment is proposed for the first time. This is realized by generating a statistical relevant number of exposure samples, approximated by a combination of basic field distributions. Using this method the OSA SAR can be determined in an efficient and accurate way. A case study of the kidney's medulla shows that there is a dependence of the OSA SAR on the type of environment.

required to further explore the results and to determine the duration of MF effects.

05-2 [13:50]

A NOVEL COIL DESIGN FOR TRANSCRANIAL MAGNETIC STIMULATION

Masaki Sekino^{1, 2, 3}, Takuya Kato¹, Taiga Matsuzaki^{3, 4}, Atsushi Nishikawa^{3, 5}, Youichi Saitoh³ & Hiroyuki Ohsaki^{1, 2}

¹Graduate School of Engineering, The University of Tokyo, Bunkyo-ku, Japan, 113-8656

²Graduate School of Frontier Sciences, The University of Tokyo, Kashiwa, Japan, 277-8561

³Center for Advanced Science and Innovation, Osaka University, Suita, Japan, 565-0871

⁴Home Healthcare Research & Development Department, Teijin Pharma Limited, Chiyoda-ku, Japan, 100-8585

⁵Faculty of Textile Science and Technology, Shinshu University, Ueda, Japan, 386-8567

Development of compact magnetic stimulators will enable us to treat some of intractable neurological diseases at home. In this study, we propose a novel coil design which induces sufficient currents in the brain at lower driving voltages of stimulator. Three-dimensional numerical simulations based on the finite element method showed the advantage of the proposed design.

05-3 [14:10]

Effects Of Pulse-Modulated RF EMF On The Human Brain: Sensitivity In Early Adolescence

Sarah Loughran¹, Dominik Benz¹, Marc Schmid¹, Manuel Murbach², Niels Kuster² & Peter Achermann¹

¹Institute of Pharmacology and Toxicology, University of Zurich, Zurich, Switzerland

²ITIS Foundation, Zurich, Switzerland

Children may be sensitive to RF EMF as brain maturation is incomplete. Studies showed exposure-related increases in EEG power in the alpha frequency range in adults, however, very little research exists regarding this effect in children. The current study aimed to determine whether RF EMF exposure influences cognition and the waking EEG in children and to establish a possible dose-response relationship. No clear effects on cognition were observed. Analysis of the EEG is currently ongoing.

05-4 [14:30]

Effects Of Pulse-Modulated RF EMF Versus Pulsed Magnetic Fields On The Human Sleep EEG

Marc Schmid¹, Sarah Loughran¹, Manuel Murbach², Caroline Lustenberger³, Niels Kuster² & Peter Achermann¹

¹Institute of Pharmacology and Toxicology, University of Zurich, Zurich,

06-2 [13:50]

Determination of the Most Suitable RF Exposure Metrics, SAR, VAR, or Sinc, for the Frequency Range 0.5-10 GHz

Robert McIntosh¹, Vitas Anderson^{1, 2}, Rodney Croft^{1, 3} & Ray McKenzie¹

¹Australian Centre for Radiofrequency Bioeffects Research (ACRBR), Australia

²Swinburne University of Technology, Hawthorn, Australia, 3122

³Wollongong University, Wollongong, Australia, 2522

This study sought to determine the most suitable RF exposure metrics over the frequency range 0.5–10 GHz. The metrics considered include the Specific energy Absorption Rate (SAR), the Volumetric energy Absorption Rate (VAR), and the incident power flux density (S_{inc}). The most appropriate averaging shapes and sizes were also considered. The general approach was to compare the degree of correlation between the metrics and induced tissue temperature rise. We recommend the use of VAR, averaged over 10 cm³ between 0.5–6 GHz; and S_{inc} for 6–10 GHz.

06-3 [14:10]

Exposure of fetuses to RF. Preliminary results assessed with different realistic 3D numerical models.

Joe Wiart^{3, 5}, Soichi Watanabe⁶, Isabelle Bloch^{1, 5}, Jeremie Anquez¹, Juan Pablo de la Plata Alcalde¹, Elsa Angelini^{1, 5}, Tamy Boubekeur^{1, 5}, Noura Faraj¹, Christian Person^{2, 5}, Yenny Pinto^{2, 5}, Nadege Varsier^{3, 5}, Thierry Kientega³, Marjorie Jala³, Abdelhamid Hadjem^{3, 5}, Azeddine Gati^{3, 5}, Man-Fai Wong³, Emmanuelle Conil^{3, 5}, Bruno Sudret⁴, Tomoaki Nagaoka⁶, Kanako Wake⁶, Osamu Fujiwara⁷, Akimasa Hirata⁷, Jianqing Wang⁷, Kazuyuki Saito⁸, Masaharu Takahashi⁸ & Koichi Ito⁸

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³RESA/WASA/WAVE, Orange Labs, Issy les moulineaux, France, 92130

⁴R&D, Phimeca, COURNON d'AUVERGNE, France, 63800

⁵Whist Lab, Issy les moulineaux, France, 92130

⁶NICT, Tokyo, Japan, 184-8795

⁷NITC, Nagoya, Japan, 466-8555

⁸Chiba University, Chiba, Japan, 263-8522

With the increasing use of mobile phones these last 30 years, exposure to electromagnetic fields has become a public concern. Experts have pointed out the need of research dedicated to pregnant women and fetus exposure.

To assess this exposure, the FETUS project is dealing with major challenges such as developing anatomically correct deformable models of pregnant women and fetuses.

First results have shown that the fetus exposure is well below the mother one and depends on several parameters.

06-4 [14:30] - STUDENT PAPER

Statistical multi-path exposure tool for realistic human body models

Gunter Vermeeren¹, Wout Joseph¹ & Luc Martens¹

¹Department of Information Technology, UGent - INTEC / IBBT, Ghent, Belgium, B-9050

Switzerland

²ITIS Foundation, Zurich, Switzerland

³University Children's Hospital, Zurich, Switzerland

It remains unclear which RF EMF components are responsible for EEG alterations during sleep. We aimed to determine whether slow modulation components are sufficient to elicit an effect, or whether EEG changes only occur when applied in combination with RF EMF. Cognition was unaffected, while the effect on the EEG spindle frequency range was restricted to RF EMF exposure. Interestingly, pulsed magnetic fields also had an effect on brain physiology.

05-5 [14:50]

Static magnetic field exposure effects of a 3 Tesla magnetic resonance imaging scanner on postural stability and finger tremor

Jodi Miller^{1, 2, 3}, Kimberley Blackwood^{1, 2, 3}, Alexandre Legros^{1, 2}, Alex Thomas^{1, 2, 3}, Frank Prato^{1, 2, 3} & Robert Stodilka^{1, 2, 3}

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³Medical Imaging, University of Western Ontario and St. Joseph's Hospital, London, ON, Canada, N6G 4V2

Subtle effects of static MF are known to cause such sensations as vertigo. It has been suggested that the vestibular system plays a role. The effects of a 3T static MF on postural stability and finger tremor were investigated in 2 separate sessions: exposure(3T MRI static field) and sham(PET/CT). To date 6 healthy males have participated. Statistical analysis yielded several trends and a significant difference in finger tremor data. As the sample size increases, we may gain a thorough understanding of the effects, which will have implications for MRI safety in clinical imaging.

05-6 [15:10]

Endoscopic Ultrasound-Guided Delivery of Nanosecond Pulsed Electric Field Tumor Therapy

Richard Nuccitelli¹, Mark Kreis¹, Ryan Wood¹, Brian Athos¹, Kaying Lui¹, Joanne Huynh¹, Subhas Banerjee², Ann Chen² & Pamela Nuccitelli¹

¹R&D, BioElectroMed Corp., Burlingame, CA, USA, 94010

²Gastroenterology, Stanford University School of Medicine, Palo Alto, CA, USA, 94304

We are developing the EndoPulse™ electrode that fits within the working channel of a curvilinear echoendoscope. Tumors in organs adjacent to the gastrointestinal (GI) tract lumen such as the pancreas, kidney and liver can be imaged and accessed by transmural puncture of the GI wall using an echoendoscope. The current prototype EndoPulse electrode can be guided to the tumor with ultrasound and treats a region 1 cm³ in size with 100 ns pulses 30 kV/cm in amplitude.

Quantifying the absorption in a human body in a realistic, multi-path exposure environment requires a statistical approach. The absorption needs to be determined for a large set of possible exposures (several thousands) in the investigated environment. In this study, this fast method developed for spheroid human body models has been extended to realistic human body models. The method is validated and the whole-body SAR in the Virtual family boy has been investigated in four realistic environments for GSM downlink at 950 MHz.

06-5 [14:50] - STUDENT PAPER

Absorption of Radiofrequency Electromagnetic Fields in the Hand due to Partial-Body Resonances

Chung-Huan Li², Mark Douglas¹, Erdem Ofli², Nicolas Chavannes¹ & Niels Kuster¹

¹ITIS Foundation, Zurich, Switzerland, 8004

²Schmid & Partner Engineering AG, Zurich, Switzerland, 8004

This study investigates the mechanisms of partial-body RF absorption from sources as 900 MHz to 6 GHz to determine the envelope of specific absorption rate (SAR) in the hand. A standardized flat phantom, used to estimate the SAR in the body, does not account for possible resonance effects in the palm and fingers. Both plane wave and dipole antenna sources are used to understand the patterns of RF absorption in tissue models of slabs and cylinders.

06-6 [15:10]

Specific Absorption Rate Measurement of Wireless Devices using Fast SAR Methods

Mark Douglas¹, Sami Gabriel², Cecile Bucher³, Dimce Iliev³, Jeton Kastrati³, Claudio Leubler³, Mike Meili³, Katja Pokovic³ & Niels Kuster¹

¹ITIS Foundation, Zurich, Switzerland, 8004

²Vodafone Group, Newbury, UK, RG14

³Schmid & Partner Engineering AG, Zurich, Switzerland, 8004

Fast SAR methodologies for the evaluation of wireless devices with respect to electromagnetic exposure limits are described. The benefits of using fast SAR methods to supplement full SAR measurements is demonstrated using three measurement systems.

Session: C3
Coffee Break
June 14, 2011 • 15:30 - 16:00
McInnes Room

Session: 07
In Vivo Studies
June 14, 2011 • 16:00 - 17:20
Ondaatje Auditorium
Chairs: Bernard Veyret & Maren Fedrowitz

Session: 08
Dosimetry - MRI & EAS
June 14, 2011 • 16:00 - 17:20
Scotiabank Auditorium
Chair: Chen Zhang

07-1 [16:00]

Effects of 900 MHz radiofrequency on corticosterone, emotional memory and markers of cerebral inflammation in middle-aged rats.

Marc Bouji¹, Rene De Seze¹ & Anne-Sophie Villegier¹
¹DRC - TOXI, INERIS, Verneuil-en-Halatte, France, 60550

This study aimed to assess if GSM exposure tested in middle aged rats was associated with changes in stress, cerebral function and biomarkers, in addition to GFAP increase previously demonstrated in adult rat brain. Results showed that GSM did not modify behavior and cytokines, while GFAP analysis is still in process. GSM-induced corticosterone increase was obtained with age differences, suggesting that GSM may be perceived as a stress in young animals but this process disappeared with ageing.

07-2 [16:20]

Desktop Reverberation Chamber for Small Scale In-vivo Radio Frequency Exposure Experiments
Myles Capstick¹, Yijian Gong¹, Niels Kuster¹ & Clemens Dasenbrock²

¹ITIS Foundation, Zurich, Switzerland, CH-8004
²ITEM, Fraunhofer Institute, Hannover, Germany, 30625

Reverberation chambers have been used for large scale animal exposure to radio frequency radiation in studies such as that performed by the NIEHS. This paper describes a desktop reverberation chamber developed for well controlled small scale exposure of mice within the EU project 'Seawind' to perform post exposure ex-vivo analyses of cells with genotoxicity and genomic instability as endpoints.

07-3 [16:40] - STUDENT PAPER

Reduction of the Ambient Magnetic Field Inhibits Drosophila Melanogaster Ability to Survive Ionizing Radiation

Lucas Portelli¹, Dinu Madapatha², Carlos Martino¹, Mark Hernandez³ & Frank Barnes¹
¹Electrical, Computer and Energy Engineering, University of Colorado, Boulder, CO, USA, 80309

²Molecular, Cellular and Developmental Biology, University of Colorado, Boulder, CO, USA, 80309

³Civil, Environmental and Architectural Engineering, University of Colorado, Boulder, CO, USA, 80309

Our results show that exposure to Reduced Ambient Magnetic Field (RAMF) for several generations, has reduced ability to survive IR exposure of 80 Gy or more for this insect model. A partially reduced ambient magnetic field did not have an effect, which indicated the existence of a RAMF response threshold. These effects resemble those caused by the modification of other environmental factors that have significant effects in cellular organismic functions such as temperature, oxygen

08-1 [16:00]

Assessment of Field Exposure by Electronic Article Surveillance Systems

Wout Joseph¹, Leen Verloock¹, Gunter Vermeeren¹, Francis Goeminne¹ & Luc Martens¹

¹Information Technology, Ghent University/IBBT, Ghent, Belgium, 9050

The objective is to assess general public exposure to in-situ Electronic article surveillance (EAS) systems. Three categories of systems are considered, namely, electromagnetic (EM) systems (typically in range 10 Hz – 20 kHz), acousto-magnetic (AM) systems (20 – 135 kHz), and radiofrequency (RF) systems (1 – 20 MHz). Safety distances for the general public and exposure ratios are provided.

08-2 [16:20]

Numerical Assessment of induced current densities and SAR caused by Electronic Article Surveillance (EAS) Devices

Gernot Schmid¹, Ana Escorihuela-Navarro¹ & Richard Überbacher¹

¹EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444

A detailed exposure assessment close to the antennas of commonly deployed LF- and RF-EAS systems showed that the basic restrictions of the ICNIRP 1998 guidelines may be exceeded at distances closer than 20 cm from the antenna of some LF-EAS systems.

08-3 [16:40]

Exposure Assessment of Patients to Pulsed Gradient Magnetic Fields in Magnetic Resonance Imaging

Mai Lu¹ & Shoogo Ueno²

¹Institute of Biophysics and Biomedical Engineering, University of Lisbon, Lisbon, Portugal, 1749-016

²Department of Applied Quantum Physics, Kyushu University, Fukuoka, Japan, 812-8581

In this study, realistic transverse x-, y-gradient coils and longitudinal z-gradient coil were numerically designed. The magnetic flux density, current density and electric fields in a 3D real human man model were calculated by employing impedance method. The exposure levels have been compared with the guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). It was found that both the magnetic flux density and induced current density greatly exceed the ICNIRP reference level and basic restriction.

concentration, pH, etc.

07-4 [17:00]

Biomagnetic laterality mapping of brain function in epilepsy

Ryan D'Arcy^{1, 2, 3}, Timothy Bardouille^{1, 2, 3}, Sean McWhinney^{1, 2, 3}, Aaron Newman^{1, 2, 3} & Michael Esser^{1, 2, 3}

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²*IWK Health Sciences Centre, Halifax, NS, Canada*

³*Dalhousie University, Halifax, NS, Canada*

Magnetoencephalography (MEG) is a powerful tool in the evaluation of brain activity for epilepsy. Preoperative testing of hemispheric dominance for language and memory is done to minimize deficits prior to epilepsy surgery. This testing has historically involved invasive, risk prone procedures, which are now being replaced by neuroimaging assessments. We report a novel MEG laterality method that provides high spatio-temporal maps of language function in healthy controls and epilepsy patients.

08-4 [17:00]

EXPOSIMETRIC INVESTIGATIONS ON INDUCED CURRENTS IN WORKERS OPERATING 0.2-1.5T MAGNETIC RESONANCE SCANNERS

Jolanta Karpowicz¹

¹*Electromagnetic Hazards Laboratory, Central Institute for Labour Protection - National Research Institute (CIOP, Warszawa, Poland, 00-701*

The use of magnetic resonance imaging (MRI) involves strong exposure to static magnetic fields (SMF) of workers attending patients. Movements of workers cause currents induced in their body by SMF of magnets, creating occupational safety and health risks. Dynamic (dB/dt) parameters of worker's exposures to SMF while routine patients attending are analyzed as a metric of induced currents. Max. dB/dt, registered with app. 7 Hz sampling rate by over 10 MRI (0.2-1.5T), covered a range 5-400 mT/s.

Session:

Social Event & Sponsor Recognition: Pier 21 Immigration Museum

June 14, 2011 • 17:30 -

Buses depart DAL

June 15, 2011

Session: P3
Plenary 3: Emerging Dosimetry, compliance and interaction mechanisms of WiFi
June 15, 2011 • 08:30 - 10:00
Ondaatje Auditorium
Chairs: Osamu Fujiwara & Michael Murphy

P3-1 [08:30]

Exposure from WiFi: Levels of Exposure, Challenges in Exposure Assessment and Compliance Testing

Niels Kuster¹, Sven Kuehn¹, Gert Pedersen², Theodoros Samaras³, Gunter Vermeeren⁴, Luc Martens⁴ & Jorgen Andersen²

¹Swiss Federal Institute of Technology (ETHZ), IT'IS Foundation, Switzerland

²Department of Electronic Systems, University of Aalborg, Denmark

³Aristotle University of Thessaloniki, Greece

⁴Interdisciplinary Institute for Broadband Technology, Belgium

WiFi communication systems have permeated our lives in the past decade. However, little is known about the maximum and average level of exposures from these devices. This talk will address the challenges posed by the exposure assessment of WiFi sources, report on the preliminary results of on-going studies, in particular, of the European FP7 project SEAWIND, as well as discuss novel and future technologies to overcome the limitations in compliance testing and exposure assessment of WiFi devices.

P3-2 [09:15]

Challenges to Studying Potential Health Risks of Wireless Local Area Networks

Kenneth Foster¹

¹Department of Bioengineering, University of Pennsylvania, Philadelphia, PA, USA

Despite some level of public concern about possible health effects of Wi-Fi networks, the question arises how health agencies should address these concerns. This talk will review the RF exposure issues raised by wireless networks, and the scientific challenges in designing meaningful bioeffects and human observational studies on the issue.

Session: PB
Poster Session B
June 15, 2011 • 10:00 - 12:00
McInnes Room

Session:
Free Afternoon Optional Tour: Whale Watch & Historical Harbour Tour
June 15, 2011 • 12:30 -
Buses depart DAL

Session: M5
Long Range Planning Committee
June 15, 2011 • 13:00 - 17:00
University Club

June 16, 2011

Session: P4
Plenary 4: Exposure Standards
June 16, 2011 • 09:00 - 10:30
Ondaatje Auditorium
Chairs: Art Thansandote & P. Thomas Vernier

P4-1 [09:00]

IEEE ICES PERSPECTIVES ON SAFETY FACTORS, EXPOSURE LIMIT SETTING AND TERMINOLOGY CHANGES

C. K. Chou¹

¹IEEE International Committee on Electromagnetic Safety, TC95, Piscataway, NJ, USA

This presentation describes the rationale for the safety factors and exposure limits of IEEE exposure standards, C95.6-2002 and C95.1-2005, and reports on the terminology changes included in a new standards project – PC95.1-201X, which combines the two standards. The changes in terminology will ensure a smooth transition between frequency bands where different interaction mechanisms predominate and will clarify and convey more obvious meaning to these terms.

P4-2 [09:30]

An independent view on safety factors, terminology and exposure limit setting

Andrew Wood¹

¹Brain and Psychological Sciences Centre, Swinburne University of Technology, Hawthorn, Australia, 3122

Faced with the task of developing an ELF standard for Australia, the drafting group noted the large discrepancies between the available standards and decided to 'go it alone'. This presentation will review how the group tried to resolve the discrepancies and will discuss why these discrepancies remain, even after ICNIRP revision.

P4-3 [10:00]

ICNIRP perspectives on safety factors, terminology and exposure limit setting

Bernard Veyret¹

¹Laboratoire IMS CNRS IEPHE, Université de Bordeaux I, Pessac cedex, France, 33607

ICNIRP is in the process of completing its series of EMF guidelines, which have been adopted by many countries worldwide. A short review of the recently published documents will be given (static, low-frequency and radiofrequency guidelines and statements). The current evolution of guidelines setting by ICNIRP will be described.

In the last years, in the course of the revision of guidelines, some changes have been made in terms of terminology and approach that will be described and justified taking examples in the EMF range.

Session: C4
Coffee Break
June 16, 2011 • 10:30 - 11:00
McInnes Room

Session: 09
Dosimetry - ELF/IF/Pulsed
June 16, 2011 • 11:00 - 12:40
Ondaatje Auditorium
Chairs: Indira Chatterjee & Gernot Schmid

Session: 10
In Vitro Studies II
June 16, 2011 • 11:00 - 12:40
Scotiabank Auditorium
Chairs: Chiyoji Ohkubo & Vijayalaxmi

09-1 [11:00]

Interactions of 60GHz Radiations with the Human Body

Maxim Zhadobov¹, Nacer Chahat¹, Yves Le Dréan², Catherine Le Quément² & Ronan Sauleau¹

¹Institute of Electronics and Telecommunications of Rennes (IETR), University of Rennes 1, Rennes, France

²Intracellular Protein Homeostasis Team, University of Rennes 1, Rennes, France

The aim of this contribution is to make an overview of some dosimetric aspects related to interactions of 60-GHz radiations with the human body. The main target tissues are identified, and reflection and transmission coefficients at the air/skin interface are analyzed for the normal and oblique incidence. It is

10-1 [11:00]

Dielectric properties of pregnancy-specific and fetal tissues

Azadeh Peyman¹

¹Physical Dosimetry Department, Health Protection Agency, Didcot, UK, OX11 0RQ

This paper presents the results of dielectric measurements on freshly delivered human placenta, amniotic fluid and umbilical cord at 37°C in the frequency range of 200 MHz-20 GHz. In addition, dielectric properties of freshly excised rat fetuses at 37°C were measured as a function of gestation period.

demonstrated that more than 90% of transmitted power is absorbed by cutaneous layers. The impact of clothing is also quantified and will be discussed during the conference.

09-2 [11:20] - STUDENT PAPER

Hybrid fMRI/EEG investigation of pulsed magnetic field effects on neuroprocessing

John Robertson^{1,3}, Nicole Juen^{1,3}, Julien Modolo¹, Jodi Miller¹, Jean Théberge^{1,2,3}, Frank Prato^{1,2,3} & Alex Thomas^{1,2,3}

¹Imaging Program, Lawson Health Research Institute, London, AB, Canada, N6A4V2

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³Medical Biophysics, University of Western Ontario, London, ON, Canada, N6A4V2

ELFMF have been shown to affect pain sensitivity in snails, rodents, and humans. Previous fMRI studies have demonstrated that pulsed magnetic fields can decrease neuroactivation during a pain task. Here, we included MRI-compatible EEG to *a priori* examine pre- and post-exposure alpha activity over just the occipital region. No significant interactions were found in our sample of 42 subjects. Ant. cing. results were consistent with earlier fMRI studies.

09-3 [11:40]

Development of the exposure apparatus with the localized magnetic field at 20kHz for pregnant rats

Yuki Hirai¹, Yukihisa Suzuki¹, Keiji Wada¹, Kanako Wake², Akira Ushiyama³ & Chiyoji Ohkubo⁴

¹Department of Electrical and Electronic Engineering, Tokyo Metropolitan University, Hachioji, Japan, 1920397

²National Institute of Information and Communications Technology, Japan

³National Institute of Public Health, Japan

⁴Japan EMF Information Center, Japan

The novel *in vivo* exposure apparatus is developed to investigate the effect of localized magnetic field in intermediate frequency band. Numerical dosimetry is performed with pregnant rat model in designing the configuration of magnetic field generation coil to obtain sufficiently localized induced quantities to fetuses of rats. The basic restriction level of general public exposure provided by ICNIRP is achieved by this apparatus within fetuses of rat.

09-4 [12:00]

Double solenoid ELF in vitro exposure system with high homogeneity and small stray field

Jan Cuppen¹, Chrisoula Sismanidou², Ad Reniers² & Peter Zwamborn^{2,3}

¹Immunent BV, Veldhoven, the Netherlands, 5508HB

²Electromagnetics, Eindhoven University of Technology, Eindhoven, the Netherlands, 5600 MB

³Electronic Defence, TNO, The Hague, the Netherlands, 2509JG

A coil system is proposed and analysed that was designed with the following goals in mind:

1. can be used for in vitro ELF cell experiments inside a standard incubator within a 400x400x400 mm volume
1. exposure range 5 μ T to \geq 1 mT
1. homogeneity 1% or better in a 130x90x20 volume

10-2 [11:20]

Modelling studies for absorption by skin and blood cells in the range 1 – 100 THz

Andrew Wood¹, Robert McIntosh¹ & Fatima Akhondzadeh-Basti¹

¹Brain and Psychological Sciences Centre, Swinburne University of Technology, Hawthorn, Australia, 3122

Results of two types of modelling study in the range 1 – 100 THz will be presented: electric parameters and maximum SAR values for a simple model of a blood cell within a skin capillary. Concordance with measured absorption coefficient and refractive index values for water in this range is improved by the inclusion of a double Lorentz term in addition to a more familiar double Debye term. SAR modelling predicts peak maximum values in the region of 50 THz, where wavelength matches cell diameter.

10-3 [11:40]

WHAT GOES ON IN CELLS AFTER 50 Hz MAGNETIC FIELD EXPOSURE?

Myrtil Simko¹, Ann-Christine Mannerling², Kjell Hansson Mild³ & Mats-Olof Mattsson^{2,4}

¹Institute of Technology Assessment, Austrian Academy of Sciences, Vienna, Austria, A-1030

²Cell Biology Laboratory, Örebro University, Örebro, Sweden, SE-70182

³Department of Radiation Sciences, Umea University, Umea, Sweden, SE-90187

⁴Department Health and Environment, AIT Austrian Institute of Technology, Seibersdorf, Austria, AT-2444

Effects of low level magnetic field exposure on cellular processes were investigated in human cell lines (K562, Mono-Mac-6, Jurkat). Most prominent effects were seen in K562 cells where an early response to MF seems to be an increased amount of oxygen radicals, leading to HSP70 induction. The results also suggest that there is a flux density threshold where 50 Hz MF exert its effects on K562 cells, at or below 0.025 mT.

10-4 [12:00]

ADAPTIVE RESPONSE INDUCED BY UMTS SIGNAL IN HUMAN BLOOD LYMPHOCYTES

Anna Sannino¹, Olga Zeni¹, Rita Massa¹, Maurizio Sarti¹, Stefania Romeo¹, Vijayalaxmi² & Maria Scarfi¹

¹IREA, CNR, Naples, Italy, 80124

²Radiology, University of Texas, San Antonio, TX, USA, TX 78229

In the present study, we have evaluated whether radiofrequency field exposure at 1950 MHz, UMTS signal, at different SARs, such as 0.15, 0.30, 0.60 and 1.25 W/kg is capable of inducing adaptive response in human peripheral blood lymphocytes challenged with a genotoxic dose of Mitomycin C. The preliminary results indicate that 0.30 W/kg is the most effective SAR to induce adaptive response, evaluated as reduction of micronucleus frequency

- I. field reduction by 1/5000 outside 1m radial or 1.5 m vertical from exposure area center
 - I. single current supply <10 A for 1 mT
 - I. simple and robust mechanical manufacturing
- A double solenoid design achieves these goals.

09-5 [12:20] - STUDENT PAPER

Study Of The Static and Low Frequency Magnetic Fields In Incubators

Theodore Schomay¹, Lucas Portelli² & Frank Barnes²

¹Physics, University of Colorado, Boulder, CO, USA, 80309

²Electrical, Computer and Energy Engineering, University of Colorado, Boulder, CO, USA, 80309

Recent experiments in our lab have shown significant and reproducible effects of modifying Ambient Magnetic Fields for several biological systems. We have used, built and modified complementary sensors in order to study static and low frequency magnetic fields (up to 600 Hz). We have found that magnetic field changes in conventional incubators that resemble those found by us and others to have significant biological effects.

10-5 [12:20]

W-Band MMW Exposure on Skeletal Muscle: Non-Thermal Effects on Contraction

Jihwan Yoon¹, Robert Wiese², Stephanie Luongo³, Pete Mastin³, Lev Sadovnik³, Indira Chatterjee¹ & Gale Craviso²

¹Department of Electrical and Biomedical Engineering, University of Nevada, Reno, Reno, NV, USA, 89557

²Department of Pharmacology, University of Nevada, Reno, Reno, NV, USA, 89557

³Sierra Nevada Corporation, Sparks, NV, USA, 89434

We exposed intact flexor digitorum brevis muscles to high (less than 3 kV/m) and low (less than 35 V/m) intensity W-band millimeter wave fields in the 94 GHz range. Specific exposure conditions included different electric field intensities and relative orientations, varied pulse modulations, sweeping the carrier frequency, and 100 Hz frequency offset. We saw a reproducible drop in force production at electric field intensities higher than 2.6 kV/m that could not be attributed to heating.

Session: L3
Lunch & Annual BEMS Business Meeting
June 16, 2011 • 12:40 - 14:00
Ondaatje Auditorium

Session: I1
Dosimetry - RF III
June 16, 2011 • 14:00 - 16:00
Ondaatje Auditorium
Chairs: Nam Kim & Luc Martens

Session: I2
Special Session: ZonMw
June 16, 2011 • 14:00 - 16:00
Scotiabank Auditorium
Chairs: Gerard van Rhoon & Mark Bouwens

11-1 [14:00]

Current Densities in a Voxel Model of the Head from Low Frequency Magnetic Fields Produced by a GSM Mobile Phone

Richard Findlay¹ & Peter Dimbylow¹

¹Health Protection Agency, Chilton, UK, OX11 0RQ

Induced current densities have been calculated for the exposure of a human head to low frequency magnetic fields produced by the battery of a GSM mobile phone. The highest values of current density occurred in the cerebro-spinal fluid, eyes and muscles surrounding the face.

12-1 [14:00]

Dutch research program on Electromagnetic Fields and Health (ZonMw)

Gerard van Rhoon¹, Peter Zwamborn², Robert Kanaar^{1, 3}, Hans Kromhout⁴ & Sandra van 't Padje⁵

¹Department of Radiotherapy, Erasmus MC, Rotterdam, the Netherlands

²Department of Electrical Engineering, The Hague and Eindhoven University of Technology, Eindhoven, the Netherlands

³Department of Cell Genetics, Erasmus MC, Rotterdam, the Netherlands

⁴Department of Environmental Epidemiology, University of Utrecht, Utrecht, the Netherlands

⁵ZonMw - Team Science and Innovation, Den Haag, the Netherlands

ZonMw, the Netherlands Organization for Health Research and Development, received the commission for the research program Electromagnetic Fields and Health (EMF&H) from the State Secretary for Housing, Spatial Planning and the Environment. It was prompted by public concern about possible health impact of exposure to EMF. A budget of € 16.6 million has been made available to boost Dutch research into EMF and their possible impact on health.

11-2 [14:20]

FEM and Interpolation Based Morphing of Whole Body Human Models

Esra Neufeld¹, Dominik Szczerba¹, Marcel Zefferer¹, Barbara Buehlmann¹, Myles Capstick^{1,2} & Niels Kuster^{1,2}

¹*IT'IS Foundation for Research on Information Technologies in Society, Zurich, Switzerland, 8004*

²*Swiss Federal Institute of Technology, Zurich, Switzerland*

The requirements for virtual anatomical models are constantly growing. It is important to provide optimal coverage of the potential population with anatomical models. The Virtual Population project already provides several "base" models. In this study we demonstrate the applicability of the finite element method (FEM) to achieve realistic body poses and to predict changes in body appearance following volume increase or decrease of body fat. Furthermore, we present a fast, interactive interpolation based method to realistically approximate required deformation fields.

11-3 [14:40]

A Simple Method to Compute Meniscus Effects on SAR at the bottom of Petri Dishes

Quirino Balzano¹ & Asher Sheppard²

¹*Department of Electrical and Computer Engineering, University of Maryland, College Park, CA, USA, 20742*

²*Asher Sheppard Consulting, Santa Rosa, CA, USA, 95405*

The meniscus along the periphery of the liquid medium in Petri dishes used for RF studies can have a surprisingly large volume and thereby significantly affect the SAR for cells adherent to the bottom or in suspension. Computationally intensive FDTD methods can be used to assess these effects. Alternatively, we present a simple method that yields estimates of meniscus effects for cells adherent to the bottom of a Petri dish with sufficient accuracy for use by experimenters.

11-4 [15:00] - STUDENT PAPER

From human skin permittivity measurements up to 65 GHz to development of skin-equivalent phantoms for body-centric applications

Nacer Chahat¹, Maxim Zhadobov¹, Robin Augustine¹ & Ronan Sauleau¹

¹*UMR CNRS 6164, Institute of Electronics and Telecommunications of Rennes, RENNES, France, 35042*

The extension of wireless body-centric communications from microwaves to millimeter waves (MMW) requires the accurate determination of the on-body propagation characteristics and absorption of the electromagnetic (EM) power in the human body. To this end, it is necessary to develop experimental phantoms emulating the dielectric properties of the skin. Starting from skin permittivity measurements in the 55-65 GHz range, we propose here two skin-equivalent semi-solid phantoms. To our best knowledge, these are the first skin-equivalent experimental models developed at MMW.

12-2 [14:20] - STUDENT PAPER

Modulation of the innate immune response in human Peripheral Mononuclear Cells by Extremely Low frequency electromagnetic field exposure

Stan de Kleijn¹, Mark Bouwens², Lidy Verburg-van Kemenade², Jan Cuppen³, Gerben Ferwerda¹ & Peter Hermans¹

¹*Laboratory of pediatric Infectious Diseases, Radboud University*

Nijmegen Medical Centre, Nijmegen, the Netherlands

²*Cell Biology and Immunology group, Wageningen University, Wageningen, the Netherlands*

³*Immunent B.V., Veldhoven, the Netherlands*

We aim to study whether ELF-EMF can modulate innate inflammatory signal pathways. PBMCs were stimulated with different TLR ligands and subsequently exposed to ELF-EMF at a field intensity of 5 μ T. No significant difference in inflammatory cytokine production could be detected. Specific ELF-EMF exposure is therefore unlikely to affect innate immune responses in vitro.

12-3 [14:40]

Time course experiments show no modulation of two low frequency electromagnetic fields of 5 microTesla on inflammatory profiles in human immune cells

Mark Bouwens¹, Stan de Kleijn², Gerben Ferwerda², Jan Cuppen³, Huub Savelkoul¹ & Lidy Verburg-van Kemenade¹

¹*Cell Biology and Immunology Group, Wageningen University,,*

Wageningen, the Netherlands, 6700 AH

²*Laboratory of pediatric infectious diseases, Radboud University Nijmegen Medical Centre, Nijmegen, the Netherlands, 6500 HB*

³*Immunent B.V., Veldhoven, the Netherlands, 5508 HB*

To reveal potential weak but biologically relevant effects of low frequency electromagnetic fields on human health, we chose to examine exposure of immune cells to two different signals, namely a complex multiple waveform field, and a 50 Hz sine wave. Using time course experiments, we determined kinetics of gene expression of human monocytes and macrophages. Exposure to neither of the two signals resulted in a significant effect on gene and protein expression of pro-inflammatory mediators.

12-4 [15:00] - STUDENT PAPER

Assessment of the Induced SAR and peak Temperature Increase in Children Exposed to Electromagnetic Fields at the ICNIRP Reference Levels

Jurriaan Bakker¹, Maarten Paulides¹, Esra Neufeld², Andreas Christ², Niels Kuster^{2,3} & Gerard van Rhoon¹

¹*Department of Radiation Oncology, unit Hyperthermia, Erasmus Medical Center, Rotterdam, the Netherlands*

²*Foundation for Research on Information Technologies in Society (IT'IS), Zurich, Switzerland*

³*Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland*

In this study we assessed the whole-body averaged, peak 1g/10g spatial-averaged SAR and the peak temperature increase in children exposed to plane waves at the ICNIRP reference levels. We assessed the uncertainty of the temperature simulations by a sensitivity study and Monte Carlo uncertainty analysis. The ICNIRP reference levels can induce a whole-body averaged SAR above the basic restrictions in children. Hence, the guidelines are not consistent and need revision. We also found a local increase of temperature in the order of 1 °C in children.

11-5 [15:20]

ELECTRICALLY CONDUCTIVE OBJECTS IN CONTACT WITH BIOLOGICAL TISSUES DURING RF EXPOSURE

C. K. Chou¹, Leonardo Angelone² & Arthur Guy³

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²Center for Devices and Radiological Health, U.S. Food and Drug Administration, Silver Spring, MD, USA, 20993

³Department of Bioengineering, University of Washington, Seattle, WA, USA, 98195

When exposing cells, animals or humans to RF fields, electrically conductive objects are often in contact with the exposed as part of the experiment. Dosimetry in the exposed object can be very different as compared to the contactless conditions. Any observed effect should be analyzed to determine whether it was due to the RF fields per se or because of the presence of the conductive objects. This presentation reviews some examples to illustrate the importance of detailed dosimetry.

11-6 [15:40]

Research on Frequency Dependent Tissue/Organ Specific SAR with Chinese Female Anatomical Model

Qing Shao¹ & Tongning Wu²

¹Telecommunication Metrology Center of Ministry of Industry and Information, Bei Jing, China, 100191

²Telecommunication Metrology Center of Ministry of Industry and Information, Bei Jing, China, 100191

This work utilizes the Chinese female anatomical model to perform FDTD simulation with frequency from 20MHz to 3GHz. SAR has been calculated for each tissue/organs on 12 frequencies. For each tissue/ organ, the maximal and minimal normalized SARs have also been shown. Results show that the tissue/ organ SAR change drastically with the frequencies and incident configurations. Comprehensive researches or simulation protocols should be done to evaluate the human exposure by wideband EMF.

12-5 [15:20]

Effect of a Proprietary ULF Magnetic Field on the Oxidative Response of Human Monocytes and Macrophages Cultured Under Low Oxygen and Steady-state Hydrogen Peroxide Conditions

Gabi Waite¹, Stephane Egot-Lemaire¹, Henry Owegi², Lidy Verburg-van Kemenade³ & Mark Bouwens³

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²Department of Chemistry, Indiana State University, Terre Haute, IN, USA, 47809

³Cell Biology and Immunology Group, Wageningen University, Wageningen, the Netherlands

It is hypothesized that the effect of the proprietary Immune magnetic field (IM) signal on farm animals is based on strengthening the animals' immune system. This study tests the *in vitro* effect of the IM signal on the oxidative response of monocytes and macrophages. Macrophages from a human cell line responded to the IM signal. Experiments are ongoing that test the IM effect on primary human monocytes and monocyte-derived macrophages from healthy volunteer donors.

12-6 [15:40]

The Dutch Activity Exposure Matrix: spatial and temporal analyses of personal exposure measurements and GPS data

John Bolte¹, Tessa Eikelboom^{1,3}, Irene Van Kamp², Mathieu Pruppers¹ & Hans Kromhout⁴

¹Laboratory for Radiation Research, National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands

²Centre for Environmental Health Research, National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands

³Institute for Environmental Studies (IVM), VU University, Amsterdam, the Netherlands

⁴Institute for Risk Assessment Sciences (IRAS), Utrecht University, Utrecht, the Netherlands

This study aims to build an Activity Exposure Matrix, describing the estimated exposure levels to electromagnetic fields (EMF) for 40 common, everyday activities (both indoor and outdoor) in 12 radiofrequency bands. We found that a clear contrast in exposure to radiofrequency EMF between everyday activities exists. The time weighted average of the total power density of the activities from 0.0276 (ironing) to 0.848 mW/m² (terrace of pub).

**Session: C5
Coffee Break
June 16, 2011 • 16:00 - 16:30
McInnes Room**

**Session: I3
Mechanisms/Theory
June 16, 2011 • 16:30 - 18:30
Ondaatje Auditorium
Chairs: Shoogo Ueno & Marvin Ziskin**

**Session: I4a
Exposure Assessment
June 16, 2011 • 16:30 - 17:50
Scotiabank Auditorium
Chairs: Patrizia Frei & Carmela Marino**

13-1 [16:30]

Keratinocyte Migration in Combined DC and AC Electric Fields

Francis Hart¹, Aimie Riding² & Christine Pullar²

14a-1 [16:30]

Relating Mobile Phone Traffic Data to Base Station Exposure

Wout Joseph¹, Leen Verloock¹ & Luc Martens¹

¹Department of Physics, The University of the South, Sewanee, TN, USA, 37383

²Department of Cell Physiology and Pharmacology, The University of Leicester, Leicester, UK, LE1 9HN

In a DC electric field of 100 V/m keratinocytes migrate toward the cathode. The mechanism for this response is not understood. We studied the migration of keratinocytes in a DC field of 100 V/m, AC fields of 1.6 Hz and 160 Hz at 40 V/m, and a combination of these AC fields with the DC field. The 1.6 Hz AC field with the DC field suppressed directional migration whereas the combination with the 160 Hz AC field did not-supporting an electromechanical transduction mechanism for the response.

13-2 [16:50] - STUDENT PAPER

A molecular dynamics study on water behavior within high endogenous and exogenous electric fields near biological structures.

Paolo Marracino¹, Francesca Apollonio¹, Valentina Di Mattia¹, Micaela Liberti¹, Andrea Amadei² & Guglielmo d'Inzeo¹

¹DIET, La Sapienza University, Rome, Italy, 00184

²Chemistry, Tor Vergata University, Rome, Italy, 00133

Because of its central role in basically all aspects of science, water is certainly one of the most extensively investigated substances from a theoretical point of view. Moreover, the characterization of liquids and solutions under the effect of exogenous electric fields is a long standing and challenging field of investigation for both theoretical and experimental approaches. In this work the behavior of water near charged interfaces has been evaluated considering two different cases: an ion in aqueous solution and a macromolecule of DNA.

13-3 [17:10]

RESPONSES OF CELLS TO LARGE ELECTRICAL PULSES: AN OVERVIEW OF MECHANISMS AND MODELS

James Weaver¹, Kyle Smith¹, Axel Esser¹, Reuben Son¹ & Thiruvallur Gowrishankar¹

¹Harvard-MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA, USA, 02139

The last decade has seen a dramatic emergence of interest in non-thermal cell killing by large (1 kV/cm or larger) electric field pulses. Both nsPEF (nanosecond electric field pulses) and IRE (irreversible electroporation) are drawing increasing attention. Importantly, nsPEF (less than a microsecond) and IRE (hundreds of microseconds to milliseconds) pulsing protocols are "drug-free" (no cytotoxic agents used). But a striking feature is that multiple pulses are often needed to kill cells. Here we review this vigorous research area.

13-4 [17:30] - STUDENT PAPER

nsPEF waveform efficiency: a microdosimetric comparison between real and ideal pulses

Caterina Merla¹, Silvia Di Lecce², Alessandra Paffi², Delia Arnaud-Cormos³, Francesca Apollonio², Philippe Leveque³ & Micaela Liberti²

¹Radiation Biology and Human Health Unit, ICEmB at ENEA, Casaccia Research Center, Rome, Italy, 00123

²Department of Information Engineering Electronic and Telecommunications, ICEmB at "Sapienza" University of Rome, Rome, Italy, 00184

³XLIM, CNRS-University of Limoges, Limoges, France, 87060

The application of nanosecond pulse electric field on biological

¹Information Technology, Ghent University/IBBT, Ghent, Belgium, 9050

The temporal variations of radio-frequency signals of base stations used in wireless systems such as GSM and UMTS are important for epidemiological studies and authorities. A simple method to calculate electric-field values at a time instant from field values at another time instant using only Erlang data is presented. The deviations between true and calculated values obtained using this approach, are limited if one uses Erlang data during day time.

14a-2 [16:50] - STUDENT PAPER

Combination of Different Exposure Assessment Methods for Low Frequency Electromagnetic Fields

Stefan Kampusch¹ & Georg Neubauer²

¹Institute of Telecommunications, Vienna University of Technology, Vienna, Austria, 1040

²Safety & Security Department, Austrian Institute of Technology, Seibersdorf, Austria, 2444

New requirements on employers in the EU will arise in the future concerning the evaluation of the exposure of workers to electromagnetic fields. Our investigations are dedicated to the development of a new, generic method which enables to combine exposure contributions from different sources assessed by different measurement equipment or by numerical tools taking into account the associated uncertainties. The applicability of this method will be validated by means of a selected scenario.

14a-3 [17:10]

Laterality phone use assessment using sensors existing in PDA

Joe Wiart^{1,2}, Emmanuelle Conil^{1,2}, Azeddine Gati^{1,2}, Thierry Sarrebourg^{1,2} & Man-Fai Wong^{1,2}

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²WHIST Lab, Paris, France

To investigate the question of possible health effect linked to the mobiles use epidemiological studies are conducted. One of the problems faced by these studies is the preferred side of the head during mobile phone use since the absorption of RF EMF from mobile phones is highly localized and the preferred side a key parameter of the exposure. To solve this problem we developed an API to be implemented in PDA working under Android system. Results are presented

14a-4 [17:30]

Statistical analysis of Traffic variations for assessing daily exposure induced by telephony networks

Azeddine Gati¹, Zaher Mahfouz¹, Man-Fai Wong¹ & Joe Wiart¹

¹RESA, Orange labs, paris, France, 92794

The main objectives is to study the variations of the exposure as a function of the daily traffic load and also the extrapolation factors for assessing a daily maximum exposure. The study focuses 2G and 3G base stations signals including different technologies (GSM, UMTS, HSPA ..). The probability of being exposed to a maximum traffic as well as to a combination of different signals is also addressed. The paper gives a traffic time-model elaborated from a Gaussian decomposition and a statistical analysis of multi-system exposure.

cells produced relevant consequences. One of the most interesting effects involves cell membranes rearrangements, i.e. nano-poration. To quantitatively investigate such effect on a single cell, the electric field as well as the transmembrane potential within cell membrane were evaluated, and consequently the pore density distribution quantified. Ideal and real pulses waveforms were compared in order to investigate the different efficiencies.

13-5 [17:50]

Analytical design technique for magnetic field therapy device

Richard Parker¹ & Marko Markov²

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Based upon using a Superconductive Quantum Interference Device (SQUID) magnetometer for registration of the magnetic field emitted by specific organs in norm and after the injury/pathology, this approach avoids empirical engineering. The signal parameters recorded by the SQUID magnetometer allow one to derive tissue and/or disease-specific signals. This is made possible using contemporary, state-of-the-art controls with engineering and computer science techniques.

13-6 [18:10] - STUDENT PAPER

Advanced tissue modeling using the time-harmonic finite-element method

Patrick Leidenberger¹, Christian Beyer¹ & Jürg Fröhlich¹

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For the numerical investigation of advanced models of tissue we have developed a time-harmonic finite-element code for distributed memory computer clusters. This code enables us to calculate dielectric spectra of large arrangements of cells with high accuracy. In comparison with most of the commercially available codes, operating on shared memory computers, we benefit from larger computer hardware.

Session: 14b
Hyperthermia: STM-BEMS Special Session
June 16, 2011 • 17:50 - 19:00
Scotiabank Auditorium
Chairs: Gerard van Rhoon & Niels Kuster

14b-1 [17:50]

Advantages & Disadvantages of CEM43 for EM Safety; A new Basis for EM Standards?

Gerard van Rhoon¹, Theodoros Samaras² & Niels Kuster³

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²Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, 54124

³ITIS Foundation, Zurich, Switzerland

CEM43°C is a method to represent an arbitrary temperature-time profile as a thermal isoeffect dose as a number of equivalent minutes (CEM) at a reference temperature of 43 °C. The advantages and disadvantages of CEM43°C will be discussed using the example of MR safety.

14b-2 [18:20]

Fast Estimation of SAR Induced Heating

Esra Neufeld¹, Maximilian Fuetterer¹, Adamos Kyriacou¹, Myles Capstick¹ & Niels Kuster^{1, 2}

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²Swiss Federal Institute of Technology, Zurich, Switzerland

Fast approaches to estimate the temperature increase based on the SAR distribution and tissue properties have been developed. These approaches use averaging techniques, Green's functions as well as information about the characteristic length of the Green's function. They show considerably improved correlation with the temperature than 1g or 10g averaged SAR or even perfusion normalized averaged SAR. Furthermore, peak temperature increase can generally be estimated conservatively with little

overestimation.

14b-3 [18:40]

EMF Exposure Assessment of Healthy Persons during Loco-Regional Hyperthermia using the BSD-2000 Sigma 60 System

Gerard van Rhoon¹, Jurriaan Bakker¹, Richard Canters¹ & Maarten Paulides¹

¹*Department of Radiation Oncology, unit Hyperthermia, Erasmus Medical Center, Rotterdam, the Netherlands*

For hyperthermia treatments of tumours in the pelvic area, we use a phased-array of eight dipole antennas at 70-100 MHz. We performed a study to assess the EMF in the treatment room and to assess the induced specific absorption rate in hyperthermia staff and accompanying persons. The EMF can be above the ICNIRP guidelines. However, for workers the basic restrictions on whole-body averaged and on peak localized 10g SAR are not exceeded. The induced whole-body averaged SAR in accompanying persons can exceed the basic restriction by a factor of two in close vicinity of the applicator.

June 17, 2011

Session: P5

Plenary 5: Emerging technologies: Terahertz radiation

June 17, 2011 • 08:30 - 09:15

Ondaatje Auditorium

Chair: Andrei Pakhomov

P5-1 [08:30]

Identification of Signature mRNA and microRNA Biomarkers Expressed in Human Cells Exposed to Terahertz Radiation

Gerald Wilmink¹, Jessica Grundt¹, Caesar Cerna¹, Caleb Roth¹ & Bennett Ibey¹

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Key Words:

Terahertz, bioeffects, thermal, microarray, gene expression, mRNA, microRNA

Session: I5

Policy & Risk

June 17, 2011 • 09:30 - 10:30

Ondaatje Auditorium

Chairs: Kenneth Foster & Sarah Loughran

Session: T2

Tutorial II: Introduction to EMF-Portal

June 17, 2011 • 09:30 - 10:30

Scotiabank Auditorium

Chair: Kerstin Hug

15-1 [09:30]

COMBINING IEEE C95.1 AND C95.6 INTO ONE EMF EXPOSURE STANDARD

C. K. Chou¹, J. Patrick Reilly¹, Robert Kavet¹, B Jon Klauenberg¹, Marvin Ziskin¹, Art Thansandote¹, Richard Tell¹, Kenneth Gettman¹, Ralf Bodemann¹ & Ronald Petersen¹

¹*International Committee on Electromagnetic Safety, TC95, IEEE, Piscataway, NJ, USA, 08854*

The ICES is combining IEEE Stds C95.6-2002 and C95.1-2005 into a single standard C95.1-201X. To make the meaning of some terms more obvious and to ensure a smooth transition between the standards, terminology changes have been made, e.g., basic restriction to dosimetric reference level; maximum permissible exposure to exposure reference level; action level to general public in unrestricted environments; persons in controlled environments to persons permitted in restricted environments.

15-2 [09:50]

General Public Exposure to LTE-Transmitters: Measurements and Communication Activities

T2-1 [09:30]

Introduction to the EMF-Portal

Roman Wienert¹, Sarah Driessen¹, Dagmar Dechent¹ & Jiri Silny¹

¹*Research Center for Bioelectromagnetic Interaction, RWTH Aachen University, Aachen, Germany*

09:30: Information offers, structure and usage of the EMF-Portal (R. Wienert)

09:50: Scientific literature: online searching, finding and using publication lists (S. Driessen)

10:10: Interactive Demonstration and Discussion (S. Driessen and R. Wienert)

Dagmar Wiebusch¹ & Karsten Menzel¹

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The Information Centre for Mobile Communication (IZMF) commissioned prior to the ubiquitous network rollout one of the worldwide first studies to assess general public's exposure to LTE transmitters. Based on the study's results IZMF realized communication activities for the broad public and for local authorities. Thus IZMF developed an effective tool for risk communication and fulfilled WHO's research agenda, that estimates the assessment of exposure of new RF technologies with high-priority.

15-3 [10:10]

Science Communication: Structuring and Reporting Risk Assessment Data by Evidence Maps

Peter Wiedemann^{1, 2}

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²INM8, Research Centre Juelich, Juelich, Germany, 52425

Evidence maps (EM) are tools for structuring and reporting scientific evidence in risk assessments. They aim to improve the reasonableness, clarity, understandability and transparency of risk characterization. The theoretical underpinnings of EM are outlined and EM are applied for the sake of illustration to the case "RF EMF and children's health". Finally, survey and experimental data are presented that indicate the usefulness of EM for reporting risk assessment to non-expert-audiences.

**Session: C6
Coffee Break
June 17, 2011 • 10:30 - 10:45
Auditorium Foyer**

**Session: P6
Plenary 6: Hot Topic: IARC Monograph on Non-Ionizing radiation (RF)
June 17, 2011 • 10:45 - 12:20
Ondaatje Auditorium
Chairs: David Black & Maria Scarfi**

P6-1 [10:45]

The IARC Monographs Working Group assessments of the carcinogenic hazards from exposure to radiofrequency electromagnetic fields

Robert Baan¹

¹WHO-International Agency for Research on Cancer, Lyon, France

In May of this year, 31 scientists met in Lyon to assess the carcinogenic hazards from exposure to radiofrequency electromagnetic fields. These assessments will be published as Volume 102 of the IARC *Monographs*. The Working Group considered (a) occupational exposures from radar and to microwaves, (b) environmental exposures to radiation from radio, television and wireless telecommunication, and (c) personal exposures from the use of mobile telephones (cell phones). The conclusions and evaluations of the Working Group will be presented and discussed.

**Session: SA
Student Awards & Closing Ceremony
June 17, 2011 • 12:30 - 13:00
Ondaatje Auditorium**

**Session: M6
BEMS BOD Meeting
June 17, 2011 • 13:00 - 19:00
University Club**

Session: PA
Poster Session A
June 14, 2011 • 10:30 - 12:30
Student Union Bldg: McInnes Room

PA-1 [10:30]

Intermediate Frequency Magnetic Fields Did Not Have Promotion or Co-Promotion Potentials in Transformation Assay Using Bhas42 Cell

Satoshi Nakasono¹, Masateru Ikehata², Masayuki Takahashi¹, Sachiko Yoshie² & Tadashi Negishi¹

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²*Biotechnology Laboratory, RTRI, Kokubunji, Japan, 185-8540*

We have investigated the effects of the intermediate frequency (IF) magnetic fields (MFs) on promotion (only MF) or co-promotion (MF and TPA) potentials. The Bhas 42 cells were exposed to a MF of 0.91mTrms at 2kHz, 1.1mTrms at 20kHz or 0.11mTrms at 60kHz. In statistical analysis, neither significant nor reproducible difference in the focus number was found between exposure and control groups. These results indicated that the strong IF MFs did not have promotion or co-promotion potentials.

PA-3 [10:30]

Evaluation of Exposure of School Children to Electromagnetic Fields from Wireless Computer Networks (Wi-Fi)

Azadeh Peyman¹, Mohammed Khalid¹, Richard Findlay¹, Carolina Calderon¹, Darren Addison¹, Terry Mee¹, Myron Maslanyj¹ & Simon Mann¹

¹*Physical Dosimetry Department, Health Protection Agency, Didcot, UK, OX11 0RQ*

This paper reports the distribution of electric field strengths and the calculated radiated powers around a sample of popular Wi-Fi devices in schools during transmission. It also presents data on the proportion of the time that devices transmit during typical school lessons. SAR values arising from Wi-Fi equipment in a 10 year old child model are also calculated and presented.

PA-5 [10:30] - STUDENT PAPER

Terahertz Radiation Induces Mitotic Disturbances In AL Cells

Henning Hintzsche¹, Christian Jastrow², Thomas Kleine-Ostmann², Thorsten Schrader², Ernst Schmid³ & Helga Stopper¹

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²*FB 2 Elektromagnetische Felder, Physikalisch-Technische Bundesanstalt, Braunschweig, Germany, 38116*

³*Institut fuer Zellbiologie, Universitaet Muenchen, Muenchen, Germany, 80336*

In the present study, the effect of 0.106 THz radiation on mitotic human-hamster hybrid cells was investigated. Cells were exposed for 30 minutes with different power densities from 0.043 to 4.3 mW/cm². All in all, more than 6,000 mitotic cells were analyzed. The frequency of mitotic disturbances was increased after irradiation with 0.043 and 0.43 mW/cm². After irradiation with 4.3 mW/cm², no further elevation could be observed.

PA-7 [10:30]

Microarray analysis of human-derived glial cells exposed to intermediate frequency magnetic fields

Tomonori Sakurai¹, Eijiro Narita¹ & Junji Miyakoshi¹

¹*Research Institute for Sustainable Humansphere, Kyoto University, Uji, Japan, 611-0011*

In Japan and Europe, the replacement of gas and electric cookers with induction heating (IH) cooktops has become popular in recent years. Intermediate frequency (IF) magnetic fields at 20 to 90 kHz leak out from IH cooktops. However, there have been very few studies of the biological effects of IF magnetic fields. In this study, we evaluated the effects of magnetic fields at 23 kHz and 100 μ T on gene expressions by microarray analysis. We demonstrate that exposure to IF magnetic fields for 2-6 h did not cause any significant alterations in gene expression.

PA-9 [10:30]

The biological effects of combined exposure to extremely low frequency electromagnetic fields and ultraviolet radiation

Junji Miyakoshi¹, Tomonori Sakurai¹, Eijiro Narita¹, Kohei Mizuno^{1, 2} & Kiyoshi Tamura²

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²*Power Engineering R&D Center, Kansai Electric Power Company, Osaka, Japan, 661-0974*

We examined the combined effects of extremely low frequency (ELF) electromagnetic fields and ultra violet (UV) light on cell viability and cyclobutadiene dimer formation. The human embryo (WI38VA13) cells and the UV-sensitive human xeroderma pigmentosum (XP2SA) cells were used in this experiment. For both cell types, UV irradiation caused a decrease in cell viability and an increase in the dimer formation in a dose-dependent manner. Exposure to ELF at 50Hz and 5mT for 24 hr before UV irradiation did not affect UV-induced cell viability and dimer formation in both cell types.

PA-11 [10:30]

Impact of dose and duration of GSM exposure on GFAP, myelin basic protein, beta amyloid 1-40 and emotional memory

Anne-Sophie Villegier¹, Marc Boujji¹, Amélie Barthélémy¹, Amandine Mouchard¹, Renaud Puigsecur¹ & Rene De Seze¹
¹INERIS

This study aimed to assess if GSM exposure (1.5W/kg-15min, 6W/kg-15 and 45min) was associated with further changes in cerebral function and biomarkers, in addition to glial fibrillary acidic protein (GFAP) increase previously demonstrated in the rat brain. Results showed a partial reproducibility on GFAP levels. Further biological responses were not dependent on SAR or exposure duration. These results strongly support the complexity of electromagnetic fields effect on biological responses and point out the need to assess the parameters of its variability.

PA-13 [10:30]

Exposure Limits: The underestimation of absorbed cellphone radiation, especially in children

L. Lloyd Morgan², Om Gandhi¹, Alvaro de Salles³, Yueh-Ying Han⁴, Ronald Herberman⁵ & Devra Davis²

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³Electrical Engineering Department, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil

⁴Department of Epidemiology and Community Health, New York Medical College, Valhalla, NY, USA, 10595

⁵Intrexon Corporation, Germantown, MD, USA, 20876-7004

The existing cellphone SAR certification method underestimates SAR. FDTD computer simulation is a superior method. An existing Virtual Family allows for inclusion of children, pregnant women, has superior resolution, and is less expensive. FDTD allows for specific tissues compared to assuming all tissues are the same. The current method underestimates the SAR for over 90% of the population and for children by up to 2-fold. Most, if not all cellphones, when used by children, exceed the exposure limits.

PA-15 [10:30]

Effects of exposure to a high-frequency electromagnetic field at 2.45 GHz on interleukin 1 β and interleukin 6 production in macrophage-like U937 cells

Eijiro Narita¹, Tomonori Sakurai¹, Yukihiisa Suzuki², Masao Taki² & Junji Miyakoshi¹

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²Department of Electrical & Electronic Engineering, Tokyo Metropolitan University, Hachioji, Japan, 192-0397

We investigated the effects of a high-frequency electromagnetic field (HFEMF) at 2.45 GHz on human interleukin 1 β (IL-1 β) and interleukin 6 (IL-6) productions in human monoblastic U937 cells. Our results showed that the exposure to a HFEMF of 2.45 GHz at SAR of 1 and 10 W/kg for 4 hours has no significant effect on IL-1 β and IL-6 productions in U937 cells.

PA-17 [10:30] - STUDENT PAPER

A Novel Band-Selective Personal Exposure Meter for Advanced Exposure Assessment

Oliver Lauer¹, Patrick Leidenberger¹, Michael Müri¹ & Jürg Fröhlich¹

¹Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zürich, Zürich, Switzerland, 8092

The realization of a prototype for a novel band-selective personal exposure assessment system is presented. The new system combines three features that are crucial for Non-Ionising-Radiation (NIR) monitoring, namely power levels of selected near field sources, e.g. internal Wi-Fi module, field levels of far field sources and global position measurements. Therefore, it uses the features of a common smartphone by an additional software application and an external exposimeter module.

PA-19 [10:30]

Single prenatal exposure to a 1.95 GHz W-CDMA field does not influence hematopoietic activity in rats

Kazuhito Sasaki¹, Hironori Yamaguchi¹, Hiroharu Yamashita¹, Soichi Watanabe⁴, Kanako Wake⁴, Hiroki Kawai⁴, Jianqing Wang², Shoogo Ueno³, Hirokazu Nagawa¹ & Joji Kitayama¹

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The aim of this study is to evaluate whether gestational exposure to an EMF targeting the head region might affect hematopoiesis in their offsprings. Pregnant SD rats were used (cage-control/ sham/ brain SAR=2, 6, 20W/Kg). Exposure was performed at gestational day 16 for 90 minutes per day. Nineteen days after delivery, bone marrow and peripheral blood cells were obtained from juvenile rats and their components were quantitatively investigated. We demonstrated that single gestational exposure to EMF at SAR=2 and 6W/Kg did not affect the hematopoiesis of their offsprings.

PA-21 [10:30]

The effects of static magnetic fields on neurotransduction

Hideyuki Okano^{1,2}

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²Product Development Division, R&D Section, PIP Co., Ltd., Osaka, Japan, 540-0011

This study focuses on the effect of SMF up to 0.7 T on the membrane excitation and refractory processes of sciatic nerve fibres of *Xenopus* frogs. The compound action potentials (CAP) values were measured for two groups, the control group ($n = 5$) and the SMF-exposed group ($n = 5$) for 6 h. The conduction velocity of C fiber was significantly delayed by not 0.25 T but 0.7 T SMF exposure for 4–6 h compared with the unexposed control group. These results imply that an SMF may diminish pain perception because the C fiber is responsible for pain transmission.

PA-23 [10:30] - STUDENT PAPER

Static magnetic fields affect tomato (*Solanum lycopersicum*) seed performance

Danny Poinapen^{1, 2, 3}, Huaiyu Wang², Girish K. Beeharry³ & Daniel C.W. Brown^{1, 2}

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³Department of Physics, University of Mauritius, Reduit, Mauritius

Static magnetic fields are known to affect the performance of seeds¹. To investigate the importance of different magnetic field parameters in horticultural crops, tomato seeds were exposed to several treatments based on an orthogonal array that included relative humidity as a variable. Seed performance was evaluated in terms of vigour (electrolyte leakage, germination, and seedling biomass accumulation), where exposure to magnetic fields (seed orientation to polarity) and magnetic field strengths were ranked more important factors than relative humidity and exposure times.

PA-25 [10:30]

Spatial 3D distribution of magnetic field forces of permanent magnets in a model for examining permanent magnetic fields onto cell cultures.

Marek Glinka¹, Stanislaw Gawron¹, Aleksander Sieron² & Grzegorz Cieslar²

¹KOMEL, Katowice, Poland, 40-203

²Department And Clinic Of Internal Diseases, Angiology And Physical Medicine, Centre For Laser Diagnostics And Therapy, Medical University Of Silesia, Bytom, Poland, 41-902

In our study we created computer simulations of the 3D distribution of the permanent magnetic field and the construction of model circuits used for the research the influence of the static magnetic field on the cells' culture in vitro. Our goal was an attempt to optimize these studies, so the statistical comparison of simulated and the real intensities distributions for the several sizes of magnets was calculated.

PA-27 [10:30]

Potential effects of millimeter-wave radiations on inflammatory biomarkers

Catherine Le Quément¹, Christophe Nicolas Nicolaz^{1, 2}, Maxim Zhadobov², Ronan Sauleau², Denis Michel¹ & Yves Le Dréan¹

¹Intracellular Protein Homeostasis Team, University of Rennes 1, Rennes, France

²Institute of Electronics and Telecommunications of Rennes (IETR), University of Rennes 1, Rennes, France

The purpose of this study is to identify power density thresholds of human cell responses to millimeter-wave (MMW). Keratinocytes were exposed at 60.4 GHz with average incident power densities ranging from 1 to 20 mW/cm², and gene expression of chemokines was assessed. Below 5 mW/cm², no significant effect was observed on CCL2, CXCL-1, and CXCL-8 expressions. Above 15 mW/cm², the expression of these chemokines was significantly reduced, but it seems results from a thermal MMW-induced effect.

PA-29 [10:30]

Permittivity Spectra of Biological Solutions in the Millimeter-Wave Range at Room and Human Body Temperatures

Maxim Zhadobov¹, Robin Augustine¹, Ronan Sauleau¹, Catherine Le Quément², Yonis Soubere Mahamoud² & Yves Le Dréan²

¹Institute of Electronics and Telecommunications of Rennes, University of Rennes 1, Rennes, France

²Intracellular Protein Homeostasis Team, University of Rennes 1, Rennes, France

The main purpose of this study is to provide measured complex permittivity spectra of several representative biological solutions in the 2-67GHz range at room (24°C) and human body (37°C) temperatures. Permittivity spectra of monomolecular solutions of proteins, amino acids, nucleic acids, and carbohydrates dissolved in water are analyzed and compared. Furthermore, measurements have been also performed for complex biomolecular solutions, including BSA-DNA-glucose mixture, mammalian cell culture medium, and yeast extract solution.

PA-31 [10:30]

Reduction Characteristics of Magnetic Fields on the Shielding Materials of Neutral Ground Reactor Outside Layer

Suk Won Min¹, Sung-Ho Lee¹ & Geun-Taek Yeo²

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²Transmission Construction, Korea Electric Power Corporation, Seoul, Korea, 135-791

Current with several harmonic components flowed in a NGR due to load unbalance in normal steady state and magnetic fields with 180 Hz and 540 Hz components were also generated around a NGR in 60 Hz Korean substation. As results of study, we found copper shielding layer could not lower current densities of a worker less than ICNIRP guideline. We finally found silicon was the most efficient to the shielding material of NGR outside layer in view of the cost and the reduction characteristics of magnetic fields.

Session: PB
Poster Session B
June 15, 2011 • 10:00 - 12:00
McInnes Room

PB-2 [10:00] - STUDENT PAPER

A Smartphone Based Questionnaire/Diary for Epidemiological Studies

Oliver Lauer¹, Patrick Leidenberger¹, Damiano Urbinello², Martin Roosli² & Jürg Fröhlich¹

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²Swiss Tropical and Public Health Institute, University of Basel, Basel, Switzerland, 4051

The realization of a novel software based questionnaire smartphone application for epidemiological studies is presented. A digital questionnaire implemented on a smartphone offers several appealing features such as geo-locating, accurate time recording as well as alarm functions, circumventing incompleteness of entries. With such a system a higher accuracy of collected data through questionnaires in epidemiological studies can be achieved.

PB-4 [10:00]

NON-THERMAL PULSE-MODULATED RF FIELDS ATTENUATE NEUROINFLAMMATION AFTER TRAUMATIC BRAIN INJURY

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³Plastic and Reconstructive Surgery, Montefiore Medical Center, Bronx, NY, USA, 10467

⁴Biomedical Engineering, Columbia University, New York, NY, USA, 10027

This study showed that a non-thermal pulse-modulated RF signal, configured to modulate CaM-dependent NO-signaling, produced significant attenuation of inflammatory markers for TBI in rat models for closed and penetrating brain injuries. Both IL-1 β and GFAP were reduced several-fold ($P < 0.02$) within 6 hours post injury. If these PEMF effects can be translated to the human, mortality, morbidity and neurological deficits in human TBI patients will be significantly reduced.

PB-6 [10:00]

Effects of electromagnetic fields emitted from mobile phones on human sleep

Setsu Nakatani-Enomoto¹, Toshiaki Furubayashi², Akira Ushiyama³, Kazumune Ueshima⁴, Shigeru Sokejima⁴, Ally Simba⁵, Kanako Wake⁵, Soichi Watanabe⁵, Kaori Miyawaki⁶, Masami Nishikawa⁷ & Yoshikazu Ugawa¹

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⁵EMC Group, Applied Electromagnetic Research Center, National Institute of Information and Communications Technology, Japan

⁶Waseda University, Japan

⁷Department of Education, Kawamura Gakuen Woman's University, Japan

We studied aftereffects of the mobile phones on human sleep. Subjects were exposed to two conditions of sham and real (1.95 GHz W-CDMA up-link signal) EMF for 3 hours on three consecutive days. Real exposure was done on the second or third day. We evaluated the sleep structures and powerspectra after the exposures using polysomnogram, and sleepiness and mood after the sleep using self-reported questionnaire in the morning. The data on the first night were discarded to eliminate the first night effect. No parameters showed significant differences between two exposure conditions.

PB-8 [10:00]

Effects on Micronuclei Formation of 60-Hz Electromagnetic Field Exposure with Ionizing Radiation, Hydrogen Peroxide, or c-Myc Overexpression

Yeung Bae Jin^{1, 2}, Ga-Young Kang², Jae-Seon Lee³, Jong-Il Choi⁴, Ju-Woon Lee⁴, Seung-Cheol Hong⁵, Sung Ho Myung⁶ & Yun-Sil Lee²

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³Korea Institute of Radiological and Medical Sciences, Seoul, Korea, 139-706

⁴Korea Atomic Energy Research Institute, Jeongseup, Korea

⁵Inje University, Korea

⁶Korea Electrotechnology Research Institute, Changwon, Korea

NIH3T3 mouse fibroblast cells and WI-38 human lung fibroblast cells were exposed for 4 h to a 60 Hz, 1 mT uniform magnetic field with or without ionizing radiation (IR, 2 Gy), H₂O₂ (100 microM) and c-Myc activation. The results obtained showed no significant differences between the cells exposed to ELF-MF alone and the unexposed cells. Moreover, no synergistic effects were observed when ELF-MF was combined with IR, H₂O₂, and c-Myc activation.

PB-10 [10:00]**Residential exposure to extremely low frequency magnetic fields from high voltage power lines and risk of Alzheimer's disease**

Patrizia Frei¹, Aslak Poulsen¹, Gabor Mezei², Martin Roosli^{3, 4}, Christoffer Johansen¹ & Joachim Schuz⁵

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⁴*University of Basel, Basel, Switzerland, 4003*

⁵*Section of Environment and Radiation, International Agency for Research on Cancer, Lyon, France, 69372*

The aim of this study is to investigate the association between residential exposure to extremely low frequency electromagnetic fields (ELF-EMF) from power lines and neurodegenerative diseases in Denmark in a case-control design. Cases are selected from the virtually complete hospital discharge registry, and complete residential history will be obtained for cases and controls from the Central Population Registry. Exposure will be modeled based on detailed data available from power line companies.

PB-12 [10:00]**ORNITHINE DECARBOXYLASE ACTIVITY IN JURKAT CELLS IS ENHANCED BY 50 Hz MAGNETIC FIELD EXPOSURE AND CYCLIC AMP STIMULATION**

Mats-Olof Mattsson^{1, 2}, Kjell Hansson Mild³ & Myrtil Simko⁴

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The human lymphoblastoid cell line Jurkat was studied in experiments designed to elucidate the cellular mechanism whereby weak low-frequency magnetic fields (MF) influence ornithine decarboxylase (ODC) activity. The present study suggests that ODC activity in Jurkat cells is influenced by cellular cAMP levels, and that 50 Hz MF treatment possibly can potentiate the effects by cAMP.

PB-14 [10:00]**A New Approach to Determine the Exposure Level in a Multiple Frequency Whole-Body Exposure System**

Jianqing Wang¹, Kanako Wake², Hiroki Kawai², Soichi Watanabe² & Osamu Fujiwara¹

¹*Nagoya Institute of Technology, Nagoya, Japan, 466-8555*

²*National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795*

In this study, we have proposed a new approach to determine the exposure level based on the classification of the documentary photos of rat activity. Using the stay frequency as a weighting factor, we have calculated the whole-body SAR for the exposed rats during the entire exposure period. As a result, we can derive the mean value, the median value and the mode value for the whole-body SARs via a statistical analysis. The approach provides more options and then higher accuracy for determining the actual exposure level.

PB-16 [10:00]**PHYSIOREF Project: Effects of mobile phone use on superficial cutaneous and internal cerebral circulation. Part II: Transcranial Doppler recording of internal cerebral vascularisation**

Rania Ghosn¹, Nathalie Loos², Brahim Selmaoui¹, Rene De Seze¹ & Gyorgy Thuroczy¹

¹*INERIS, Verneuil-en-Halatte, France, 60550*

²*EA 4285 UMI-INERIS, Laboratory PERITOX, Amiens, France, 80000*

The cerebral circulation may be potentially affected due to the exposure to RF emitted by mobile phone. The objective of present human study is to investigate internal cerebral and superficial vascularisation using GSM 900 MHz mobile phones. The basic approach is to compare the vascularisation of the exposed and non-exposed hemisphere before, during and after of 20 minutes RF exposure using transcranial ultrasound Doppler and laser Doppler flowmetry simultaneously with temperature recording.

PB-18 [10:00]**Design and dosimetric analysis of a new head exposure system for provocation studies concerning possible effects of TETRA on central nervous processes**

Gernot Schmid¹, Thomas Bolz², Richard Überbacher¹, Achim Bahr², Hans Dorn³, Cornelia Sauter³, Thorsten Eggert³ & Heidi Danker-Hopfe³

¹*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444*

²*IMST, Kamp-Lintfort, Germany, D-47475*

³*Competence Center of Sleep Medicine, Charite Universitätsmedizin, Berlin, Germany, D-14050*

A novel head exposure setup for a currently ongoing double blinded provocation study concerning possible effects of TETRA handset exposure on the central nervous system has been developed and dosimetrically analyzed. The exposure system provides reasonable efficiency (14 W/kg/W) and uncertainty ($\pm 45\%$) with respect to the maxSAR_{10g} in the subjects' head. A brain tissue specific absorption analysis provided detailed insight about the distribution of absorption caused by the exposure system.

PB-20 [10:00] - STUDENT PAPER

Measurement of the duty cycle of WLAN in different environments

Gunter Vermeeren¹, Leen Verloock¹, Wout Joseph¹ & Luc Martens¹

¹Department of Information Technology, UGent - INTEC / IBBT, Ghent, Belgium, B-9050

Nowadays, Wireless Local Area Networks (WLANs) are commonly deployed in office buildings and at home. As a consequence, many people are exposed to the electromagnetic fields irradiated by these networks during long periods of time. Exposure to Wi-Fi is only rarely investigated. In an exposure assessment of WLAN the duty cycle has to be taken into account because data packets are transmitted in bursts. In this study, the duty cycle is measured using a spectrum analyzer in zero span in an office building and at a total of 151 locations in Belgium and the Netherlands.

PB-22 [10:00]

An observation of the hand effects on the HAC of the mobile phones

Dong-geun Choi¹, Chungsang Ryu¹ & Jaehoon Choi²

¹Research of Radio environment, Radio Research Agency, Korea Communications Commission, Seoul, Korea, 140-848

²Department of Electrical Computer Engineering, Hanyang University, Seoul, Korea, 133-791

In this paper, the influence of the grabbing type of mobile phone on the RF strength is observed in the aspect of HAC. Antenna (835 MHz, 1.765 GHz) is designed. It is simulated and measured for the verification in the aspect of HAC. To simplify the analysis, it is found out that the hand effect on the RF strength comes mainly from the resonance frequency shift caused by the hand. The narrower band characteristics of a device would cause the wider variation in the measurement of RF strength in the HAC evaluation.

PB-24 [10:00]

4-layer Flat Body Tissue Modeling and Evaluation for Electromagnetic Numerical Analysis

Soonyong Lee¹, Uisheon Kim¹, Seo Wonbum¹ & Jaehoon Choi¹

¹Electrical and Computer Engineering, Hanyang University, Seoul, Korea, 133-791

In this paper, the suitable human body modeling to account for human body effect in designing an electric device is proposed. The proposed modeling is evaluated by a commercial simulation tool for analyzing human body effect and SAR. In order to verify the accuracy of the proposed 4-layer modeling of a human body, S-parameter characteristics for an implant antenna are calculated and compared with those of 3 different reference human body models. The S-parameter characteristics for the proposed model agree well with those of complicated virtual voxel model.

PB-26 [10:00]

THE PERCEPTION THRESHOLD FOR LF-MF BAND CURRENTS: ITS CURRENT DURATION DEPENDENCE

Yoshitsugu Kamimura¹, Toshiaki Furubayashi², Ritsuko Hanajima⁴, Yasuo Terao⁴, Taiji Sakai³, Kanako Wake³, Soichi Watanabe³ & Yoshikazu Ugawa²

¹Department of Information Science, Utsunomiya University, Utsunomiya, Japan, 321-8585

²Department of Neurology, Fukushima Medical University, Fukushima, Japan, 960-1295

³EMC Group, National Institute of Information and Communications Technology, Koganei, Japan, 184-8795

⁴Department of Neurology, The University of Tokyo, Japan, 184-8795

We investigate the current duration dependence of 100 kHz and 300 kHz electric currents perception threshold using the method of constant stimuli (MoC) to clarify how the threshold is modified by the frequency of electric currents and to determine the best current duration for threshold tracking. The threshold was determined with MoC using four kinds of current duration. For 100 kHz currents, the threshold is not affected by the current duration. In contrast, however, it definitely depends on the current duration for 300 kHz currents.

PB-28 [10:00]

In situ expression of HSPs and 3-Nitrotyrosine in the brains of young rats exposed in utero and during early life to a Wi-Fi signal

Saliha Ait Aissa¹, Murielle Taxile¹, Bernard Billaudel¹, Florence Poulletier De Gannes¹, Annabelle Hurtier¹, Emmanuelle Haro¹, Gilles Ruffie², Axel Athane¹, Tongning Wu³, Joe Wiart⁴, Bernard Veyret¹ & Isabelle LaGroye¹

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³China Academy of Telecommunication Research of MIIT, Beijing, China

⁴Orange Labs R&D, Issy-les-Moulineaux, France, 92794

To investigate the bioeffects of Wi-Fi exposure on the developing nervous systems of rodents, we assessed the *in vivo* expression level of stress markers: the 3-Nitrotyrosine involved in the action of reactive nitrogen species and two Heat Shock Proteins (Hsp25 and Hsp70), well known to prevent cells from thermal and oxidative stress. The exposure of young rats from day 6 of gestational period to day 35 after birth showed no consistent radical stress measured by immuno-histochemistry suggesting that Wi-Fi exposure had no influence on immature brain integrity.

PB-30 [10:00] - STUDENT PAPER

Numerical assessment of induced disturbance voltages at the input of implantable cardiac pacemakers during exposure close to various RFID devices

David Sainitzer¹ & Gernot Schmid^{1, 2}

¹Biomedical Engineering Sciences, University of Applied Sciences Technikum Wien, Vienna, Austria, 1220

²EMC&Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444

An analysis of the potential of interference between different RFID applications (including EAS systems) and cardiac pacemakers is presently carried out based on numerical computations of the induced peak-to-peak disturbance voltage at the pacemaker input. Several different numerical models of real RFID and EAS devices and a wide range of different realistic pacemaker configurations will be considered. A complete set of computational results will be presented at the meeting.

PB-32 [10:00] - STUDENT PAPER

Numerical assessment of induced current densities and SAR around metallic implants during exposure close to various RFID devices

Andreas Weinfurter² & Gernot Schmid^{1, 2}

¹EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444

²Biomedical Engineering Sciences, University of Applied Sciences Technikum-Wien, Vienna, Austria, 1200

Several exposure situations for patients bearing metallic implants in the immediate environment of several different RFID devices covering the frequency range from 58 kHz up to 2.45 GHz are dosimetrically analyzed based on numerical simulations using detailed anatomical models, realistic numerical representations of several different implants and validated numerical source models of real RFID devices.

PB-34 [10:00]

Evaluation of Electromagnetic Field Exposure Levels from RFID System

Seon-eui Nong¹ & Ae-kyoung Lee¹

¹Radio Technology Research Department, Electronics and Telecommunication Research Institute, Korea, 305-700

Not Submitted

PB-36 [10:00]

Real-Time Characterization of Hsp70 Response to Heat Stimuli

Michelle Belton¹, Frank Prato¹ & Jeffrey Carson^{1, 2}

¹Imaging Program, Lawson Health Research Institute, London, ON, Canada

²Medical Biophysics, University of Western Ontario, London, ON, Canada

Reporter gene systems have been used to study the activation by magnetic fields of promoters such as that of heat shock protein 70 (Hsp70). We report the real-time characterization of Hsp70 production in response to various durations of heat (42°C) and recovery from heat (37°C). There were significant changes in the instantaneous rate of change which were dependent on the duration of exposure to heat. This may be of interest to those using the reporter system to examine biological effects of magnetic fields.

PB-38 [10:00]

Effects of mobile phone use on superficial cutaneous and internal cerebral circulation (PHYSIOREF project). Part I: Laser-Doppler recording of microflow- and temperature- modifications of head's skin

Nathalie Loos¹, Rania Ghosn², Gyorgy Thuroczky² & Rene De Seze²

¹EA 4285 UMI-INERIS, Laboratory PERITOX, Amiens, France, 80036/cedex 1

²INERIS, Verneuil-en-Halatte, France, 60550/BP2

Heating caused by mobile phone exposure could modify cutaneous thermoregulation. The aim of the study was to quantify, simultaneously and at the same site, cutaneous microflow- and temperature- variations of the cheek by laser Doppler flowmetry in young adults during 900 MHz GSM exposure of 20 minutes. The preliminary results obtained in 8 subjects shown a significant and gradual increase in skin microflow associated with proportional increase in local skin temperature under mobile phone exposure.

PB-40 [10:00]

Induction of FGF2 transcription in differentiated myoblast cells upon 1,763 MHz RF radiation

Kyu-Tae Kim¹, Sun-Young Yoon², Seong-Jin Jo², Oh-Sang Kwon², Soon-Ik Jeon³, Jeong-Ki Park⁴ & Woong-Yang Park¹

¹Department of Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, 110-799

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³Antenna Research Team, Radio Technology Research Department, Communications & Broadcasting Convergence, ETRI (Electronics and Telecommunications Research Institute), Daejeon, Korea, 305-700

⁴Department of Radio Science and Engineering, Chungnam National University, Daejeon, Korea, 305-704

We have compared the gene expression upon 1763MHz RF radiation along the differentiation status of myoblast cell. RF radiation triggered the induction of FGF2 in differentiated cells, while the effect was hardly detected in undifferentiated counterpart. Because the expression of CACNA1S is up-regulated in the differentiated, we speculate that the elevated calcium influx caused by RF radiation may initiate the signaling for the induction of FGF2. From these results, we suggest that some cell types may interact with RF radiation through the cell type-specific gene expression.

PB-42 [10:00]

Exposure assessment in the vicinity of RFID devices

Gernot Schmid¹, Richard Überbacher¹, Ana Escorihuela-Navarro¹ & Stefan Cecil¹

¹EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444

A detailed exposure analysis of typical devices of present RFID technology (except electronic article surveillance devices) based on measurements and numerical computations demonstrated that exposure from present RFID reader devices can be considered compliant with the basic restrictions for general public exposure defined by the ICNIRP 1998's guidelines. One possible exception might be LF-Vicinity coupling readers in situations when a person comes very close to the reader antenna.

PB-44 [10:00] - STUDENT PAPER

Extremely low frequency electromagnetic field exposure modulates stress regulation in mice.

Stan de Kleijn¹, Jos Trentelman², Joop Arts², Jan Cuppen³, Linda De Jager⁴, Gerben Ferwerda¹, Peter Hermans¹ & Lidy Verburg-van Kemenade²

¹Laboratory of Pediatric Infectious Diseases, Radboud University Nijmegen Medical Centre, Nijmegen, the Netherlands

²Cell Biology and Immunology group, Wageningen University, Wageningen, the Netherlands

³Immunent B.V., Veldhoven, the Netherlands

⁴Central University of Technology, Free state, Bloemfontein, South Africa

Health effects of ELF-EMF are currently unclear. We exposed mice to ELF-EMF during a short term experiment and assessed stress regulation and leukocyte counts. ELF-EMF significantly modulates stress axis regulation at the level of adrenal gland and increased the amount of circulating leukocytes. Therefore, ELF-EMF is considered to have modulating effects in vivo

PB-46 [10:00]

Therapeutic applications of EMF in cancer.

Yann Percherancier¹, Murielle Taxile¹, Emmanuelle Haro¹, Renaud Charlet De Sauvage¹, Isabelle LaGroye¹ & Bernard Veyret¹

¹IMS / UMR5218, cnrs, Pessac, France, 33607

It is today urgent to find new therapeutic approaches to fight cancer using novel, less toxic, and cheaper treatments. Compared to pharmaceuticals, non-invasive MF/EMF applications open up the prospect of significantly less-expensive therapeutic alternatives with fewer, if any, side effects. We will explore here the beneficial use of low-level, non-invasive, pulsed magnetic fields and amplitude-modulated radiofrequency waves for cancer therapy using animal models and cell lines.

PB-48 [10:00] - STUDENT PAPER

SAR Reduction Technique for Future On-Body Communications: Application to a Dual-Band Textile Antenna

Nacer Chahat¹, Maxim Zhadobov¹ & Ronan Sauleau¹

¹UMR CNRS 6164, Institute of Electronics and Telecommunications of Rennes, RENNES, France, 35042

Currently there is a growing interest in wireless body-worn communication technologies involving on- and off-body communications. In this study, we propose a technique based on the utilization of electromagnetic band gap (EBG) structures for the specific absorption rate (SAR) reduction. This approach has been validated for a dual-band wearable textile antenna designed for future body-centric applications and demonstrated a SAR reduction in the body of more than 97%.

PB-50 [10:00]

Investigation of prediction of the whole body SAR induced in a fetus exposed to plane wave at 900 MHz.

Abdelhamid Hadjem^{1,2}, Thierry Kientega^{1,2}, Emmanuelle Conil^{1,2} & Joe Wiart^{1,2}

¹RESA/WASA/WAVE, Orange Labs, Issy les moulineaux, France, 92794

²Whist Lab, Issy les moulineaux, France, 92794

In this paper, a real abdomen pregnant woman model has been used to build a surrogate model to predict the whole body exposure in fetus depending on the highlighted surface of the fetus model, and the tissue volume of pregnant woman (located between the direction incident plane wave and the fetus), and on the direction of arrival of the incident plane wave. This work is based to calculate the whole body exposure induced in the fetus using the plane wave with different angle of arrival at 900MHz.

PB-52 [10:00]

Cytokine expression profiles in carp (*Cyprinus carpio* L.) phagocytes after in vitro exposure to Extremely Low Frequency Electromagnetic Fields (ELF-EMF).

Joop Arts¹, Lieke Golbach¹, Jan Cuppen², Huub Savelkoul¹ & Lidy Verburg-van Kemenade¹

¹Cell Biology & Immunology Group, Wageningen University, Wageningen, the Netherlands, 6700 AH

²Immunent, Veldhoven, the Netherlands

We studied the influence of ELF-EMF on isolated phagocytes of carp. Fish are early vertebrates with a well-developed innate and adaptive defense. A multiple frequency ELF-EMF with steep rise times and exponential decays, was selected to expose phagocytes. A solenoid coil with optimized geometric parameters was designed for *in vitro* experiments. We measured gene expression profiles of inflammatory mediators, after a typical innate immune stimulation, combined with exposure to the ELF-EMF signal.

PB-54 [10:00]**Broadband characterization of Triton X100-based solutions for breast tissues mimicking**

Stefania Romeo^{1, 2}, Loreto Di Donato^{1, 3}, Ilaria Catapano¹, Lorenzo Crocco¹, Maria Scarfi^{1, 4} & Rita Massa⁴

¹*Institute for Electromagnetic Sensing of the Environment, National Research Council of Italy, Napoli, Italy*

²*Department of Information Engineering, Second University of Naples, Aversa, Italy*

³*Department of Informatics, Mathematics, Electronic and Transportation, Mediterranean University of Reggio Calabria, Reggio Calabria, Italy*

⁴*Department of Physical Sciences, Federico II University of Naples, Napoli, Italy*

The possibility of mimicking different types of breast tissues to realize experimental phantoms has been investigated by measuring the complex permittivity of polyethylene glycol mono phenyl ether (Triton X-100) and distilled water solutions. In this respect, broad band electromagnetic characterization of several mixtures, at different concentrations, has been carried out in the 0.5-12 GHz frequency range.

PB-56 [10:00] - STUDENT PAPER**In vitro study of the effects of pulsed ELF on genes expression in human epidermal cells.**

Jean-Francois Collard¹ & Maurice Hinsenkamp¹

¹*Laboratoire de Recherche en Orthopédie Traumatologie, Université Libre de Bruxelles, Brussels, Belgium, 1070*

The present microarrays analysis shows that the application of pulsed ELF is responsible of a modification of genes expression of epidermis cells. These genes play a role in acceleration of the differentiation at the expense of the proliferation. In this protocol, we use keratinocytes culture on a deepidermized human dermis. Electrical stimulation is applied through Pt electrodes in contact with dermis support. The results for the sampling times J7 and J12 will be presented and compared with J4.

PB-58 [10:00]**Statistical Analysis of the influence of the position of a phone on the exposure of brain tissues**

Amal Ghanmi^{1, 2, 3}, Nadege Varsier^{1, 2}, Abdelhamid Hadjem^{1, 2}, Yenny Pinto², Emmanuelle Conil^{1, 2}, Azeddine Gati^{1, 2}, Odile Picon³ & Joe Wiart^{1, 2}

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³*ESYCOM, Université Paris Est Marne la vallée, France, 77454*

For epidemiological studies it is of interest to analyse the influence of the phone position relatively to the head on the exposure of brain tissues. To analyze this influence we use 4 parameters defining a non-ambiguous position of the phone. In spite of important advances in High Performance Calculation the FDTD computational time doesn't allow using methods like Monte Carlo. We used the Polynomial Chaos to build a meta-model minimizing the computational cost.

PB-60 [10:00]**RF-Dosimetry of the domesticated Honey Bee (Apis Mellifera) in the Frequency Range from 500 MHz up to 20 GHz**

Richard Überbacher¹, Stefan Cecil¹ & Gernot Schmid¹

¹*EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

In this investigation the absorption of energy of honey bees in an electromagnetic field was evaluated by using numerical models of sitting and flying bees. The dielectric properties of the bees were evaluated by using a dielectric probe kit. The results of the numerical simulations showed, that the bees have a maximum of energy absorption at a frequency of 8,3GHz.

PB-62 [10:00]**Current densities and internal electric field from occupational exposure to electric fields in work tasks at 110 kV substations in the Tampere Region**

Rauno Pääkkönen¹, Hiroo Tarao², Fabriziomaria Gobba³ & Leena Korpinen⁴

¹*Finnish Institute of Occupational Health, Tampere, Finland*

²*Department of Electrical and Computer Engineering, Kagawa National College of Technology, Kagawa, Japan*

³*Department of Public Health Sciences, University of Modena and Reggio Emilia, Modena, Italy*

⁴*EPR, Environmental Health, Tampere University of Technology, Tampere, Finland*

The aim of this paper is to investigate the current densities and internal electric field induced from occupational exposure to electric fields in work tasks at 110 kV substations in the Tampere region using a sphenoid model. From the highest measured field the calculated current density was 4.2mA/m² and the internal electric field 0.4 - 0.8mV/m. Results show that even if the action values of the EU Directive 2004/40/EC were exceeded in some of the examined areas, the limit values were never exceeded. According to data, the limits of the Directive are currently respected in substations.

PB-64 [10:00]**Real-time assessment of hydrogen peroxide degradation by macrophages exposed in vitro to a ULF magnetic field**

Stephane Egot-Lemaire¹, Mark Bouwens², Roger Sladek³, Charles Joenathan³, Walter Balcavage⁴, Jan Cuppen⁵ & Gabi Waite¹

¹*Cellular and Integrative Physiology, Indiana University, Terre Haute, IN, USA, 47809*

²*Cell biology and Immunology Group, Wageningen University, Wageningen, the Netherlands*

³*Physics and Optical Engineering, Rose-Hulman Institute of Technology, Terre Haute, IN, USA*

⁴Biochemistry and Molecular Biology, Indiana University, Terre Haute, IN, USA, 47809

⁵Immunent B.V., Veldhoven, the Netherlands

This study tests the hypothesis that a magnetic field produced by the Immunent signal can modulate the activity of human macrophages in vitro, in regards to H₂O₂ degradation. To assess potential changes in real time, a flow system was built. Whether the cells were kept at ambient oxygen conditions, or at 1% oxygen concentration for 4 hours before the test, no effect of the magnetic field could be found as compared to sham exposures.

PB-66 [10:00]

Time reduction to demonstrate SAR compliance of GSM/UMTS mobile phones

Mauro Francavilla¹

¹Testing Labs, Telecom Italia, Turin, Italy, 10148

SAR (Specific Absorption Rate) measurement procedures have been defined in several International Standards. Multiple tests may be necessary to demonstrate compliance, which became a time consuming issue.

Here, a statistical based approach is introduced, to reduce the time needed to demonstrate compliance in the case of GSM900, DCS1800 and UMTS band I handsets. The method introduces a threshold value to check whether the “zoom scan” session, in the generic measurement procedure, is really needed.

PB-68 [10:00]

The ERNAM project: exposure of neuronal networks to the GSM-1800 signal

Daniela Moretti¹, Noëlle Lewis¹, André Garenne², Florence Poulletier De Gannes¹, Emmanuelle Haro¹, Isabelle LaGroye¹, Yannick Bornat¹, Youssef Boutaib¹, Sylvain Saighi¹, Sylvie Renaud¹ & Bernard Veyret¹

¹IMS laboratory, University of Bordeaux, Pessac, France, 33607

²MAC laboratory, Univeristy of Bordeaux, Bordeaux, France, 33076

In the context of several recent reports showing that RF exposure alters the EEG spectrum, we developed a new RF exposure system (TEM cell, GSM-1800 signal) in which neuronal networks (from the cortex of rat embryos) are cultured in MEAs (multiple electrode arrays). The neurons are exposed on top of electrodes which allows the acquisition of the extracellular electrical activity of the neurons (spikes) with/without exposure. The first results will be presented at the meeting.

PB-70 [10:00] - STUDENT PAPER

Sensitivity of Dielectric Spectroscopy in Cell Suspensions

Christian Beyer¹, Niels Haandbaek², Ludovica Colella³, Philippe Renaud³, Mark Talary⁴, Andreas Hierlemann² & Jürg Fröhlich¹

¹Laboratory for Electromagnetic Fields and Microwave Electronics, Zurich, Switzerland, 8092

²Bio Engineering Laboratory, Zurich, Switzerland, 8092

³Laboratory of Microsystems (LMIS 4), Lausanne, Switzerland, 1015

⁴Solianis Monitoring AG, Zurich, Switzerland, 8050

An approach to sensing changes in biological cell features via dielectric impedance spectroscopy comprising experiments and numerical analysis has been outlined. The focus of this study was on assessing the sensitivity to specific changes in microscopic cell features and the correlation to changes in the measured spectrum. Preliminary results have been presented.

PB-72 [10:00]

Infection pressure increases mortality decrease and productivity improvement in farmed animals exposed to extremely low frequency electromagnetic fields

Jan Cuppen¹

¹Immunent BV, Veldhoven, the Netherlands, 5508HB

Immune stimulation by ELF, Immunent signal, between 0.03 μ T and 5 μ T was applied in field studies at 5 commercial chicken farms and 6 rabbit farms. In an earlier experimental setup significant improvements in mortality, growth and feed conversion were obtained. In field trials these only occurred in situations with infection outbreaks, weak animals and/or bad circumstances. Implications for practical application of immune stimulation by EMF, including in human medicine, are discussed.

PB-74 [10:00]

Isotropy of four different radiofrequency dosimeters

Dominique Picard¹, Luce Fouquet² & Sébastien Chauvin²

¹EMG-DRE, Supélec, Gif sur Yvette, France, 91192

²fréquences et protection, Bouygues Telecom, Issy les Moulineaux, France, 92130

It is possible to evaluate the exposure of a person to the electromagnetic fields using a personal dosimeter. This device is carried to the body. It measures and records the level of the electromagnetic field. There exist several models of radio frequency dosimeters and we studied their performances. This paper presents a study of the isotropy of the different dosimeters. The isotropy is measured in three perpendicular planes for parallel and orthogonal polarizations.

PB-76 [10:00]**Mobile phone use, blood lead and attention deficit hyperactivity**Mina Ha¹ & Nam Kim²¹Preventive Medicine, Dankook University, Cheonan, Korea, 330 714²Chungbuk National University, Cheongju, Korea, 361 763

To examine the possible association between mobile phone use and ADHD considering the effect of lead exposure on ADHD. A total of 2,189 school-aged children was evaluated using a Korean version of the ADHD rating scale and questions about ownership and use of a mobile phone. The ADHD was associated with mobile phone use for voice calls when excluding children with high blood lead levels without dose-response relationships. A possible reverse causality could not be ruled out.

PB-78 [10:00]**Measurements of Digitally Modulated Pulsed RF Signals using Isotropic Broadband Probes**Thierry Letertre¹, Vikass Monebhurrn² & Zeno Toffano¹¹Department of Telecommunications, SUPELEC, Gif-sur-Yvette Cedex, France, 91192²Department of Electromagnetics, SUPELEC, Gif-sur-Yvette Cedex, France, 91192

Measurements of digitally modulated pulsed RF signals using isotropic broadband probes may yield incorrect electric field evaluations. The responses of two such commercially available probes are herein examined. Both probes provide underestimations of the electric fields in the case of WIMAX signals. Appropriate correction factors are proposed to account for the underestimations.

PB-80 [10:00]**Information Overload – A Challenge in EMF Risk Communication**Frank Gollnick¹, Gabi Conrad¹, Annette Hillebrand¹, Franz Büllingen¹ & Karl-Heinz Neumann¹¹Working Group “EMF and Environment”, WIK – Scientific Institute for Infrastructure and Communication Services, Bad Honnef, Germany, D-53604

To improve the situation of large inconsistency between scientific evidence and public perception in EMF risk communication, the WIK “EMF and Environment” Working Group took measures leading to a better information flow. For RF and ELF frequency ranges, the group provides concentrated, unbiased, easy to understand information about science and public discourse. The established information products include website, weekly newsletter, quarterly scientific magazine, and an extranet for clients.

PB-82 [10:00]**Effect of Whole Body Exposure to 845 MHz Radiofrequency Mobile Phone on Hippocampal and Subventricular Neurogenesis in Rat Brain. - Preliminary Report**Young Hwan Ahn¹, Hae Sun Kim¹, Youn Ju Kim¹, Man Jeung Paik², Gwang Lee², Yun-Sil Lee³ & Nam Kim⁴¹Department of Neurosurgery, Ajou University, Suwon, Korea, 442-721²Department of Molecular Science and Technology, Ajou University, Suwon, Korea, 442-721³Division of Life Science and Pharmaceuticals, Ewha Woman's University, Seoul, Korea, 120-750⁴Department of Electrical and Computer Engineering, Chungbuk National University, Cheongju, Korea, 351-763

We investigated the effects of 845 MHz EMF exposure on the subventricular zone (SVZ) and hippocampal dentate gyrus in the adult brain. We observed that the number of BrdU positive proliferating cells did not significantly changed with EMF exposure. We suggest that subchronic EMF exposure does not cause a harmful effect on neurogenesis in adult rat brain.

PB-84 [10:00]**Effects of radiofrequency exposure in aged and Alzheimer's disease mice: combined behavioural, molecular and neurovascular studies**Isabelle LaGroye^{1,3}, Nathalie Macrez², Bernard Billaudel¹, Hiroshi Masuda¹, Nathalie Biendon², Florence Poullietier De Gannes¹, Emmanuelle Haro¹, Gilles Ruffie¹, Murielle Taxile¹, Jean-Luc Morel², Annabelle Hurtier¹, Bernard Veyret^{1,3} & Bruno Bontempi²¹IMS laboratory, CNRS, Pessac, France, 33607²Institute of Neurodegenerative Diseases, CNRS, Talence, France, 33400³Bioelectromagnetics Laboratory, EPHE, Pessac, France, 33607

We will investigate the effects of Wi-Fi signal exposures during normal and pathological ageing using a combined behavioural, molecular and neurovascular approach in aged and APP/PS1 double transgenic Alzheimer's disease (AD) rodents. Animals will be exposed to a Wi-Fi signal 2 h/day, 5 d/w, during 12 weeks at 0, 0.08, 0.4, and 4 W/kg.

PB-86 [10:00]**Characterisation and applications of fluorescent magnetic nanoparticles**Oscar Cespedes^{1,2} & Shoogo Ueno¹¹Applied Quantum Physics Department, Kyushu University, Fukuoka, Japan, 812-8581²School of Physics & Astronomy, University of Leeds, Leeds, UK, LS2 9JT

The biomedical applications of magnetic nanoparticles are rapidly extending from hyperthermia to gene delivering. We find that iron oxide nanoparticles have a fluorescence signal with Stokes shifts of 60-100 nm, and maximum excitation at 390 nm. The fluorescence is dependent on the local conditions, and can be used to determine the temperature, pH, iron loads in ferritin and rates for the

formation of different peptide bonds. Future applications include the detection and dissolution of beta-sheet aggregates that cause Alzheimers and other forms of dementia.

PB-88 [10:00] - STUDENT PAPER

A model to forecast actual cellphone use from recalled data

Mary Redmayne¹, Euan Smith¹ & Michael Abramson²

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Paired recalled and billed SMS data from a sample study (n = 113) with adolescents were used to develop a model for forecasting actual levels of use. Data were skewed; billed data were still not Gaussian after log transformation, but residuals after regression were so. A regression model with log-transformed data was tried but, because of scatter, exaggerated high end use. We therefore adopted a Bayesian approach using Maximum likelihood estimation of actual use, overcoming this problem.

PB-90 [10:00]

A Meandered Inverted-F Antenna for Ingestible Medical Devices

Seo Wonbum¹, Soonyong Lee¹, Uisheon Kim¹ & Jaehoon Choi¹

¹*Electrical and Computer Engineering, Hanyang University, Seoul, Korea, 133-791*

In this paper, a meandered inverted F capsule antenna is proposed for Ingestible Medical Devices. To study the effect of a human body, the antenna is placed in the various organs of the human body. The return loss, radiation pattern characteristics and SAR distribution of the antenna are discussed at the WMTS frequency band. The antenna has a wideband characteristic of 500 MHz for VSWR < 2 and an omnidirectional radiation pattern. The maximum 1-g average SAR value is 0.724 W/kg.

PB-92 [10:00]

Comparison of Different Safety Standards in Terms of Human Exposure to Electric and Magnetic Fields at 100 kHz

Jagadish Nadakuduti¹, Mark Douglas¹, Pedro Crespo-Valero² & Niels Kuster¹

¹*ITIS Foundation, Zurich, Switzerland, 8004*

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At frequencies up to 100 kHz, the basic restrictions on electromagnetic field exposure are defined differently in several international standards. There is a need to understand how product compliance is affected by these different basic restrictions. In this study, human anatomical models are exposed to uniform electric and magnetic fields at 100 kHz. A comparison is made between the basic restrictions in four international standards.

PB-94 [10:00]

Assessment of the Welder's Exposure to the Magnetic Field according to the Welding Type in Korea

Seung-Cheol Hong¹ & Yoon-Shin Kim²

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²*Institute of Environmental and Industrial Medicine, Seoul, Korea*

This is on-going study. To evaluate the 24 h individual exposure of welders, who are supposedly more exposed to the magnetic field than other occupation groups, was measured, and the difference in the magnetic field exposure was examined by welding type.

PB-96 [10:00] - STUDENT PAPER

THE UNDERLYING MECHANISMS AND BIOLOGICAL CONSEQUENCES OF ELEVATED γ H2AX FOCI FORMATION IN HUMAN SKIN FIBROBLASTS IN RESPONSE TO 1800 MHZ ELECTROMAGNETIC FIELD EXPOSURE

Shanshan Xu¹, Chunjing Chen¹ & Zhengping Xu¹

¹*Bioelectromagnetics Laboratory, Zhejiang University School of Medicine, Hangzhou, China, 310058*

By employing γ H2AX focus formation as a biomarker of early DSB, we have HSF cell as a kind of sensitive cells in response to 1800 MHz GSM mobile phone RF-EMF exposure from six different cell types. To further elucidate the biological consequences of elevated γ H2AX foci and its underlying mechanisms, we exposed the HSF cells to SAR 3 W/kg for 24 hr and then withdrew the fields, and further cultured the cells up to additional 48 hr. The cells were subjected to cell cycle, proliferation, apoptosis, redox status, genome stability, and DNA repair pathway analyses.

PB-98 [10:00]

Exposure close to the base station antennas

Dominique Picard¹, Luce Fouquet² & Sébastien Chauvin²

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²*Direction fréquences et protection, Bouygues Telecom, Issy les Moulineaux, France, 92130*

Base station antennas can expose people to radiofrequency electromagnetic fields. When the distance between the person and the antenna is sufficient, i.e. a few tenth of meter, it is possible to measure or evaluate the reference level as electric field. On the other hand, if the distance is very weak the problem is more difficult and it is then necessary to measure the basic restrictions i.e. the SAR. This study is devoted to the dosimetry of 8 different base station antennas.

PB-100 [10:00]**RF electromagnetic field exposure levels from cellular base stations**Byung Chan Kim¹¹Radio Technology Research Department, ETRI, Daejeon, Korea, 305-700

The measurement results of human exposure to CDMA800 and CDMA1800 signals at locations in Korea where the general public has expressed concern are presented. Measurements were performed at 50 locations across the country to compare the electromagnetic field levels with the general public exposure compliance limits. The measured exposure levels were very low compared with the international standard and the Korean human protection notice. The highest field level was 1.5 V/m, which corresponds to 0.15% of the ICNIRP guidelines for human exposure.

PB-102 [10:00]**Study on the Variation of the SAR Values for Mice or Rats in the Whole-Body Exposure Environment**Ji-Yeon Mun¹, Oh Joonhyeok¹, Mingyeong Seo¹, Tae-Hong Kim¹ & Jeong-Ki Paek¹¹Radio Science and Engineering, Chungnam National University, Daejeon, Korea

The objective of this study is to investigate the variation of the SAR values due to various exposure environments.

PB-104 [10:00]**Exposure to 2.45 GHz electromagnetic fields elicits a stress response in rat hippocampus**Zhou Zhou¹, Chuan Liu¹ & Zhengping Yu¹¹Key Laboratory of Medical Protection for Electromagnetic Radiation, Chongqing, China, 400038

To determine whether electromagnetic field exposure could be capable of producing stress responses, we analyzed 2,048 candidate genes in hippocampus. Of these genes, stress-associated proteins, such as heat shock proteins (HSPs), showed an increase in expression; this was further verified by immunocytochemistry. Nonlinear increases in HSP27 and HSP70 expression were confirmed by reverse-transcription PCR (RT-PCR) and Western blotting. Our data provide direct evidence that exposure to electromagnetic fields elicits a stress response in the rat hippocampus.

PB-106 [10:00]**Analysis of Magnetic Field Distribution Under EHV and HV Double-Circuit Power Lines**Takashi Matsumoto¹, Hitoshi Hirata¹, Hiroo Tarao², Noriyuki Hayashi³ & Katsuo Isaka⁴¹Electrical and Electronic Engineering, Anan National College of Technology, Anan-shi, Japan, 774-0017²Electrical and Computer Engineering, Kagawa National College of Technology, Takamatsu-shi, Japan, 761-8058³Electrical and Electronic Engineering, University of Miyazaki, Miyazaki-shi, Japan, 889-2192⁴Electrical and Electronic Engineering, The University of Tokushima, Tokushima-shi, Japan, 770-8501

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 (Extra High Voltage) and HV (High Voltage) double-circuit line conductors to decrease magnetic fields in the vicinity of the ground. In this paper, a special emphasis is placed on the effect of the phase order on the total magnetic field distribution.

PB-108 [10:00]**AN ANALYSIS OF THE EXPOSED MAGNETIC FIELD BEFORE & AFTER CONSTRUCTION OF TRANSMISSION LINE & SUBSTATION**Geun-Taek Yeo¹, Jeong-Il Hwang¹ & Byeong-Wook Min¹¹Transmission & Substation Construction Department, Korea Electric Power Corporation (KEPCO), Seoul, Korea, 135-791

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PB-110 [10:00]**Electrodermal activity at acupuncture points: literature review and recommendations for reporting clinical trials**Agatha Colbert¹, Keith Spaulding², Adrian Larsen³, Andrew Ahn⁴, Jan Cutro⁵ & Marko Markov⁶¹Helfgott Research Department, National College of Natural Medicine, Portland, OR, USA²D'Adamo Institute for the Advancement of Natural Therapies, Portsmouth, NH, USA³Miridia Technology Incorporated, Meridian, ID, USA⁴Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA, USA⁵New England School of Acupuncture, Newton, MA, USA⁶Research International, Williamsville, NY, USA

The research methodologies in clinical trials that measure electrodermal activity (EDA) at acupuncture points (APs) vary greatly and often lack sufficient details about electrical instrumentation and procedures for replication. Using a 10-category (54 sub item) Quality of Reporting scale, we reviewed 29 studies. Only 9 studies scored greater than 50% for describing essential information. To standardize research methods, we propose a checklist of items to be reported in future trials of EDA at APs.

PB-112 [10:00] - STUDENT PAPER

Exposure of children to intermediate-frequency magnetic fields generated by induction cookers

Bor Kos^{1, 2}, Blaz Valic², Damijan Miklavcic¹, Tadej Kotnik¹ & Peter Gajsek²

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²Institute of Non-ionizing Radiation, Ljubljana, Slovenia, 1000

Electric field (E) and induced current (J) inside 6- and 11- year old children generated by exposure to magnetic fields produced by an induction cooker were computed. Both E and J were found to be below the basic restrictions. However, our results indicate that E and J could exceed basic restrictions even with the appliance in compliance with the relevant standards.

PB-114 [10:00]

The Nociception Response to ELF Magnetic Field Exposure is an Ideal Observable in the Study of the Initial Biophysical Detection Mechanism

Frank Prato^{1, 2, 3}, John Robertson^{1, 3}, Dawn Desjardins-Holmes¹, Lynn Keenlside¹, Janice DeMoor¹, Robert Stodilka^{1, 2, 3} & Alex Thomas^{1, 2, 3}

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The discovery of the initial transduction mechanism has been one of the holy grails of bioelectromagnetics research. However the "observable" used in in vivo studies is always significantly removed from the initial biophysical event. This physiological filter inevitably distorts the important measurement with respect to amplitude and frequency responses. Here we present a strategy to address this issue.

PB-116 [10:00]

Short term exposure effect of electromagnetic fields on immune parameters of the mouse.

Linda De Jager¹

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The possible effects of a low frequency electromagnetic field on the immune system of mammals was investigated. Young adult mice, were continuously exposed or sham-exposed for one week to a low field strength. The total lymphocyte count, T helper cells, T suppressor, B lymphocyte and natural killer cells were determined with immunophenotyping. A statistically significant increase in the total lymphocyte count and the T lymphocyte count was found. The results thus indicate that ELF EMF significantly increases the number of lymphocytes.

PB-118 [10:00]

A 10 ohm generator for nanosecond pulsed electric fields: performances optimization

Ilaria Liorni¹, Caterina Merla², Delia Arnaud-Cormos³, Francesca Apollonio¹, Micaela Liberti¹ & Philippe Leveque³

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The development of generators for investigating nanosecond pulsed electric fields effects are of high importance. Recently, a 2 ns 10 Ω generator combining microstrip-line technology and laser-triggered photoconductive semiconductor switches was developed. Nevertheless, when the device is used in conjunction with standard electroporation cuvette a pulse deformation across the electrodes is observed. In this work we attempt to improve such deformation performing a broad band matching of the device to the biological load.

PB-120 [10:00]

Electric Shock Job Exposure Matrix

Ximena Vergara^{1, 2}, Leeka Kheifets¹, Michael Silva³, Dan Bracken⁴ & Michael Yost⁵

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To evaluate a consistent association between jobs in "electric" occupations and amyotrophic lateral sclerosis (ALS), a comprehensive job exposure matrix (JEM) that includes electric shocks and magnetic fields is needed. We used existing data on electric shocks and electrocutions along with expert judgment to create a JEM that was integrated into an existing MF JEM. The final JEM contained electric-shock exposure assignment of low, medium or high for 501 job titles.

PB-122 [10:00]

NON-THERMAL EMF SIGNALS MODULATE CALMODULIN-DEPENDENT NITRIC OXIDE SIGNALING IN TISSUE MAINTENANCE AND REPAIR

Arthur Pilla¹, David Muehsam¹ & Diana Casper²

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²Neurological Surgery, Montefiore Medical Center, Bronx, NY, USA, 10467

This study showed that a non-thermal pulse-modulated RF signal could be configured to modulate CaM-dependent NO/cGMP signaling, assuming voltage-dependent Ca/CaM binding as the EMF target. Model predictions were tested on NO and cGMP production from MN9D dopaminergic neuronal cells. EMF significantly increased NO and cGMP, which was abolished by the CaM antagonist W-7. Results are consistent with a role for Ca/CaM-dependent NO production as an important mediator of EMF bioeffects.

PB-124 [10:00]

Static and ELF magnetic field levels generated by photovoltaic system

Tatsuya Tsukada¹, Hiroyuki Yomori¹, Chiyoji Ohkubo¹ & Katsuo Isaka²

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²The University of Tokushima, Tokushima-city, Japan, 770-8506

The photovoltaic systems (PV) have been increasingly installed in Japan as possible alternatives of fossil fuels, while the magnetic fields from PV cause some people health concern. We measured the static field from PV panels with cancellation of geomagnetism, and the AC fields from power inverters. The static fields at 0.20m from PV panels are much smaller than geomagnetism. The EMF magnetic field levels at 0.20m from power inverters are estimated to be similar to those of other electric appliances.

PB-126 [10:00]

Do Magnetic fields bioeffects brought into play a Cellular Perception?

Pierre Le Chapellier¹

¹Service Algologie, Algology Department, Centre Hospitalier de Soissons, Soissons General Hospital, Soissons, France, 02200

Static Magnetic Fields, SMF, induce bioeffects in living cells, which must be explained, because they have no clear Reductionist explanation. An epistemological use of Philosophy of Nature introduces here to cellular perception and to qualitative topology concepts. Under SMF exposure, an evolution of the medium qualitative topology may arouse possible cell bioeffects through a modulation of cellular perception.

PB-128 [10:00] - STUDENT PAPER

Study Of The Effects Of Pulsed Temperature Stimulus On Fibrosarcoma HT1080 Cells

Lucas Portelli¹, Aditya Kausik¹, Carlos Martino¹ & Frank Barnes¹

¹Electrical, Computer and Energy Engineering, University of Colorado, Boulder, CO, USA, 80309

We cultured fibrosarcoma HT 1080 cells in a thermoelectric actuator in order to generate a pulsed temperature waveform around 37°C but with AC amplitude varying at +/- 0.5, 1.5 and 2 °C. Temperature pulsing at relevant metabolic frequencies had a limiting effect on cells replication of around 20% for the exposure parameters tested, increasing as the AC temperature increased.

PB-130 [10:00] - STUDENT PAPER

Shifts In Ambient Magnetic Fields Effects In Murine Melanoma Models In-Vivo And In-Vitro

Lucas Portelli¹, Gail Ackerman², Luis Martinez², Kim Man Loh¹ & Frank Barnes¹

¹Electrical, Computer and Energy Engineering, University of Colorado, Boulder, CO, USA, 80309

²Molecular, Cellular and Developmental Biology, University of Colorado, Boulder, CO, USA, 80309

Past work has shown reduction in cancer cell growth rates by changing the Ambient Magnetic Fields. This has been proven to be true in our lab in in-vitro as well as in in-vivo in SKID models. Now we have studied the effects of affected Ambient Magnetic Fields in B16-B16 murine melanoma cells as well as in C57BL/6 mice.

PB-132 [10:00]

Maximum peak power density values as a more reliable marker for measurement procedures to elucidate RF EMF health effects: Leganes project.

Ceferino Maestu Unturbe¹, Álvaro Cortés¹, Noé Jiménez¹, Rocío López¹ & Francisco Pozo Guerrero¹

¹Centro de Tecnología Biomédica, Madrid, Spain, 28223

Considering the measurement procedures recommended by the ICNIRP, this communication is a proposal for a measurement procedure based in the maximum peak values of equivalent plane wave power density. This procedure has been included in a project being developed in Leganés, Spain. The project plans to deploy a real time monitoring system for RF to provide the city with a useful tool to adapt the environmental EM conditions to the new regulations approved. A first stage consisting of 105 measurement points has been finished and all the values are under the threshold of the regulation.

PB-134 [10:00]

Alterations in acetylcholine release in hippocampus of mice brain after exposure of radiofrequency radiation of CDMA Cellular phone

Neeraj Kumar¹

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We studied acetylcholine (ACh) release after acute exposure in the rat brain exposed for 3 h per day and 7days in a week from CDMA cellular phone. 10 pairs of 30 days old mice was grouped as control and exposed. CCPE cage was specially designed for exposure from the cellular phone to the mice in the natural environment and mice were allowed to move around the device within

circular area of 10 cm radius. The exposure of 3h/day from CDMA cellular phone could not show a significant alteration of Ach release in compare to controls.

PB-136 [10:00]

EMF and Health: Predicting Human Disease Using Microarrays and Pathway Analyses

Meike Mevissen¹, Fred Parham², Xiaoqing Chang² & Christopher Portier³

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Gene expression can predict effects from exposure to chemical agents. We used pathway-based analyses to identify linkages between exposure to EMF and human disease. Several studies evaluated changes in gene expression in cells following EMF exposure and were linked to KEGG pathways. We linked KEGG pathways to human diseases using genetic polymorphisms. Given the linkages between EMF and pathways and pathways and human diseases, we predict plausible linkages between EMF and human disease.

PB-138 [10:00]

Modification of the body energy balance in developing rats exposed to a radiofrequency electromagnetic fields

Amandine Pelletier¹, Stéphane Delanaud¹, Jean-Pierre Libert¹, Véronique Bach¹, Gyorgy Thuroczy², Rene De Seze² & Nathalie Loos¹

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Sleep disturbances by radiofrequency electromagnetic fields (RF-EMF) are controversial. We hypothesize that the effects of RF-EMF exposure on homeostatic functions such as sleep could be dependent from thermal condition. In the present study, the effects of a continuous RF-EMF exposure were investigated on 3 main functions implicated in the body energy balance: sleep, locomotor- and feeding- activities in developing rats at ambient temperature of 24°C and 31°C.

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Mobile Manufacturers Forum

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U.S. Air Force Research Laboratory, 711th Human Performance Wing, Radio Frequency Radiation Branch in Brooks Air Force Base began in 1968 under the leadership of John C. Mitchell. Today it is one of the largest centers for the study of the effects of RFR on humans and their environment. Original research is conducted in the science of RFR dosimetry and RFR bioeffects. Quality research is promoted through the publication of the USAF RFR Dosimetry Handbook and support of the International EMF Dosimetry Project. International RFR standards development and harmonization are promoted by working with the IEEE and the World Health Organization. Lt. Col. Scott Nicholson is the Chief of the Radio Frequency Radiation Branch.

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The GSM Association (GSMA)



The GSM Association (GSMA) represents the interests of the worldwide mobile communications industry. Spanning 219 countries, the GSMA unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organisations. The GSMA is focused on innovating, incubating and creating new opportunities for its membership, all with the end goal of driving the growth of the mobile communications industry.

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