

BioEM2015

14-19 June

Asilomar Conference Center

California USA

The Annual Meeting of
Bioelectromagnetics Society

European Bioelectromagnetics Association



www.bioem2015.org

PROGRAM



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Local Organizing Committee



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From the Chair of the Local Organizing Committee

Welcome to Northern California! Asilomar, a name created from Spanish roots (“asilo” meaning refuge or retreat, and “mar” meaning sea) is literally a refuge by the sea. It offers an architecturally interesting and picturesque retreat space and is considered one of the best conference centers in the United States. I am sure that you will enjoy your time here. One major advantage of this meeting site is that it is structured to provide many opportunities for networking and interactions, including ongoing conversations over shared meals in the common dining area.

One concern we’ve heard about previous meetings is that the poster sessions seem too rushed. Here you will find that we have moved the poster sessions to the evening hours, allowing 2 hours of free time every day for you to explore the beautiful Pacific Ocean location of Asilomar. We are also extending the poster sessions to 3 hours each, with refreshments and snacks available for your enjoyment during each session. We’ve also been able to find a very pleasant space for the posters that allows all posters to remain up for the entire meeting.

All of the Plenary Sessions will be held in Merrill Hall with the parallel platform sessions being held next door to each other in Fred Farr and Kiln. This will allow you to easily move between sessions.

Our Wednesday banquet will be held at the Monterey Bay Aquarium, a world renowned showcase for the sea life found in one of the world’s richest marine regions. You’ll find more than 35,000 creatures there, representing over 500 species, in a setting that is as spectacular as the region. Following the BioEM tradition, there will be dancing after dinner.

We are very grateful for the generous support of our sponsors, listed both on the meeting website and at the end of this booklet. We also thank Lisa Marciano and her colleagues at Peak Travel for their help with the website and registration for the meeting.

Welcome to Asilomar! I look forward to seeing you throughout the week.

Richard Nuccitelli
Chair, Local Organizing Committee

Technical Program Committee



Thomas Vernier
Co-chair
United States



Niels Kuster
Co-chair
Switzerland



Meike Mevissen
Switzerland



Micaela Liberti
Italy



Heidi
Danker-Hopf
Germany



Francesca
Apollonio
Italy

From the Co-chairs of the Technical Program Committee

Dear Colleagues and Guests,

It is our great pleasure to welcome you to beautiful Asilomar, California for the 2015 Joint Annual Meeting of The Bioelectromagnetics Society (BEMS) and the European BioElectromagnetics Association (EBEA), BioEM2015.

As the preeminent annual gathering for scientists in bioelectromagnetics, the Annual Meeting showcases the full spectrum of translation in bioelectromagnetics, from discoveries in basic research and insights into the interactions of electromagnetic fields (EMF) with biological systems to the potential technical and medical applications of EMF. Our small but prestigious societies generates and disseminates interdisciplinary knowledge through research, innovation, and education; by facilitating and encouraging open debate and high-level discourse; and by helping researchers and students build global networks of collaboration and cooperation. As we gather at a site famous for scientific meetings, Asilomar, on the Pacific coast of the Monterey Peninsula in northern California, BioEM2015 is intended to stimulate further research in bioelectromagnetics through the exchange of ideas and lively debate on state-of-the-art knowledge in a location ideal for scientific conversation and contemplation.

Drawn in part from the over 200 abstracts submitted by distinguished researchers from 34 countries, this year's meeting brings a diversity of topics and a plurality of interests and perspectives to the five days of robust scientific sessions, informative workshops, celebrated lectures, and celebrations, including five plenary sessions, 14 platform sessions, two poster sessions preceded by flash student poster presentations, and four workshops. In keeping with tradition, the three best student poster presenters and the three best student oral presenters will receive awards on the final day as they represent the future of bioelectromagnetics and our societies. BioEM2015 is also proudly hosting the inaugural Chiabrera Lecture to be given by Maxim Zhadobov, the first recipient of the Alessandro Chiabrera Award for Excellence in Bioelectromagnetics, an honor bestowed on an outstanding young researcher by EBEA. In addition, the prestigious d'Arsonval Award from BEMS will be presented to Dr. James C. Weaver this year for his wide-ranging contributions on cells and organisms in weak electric and magnetic fields, followed by an intriguing lecture highlighting his numerous and essential research contributions.

BioEM2015 provides a unique opportunity for researchers, experts, and students to meet and interact, to inspire and be inspired, and to share visions for the future of the field, while also enjoying an enriching social experience in the natural beauty and offerings of Asilomar and its surroundings. This opportunity and the success of the Annual Meeting are made possible by the tremendous efforts and dedication of our volunteers and members, in particular, the members of the Technical Program Committee, Rich Nuccitelli and the Local Organizing Committee, and Jeffrey Carson and Astrid Chamson-Reig from Lawson Health Research Institute in Canada.

We thank you for your participation in the meeting and for your continued support of BEMS and EBEA. Enjoy!

Niels Kuster and P. Thomas Vernier
Co-Chairs, Technical Program Committee, BioEM2015

Technical Program Review Committee



Francesca
Apollonio
Italy



Quirino Balzano
United States



Carl Blackman
USA



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Myrtil Simko
Austria



Eric Van Rongen
Netherlands



Marthinus Van
Wyk
South Africa



Thomas Vernier
United States



Jianqing Wang
Japan



Jonna Wilen
Sweden



Andrew Wood
Australia



Sachiko
Yamaguchi-Sekino
Japan



Luigi Zeni
Italy



Olga Zeni
Italy



Gunde
Ziegelberger
Germany

Schedule at a Glance

NO PHOTOS ARE ALLOWED DURING THESE PRESENTATIONS

Sunday, June 14, 2015

Time	Session	Name	Location
07:30 - 08:30		Breakfast	Crocker Dining Hall
08:30 - 14:00	M1	BEMS Board Meeting	Oak Shelter
08:30 - 14:00	M2	EBEA Council Meeting	Evergreen
08:30 - 17:00	W1	Workshop I — IEEE ICES - Current status of LF dosimetry modeling	Chapel
12:00 - 13:00		Lunch	Crocker Dining Hall
13:00 - 18:00		Registration	Merrill Hall
18:00 - 19:00		Dinner	Crocker Dining Hall
19:00 - 22:00		Reception	Barbecue Pit
20:00 - 22:00		Student icebreaker	Surf and Sand

Monday, June 15, 2015

Time	Session	Name	Location
07:30 - 08:30		Breakfast	Crocker Dining Hall
08:45 - 09:00		Welcome - Introduction	Merrill Hall
09:00 - 10:45	PI	Plenary I: 2B or not 2B: Should IARC's classification of RF-EMF invoke the precautionary principle?	Merrill Hall
10:45 - 11:15		Coffee Break	
11:15 - 12:00	FA	Student Flash Poster Session A	Merrill Hall
12:00 - 13:00		Lunch	Crocker Dining Hall
13:15 - 14:15	FB	Student Flash Poster Session B	Merrill Hall
14:30 - 15:50	01	Epidemiology and Exposure Evaluations I (ELF EMF)	Fred Farr Room
14:30 - 15:50	02	Methods Toward Mechanisms	Kiln Room
15:50 - 16:05		Coffee Break	
16:05 - 17:25	03	EMF Effects and Underlying Mechanisms	Fred Farr Room
16:05 - 17:25	04	Human Neurophysiology and Motor Control	Kiln Room
18:00 - 19:00		Dinner	Crocker Dining Hall
19:00 - 22:00	PA	Poster Session A	Fireside Underground

Tuesday, June 16, 2015

Time	Session	Name	Location
07:30 - 08:30		Breakfast	Crocker Dining Hall
08:45 - 09:00		Introduction	Merrill Hall
09:00 - 09:45	DA	The d'Arsonval Lecture. James Weaver: A curious pursuit of research	Merrill Hall
09:45 - 10:15		Coffee Break	
10:15 - 11:55	05	Epidemiology and Exposure Evaluations 2 (RF EMF)	Fred Farr Room
10:15 - 11:55	06	Toward Cancer Treatment 1 (Exposure Conditions and Mechanisms)	Kiln Room
12:00 - 13:00		Lunch	Crocker Dining Hall
12:00 - 13:00	M3	EBEA General Assembly	Woodlands Dining Room
13:15 - 13:25		Introduction	Merrill Hall
13:25 - 13:45	CL	Chiabrera Lecture. Maxim Zhadobov: Bioelectromagnetics Applied to Emerging Body-Centric Wireless Technologies	Merrill Hall
13:45 - 14:45	P2	Plenary 2: Dosimetry — gaps, challenges	Merrill Hall
14:45 - 15:00		Coffee Break	
15:00 - 16:20	07	EMF Safety 1: ELF/IF (Standards, Mechanisms, Policy)	Fred Farr Room
15:00 - 16:20	08	Toward Cancer Treatment 2 (Exposure Conditions, Methods, Applications)	Kiln Room
16:20 - 18:00		Free time	
18:00 - 19:00		Dinner	Crocker Dining Hall
19:00 - 22:00	PB	Poster Session B	Fireside Underground

Wednesday, June 17, 2015

Time	Session	Name	Location
07:30 - 08:30		Breakfast	Crocker Dining Hall
08:45 - 09:45	P3	Plenary 3: Electric fields and nonresectable tumors — clinical practice and physical models	Merrill Hall
09:45 - 10:15		Coffee Break	
10:15 - 11:55	09	EMF Safety 2: Thermal (Standards, Mechanisms, Policy)	Fred Farr Room
10:15 - 11:55	10	EMF: Microscale and Nanoscale Effects	Kiln Room
12:00 - 13:00		Lunch	Crocker Dining Hall
13:00 - 18:00		Open afternoon	Buses to Monterey and Carmel
18:00 - 19:00		Dinner (not banquet attendees)	Crocker Dining Hall
19:00 - 22:45		Banquet - Sponsor recognition	Monterey Bay Aquarium

Thursday, June 18, 2015

Time	Session	Name	Location
07:30 - 08:30		Breakfast	Crocker Dining Hall
08:45 - 09:45	P4	Plenary 4: Electrohypersensitivity (Idiopathic environmental intolerance to EMF)	Merrill Hall
09:45 - 10:15		Coffee Break	
10:15 - 11:55	I1	EMF Safety 3: SAR (Standards, Mechanisms, Policy)	Fred Farr Room
10:15 - 11:55	I2	Neuroplasticity <i>in vivo</i> and <i>in vitro</i> I	Kiln Room
12:00 - 13:00		Lunch	Crocker Dining Hall
12:00 - 13:00	M4	BEMS Business Meeting	Woodlands Dining Room
13:15 - 14:45	W2	Workshop 2 - Contemporary issues relevant to EMF/RF guidelines & standards	Merrill Hall
15:00 - 18:00	W3	Workshop 3 - Safety of wireless transmitting devices	Merrill Hall
16:30 - 18:00		Free time	
18:00 - 19:00		Dinner	Crocker Dining Hall
19:00 - 20:00	W4	Workshop 4 - Submitting papers for publication in Bioelectromagnetics	Merrill Hall
20:00 - 22:00		Poster Party	Fireside Underground

Friday, June 19, 2015

Time	Session	Name	Location
07:30 - 08:30		Breakfast	Crocker Dining Hall
08:45 - 09:45	P5	Plenary 5: Electric fields and calcium signaling	Merrill Hall
09:45 - 10:15		Coffee Break	
10:15 - 11:15	I3	EMF Safety 4: SAR (Standards, Mechanisms, Policy)	Fred Farr Room
10:15 - 11:15	I4	Neuroplasticity <i>in vivo</i> and <i>in vitro</i> 2	Kiln Room
11:30 - 11:50	SA	Student Awards	Merrill Hall
11:50 - 12:00	CC	Closing Ceremony	Merrill Hall
12:00 - 13:00		Lunch	Crocker Dining Hall
13:00 - 18:00	M5	BEMS Board Meeting	Marlin
13:00 - 18:00	M6	EBEA Council Meeting	Curlew

General Information

REGISTRATION AND INFORMATION DESK

The Registration and Information Desk will be located in the rear of Merrill Hall beginning Sunday afternoon, June 14th at 3 pm and will be open throughout the days during the meeting.

WELCOME FUNCTION

Sunday, June 14th, 7 pm, Barbeque area west of Crocker Dining Room

STUDENT ICEBREAKER

Sunday, June 14th, 8 pm, Surf and Sand Meeting Room

CONFERENCE BANQUET

Wednesday, June 17th, 7 - 10 pm, Monterey Bay Aquarium

THE CONFERENCE VENUE

Asilomar Conference Center is located on the Pacific Ocean in Pacific Grove, California 2 hours' drive from San Francisco. You will be staying in private cabins nestled among spruce, juniper, pine and redwood trees. Wi-Fi service is offered complimentary in the Business Center and the Phoebe Hearst Social Hall. There is also complimentary Wi-Fi service available in all our guest rooms and meeting rooms.

JITNEY SERVICE:

Jitney service is provided 24 hours/day for registered conference attendees.

Wheelchair (push type only) vans are available to transport guests to and from their sleeping or meeting rooms. Luggage assistance is available to the elderly or disabled only; "bell" service is not available from Asilomar employees. There is no charge for the service, which can be accessed by dialing "0".

HOUSEKEEPING:

One-day laundry service is available (for a fee) if items are brought to the Asilomar Front Desk in the Hearst Social Hall by 8:30 am (Monday - Saturday). Rollaway beds, cribs, irons, ironing boards, hair dryers, and extra blankets or pillows can be delivered to guestrooms by Asilomar's housekeeping staff.

(3) Ice machines are located on the Asilomar grounds (see Asilomar Grounds Map). Ice buckets are located in the guestrooms.

Call housekeeping extension 2276 for lost items. Articles left in rooms will be held for 90 days.

For lost keys or meal tickets, go to the Asilomar Front Desk for assistance.

BUSINESS CENTER:

The Business Center is located next to Asilomar Front Desk in the Hearst Social Hall and is open from 6:30 am - 12 midnight daily.

Safe deposit boxes are available at the Front Desk.

PARK STORE:

Located in the Phoebe A. Hearst Social Hall across from the Front Desk, the Park Store is open daily from 8:00 a.m. to 8:00 p.m. Here are just a few of the items that can be purchased at our Park Store: Bike Rentals, Beverages, Snacks, Sundries, Gifts, Clothing

PHOEBE'S CAFÉ:

Asilomar has created an additional venue within the Hearst Social Hall which has quickly become a favorite place to gather and relax for guests and local residents alike. Phoebe's Café has enhanced the Asilomar experience in a style that remains true to the historic nature of the entire grounds. The Café's Hours:

6:30 AM to 9:00 PM - Sunday through Thursday

6:30 AM to 10:00 PM - Friday and Saturday

PARKING:

Please park in designated areas. Please be aware of one-way roads, the speed limit of 10 mph, and loading zones. Roads must be kept clear at all times for emergency and service vehicles. Violators are subject to citation under the California Vehicle Code and under California State Park Rules and Regulations. We request that you strictly observe the 10-minute parking zone next to the Hearst Social Hall.

EMERGENCIES:

In case of emergency, please dial "0" from any house phone and encourage all attendees to do the same. This process ensures that Asilomar staff knows where the emergency is located and are then able to direct emergency vehicles to that location.

SURROUNDING ENVIRONMENT:

Asilomar's 107 acres are dedicated to a natural ecological environment. Please walk on paved areas only. The dunes are a particularly fragile environment, and we request that you use the boardwalk that leads you to a vista point and to the beach. Also, please be aware that Poison Oak is abundant on the Asilomar grounds.

SWIMMING

Park guest can unwind in Asilomar's outdoor heated swimming pool, open from dawn to dusk each day, year-round. Towels are available for use at the pool only.

Please note: There is no life guard on duty at the pool.

BIKING

Trail riding or beach riding - why not do both? If you don't have your own bike, we have bikes available for rent at the Park Store.

BILLIARDS

We have two antique billiard tables located in the Hearst Social Hall. Use of these billiard tables is complimentary.

ORAL AND POSTER PRESENTATION GUIDELINES

Please find below some potentially useful material to assist you in preparing a presentation for BioEM2015.

Papers are to be presented in two basic formats: Oral and Poster Presentations. Below you will find specific information concerning these two formats.

If for any reason you find yourself unable to personally present your paper, please try to arrange for someone else to present it. **If nobody is available to present your work, you must notify the TPC Chairs well ahead of time (at tpc@bioem2015.org). If the presentation does not take place, without having previously notified the TPC, the corresponding abstract will be removed from the online abstract book.**

NO PHOTOS ARE ALLOWED DURING THESE PRESENTATIONS

Oral Presentations

All oral presentations have been allocated a 20-minute time slot. These 20-minutes must include the presentation, questions, and transitioning to the next speaker. It is recommended that speakers plan on a 15-minute presentation to allow for 5 minutes of questions. It is important to strictly adhere to this schedule as most oral presentations are scheduled in parallel sessions. Arrive at least 10 minutes early prior to the start of the session and introduce yourself to the chair while familiarizing yourself with the audiovisual equipment and session chair guidelines.

Each meeting room will be equipped with a personal computer to accommodate PowerPoint and PDF presentation formats with Quicktime, avi and other movie formats. Technical support will be present in each meeting room to ensure flawless execution. Authors must load their presentations onto the designated computer at the conference venue on the day before their session. Presenters will not be allowed to connect their own computer to the projection system. Presentations can be loaded via either CDROM or USB flash memory stick. Authors are urged to try to minimize any potential problems by taking advantage of redundancy whenever possible: save and bring presentations in multiple formats (e.g., PowerPoint and Adobe pdf), store presentations in more than one media (e.g., a CD and a flash memory stick, etc.), and hand carry presentations during travel.

Student Poster Presentations with Flash Presentation

Poster sessions are an important part of the BioEM2015 conference and a method for immediate and effective communication between all those interested in specific subjects, actions or programs. Posters should be carefully designed and prepared to ensure their full impact.

The poster presenters are kindly requested to follow the instructions below:

- Two poster sessions, i.e., A on Monday, June 15, and B on Tuesday, June 16, are planned.
- **All student posters** will be presented as **poster flash presentation**. The two poster flash sessions will take place on Monday June 15, in Merril Hall from 11:15 to 12:00 (FA) and from 13:15 to 14:15 (FB).
- Please ensure that you plan your communication carefully. The language is English. Each presenter will have **2 minutes** time to present **4 slides maximum** for the flash presentation (discussions will follow afterwards at your poster). Please introduce yourself in the beginning of your presentation and point out the main findings of your work. Hence your presentation should not include new material that is not shown on your poster.
- The Chairs will call up the next presenter after the 2 min are over and you have to leave the podium.
- Please send your presentation to tpc@bioem2015.org by June 10, 2015 either in Powerpoint (.ppt) or PDF format, since all flash poster presentations will be uploaded beforehand on the same computer and in a single presentation. The presenters will not be allowed to use their USB memory sticks or laptops during the session.

The best student poster(s) will be awarded.

Poster Presentations

The Poster Sessions will be held in **Fireside Underground**. Double-sided boards will be available for each author to attach their posters to. Authors are advised to **limit their poster size to 120 cm (4 ft) wide by 90 cm (3 ft) high**. Double-sided tape will be provided by the organizers for mounting posters. The boards will be numbered to correspond with poster numbers in the Program and student posters will be clearly identified. The organizers are not liable for any poster materials.

Authors should be present at their stations for the duration of their assigned session to discuss their work and answer questions, as there will be a flux of attendees.

Mounting: Posters can be mounted anytime beginning on Sunday afternoon. Each board will be marked with the poster number, as indicated in the final program. Double sided tape will be provided to mount the posters.

Removal: Posters must be removed before June 19, 2015.

CONFERENCE ORGANIZERS

Peak Travel

Lisa Marciano
Vice President of Groups and Meetings
408.881.0910 direct
800.366.0455 main | 2510 ext
408.295.5661 fax

For details regarding registration
please contact:
RegMadeEasy Administrator
Email: support@regmadeeasy.com

Lawson Health Research Institute Website and Meeting Support

Abstract submission, abstract review, program and abstract books, student award judging, and meeting survey

Jeffrey Carson
Astrid Chamson-Reig

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Technical Program

Sunday June 14, 2015

Breakfast
Sunday June 14, 2015 • 07:30 - 08:30
Crocker Dining Hall

Session: M1
BEMS Board Meeting
Sunday June 14, 2015 • 08:30 - 14:00
Oak Shelter

Session: M2
EBEA Council Meeting
Sunday June 14, 2015 • 08:30 - 14:00
Evergreen

Session: W1
Workshop I — IEEE ICES - Current status of LF dosimetry modeling
Sunday June 14, 2015 • 08:30 - 17:00
Chapel
Chairs: Akimasa Hirata & J. Patrick Reilly

W1-1 [08:30] -
Organizers Opening Remarks

Akimasa Hirata¹ & J. Patrick Reilly²

¹*Nagoya Institute of Technology, Japan*

²*Metatec Associates, USA*

W1-2 [08:40] -
Rationale behind EMF Compliance Assessment Protocols

Andreas Christ¹ & Jafar Keshvari²

¹*Research Consultant, Cabo Frio, Brazil*

²*Microsoft Corporation, EMF Research and Standards, Espoo, Finland*

W1-3 [09:10] -
Measurement of dielectric characteristics of biological tissues from ELF to MMW frequencies

Kanako Wake¹, Kensuke Sasaki¹ & Soichi Watanabe¹

¹*National Institute of Information and Communications Technology, Tokyo, Japan*

W1-4 [09:40] -
The role of skin modelling in ELF/LF magnetic field exposure assessment based on IEEE C95.6 and ICNIRP 2010

Gernot Schmid¹

¹*Seibersdorf Laboratories, Austria*

W1-5 [10:20] -
Break - 10:20-10:40

**WI-6 [10:40] -
Review of ELF/LF dosimetry for magnetic field exposure in Japan**

Kenichi Yamazaki¹

¹*CRIEPI, Yokosuka, Japan*

**WI-7 [11:10] -
Modeling of transcranial Electrical Stimulation (tES): Implications for Safety and Efficacy**

Dennis Truong¹ & Marom Bikson¹

¹*City College New York, USA*

**WI-8 [11:40] -
Survey of Electrostimulation models**

J. Patrick Reilly¹

¹*Metatec Associates, USA*

**WI-9 [12:10] -
Break - 12:10-13:30**

**WI-10 [13:30] -
Magnetophosphene perception threshold in humans exposed to ELF MF up to 50 mT – experimental data and a modelling approach**

Alexandre Legros¹

¹*Lawson Health Research Institute, London, ON, Canada*

**WI-11 [14:00] -
Insights on human response to EMF exposure obtained by combining detailed anatomical induction models and modern neuronal dynamics models**

Esra Neufeld¹

¹*IT'IS Foundation, Switzerland*

**WI-12 [14:30] -
Multi-scale induction and electrostimulation model with experimental validation**

Ilkka Laakso¹ & Akimasa Hirata¹

¹*Nagoya Institute of Technology, Japan*

**WI-13 [15:00] -
Break - 15:00-15:20**

**WI-14 [15:20] -
Discussion on Future Research Topics**

Lunch
Sunday June 14, 2015 • 12:00 - 13:00
Crocker Dining Hall

Registration
Sunday June 14, 2015 • 13:00 - 18:00
Merrill Hall

Dinner
Sunday June 14, 2015 • 18:00 - 19:00
Crocker Dining Hall

Reception
Sunday June 14, 2015 • 19:00 - 22:00
Barbecue Pit

Student icebreaker
Sunday June 14, 2015 • 20:00 - 22:00
Surf and Sand

Monday June 15, 2015

Breakfast
Monday June 15, 2015 • 07:30 - 08:30
Crocker Dining Hall

Welcome - Introduction
Monday June 15, 2015 • 08:45 - 09:00
Merrill Hall
Chairs: Richard Nuccitelli & Niels Kuster

Session: P1
Plenary I: 2B or not 2B: Should IARC's classification of RF-EMF invoke the precautionary principle?
Monday June 15, 2015 • 09:00 - 10:45
Merrill Hall
Chairs: Kurt Straif & Niels Kuster

PI-1 [09:00] -
Should IARC's classification of RF-EMF invoke the precautionary principle?

Kurt Straif¹

¹Head of IARC Monographs Section, International Agency for Research on Cancer, Lyon, France



Biographical sketch

Dr Straif is Head of the IARC Monographs programme of IARC/WHO, Lyon, France. His research focuses on environmental risk factors for cancer. He serves on several national and international committees on primary and secondary prevention of cancer, and as the Scientific Director of the annual IARC International Summer School on Cancer Epidemiology.

He studied medicine and philosophy (theory of science) at the Universities of Liège, Heidelberg and Bonn. He is Board-certified in Internal Medicine and Occupational, Environmental and Social Medicine, and received his MPH and PhD in Epidemiology from the School of Public Health, University of California, Los Angeles.

Abstract

In 2011, an IARC Monographs Working Group evaluated the carcinogenic hazards from exposure to radiofrequency electromagnetic fields, including from exposures associated with use of cellphones. The INTERPHONE study, a multicentre case-control study, is the largest investigation of cellphone use and brain tumours (glioma, meningioma, acoustic neuroma). The odds ratio (OR) for ever vs never users was 0.81 (95% CI 0.70–0.94). For cumulative call time, ORs were uniformly below or close to unity for all deciles of exposure except for the highest decile (>1640 hours of use, OR 1.40, 95% CI 1.03–1.89). A pooled analysis from Sweden comprised two very similar studies of associations between cell/cordless phone use and glioma, meningioma, and acoustic neuroma. Use of a cellphone for more than one year gave an OR for glioma of 1.3 (95% CI 1.1–1.6). The OR increased with increasing time since first use and with total call time, reaching 3.2 (95% CI 2.0–5.1) for more than 2000 hours of use. Ipsilateral use of the mobile phone was associated with higher risk for glioma. The WG concluded that the epidemiological studies overall provided limited evidence of carcinogenicity and classified Radiofrequency Electromagnetic Fields as “possibly carcinogenic to humans” (Group 2B).

PI-2 [09:20] -
A Case for Precaution in the Application of the Precautionary Principle

Kenneth Foster¹

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Biographical sketch

Kenneth R. Foster is a Professor of Bioengineering at the University of Pennsylvania. He has been involved in EMF issues since 1971 in a variety of contexts.



Abstract

The Precautionary Principle (PP) has become enshrined in numerous international treaties and declarations and is, by the Treaty on European Union, the basis for European environmental law. Within the EU, the use of the PP is constrained by EU policy (in particular a 2000 commentary by the EU) and by a body of case law in international European tribunals; the US and Canada have no such legal precedent and little to guide its application. This talk will review recommendations for use of the PP that derive from the 2000 EU commentary against a background of several "precautionary" policies that have been proposed or adopted in the US and Canada for regulation of exposure to electromagnetic fields, as well as "precautionary" policies (or lack thereof) that have been proposed or adopted for other potentially hazardous agents. One can be sympathetic to the value of "precaution" in setting policies for risk management but at the same time aware of the need to avoid unwise applications of the PP.

Reference

Foster, Kenneth R., Paolo Vecchia, and Michael H. Repacholi. "Science and the precautionary principle." *Science* 288.5468 (2000): 979-981.4.

PI-3 [09:40] - The Precautionary Principle Should be Invoked for RF-EMF

Christopher Portier¹

¹Research Consultant, Thun, Switzerland



Biographical sketch

Dr. Portier is an expert in the design, analysis, and interpretation of environmental health data and has contributed to the development of national and international risk assessment guidelines. He has directed or contributed significantly to numerous scientific reviews including those for dioxins, aflatoxins, electromagnetic fields, diesel particle emissions and climate change. Dr. Portier has served on US NAS committees, has served on USEPA's Science Advisory Board and USEPA's Science Advisory Panel, and numerous other scientific committees. He has received numerous awards including the Spiegelman Award from the APHA and the Outstanding Practitioner of the Year Award from the International Society for Risk Analysis. Until 2013, Dr. Portier was the Director of the US National Center for Environmental Health and the US Agency for Toxic Substances and Disease Registry. Prior to CDC, Dr. Portier was the NIEHS Associate Director and Associate Director of the National Toxicology Program and has over 250 scientific publications.

Abstract

One of the most widely accepted definitions for the Precautionary Principle is from the Rio Conference in 1992 where Principle 15 states: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." A key aspect of invoking the Precautionary Principle is what, if any, actions that should be taken. For example, in California, the Safe Drinking Water and Toxic Enforcement Act (Proposition 65) is invoked if "an Authoritative Body" declares a chemical to have sufficient evidence for carcinogenicity (in animals and/or humans). When invoked, the chemical is added to the Prop 65 list and warnings are required to protect the general public. If RF EMF were a chemical, then California would require labeling of RF EMF devices for a possible cancer risk because IARC "is designated as authoritative for the identification of chemicals as causing cancer (Section 25306(m))." In the EU, the February 2000 Communication from the Commission on the Precautionary Principle states that "Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty." In addition, they state that action should be "proportional to the chosen level of protection" and "In some cases, the right answer may be not to act or at least not to introduce a binding legal measure." Thus, invoking the precautionary principle does not immediately mean actions should be taken. In my support for the resolution, I will demonstrate that a careful review of the scientific literature demonstrates there are potentially dangerous effects from RF EMF and that the data is insufficient to allow the risk to be determined with certainty.

Coffee Break
Monday June 15, 2015 • 10:45 - 11:15

Session: FA
Student Flash Poster Session A
Monday June 15, 2015 • 11:15 - 12:00
Merrill Hall
Chairs: Christopher Portier & Niels Kuster

FA-1 [11:17]
STUDENT PAPER

Effects of weak static and pulsed magnetic fields on fibroblast and fibrosarcoma cells under a controlled magnetic environment

Julian Cyrus¹, Aditya Kausik¹, Karthik Bangaloreradhakrishna¹, Tosin Feyintola² & Frank Barnes¹

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Keywords: In vitro, Pulsed, Work in Progress

Changes in the growth rates of fibrosarcoma and fibroblast cells for exposures to weak extremely low frequency magnetic fields (MF) are reported. Measurements of the oxidative stresses and cell counts show that the pulse repetition rates from once every 7 seconds to once every 20 seconds and magnetic fields in the range from 1 μ T to 200 μ T affect the fibrosarcoma cell to a greater extent than the fibroblast cells.

FA-2 [11:19]
STUDENT PAPER

IEI-EMF provocation case studies: A novel approach to testing sensitive individuals

Adam Verrender^{1,2}, Sarah Loughran^{1,2}, Vitas Anderson^{1,3} & Rodney Croft^{1,2}

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Keywords: Human, RF/Microwaves, Work in Progress

While it has been consistently shown that there is no relationship between RF exposure and self-reported symptoms, the possibility that exposure does play a causal role cannot be completely ruled out due to a number of methodological constraints. The present study will determine whether there is a relationship between RF exposure and self-reported symptoms using a number of individual case studies which incorporate several methodological improvements.

FA-3 [11:21]
STUDENT PAPER

Assessment of MRI patient exposure for epidemiological studies

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¹Department of Radiation Sciences, Umeå University, Umeå, Sweden

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

It is of interest to perform epidemiological studies on magnetic resonance imaging (MRI) patients to understand possible long-term effects. However, the switched gradient magnetic fields and the radiofrequency magnetic field of the MRI scanner are not well described from an exposure point of view. Our aim is to assess the radiofrequency- and switched gradient magnetic field exposure when varying scanner parameters such as bandwidth, flip angle, and slice thickness. A choice of MRI sequences will be evaluated over a span of internal parameters, to see if and how the exposure is affected by varying these parameters.

FA-4 [11:23]
WITHDRAWN

**FA-5 [11:26]
STUDENT PAPER**

Efficacy of ELF-MF in ameliorating oxidative stress in 6-OHDA model of Parkinson disease in rats

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

In unilateral intrastriatal 6-hydroxydopamine rat model, ELF-MF (50 Hz, 17.9 μT for 2h/d for 7days) significantly attenuated the oxidative stress; improved motor and non-motor symptoms and maintained dopamine concentration besides maintaining normal mitochondrial ultrastructure. The beneficial effect of ELF-MF in the progression of PD is mediated by attenuating oxidative stress

**FA-6 [11:28]
STUDENT PAPER**

Development of an instrument to measure the amount of RF absorption that takes place in humans

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¹Department of Electrical Engineering, University of North Dakota, Grand Forks, ND, USA, 58202

Keywords: Human, RF/Microwaves, Work in Progress

As a pilot project, we are examining the phenomenon known as Electron Spin Resonance (ESR) to determine the range of frequencies humans absorb the most. A system has been developed to test various samples pork, beef, chicken, as well as aqueous solutions of salt and sugar. Interpreting the results of this will aid in the development of safe use guidelines for consumer products.

**FA-7 [11:30]
STUDENT PAPER**

Investigation of the effects of Omega 3 and Melatonin on adult rat brain exposed to electromagnetic field

Gamze Altun¹, Süleyman Emre Kocacan², Ö. Gülsüm Deniz¹, Elvide Gizem Kivrak¹, Aysin Pinar Türkmen¹, Mehmet Emin Önger¹,

Berrin Zuhul Altunkaynak¹, Cafer Marangoz² & Süleyman Kaplan¹

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

Aim of the present study was to examine the possible structural and functional effects of 900 MHz electromagnetic field (EMF) on neuronal tissues and reveal the effects of omega 3 fatty acids (ω3) and melatonin (Mel) against to this exposure. We have demonstrated neuronal loss and low cognitive activity caused by EMF exposure. Mel and ω3 significantly contributed to prevent the neuronal loss.

**FA-8 [11:33]
STUDENT PAPER**

Effects of interaction with electromagnetic field on cell culture of *Saccharomyces cerevisiae*

Aracely Martínez¹, Julio César Villagómez², Modesto Antonio Sosa¹, Antonio Horta³ & Teodoro Cordova-Fraga¹

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²Departamento de Biología Celular, Universidad de Guanajuato, Guanajuato, Mexico, 36050

³Departamento de Ingeniería Civil, Universidad de Guanajuato, Guanajuato, Mexico, 36000

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

In this work, we studied the change in the rate of cell reproduction of *Saccharomyces cerevisiae* and its changes in the pattern of growing of a cell culture when it is stimulated magnetically at frequencies of 60, 100, 800, 1500 and 2450 Hz. Any samples showed an increase in the rate of cell proliferation. For the study about changes in the pattern of growth, it was performed a fractal analysis by box counting method. The results suggest that there are no changes in the pattern of crop growth.

**FA-9 [11:35]
STUDENT PAPER**

Calcium-independent disruption of microtubule growth following nanosecond pulsed electric field exposure in U87 human glioblastoma cells

Lynn Carr¹, Sylvia M. Bardet¹, Malak Soueid², Delia Arnaud-Cormos², Philippe Leveque² & Rodney P. O'Connor¹

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²Xlim Research Institute, University of Limoges and CNRS, Limoges, France, F-87060

Keywords: In vitro, Pulsed, Work in Progress

Nanosecond pulsed electric field (nsPEF) exposure causes apoptosis in cancer cells via a currently unknown mechanism. We used live cell imaging to show that 100, 10 ns, 15 kV/cm pulses, applied at 10 Hz to U87 EB3-GFP glioblastoma cells, results in calcium-independent disruption of microtubule growth. Microtubule depolymerization is a key event in apoptosis execution, making the effect we report on the microtubule network a candidate for the mechanism behind nsPEF induced apoptosis.

FA-10 [11:37] STUDENT PAPER

The anti-proliferative effects of RF EMF amplitude-modulated at tumor specific frequencies are mediated by calcium

Hugo Jimenez^{1,2}, Jacquelyn Zimmerman³, Ralph D'Agostino^{2,4}, Carl Blackman^{1,2}, Ivan Brezovich⁵, Dongquan Chen⁶, Niels Kuster⁷, Frederico Costa⁸, Alexandre Barbault⁹ & Boris Pasche^{1,2}

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⁹TheraBionic, TheraBionic GmbH, Ettlingen, Germany

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

Experimental and clinical evidence suggests that administration of low level radiofrequency electromagnetic fields, amplitude-modulated (AM RF EMF) at specific frequencies ranging from 400 Hz to 21 kHz, elicits therapeutic responses in patients with cancer. Furthermore, modulation frequencies randomly chosen within the same frequency range did not affect the growth of HCC and breast cancer cell lines, demonstrating the frequency specificity of the observed biological effects. Here, we provide the first evidence of tumor inhibition in an *in vivo* setting.

FA-11 [11:40] STUDENT PAPER

SAR_{wb}-meter in diffuse fields, calibrated in a reverberation room

Arno Thielens¹, Aliou Bamba^{1,2}, Gunter Vermeeren¹, Emmeric Tanghe^{1,2}, Lamine Koné², Davy Gaillot², Martine Lienard², Luc Martens¹ & Wout Joseph¹

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

A whole-body absorption meter, calibrated for simultaneous on-body measurements of the incident power density (S_{inc}) and whole-body averaged specific absorption rate (SAR_{wb}) in diffuse fields, is proposed. The meter consists of an on-body, textile antenna tuned to the GSM 900 DL band and is worn by a subject who is exposed to diffuse fields at 942.5 MHz in a reverberation chamber. The set-up allows for measurements of both the subject's absorption cross section (0.32 m^2), using measurements of the reverberation time, and the antenna aperture ($2.8\text{-}3.3 \text{ cm}^2$) of an on-body antenna. This antenna can thus be used for a simultaneous on-body measurement of the SAR_{wb} and the S_{inc} .

FA-12 [11:42] STUDENT PAPER

Heart rate variability affected by high frequency electromagnetic field in adolescent students

Jakub Misek¹, Jan Jakus¹, Ingrid Tonhajzerova², Tomas Vasicko³, Marcel Veternik¹, Daniela Spiguthova¹, Viera Jakusova⁴ & Oto Osina³

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Keywords: Human, RF/Microwaves, Work in Progress

This study, on high school students, focused on the effects of high frequency electromagnetic fields (HF EMF) under accepted but limit values of electric field intensity. Group of 13 volunteers had been exposed to HF DCS-1800 frequency band EMF to examine physiological changes in the heart rate variability (HRV) determining functional changes of autonomic

nervous system. Rest-to-stand protocols had been done twice, once with EMF and second one with no exposure as verification and comparison of HRV.

**FA-13 [11:44]
STUDENT PAPER**

***In vitro* effects of mobile phone Electromagnetic Radiation on neuroblastoma cells: possible role of EMFs in Alzheimer's disease**

Aikaterina Stefi¹, Emmanouil Vourakis², Dido Vassilacopoulou² & Lukas Margaritis¹

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

This study has focused on the biological impact of low level EMFs that millions of people, around the world, are faced with. Particularly, we examined the effects of the radiation emitted by a GSM 1800MHz mobile phone in human cells of neuronal origin. Our results have indicated an alteration in the processing of APP (Amyloid Precursor Protein) after irradiation. This observation will require further investigation as our experiments could provide new evidence for the effect of low level Electromagnetic Radiation on A β production and brain deposition, attributing a possible role of EMFs in AD (Alzheimer's disease) pathogenesis.

**FA-14 [11:47]
STUDENT PAPER**

Design optimization and displacement robustness of dome-shaped coil for transcranial magnetic stimulation

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Keywords: *Clinical (therapy)*, Pulsed, Completed (published)

Previously, we proposed transcranial magnetic stimulation (TMS) therapy using a dome-shaped coil, which can stimulate a localized but wider area of the brain. The expanded distribution of the induced electric field led to greater robustness of the coil against coil-positioning errors. In the present study, we systematically investigated the design parameters to maximize the stimulus intensity without unnecessarily expanding the stimulated region, based on its head-contact area. In addition, we evaluated its robustness to positioning errors by numerical simulation using a realistic brain model.

**FA-15 [11:49]
STUDENT PAPER**

Simulation of PsSAR associated with the use of laptop computers as a function of position in relation to the adult body

Sergio M Racini¹, Alvaro de Salles¹, Sergio LS Severo¹, Johan LT Garzon¹, Robert D. Morris² & Devra Davis²

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

The Specific Absorption Rate (SAR) is estimated in the body of a seated 34 year old male exposed to 2.4 GHz electromagnetic field (EMF) emitted by laptops. The laptop position is varied vertically and horizontally from the seated model in order to estimate the changes in SAR associated with changes in distance from the body. The estimated results are compared to the psSAR (peak spatial SAR) recommended exposure limits. The different SAR simulation situations are calculated using the Finite Difference Time Domain-FDTD employing the SEMCAD X software.

**FA-16 [11:51]
STUDENT PAPER**

Applicator based on printed circuit board *in vitro* at 60 GHz and 120 GHz

Takeo Shiina^{1,2}, Kensuke Sasaki², Soichi Watanabe² & Masao Taki¹

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Keywords: *Dosimetry (computational)*, THz, Work in Progress

The purpose of this study is to develop a novel *in vitro* Sub-THz exposure apparatus which allows high power efficiency with reasonably good homogeneity of exposure over a sufficient area as well as the easy implementation of temperature control. A applicator for exposure apparatus has a sufficient exposure area, which is fed using post-wall waveguide techniques. Operating frequencies were 120 GHz or 60 GHz. The apparatus operating at 60 GHz was previously reported. Spatial average value of SAR in the bottom of the culture medium were 470 W/kg at 60 GHz and 3200 W/kg at 120 GHz at

an input power of 1 W. We found that it was important for avoidance of the artifact to estimate the polarization characteristics.

**FA-17 [11:54]
STUDENT PAPER**

In vitro effect of Extremely Low Frequency Magnetic Field on the sperm motility of Alpacas: A preliminary study

Juana Quispe¹, Andree Valle-Campos¹, Gabriela Ulloa¹, Luis Rodriguez¹, Eduardo Granados¹, Orlando Limaymanta¹, Arturo Liñan¹, Dennis Carhuarica¹, Pamela Fuentes¹, Victor Cruz² & Martha Valdivia¹

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Keywords: *In vitro*, **ELFILF**, **Work in Progress**

The alpaca is an economically important Andean livestock with serious reproductive problems. As is well known, there is concern about the effects on animals exposed to magnetic fields from power lines. Is why the effect of this agent on livestock reproduction deserve evaluation. The aim of this study was to evaluate the effect of an acute exposure to ELF-MF (60Hz, 750 μ T) on the sperm motility of alpaca. It was found that, after 3h of exposure, ELF-MF induced a significant reduction on the amount of sperm with fully active mitochondria halfway down, and a consequently decline on their fertilizing capacity. This suggest that the exposure to this strange magnetic field can critically affect the reproductive characteristics of male alpaca.

Lunch
Monday June 15, 2015 • 12:00 - 13:00
Crocker Dining Hall

Session: FB
Student Flash Poster Session B
Monday June 15, 2015 • 13:15 - 14:15
Merrill Hall
Chairs: Christopher Portier & Niels Kuster

**FB-1 [13:17]
STUDENT PAPER**

MOSFET-based electroporation system design for experiments from nanoseconds to microseconds

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Keywords: **Electroporation**, **Pulsed**, **Work in Progress**

A flexible and scalable electroporation pulse generation system has been designed to accommodate the pulse widths from 300ns to 10 μ s. The peak amplitude of the pulse across the designed applicator has shown peak strength of approximately 40kV/cm. The generator is MOSFET-based, with digital manipulation, while the applicator follows the three layers' structure to generate corresponding field. The preliminary biological test based on the designed system is also presented.

**FB-2 [13:19]
STUDENT PAPER**

Magnetic field exposure of the hands by deactivators for labels of electronic article surveillance systems – an example case for the assessment of high level limb exposure according to the European directive 2013/35/EU

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

A magnetic deactivation device for EAS labels was assessed with respect to the induced in situ electric field strengths inside the hands of the operator. Using common state of the art anatomical models with a single layer skin representation failed to demonstrate compliance. However, using a two layer skin model, taking into account a low conductive cover layer (representing stratum corneum) on top of a dermis layer enables demonstration of the device's compliance with basic restrictions. In general, this clearly indicates that appropriate skin modelling plays a major role in exposure assessment based on in situ electric field strengths inside skin tissue.

FB-3 [13:21] STUDENT PAPER

Induced electromotive force in human blood stimulated magnetically

Dulce Magdaleno¹, Myrna Sabanero-López², Blanca Murillo-Ortiz³ & Teodoro Cordova-Fraga¹

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

Changing magnetic fields (CMF) are able to stimulate some kinds of cells, they induce an electromotive force (fem) in the biological system causing a current flux density related to some effects in the cells. In this work is presented theoretical calculations of induced fem in human blood; also the experimental measurements of fem are compared with theoretical calculations. The results shows a compatibility in order of magnitude between theoretical calculations and experimental measurements.

FB-4 [13:23] STUDENT PAPER

How does the accuracy of the RF body coil model affect the analysis of RF-induced electric field with partially implanted wires?

Elena Lucano^{1,2}, Micaela Liberti², Francesca Apollonio², Gonzalo Mendoza¹, Tom Lloyd³, Steve Wedan³, Wolfgang Kainz¹ & Leonardo M. Angelone¹

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

Accurate modeling of the electric field is necessary for evaluating medical devices that are partially implanted in the body. Three coil configurations of a 64 MHz birdcage body coil loaded with an ellipsoidal phantom were implemented in this study. The computational results were compared against measurements of a geometrically matching coil. The effect of the different models on the electric field near a 400 mm bare wire partially implanted in the phantom was also assessed. The three numerical models showed less than 4% difference of the magnetic field magnitude compared to the measurements. Conversely, the peak local 1g-averaged SAR near the wire simulated with one of the models was six-fold higher compared to the other two.

FB-5 [13:26] STUDENT PAPER

Modeling military exposures to RF electromagnetic fields for the INTEROCC study

Taichi Murata^{1,2}, Joseph Bowman¹, Martin Doczkat³ & Elisabeth Cardis^{4,5,6}

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Keywords: *Occupational, RF/Microwaves, Work in Progress*

The goal of this study is to estimate RF electromagnetic field exposures of INTEROCC subjects from military sources. Antenna models, device specifications from the U.S. military's RF safety manual, and interview data were combined to estimate RF electric field exposures from army and air force radar antennas for the INTEROCC epidemiologic study of brain cancer. Outcomes of these models provide quantitative estimates of RF electric field levels for the highly exposed military personnel in the INTEROCC study.

FB-6 [13:28] STUDENT PAPER

2.1 GHz MW radiation effects in magnetite treated Neuroblastoma cells

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¹Biophysics Dept., Gazi University, Ankara, Turkey, 06500

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

The effects of 2.1 GHz MW radiation; on the apoptotic activity of magnetite (Fe₃O₄) treated neuroblastoma cells were research in this study.

FB-7 [13:30]

STUDENT PAPER

Interpolation in between road measurements in RF-EMF exposure assessment

Sam Aerts¹, Wout Joseph¹, Loek Colussi², Jos Kamer², Luc Martens¹ & John Bolte³

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

We assess the possibility of using the in some European countries existing databases of large-scale radiofrequency (RF) electromagnetic field (EMF) measurements for ether regulation for the assessment of RF exposure over large areas. Using a car-mounted frequency-selective measurement system, signals from mobile-phone base station were measured within and around a residential area. We interpolated the data on the edge (along a closed and an open loop) complemented with increasing amounts of inner data to achieve progressively accurate exposure models. Through analysis of a 50-point validation, we found that 80 inner data points per km² could be sufficient to obtain an accurate interpolation model.

FB-8 [13:33]

STUDENT PAPER

Dielectrophoretic single-cell gene expression profiling for breast cancer research

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Keywords: Electrochemistry, ELFI/LF, Completed (unpublished)

We have developed a high-throughput single-cell gene expression profiling technology. Our technology is based on selective extraction of mRNA molecules from single-cells using dielectrophoresis (DEP). A micropipette was fabricated and DEP was established at its apex. The micropipette is inserted into single-cells to extract mRNA molecules. Extracted molecules are quantified or sequenced using traditional techniques to profile gene expression.

FB-9 [13:35]

STUDENT PAPER

Application of a voltage sensitive dye to study the effect of nanosecond pulsed electric fields (nsPEF) on membrane potential in human U87 glioblastoma cells

Ryan Burke¹, Sergii Romanenko¹, David Moreau¹, Delia Arnaud-Cormos¹, Philippe Leveque¹ & Rodney P. O'Connor¹

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Keywords: In vitro, Pulsed, Work in Progress

We have applied a fluorescent voltage sensitive dye (VSD) to quantify the influence of nsPEF on membrane potential in U87 glioblastoma cells. Patch-clamp electrophysiology was used to calibrate the VSD, yielding a second order regression equation that was applied in further experiments to monitor the slow changes over time resulting from the application of a single 10ns nsPEF. Cellular voltage imaging revealed a prolonged depolarization of the plasma membrane after a single pulse, similar to that previously reported by other groups with electrophysiology. This voltage imaging approach is promising as it can be combined with other probes that show the effects of nsPEFs on the membrane potential of intracellular organelles.

FB-10 [13:37]

WITHDRAWN

FB-11 [13:40]

STUDENT PAPER

Effects of pulsed electric fields on the polyphenols content, antioxidant capacity and juice extraction yield of orange fruit

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Keywords: Electroporation, Pulsed, Completed (unpublished)

In this study the polyphenols content, the antioxidant capacity and the yield extraction are investigated in orange fruits treated by Pulsed Electric Fields (PEF). For the analysis, sweet oranges (*Citrus sinensis*) were treated with 50 pulses of

1kV/cm, 100 μ s, at 2.5 and 10 Hz. The yield compared with untreated samples showed an increase of 3.83% at 10 Hz; the polyphenol content increased 27% in PEF treated juice. This study shows that PEF technology can contribute to make juices with higher nutritional quality under gentle conditions.

FB-12 [13:42]

STUDENT PAPER

Decreasing SAR and enhancing transmission of an in-body biotelemetry capsule by reducing the near-field coupling with surrounding tissues

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

This study focuses on the reduction of the near-field coupling with surrounding tissues of an *in-body* wireless biotelemetry capsule operating in the 434 MHz ISM band. This allows enhancing through-body transmission performances and reducing exposure levels simultaneously by weakening the local SAR within the tissues adjacent to the capsule.

FB-13 [13:44]

STUDENT PAPER

Towards a new correction law for EMF assessment errors at the vicinity of human body

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

We present in this paper a new correction law for overcome the EMF assessment errors due to the presence of exposimeter at the vicinity of human body. The Correction law proposes to use 2, 3 or 4 measuring points of the field, depending on the desired confidence. These measurements are made at regularly goshawks separate points of the body, either in the chest or abdomen or either at the waist. The goal is to propose a useful distributed worn-body exposimeter who can apply a correction law to these separate values compared to the maximum value known beforehand. This correction law is now performed with simulation and shortly by measures in anechoic room for GSM 942 MHz downlink frequency.

FB-14 [13:47]

STUDENT PAPER

Numerical assessment of the induced SAR within humans due to EM radiations from Smart Meters

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

Absorption of electromagnetic waves emitted by smart meters has been investigated by using numerical models representing a sample of the population: namely, a 23-year old female (NAOMI), a 34-year old male (NORMAN) and a 7-year old child (Eartha). Absorption within each of the models has been assessed at two different frequencies representing the ZigBee (2450MHz) and general purpose telemetry (868MHz) band. Frequency-dependent and age-dependent tissue properties have been taken into consideration within each model. The Specific Energy Absorption Rate (SAR) induced inside each heterogeneous voxel model has been calculated with IWV input power, fed to an optimised antenna similar to that used in commercial devices.

FB-15 [13:49]

STUDENT PAPER

The impact of extremely low frequency (< 300 Hz) magnetic fields (up to 100 mT) on human standing balance

Alicia Allen^{1,4}, Julien Modolo^{1,2,3}, Michael Corbacio^{1,2}, Daniel Goulet⁵, Michel Plante⁵, Martine Souques⁶, François Deschamps⁷, Genevieve Ostiguy⁵, Jacques Lambrozo⁶, Alex Thomas^{1,3} & Alexandre Legros^{1,2,3,4}

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Keywords: Human, ELF/ILF, Work in Progress

Studies have found that extremely low-frequency (ELF, < 300 Hz) magnetic fields (MF) can modulate standing balance. However, acute effects of ELF MF on standing balance have not been systematically investigated yet. We aim to establish the threshold for standing balance modulation during ELF MF exposure. 80 participants will be exposed to an ELF MF (0 to 100 mT) and transcranial electric stimulation (DC and AC, 1 mA). The displacement of their center of pressure will be collected and analyzed using validated sway characteristics in order to detect modulations of vestibular system function. Results will contribute to further documentation of the rationale for exposure guidelines aiming to protect power-line workers and the general public.

FB-16 [13:51]

STUDENT PAPER

Specific Absorption Rate (SAR) simulations in eyewear and Bluetooth communicating devices operating close to the user's head

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

Two popular wireless communication devices are considered in this paper. Firstly, the Bluetooth which is one of the most popular mobile accessories and the Google glasses which are a representation of the new futuristic vision. The Specific Absorption Rate (SAR) is simulated for three different head models and compared with the available international recommendations. The first model used is the Specific Anthropomorphic Mannequin (SAM phantom), as well as two realistic models of human head (i.e., a 34 years old adult and a 10 years old child). The simulations were performed using the finite difference time domain (FDTD) method and the frequency used to feed the antennas was 2.45 GHz.

FB-17 [13:54]

STUDENT PAPER

Ionomycin-induced changes in transmembrane electric potential alter electroporation outcomes in HL-60 Cells

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Keywords: Electroporation, Pulsed, Completed (unpublished)

We evaluated changes in electroporation outcomes resulting from modifying the resting transmembrane electric potential of HL-60 cells using ionomycin [1]. At lower electric field strengths, the probability of reversible electroporation increased, while at higher electric field strengths, the probability of irreversible electroporation increased.

FB-18 [13:56]

STUDENT PAPER

Electropermeabilization of inner and outer membranes of cells with microsecond pulsed electric fields: Quantitative study with calcium ions

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Keywords: Electroporation, Pulsed, Completed (unpublished)

In our study, calcium was used as a marker of internal or external membrane electropermeabilization in two different types of attached cells exposed to one single 100 microsecond electric pulse. Response curves of DC-3F cells and human adipose mesenchymal stem cells (haMSC) to different electric field amplitudes were achieved in media with and without calcium ions. The calcium peaks detected in a medium without calcium demonstrated that “classical” micropulses can permeabilize the inner membranes of the cells, notably those of the endoplasmic reticulum. Viability was fully preserved in the haMSC even though field amplitude were higher than those necessary to permeabilize the plasma membrane of these cells.

FB-19 [13:58]

STUDENT PAPER

Current uses and public policy issues of radio frequency electromagnetic wave technology

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

New public management and e-governance mantras have supported public administration's use of radio frequency electromagnetic wave transmission devices. The application of invisible technologies is centrally important to numerous federal objectives that impact various sectors of the economy. There are several outstanding key public policy issues related to the widespread societal use of electromagnetism for the benefit of businesses and government, largely at the expense of the public. Specific challenges involve health concerns of subjects and users, privacy rights, regulation, and governance. A review of public policies and political factors governing the new technocracy is yearned-for by communities.

**FB-20 [14:01]
STUDENT PAPER**

Gene expression profile changes in *D. melanogaster* induced by cell phone exposure of adult flies: a microarray analysis of ovarian tissue

Areti Manta¹, Deppie Papadopoulou², Alexander Polyzos², Adamantia Fragopoulou¹, Katerina Skouroliakou³, Issidora Papassideri¹, Dimitris Thanos², Dimitrios Stravopodis¹ & Lukas Margaritis¹

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

Whole body exposure of adult *Drosophila melanogaster* flies to GSM 1800 MHz mobile phone radiation (SAR 0.12 W/kg) for 30 min is capable to provoke gene expression alterations in the early and mid stage ovarian follicles, as revealed by microarray analysis. 168 genes changed their expression; 158 genes were up-regulated (1.25- to 2.1-fold) and 10 genes were down-regulated (0.8- to 0.41-fold). The altered genes are implicated in metabolic processes, endocytosis, phagocytosis, apoptosis, whilst 124 human orthologs were identified to be implicated in human patho-physiology.

**FB-21 [14:03]
STUDENT PAPER**

Uniformity of extremely low frequency electromagnetic field functions as a major parameter of its biological effects

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

We investigated the biological effects of a 60 Hz gradient or uniform extremely low frequency electromagnetic field (ELF-EMF) at 6 mT to both cancerous HeLa and normal primary fibroblast IMR90 cells. Gradient ELF-MF induces DNA double strand breaks (DSBs) in both cells, leading to apoptosis. Unlikely to gradient ELF-MF, uniform MF exposure did not show any DNA DSBs and apoptosis in both HeLa and IMR90 cells. Moreover, uniform MF exposure to HeLa cells promotes cell proliferation without any DNA damage. These observations suggest that uniformity of MF is a key factor for the biological effects of MF.

**FB-22 [14:05]
WITHDRAWN**

**FB-23 [14:08]
STUDENT PAPER**

Behavioral effects of long-term exposure to IF magnetic fields

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Keywords: Behavioural, IF, Work in Progress

The summary will describe the experimental study on the behavioural effects of intermediate frequency (IF) magnetic fields. Studies on the biological and health effects of IF magnetic fields are needed, because human exposure is and information on potential health effects is sparse. Groups of 20 male C57BL/6J mice will be exposed continuously for 5 weeks to 7.5 kHz magnetic fields at 12 or 120 μ T. Results of the behavioural tests will be reported in the BioEM 2015 meeting.

**FB-24 [14:10]
STUDENT PAPER**

Molecular dynamics simulation of plasma reactive species with lipid bilayers

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Keywords: Mechanistic/Theoretical, All Frequencies, Work in Progress

Using Molecular Dynamics (MD) simulations, the stability of past simulations is evaluated by calculation of order parameter for carbon chains that form the lipid tails in a DPPC lipid bi-layer. The calculation results are then compared to experimental data showing stability of the membrane in the simulations.

Session: 01
Epidemiology and Exposure Evaluations I (ELF EMF)
Monday June 15, 2015 • 14:30 - 15:50
Fred Farr Room
Chairs: Marthinus Van Wyk & Andrew Wood

Session: 02
Methods Toward Mechanisms
Monday June 15, 2015 • 14:30 - 15:50
Kiln Room
Chairs: Francesca Apollonio & Micaela Liberti

01-1 [14:30]

The California Power Line Study: estimating magnetic fields of homes near transmission lines

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Keywords: Epidemiology, ELF/ILF, Work in Progress

The California Power Line Study (CaPS) is a case-control study investigating the relation between residences near transmission lines and risk of childhood leukemia. We describe methods for calculating magnetic fields at study residences and characterizing sources of uncertainty. We found good correlation between calculated fields and magnetic field spot measurements taken on-site during visits. Our modeling strategies yielded similar extrapolated load estimates, and they were in very good agreement with utility extrapolations. Our findings suggest high specificity in exposure assessment is achievable to investigate the relationship between power lines and childhood leukemia risk.

01-2 [14:50]

EXPERTS study: analysis of the highest exposures of children to ELF magnetic field

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

We have studied the highest exposures of children of the EXPERS study, which we defined as the mean exposures higher than 0.4 μ T. The exposure sources were analyzed from a statistical and a qualitative point of view. Various sources, other than high voltage power lines, were found.

02-1 [14:30]

Study of transmembrane voltage dynamics during 100 μ s pulse using voltage sensitive dyes

Aude Silve¹, Clair Poignard², Michael Leguebe², Sarah Rocke¹, Martin Sack¹ & Wolfgang Frey¹

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Keywords: Electroporation, Pulsed, Work in Progress

We present an experimental study of the dynamics of transmembrane voltage (TMV) on mammalian cells submitted to 100 μ s electric pulses. Measurements are performed with the fluorescent dye ANNINE-6. The observed dynamics of the TMV are very different from the one suggested by theoretical models. In particular, for all tested field values (even those above electroporation threshold), TMV is stable for several microseconds before it slowly decreases. On the contrary, models predict very fast stabilization of the TMV at low values after permeabilisation. Results enable to describe membrane's conductivity increase during electroporation. They can be used to improve theoretical models that currently do not reflect the observations.

02-2 [14:50]

Minimally disruptive studies of electroporation in adherent cells on indium tin oxide (ITO)-coated glass coverslips

Andrei Pakhomov¹, Gintautas Saulis², Vitalij Novickij³ & Olga Pakhomova¹

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Keywords: Electroporation, Pulsed, Completed (unpublished)

We introduced and characterized a novel method of electroporation of adherent cells on ITO-covered glass

01-3 [15:10]

Characterization of extremely low frequency magnetic fields from diesel, gasoline and hybrid cars under controlled conditions

Madhuri Sudan¹, Ronen Hareuveny², Malka Halgamuge³, Yoav Yaffe², Yuval Tzabari⁴, Daniel Namir⁴ & Leeka Kheifets¹

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Keywords: Dosimetry (measurements), ELF/ILF, Completed (published)

The transportation system is a possible source of extremely low frequency (ELF) electric and magnetic fields (MF), but more research on this exposure is needed. In this study, measurements were conducted to characterize MF levels across engine types, seat positions, and operating conditions in 10 car models. Levels were lowest in diesel, higher in gasoline, and highest in hybrid cars. Differences in MF levels were also observed between moving and standing conditions, high and low speeds, and different seat positions. Net currents flowing through the cars' metallic chassis may be a possible source of MF, but larger surveys with different types of vehicles should be conducted.

01-4 [15:30]

Association of EMF exposure with non-specific physical symptoms within individuals

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

This study explores relationships between exposure to radiofrequency electromagnetic fields and non-specific physical symptoms within individuals over time, as studying exposure response relations in groups of persons may average out associations existing on an individual level. The focus is on specific EMF frequency bands and symptoms that the participants indicated to be relevant for their particular situation. Participants registered non-specific physical symptoms and perceived RF-EMF exposure using an electronic diary daily at three set times for a period of three weeks. During the same period personal exposure

coverslips. It offers a simple and efficient way to explore cellular and cytotoxic effects of electroporation while minimizing the impact of compounding factors. This method enables new and unique studies of the impact of drugs and media additives in conjunction with electric field treatments.

02-3 [15:10]

STUDENT PAPER

Dielectric permittivity of hydrated bilayers from molecular dynamics simulations

Maura Casciola^{1,2,3}, Paolo Marracino³, Micaela Liberti³ & Francesca Apollonio³

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

We provide local spatial profiles of the apparent permittivity of the water at membranes interface both in absence and under the influence of exogenous electric fields, by means of full-atomistic simulations. Investigate the water domains at biological interfaces is essential to give an insight to the comprehension of emergent medical techniques which rely on the application of intense electric field (10^8 V/m) and still poorly understood, such as electroporation, and to link the molecular level to the continuum approach of microdosimetry and dosimetry.

02-4 [15:30]

Transient versus sustained Ca^{2+} responses evoked in adrenal chromaffin cells by 5 ns pulses: pulse delivery considerations

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Keywords: In vitro, Pulsed, Work in Progress

Exposing adrenal chromaffin cells to a single 5 ns pulse evokes a rapid rise in intracellular calcium, the characteristics of which depend on how the pulse is applied. The response is transient when cell exposure is carried out in microelectrode chambers formed by the walls of two gold electrodes whereas a sustained response occurs when cell exposure is mediated by a pair of cylindrical tungsten rod electrodes. While both responses involve calcium influx via voltage-gated calcium channels, the sustained response also involves another calcium influx pathway, possibly direct

was monitored using exposimeters. Statistical analyses are currently ongoing and will be finished in April 2015.

plasma membrane permeabilization. Thus, different cellular responses are evoked by different pulse delivery systems, the basis for which is under investigation.

Coffee Break
Monday June 15, 2015 • 15:50 - 16:05

Session: 03
EMF Effects and Underlying Mechanisms
Monday June 15, 2015 • 16:05 - 17:25
Fred Farr Room
Chairs: Francis Hart & Dariusz Leszczynski

Session: 04
Human Neurophysiology and Motor Control
Monday June 15, 2015 • 16:05 - 17:25
Kiln Room
Chairs: Sarah Loughran & Heidi Danker-Hopfe

03-1 [16:05]
WITHDRAWN

04-1 [16:05]
Radiofrequency electromagnetic fields influence human working memory

Sarah Loughran^{1,2}, Adam Verrender^{1,2}, Nigel Taylor^{1,3}, Anna Dalecki² & Rodney Croft^{1,2}

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Keywords: Human, RF/Microwaves, Work in Progress

Research has consistently shown that RF EMFs, such as those emitted by mobile phones, affect the EEG. Given this repeatable effect on brain electrical activity, a consequent effect on human cognitive performance could be expected, and numerous studies have investigated this. Although some studies have reported an influence of RF EMF on cognition, to date, these have not been consistent, and no such effect has been substantiated. Therefore the potential functional significance of the effect on the EEG remains unknown. Using an improved methodology, preliminary analysis shows an effect of RF EMF exposure on reaction time in a working memory task. Results also show that exposure may have differential effects based on gender.

03-2 [16:25]
Electric fields increase amoeba motility by modifying the glycocalyx-substrate interaction

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

The movement of amoeba in DC electric fields ranging from 15 V/m to 800 V/m is analyzed by tracking the cells in time-lapse movies in which each amoeba serves as its own control. The field-increased motility, but not the field-increased directionality, depends on the initial cell motility. These effects are consistent with an electromechanical transduction mechanism. The dependence of an electric field effect on an additional parameter (initial cell motility)

04-2 [16:25]
Does TETRA exposure (1.5 W/kg and/or 6 W/kg) affect the power spectra of the resting state EEG?

Heidi Danker-Hopfe¹, Torsten Eggert¹, Hans Dorn¹, Gernot Schmid³, Thomas Bolz^{2,4} & Cornelia Sauter¹

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

The study investigates whether RF-EMF emitted by TETRA handheld devices affect the resting state waking EEG. Powerspectra of the waking EEG at 15 electrodes were analysed on the basis of frequency bands (delta, theta, alpha

has implications for discussions of experimental reproducibility.

03-3 [16:45]

Differential pro-inflammatory responses of astrocytes and microglia involve STAT3 activation in response to 1800 MHz radiofrequency fields

Yong-Hui Lu¹, Mindi He¹, Lei Zhang¹, Chun-Hai Chen¹, Chuan Liu¹, Zhou Zhou¹ & Zheng-Ping Yu¹

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Keywords: *In vitro*, RF/Microwaves, Completed (published)

We investigated the pro-inflammatory responses of microglia and astrocytes and the involved mechanism in response to RF fields. RF exposure induced differential pro-inflammatory responses in astrocytes and microglia, characterized by different expression and release profiles of IL-1 β , TNF- α , IL-6, PGE2, nitric oxide (NO), inducible nitric oxide synthase (iNOS) and cyclooxygenase 2 (COX2). Moreover, the RF exposure activated STAT3 in microglia but not in astrocytes. This data provide novel insights into the potential mechanisms of the reported CNS impacts associated with mobile phone use and present STAT3 as a promising target to protect humans against increasing RF exposure.

03-4 [17:05]

Spin biochemistry modulates reactive oxygen species production by radio frequency magnetic fields

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Keywords: *Mechanistic/Theoretical, IF, Completed (published)*

and beta1). RmANOVA revealed a significant main effect for exposure (sham, 1.5 W/kg, 6 W/kg) for the theta frequency band but neither for hemisphere nor for an interaction between these two factors. Post-hoc pairwise analyses for exposure showed that theta power was significantly higher for both exposure conditions when compared to sham (1.5 W/kg vs. sham: adjusted $p = 0.013$; 6.0 W/kg vs. sham: adjusted $p = 0.013$). Differences between both verum exposure conditions were, however, not statistically significant.

04-3 [16:45]

Magnetophosphene perception threshold and EEG response in humans exposed to 20, 50, 60 and 100 Hz MF up to 50,000 μ T

Alexandre Legros^{1,2,3,4}, Julien Modolo^{1,2,3}, Daniel Goulet⁵, Michel Plante⁵, Martine Souques⁶, François Deschamps⁷, Genevieve Ostiguy⁵, Jacques Lambrozo⁶ & Alex Thomas^{1,2,3}

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Keywords: *Human, ELF/IF, Work in Progress*

OBJECTIVE: Quantify human magnetophosphene perception and associated electroencephalographic (EEG) response to 20, 50, 60 and 100 Hz magnetic fields (MF) up to 50 mT. **METHODS:** Magnetophosphene perception and EEG collected during 55 MF conditions at each frequency. **RESULTS:** The magnetophosphene perception threshold is at 15 mT at power frequencies (50/60 Hz) for a global head exposure, with decreased associated EEG alpha activity above this threshold. **CONCLUSIONS:** Results from a first experiment ($n=51$) at 50 and 60 Hz provide a preliminary estimate of magnetophosphene perception thresholds and associated EEG changes. Results from a second experiment ($n=80$) additionally testing exposures at 20 and 100 Hz will be presented at the conference.

04-4 [17:05]

Acute Effect of a 60 Hz Magnetic Field of up to 100 mT on Human Neuromotor Control: an EEG/EMG/Tremor Study

Alexandre Legros^{1,2,3,4}, Michael Corbacio¹, Shirin Davarpanah Jazi^{1,4}, Julien Modolo^{1,2,3} & Alex Thomas^{1,3}

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In the current paper, we wish to extend prior experimental studies by determining mechanisms and quantum effects of radio frequency magnetic fields (RF) in biological systems. This represents a completely new area of Quantum Biology and the proposed work will provide a deeper understanding of the role of quantum coherence in biochemical processes.

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Keywords: Human, ELF/LF, Work in Progress

OBJECTIVE: Quantify the acute impact of a 60 Hz magnetic field (MF) up to 100 mT on human neuromotor control. **METHODS:** Postural tremor, electroencephalography (EEG), and electromyography (EMG) collected during 55 MF conditions (from 0 to 50 mT, 5 mT increments, 5 s each) at 60 Hz. Additional experiment up to 100 mT undergoing. **RESULTS:** Decrease of the EEG μ rhythm (8-12 Hz) spectral power with increasing MF flux density in the left primary somatosensory cortex, responsible for tactile perception. **CONCLUSIONS:** Pilot results with exposure up to 50 mT do not produce a functional outcome, despite a small but significant decrease in EEG μ rhythm. Additional results under exposures up to 100 mT will be presented at the conference.

Dinner
Monday June 15, 2015 • 18:00 - 19:00
Crocker Dining Hall

Session: PA
Poster Session A
Monday June 15, 2015 • 19:00 - 22:00
Fireside Underground
Chairs: P. Thomas Vernier & Meike Mevissen

Tuesday June 16, 2015

Breakfast
Tuesday June 16, 2015 • 07:30 - 08:30
Crocker Dining Hall

Introduction
Tuesday June 16, 2015 • 08:45 - 09:00
Merrill Hall

Session: DA
The d'Arsonval Lecture. James Weaver: A curious pursuit of research
Tuesday June 16, 2015 • 09:00 - 09:45
Merrill Hall
Chairs: Philip Chadwick & Alexandre Legros

Coffee Break
Tuesday June 16, 2015 • 09:45 - 10:15

Session: 05
Epidemiology and Exposure Evaluations 2 (RF EMF)
Tuesday June 16, 2015 • 10:15 - 11:55
Fred Farr Room
Chairs: John Tattersall & Jianqing Wang

Session: 06
Toward Cancer Treatment I (Exposure Conditions and Mechanisms)
Tuesday June 16, 2015 • 10:15 - 11:55
Kiln Room
Chairs: Richard Nuccitelli & Lluís M. Mir

05-1 [10:15]

Pregnancy outcomes after parental cell phone exposure

Valborg Baste¹, Gunnhild Oftedal², Ole Mollerlokken¹, Kjell Hansson Mild³ & Bente Elisabeth Moen^{1,4}

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²Faculty of Technology, Sør-Trøndelag University College (HiST), Trondheim, Norway

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

Based on the Norwegian Mother and Child Cohort Study (1999-2009), information on maternal cell phone use during pregnancy and paternal cell phone use prior to conception was obtained. The cohort was linked to the Medical Birth Register, Norway to obtain information about all singleton pregnancy. The cohort comprises 100730 singleton births, response rate: 38.7%. There was no association between maternal cell phone use and adverse pregnancy outcomes. Fathers with testis exposure when using cell phones were associated with a borderline increased risks of perinatal mortality and slightly decreased risk of partner experience of preeclampsia during pregnancy compared with no cell phone exposure of head or testis.

06-1 [10:15]

Dielectric properties of human liver and liver tumours

Azadeh Peyman¹, Bor Kos², Mihajlo Djokić³, Blaž Trotovšek³, Clara Limbaeck-Stokin⁴, Gregor Serša⁵ & Damijan Miklavcic²

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²Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, Slovenia

³University Medical Centre, University Medical Centre, Ljubljana, Slovenia

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⁵Institute of Oncology, Institute of Oncology, Ljubljana, Slovenia

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

This work presents dielectric properties of freshly excised human normal and cancerous liver tissues (*ex-vivo*) in the frequency range of 50 MHz to 5 GHz. The differences in dielectric behaviour of normal and cancerous tissues at microwave frequencies are discussed based on pathological state of each tissue. Dielectric properties of normal and pathological tissues have also been characterised mathematically. The data presented are vital for understanding the interaction of electric pulses with liver tissues of different pathological state. This knowledge is of importance in medical applications such as irreversible electroporation, and nanosecond pulsed electric fields ablation to treat liver tumours.

05-2 [10:35]

Trends in cell phone use behaviors among children in the Danish National Birth Cohort at ages 7 and 11 years: A prospective analysis

Madhuri Sudan¹, Leeka Kheifets¹, Onyebuchi Arah¹, Victor Shiau¹, Torben Sigsgaard² & Jorn Olsen³

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²Institute of Environmental and Occupational Medicine, Aarhus University, Aarhus, Denmark

³Danish Epidemiology Science Centre, Aarhus University, Aarhus, Denmark

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

Cell phone use has rapidly grown to become a pervasive part of society. There are concerns about the potential health effects of radiofrequency exposure from cell phones, particularly among children. To optimize exposure assessment methods in epidemiologic studies, it is important to examine cell phone use behaviors among children and changes in patterns of use over time and with age. This study examines such patterns in cell phone use behaviors among children using prospectively-collected data from the Danish National Birth Cohort. Preliminary findings are reported here, and further analysis will be presented at the meeting.

05-3 [10:55]

STUDENT PAPER

Use of portable exposimeters to monitor radiofrequency electromagnetic field exposure in the everyday environment

Sanjay Sagar^{1,2}, Benjamin Struchen^{1,2}, Marloes Eeftens^{1,2}, Katharina Roser^{1,2}, Anna Schoeni^{1,2}, Milena Foerster^{1,2} & Martin Roosli^{1,2}

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²University of Basel, Basel, Switzerland, 4051

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

In this microenvironmental measurement study RF-EMF was measured by means of EXPOM3 devices in 51 different outdoor microenvironments during approximately 30 minutes and in public transports. The reproducibility and spatial representativity of this measurement approach was evaluated. The study concludes that mobile phone base station exposure is most relevant for outdoor exposure. Repeated measurements were highly reproducible and thus the approach is considered useful to monitor environmental RF-EMF over an extended time period.

05-4 [11:15]

STUDENT PAPER

Personal radiofrequency measurement campaigns in 6 European countries within the GERoNiMO Project: First results from Switzerland

Benjamin Struchen¹, Jonas Fischer¹, Marloes Eeftens¹, Milena Foerster¹, Katharina Roser¹, Anna Schoeni¹ & Martin Roosli¹

06-2 [10:35]

STUDENT PAPER

The role of pH gradients in tissue electroporation-based treatments

Felipe Maglietti¹, Sebastian Michinski¹, Nahuel Olaiz¹, Marcelo Castro², Cecilia Suarez¹ & Guillermo Marshall¹

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Keywords: Electroporation, Pulsed, Completed (published)

Treatments based on electroporation induce extreme pH changes as a consequence of the electrolysis of the water molecules. These changes are neutralized by the buffers that are naturally present in the tissue, but with some pulse parameters a long time passes before the normal pH is completely restored. Extreme pH conditions can lead to unwanted effects such as tissue damage and plasmid denaturation, thus it is important to determine the best pulse parameters in order to reduce unwanted effects and still have the best possible result with the treatment.

06-3 [10:55]

The transcellular current density plays a critical role in the nanoelectroablation of tumor cells

Richard Nuccitelli¹, Zachary Mallon¹, Casey Berridge¹, Mark Kreis¹, Brian Athos¹ & Pamela Nuccitelli¹

¹Research and Development, Electroplate Corp., Burlingame, CA, USA, 94010

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

We have been developing a non-thermal nanoelectroablation therapy for treating tumors and unwanted skin lesions. Effective nanoelectroablation of subdermal allograft tumors requires a field strength of at least 10 kV/cm (1) and at least 20 A of peak current flow (2). To further elucidate this dependence on current density we have been treating tumor cells in parallel plate electroporation cuvettes and varying conductivity to modify the current density for a given electric field. As first reported by Aude Silve (3) in 2011, we find that ablation efficacy falls off sharply when the current density passing through the cells falls below 50 A/cm².

06-4 [11:15]

Establishment of an in vitro model for the medical application of IRE

Andreas Ritter¹, Katharina Kolvenbach², Daniel Busch², Sarah Hilswicht², Thomas Schmitz-Rode¹, Uwe Neumann², Anne Esser² & Martin Baumann¹

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

In the framework of the EU FP7 funded international multi-center research project GERoNiMO (**Generalised EMF Research using Novel Methods**) personal RF exposure measurements in 6 European countries (Switzerland, Slovenia, Spain, Denmark, Italy, Netherlands) are and will be conducted following a common measurement protocol. First measurements from 49 adolescents and 50 parents in Switzerland yielded an average personal RF-EMF exposure of 0.19 V/m. Average personal RF-EMF exposure by activity was 0.15 V/m at home, 0.13 V/m at school, 0.21 V/m at work, 0.25 V/m outside, 0.54 V/m in train, 0.29 V/m in bus or tram, 0.29 V/m in car and 0.34 V/m during miscellaneous other activities.

05-5 [11:35]

Power level distributions of RBS equipment and user devices in a 3G mobile communication network in India

Paramananda Joshi¹, Björn Thors¹, Davide Colombi¹ & Christer Tornevik¹

¹*Ericsson Research, Ericsson AB, Stockholm, Sweden, 164 80*

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

Output power level distributions of radio base stations (RBSs) and user devices have been obtained via network-based measurements in a 3G network in India. In downlink, data from 868 RBSs were gathered during one week. The mean, median and 90th percentile RBS output power values were found to be 24%, 21% and 42%, respectively, of the maximum power. In uplink, data from 3G devices connected to 1,256 RBSs were gathered. In total, more than 1 million hours of data traffic and more than 700,000 hours of voice calls were measured. The normalized mean output power for voice, data, voice + data and video services were found to be around 1%, 3%, 2% and 4%, respectively. The findings are in line with previously published results.

Lunch
Tuesday June 16, 2015 • 12:00 - 13:00
Crocker Dining Hall

Aachen University, Aachen, Germany, 52074

²*Department of General, Visceral and Transplantation Surgery, RWTH Aachen University Clinic, Aachen, Germany, 52074*

Keywords: Electroporation, Pulsed, Work in Progress

Irreversible electroporation (IRE) and electrochemotherapy (ECT) are two innovative, non-thermal and minimally invasive techniques in cancer therapy, both based on electroporation (EP). ECT has already been established successfully in malignancies of the skin, but for an intraabdominal usage (e.g. liver tumor) none of them are established in clinical practice yet. In most publications, for all kinds of tissue the same threshold values for the electric field strength are used, but first measurements confirm that they differ between tissues. Therefore, different cell lines and their survival rates in dependence to the applied voltage respectively the resulting electric field strength.

06-5 [11:35]

Numerical models confronted to the “real life” of experiments: An overview of the different models, of their strength and of their limits

Clair Poignard¹, Lars Wegner² & Aude Silve²

¹*Applied Mathematics, Inria, Bordeaux, France*

²*IHM, Karlsruhe Institute of Technology, Karlsruhe, Germany*

Keywords: Electroporation, Pulsed, Work in Progress

The aim of this work is to compare precisely the current numerical models with several experiments that have been recently performed. We will present the main ideas the numerical models have been derived from, and we will discuss the pros and the cons, in order to improve the understanding of the electroporation phenomenon. It is worth noting that most of the current models have been derived in the late 90s, and it seems crucial to provide new tools in accordance with the latest experimental discoveries.

Session: M3
EBEA General Assembly
Tuesday June 16, 2015 • 12:00 - 13:00
Woodlands Dining Room

Introduction
Tuesday June 16, 2015 • 13:15 - 13:25
Merrill Hall

Session: CL
Chiabrera Lecture. Maxim Zhadobov: Bioelectromagnetics Applied to Emerging Body-Centric Wireless Technologies
Tuesday June 16, 2015 • 13:25 - 13:45
Merrill Hall
Chairs: Eric Van Rongen & Heidi Danker-Hopfe

Session: P2
Plenary 2: Dosimetry — gaps, challenges
Tuesday June 16, 2015 • 13:45 - 14:45
Merrill Hall
Chairs: Joe Wiart & Philip Chadwick

**P2-1 [13:45] -
Challenges for radio-frequency dosimetry in real-life environments**

Luc Martens¹

¹WiCa-Department of Information Technology, iMinds-Ghent University, Ghent, Belgium

Biographical sketch

Luc Martens is Full Professor at the Department of Information Technology (INTEC) of Ghent University. His Ph.D. was focused on the physical aspects of hyperthermic cancer therapy. Since 1991, he is head of the WiCa research group at INTEC. This group is also part of the iMinds institute.

His expertise and current interests are in modelling and measurement of electromagnetic channels, of radio-frequency electromagnetic exposure, and of energy consumption in wireless networks. He and his group have been involved in numerous national and European projects in the domain of electromagnetic channel predictions and of health and wireless communications.

He is author or co-author of more than 300 publications.

Abstract

Radio-frequency electromagnetic fields are very complex in real-life environments due to the complex sources and influencing details of the environments. First, the information about the sources such as basestation antennas for wireless communications required to estimate the radiated fields is mostly only partly known and the electromagnetic fields from these sources vary dynamically as they may be dependent on time variables such as data traffic. Second, the environment is also dynamic and the geometry and materials of surrounding buildings, trees, etc. and moving objects such as cars will influence local electromagnetic fields. Third, people are also moving in this complex environment, which will also have an impact on the personal incident fields. These challenges will be further elaborated in the talk and state of the art solutions for these challenges will be explained in the talk. Finally, hopefully inspiring ideas to further develop innovative solutions will be presented to the audience.

**P2-2 [14:15] -
Microdosimetry: shared knowledge, gaps and challenges**

Micaela Liberti¹

¹Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome, Rome, Italy, 00184

Biographical sketch

Micaela Liberti received the Doctorate Degree from Sapienza University of Rome, Italy in 2000. In 2002, she became an Assistant Professor with the Department of Electronic Engineering, Sapienza University of Rome. Since 2008, she has



being a member of the Scientific Council of the EBEA, being General Chair of EBEA2011 in Rome 2011. Since 2011, she has been serving as EBEA scientific secretary.

Since 2008, she has been involved in main COST actions: BM0704 EMF-Fields Effects, TD1104 Electroporation, BM1309 EMF-MED. Her scientific interests concern interaction mechanisms between EM fields and biological systems, microdosimetry, exposure systems design and dosimetry.

Abstract

Microdosimetry deals with the quantitative study of the spatial, temporal, and spectral distributions of EM fields imparted to cellular and subcellular structures. To approach microdosimetry two steps are needed. The first one involves the setup of a dielectric cell model, especially of the plasmatic membrane, unanimously considered one of the main EM interaction targets. The second step concerns the setup of appropriate EM solutions.

Both analytical methods applied to simplified cell shapes and numerical ones applied to irregular-shaped cells were used. In spite of the huge work done, some open issues are still alive and represent key challenges in the development of microdosimetry. The first one is represented by the microthermal issue. Second important point is represented by the computational/numerical difficulty to relate the microscopic field to the field at the mesoscopic one were clusters of cells are to be considered, finally, the importance of molecular details like the structure of the membrane bilayer, anisotropy, the presence of solvated shells, water at interface.

Major challenge is represented by the capability to validate microdosimetric results with reliable experimental work.

Aim of this work is to establish the shared scientific bases and main results, and to identify the needs for future research.

Coffee Break Tuesday June 16, 2015 • 14:45 - 15:00

**Session: 07
EMF Safety I: ELF/IF (Standards, Mechanisms,
Policy)
Tuesday June 16, 2015 • 15:00 - 16:20
Fred Farr Room
Chairs: Myles Capstick & Philip Chadwick**

**Session: 08
Toward Cancer Treatment 2 (Exposure
Conditions, Methods, Applications)
Tuesday June 16, 2015 • 15:00 - 16:20
Kiln Room
Chairs: Boris Pasche & Andrei Pakhomov**

07-1 [15:00] Exposure Assessment Method for Wireless Power Transfer Systems Used in Close to the Human Body at 6 MHz Band

Teruo Onishi¹, Tetsu Sunohara², Satoshi Ishihara¹ & Akimasa Hirata²

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²Department of Computer Science and Engineering, Nagoya Institute of Technology, Nagoya, Japan, 466-8555

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

Recently Wireless Power Transfer (WPT) systems for mobile phones, electric vehicles and so on have been paid attention and standardized by some international bodies. An exposure assessment for the WPT systems is important to ascertain the actual exposure level from commercial WPT systems when they are used close to the body. It is desirable to develop a practical compliance procedure that associates measured external fields with induced quantities in the body for such a near-field exposure. Therefore this study discusses a practical exposure assessment method

08-1 [15:00] Minimally disruptive gene electrotransfer to substrate-attached adherent cells

Olga Pakhomova¹, Vera Khorokhorina², Shu Xiao^{1,3} & Andrei Pakhomov¹

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

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³Dept. of Electrical and Computer Engineering, Old Dominion University, Norfolk, VA, USA, 23508

Keywords: Electroporation, Pulsed, Completed (unpublished)

We demonstrated the feasibility and efficiency of minimally disruptive gene electrotransfer to cells grown on indium tin oxide (ITO)-covered glass coverslips. The ITO layer did not interfere with cell imaging and did not affect cell growth. The added benefits of the method are its simplicity, low cost, and superior flexibility. The method will be particularly useful in cells with complex morphology or with advanced intercellular connections.

with a coupling factor for WPT systems operating at 6 MHz band.

07-2 [15:20]

STUDENT PAPER

Dielectric property of biological tissues measured with high speed sampling system below 10 MHz

Hiroyuki Nedate^{1,2}, Kanako Wake², Kensuke Sasaki², Katsumi Fujii², Soichi Watanabe², Ryosuke Suga¹ & Osamu Hashimoto¹

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²Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Koganei, Japan, 1848795

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

Dielectric properties of body tissues reported by Gabriel have been widely used for research on bioelectromagnetics. However, Gabriel pointed out that large uncertainties are included in their measured dielectric data below 1 MHz. Therefore, further studies on the dielectric property measurement are necessary at frequency below 1 MHz. In this study, we developed a measurement system using a high-speed sampling oscilloscope to measure the dielectric property of biological samples. The measurement result of porcine blood indicates fair agreement for conductivity comparing with data derived from parametric model by Gabriel. However, clear difference was observed for the result of permittivity below 1 kHz.

07-3 [15:40]

EU directive 2013/35/EU: 50 Hz action level for magnetic limb exposure does not ensure compliance with exposure limit values for in situ electric strength inside skin tissue in realistic exposure scenarios

Gernot Schmid¹ & Rene Hirtl¹

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

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

In situ electric fields strengths for occupational 50 Hz magnetic field exposure situations were investigated by numerical computations considering an upright standing person with both hands in contact to a metallic object. The obtained results clearly demonstrated that an appropriate skin modeling is required for a physiologically and dosimetrically sound assessment and that the 50 Hz action level for limb exposure specified in EU directive 2013/35/EU does not ensure compliance with underlying exposure limit levels for health effects.

08-2 [15:20]

Gene Electrotransfer of Plasmids Encoding Cytokines as an Effective Approach for Immunotherapy

Richard Heller^{1,2}, Cathryn Lundberg¹, Niculina Burcus¹ & Shawna Shirley¹

¹Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA, 23508

²School for Medical Diagnostics and Translational Science, Old Dominion University, Norfolk, VA, USA, 23508

Keywords: Electroporation, Pulsed, Work in Progress

Gene electrotransfer (GET) is a reliable and effective physical method for in vivo delivery of plasmid DNA (pDNA). GET can be used to efficiently deliver plasmids containing immunomodulating agents to induce an effective anti-tumor response. This approach has been used to deliver plasmids encoding cytokines to induce an effective local and systemic response against melanoma. Successful therapy has been demonstrated both in animal studies and human clinical trials. Current efforts are focused on improving the therapeutic response.

08-3 [15:40]

STUDENT PAPER

Presentation of a fully functional prototype for establishing electrochemotherapy in interstitial usage with a Q factor optimization model for the physician

Andreas Ritter¹, Philipp Bruners², Thomas Schmitz-Rode¹,

Joachim Pfeffer² & Martin Baumann¹

¹Applied Medical Engineering (AME), Helmholtz Institute, RWTH Aachen University, Aachen, Germany, 52074

²Department of Diagnostic and Interventional Radiology, RWTH Aachen University Clinic, Aachen, Germany, 52074

Keywords: Electroporation, Pulsed, Completed (unpublished)

Irreversible electroporation (IRE) and electrochemotherapy (ECT) are two innovative, non-thermal and minimally invasive techniques in cancer therapy, based on electroporation (EP). ECT was established successfully for malignancies of the skin, but for an interstitial / intraabdominal usage none of them are established in clinical practice yet [1-4]. In order to establish a combination of ECT and IRE, we developed a needle-shaped probe, which can be used as percutaneous, image-guided, minimally invasive treatment option for malignant liver tumors. The cylinder shaped probe bears four expandable hollow electrodes used for both: injecting the chemotherapeutic agent inside the tumor and creating the electric field, shaped to fit the target area.

07-4 [16:00]

STUDENT PAPER

Systematic numerical analysis of occupational magnetic field hand exposure scenarios reveals importance of skin modeling in compliance assessment according to ICNIRP 2010 and European directive 2013/35/EU

Rene Hirtl^{1,2} & Gernot Schmid¹

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²Institute of Electrodynamics, Technical University of Vienna, Vienna, Austria, 1040

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

Evaluation of in situ electric fields has been made over large variety of parameters for two occupational hand exposure scenarios including a finger loop exposed by a homogenous magnetic field and a hand holding a high current source. The extent of possibly resulting overestimation of the in situ electric field strength when not using a layered skin model causes conflicts with basic restrictions and does not fit correspondingly in a dosimetrically and physiologically sound manner. Consequently, usage of a simple two layered skin model for numerical ELF/LF dosimetry according to ICNIRP 2010 and 2013/35/EU is highly recommended.

08-4 [16:00]

Identification and characterization of specific hemodynamic patterns during exposure to radiofrequency electromagnetic fields amplitude-modulated at tumor-specific frequencies

Frederico Costa¹, Brenda Gumz¹, Tan Chen², Antonio Iemma³, Denise Hatchul⁴, Edison Parise⁵, Tatiana Zanesco¹, Riccardo Marques¹, Niels Kuster⁶, Alexandre Barbault⁷ & Boris Pasche⁸

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Keywords: Clinical (diagnostics), RF/Microwaves, Completed (unpublished)

We have previously reported the identification of changes in pulse amplitude in patients with a diagnosis of cancer when exposed to low and safe levels of AM RF EMF. The observation that changes in pulse amplitude occur at exactly the same frequencies in patients with the same type of cancer led us to hypothesize that each type of cancer has a specific frequency signature. Here we report the identification and characterization of new algorithms allowing for the diagnosis of hepatocellular carcinoma and breast cancer in a blinded fashion based solely on hemodynamic parameters measured before and during exposure to 27.12 MHz RF EMF amplitude modulated at tumor-specific frequencies.

Free time
Tuesday June 16, 2015 • 16:20 - 18:00

Dinner
Tuesday June 16, 2015 • 18:00 - 19:00
Crocker Dining Hall

Session: PB
Poster Session B
Tuesday June 16, 2015 • 19:00 - 22:00
Fireside Underground
Chairs: P. Thomas Vernier & Meike Mevissen

Wednesday June 17, 2015

Breakfast
Wednesday June 17, 2015 • 07:30 - 08:30
Crocker Dining Hall

Session: P3
Plenary 3: Electric fields and nonresectable tumors — clinical practice and physical models
Wednesday June 17, 2015 • 08:45 - 09:45
Merrill Hall
Chairs: Richard Nuccitelli & Meike Mevissen

P3-1 [08:45] -

How can basic science and neat models help us combat erratically growing, uncontrolled cancer?

Julie Gehl¹

¹Consultant Oncology, C*EDGE (Center for Experimental Drug and Gene Electrotransfer), Copenhagen University Hospital Herlev, Herlev, Denmark



Biographical sketch

Dr. Gehl is an MD and oncologist, with extensive experience in translational medicine. For almost 20 years she has focused her research on drug and gene delivery by electroporation, publishing extensively within preclinical and clinical research. Dr. Gehl has been a pioneer within electrochemotherapy, and in particular in the transition from research to routine treatment. A novel contribution is the use of electroporation to introduce supraphysiological doses of calcium into cancer cells – cancer cell death associated with acute energy depletion. Within gene delivery, Dr. Gehl has made important contributions to the understanding of how gene therapy, using gene delivery by electric pulses, may be utilized for the treatment of cancer and chronic diseases.

As a practicing oncologist, Dr. Gehl has a direct knowledge of the challenges in cancer treatment, and continues to endeavor developing new tools in the treatment armamentarium.

Abstract

Cancer continues to be a leading cause of death and morbidity. Progress has been made, but the need for new treatment possibilities is unabated. Electrochemotherapy describes the use of electric pulses to permeabilise cell membranes, allowing influx of chemotherapy to tumor cells. Electrochemotherapy is routinely used in over 100 cancer centers. On the background of clinical examples, the importance of basic science, engineering, and medical knowledge to present patients with relevant treatment choices, is described and discussed.

P3-2 [09:15] -

Cell electroporation modeling for biomedicine: Where are we and where are we going?

James Weaver¹

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



Biographical sketch

James C. Weaver is Senior Scientist (biophysics/biomedical engineering) at MIT, with degrees from Carleton College (BA) and Yale (MS, PhD). After temporary MIT positions, he joined the Harvard- MIT Division of Health Sciences and Technology (HST). Following research with gel microdrops for single cell and microcolony assays and manipulations, he transitioned to bioelectrochemistry and bioelectromagnetics. He pursued theory of weak and strong electromagnetic field interactions with biological systems, experiments involving electroporation of cells and skin, and now increasingly realistic models of cell electroporation. He is a fellow of the American Institute for Medical and Biological Engineering, and he received a NIH Shannon Award, the Giulio Milazzo Prize of the Bioelectrochemical Society, and the D'Arsonval Award of the Bioelectromagnetics Society.

Abstract

The 1970s and 1980s saw the emergence of electroporation (EP), a rapid, electrical disruption of pure lipid and cell membranes, characterized by huge increases in membrane conductance and transfer of ions and molecules into cells. Now there are existing and emerging applications, in vitro and in vivo, even though basic mechanisms are not established, and predictive models are not generally available. The huge EP parameter space involves pulse strengths from 0.1 to 100 kV/cm, durations from nanoseconds to seconds, and molecular, subcellular, cellular and tissue levels, all for different size cells in varying environments. This space is only slightly explored by experiments. However, recent and ongoing modeling presented here is making significant headway in quantitatively predicting essential quantities, and the “standard model” is about to be fundamentally challenged (Weaver et al. unpublished). We envision patient-specific cell EP models being used with regional body models, to guide tumor ablation that spares some vital structure (e.g. major blood vessels), due to non-thermal cell death with/without drugs, and cell death mechanisms leading to intrinsic apoptosis or accidental necrosis. Regional tissue models are expected to suggest placement of thin needle electrodes, or even electrode-free interventions, and also pulsing protocols. This could revolutionize one type of personalized medicine.

Coffee Break Wednesday June 17, 2015 • 09:45 - 10:15

Session: 09
EMF Safety 2: Thermal (Standards, Mechanisms, Policy)
Wednesday June 17, 2015 • 10:15 - 11:55
Fred Farr Room
Chairs: Gunter Vermeeren & Joe Wiart

Session: 10
EMF: Microscale and Nanoscale Effects
Wednesday June 17, 2015 • 10:15 - 11:55
Kiln Room
Chairs: P. Thomas Vernier & Indira Chatterjee

09-1 [10:15]

Local Thermoregulation and Fast Thermal Dose-Based MRI Safety Assessment

Esra Neufeld^{1,2}, Manuel Murbach^{1,2} & Niels Kuster^{1,2}

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²Department of Information Technology and Electrical Engineering, Swiss Federal Institute of Technology (ETHZ), Zurich, Switzerland, 8092

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

A method to rapidly evaluate magnetic resonance imaging safety for any scan sequence based on specific absorption rate (SAR) data has previously been presented. The method, which takes local hot-spots, exposure duration, tissue sensitivity, and heating history into consideration by calculating thermal dose, has been extended to account for the important impact of local thermoregulation. Validation against detailed electromagnetic and thermal simulations of complex pulse and scan sequences showed agreement within the carefully determined uncertainty budget. The predictions are also in agreement with existing measurement data and have also been found to be applicable for shimmed coils.

09-2 [10:35]

The impact of eye injury studies on RF exposure limits

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10-1 [10:15]

Molecular mechanisms of the interaction of electric pulses with cells : a new and unifying model

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Keywords: Electroporation, Pulsed, Completed (unpublished)

Following our results on the electrotransfer of nucleic acids, we have studied the basic mechanisms of the interaction of membranes and electric pulses both from a biological and a chemical point of view. Thanks to these experiments, we propose a new model of the interaction of electric pulses with cells which reunites electroporation and electropermeabilization.

10-2 [10:35]

STUDENT PAPER

Ca²⁺ release from internal stores of adrenal chromaffin cells is not evoked by 5 ns electric pulses

Josette Zaklit¹, Jihwan Yoon¹, Indira Chatterjee¹, Eric Evans², P. Thomas Vernier³, Normand Leblanc² & Gale Craviso²

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

Radiofrequency (RF) safety standards developed in 1966 through 1991 contained a caution regarding RF exposure of the eye but did not set limits using eye injury studies; however, both the ICNIRP 1998 guidelines and the IEEE C95.1-2005 standard set localized exposure limits based on cataract studies in laboratory animals. In this presentation, we review how the eye injury studies were used in setting RF exposure limits and comment on the results of the research on RF-induced eye injuries published over the last 10 years.

09-3 [10:55]

Association of maximum SAR exposure in the eyes with acute ocular effects during prolonged RF exposure

Fatemeh Adibzadeh¹, Gerda Verduijn², Gerard van Rhoon¹ & Maarten Paulides¹

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

The eye is considered to be a critical organ when determining safety standards for radio-frequency (RF) radiation. Hereto we computed the SAR levels induced during head and neck hyperthermia (H&N HT) treatments and analyzed ocular effects using a treatment toxicity score. The results show that, while the basic restrictions on SAR_{10g} were exceeded by at least up to 6-fold, no serious ocular damage was induced.

09-4 [11:15]

Assessment of the *in-situ* Electric Field in the Human Skin at the Maximum B-Field Permissible Exposure Levels

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Keywords: Standards, ELF/ILF, Completed (unpublished)

In this paper, the *in-situ* electric field induced in the skin, i.e., a potential target tissue for peripheral nerve system stimulation, due to low frequency magnetic field exposure,

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Keywords: In vitro, Pulsed, Work in Progress

Nanosecond electric pulses have been shown to affect intracellular structures in different cell types and evoke a number of cellular responses, such as Ca²⁺ release from internal stores. Adrenal chromaffin cells, however, do not show evidence of Ca²⁺ release from internal stores when exposed to trains of 5 ns pulses but clearly show Ca²⁺ mobilization from internal stores when stimulated by brief exposure to a receptor agonist. The basis for the lack of effect on intracellular Ca²⁺ stores by 5 ns pulses is unclear since preliminary cell modeling results suggest that pores are formed on intracellular membranes.

10-3 [10:55]

Cell membrane permeabilization by mono- and bipolar nanosecond electric oscillations

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Keywords: Electroporation, Pulsed, Completed (unpublished)

In this study, we show that asymmetric, oscillation-type bipolar nsEP are 2-3-fold less efficient at permeabilizing the cell membrane than monopolar rectified oscillation-type nsEP. This effect is seen across a range of EF amplitudes, and is not altered by changes in pulse parameters or removing extracellular Ca²⁺. This reduced permeabilization by bipolar nsEP likely manifests as an overall smaller pore size and/or number of pores in the membrane. These data indicate that, though it may be partially involved, the reverse electrophoretic transport of Ca²⁺ is not responsible for the lower efficiency of bipolar nsEP compared to monopolar pulses.

10-4 [11:15]

Electropore formation in mechanically constrained phospholipid bilayers

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is evaluated. The induced electric fields are then compared with the basic restrictions provided by the existing guidelines and safety standards. This comparison shows that the basic restrictions could be exceeded when exposing a realistic anatomical model in a standing posture to the maximum allowable external magnetic fields.

09-5 [11:35]

Safety evaluations for anatomical pregnant human models within two-port 3T MRI body coils

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

In this study, we investigated the radiofrequency (RF) safety of two-port body coils in 3 T magnetic resonance imaging (MRI) for pregnant women models at different gestational stages. While traditional excitation at 1.5 T in circularly polarized (CP) mode leads to exposure patterns that are spatially equalized, the linear polarizations from two-port RF shimmed coils at 3 T may lead to higher localized fields, and also to higher thermal loads on the fetus. Evaluations of the different excitation regimes show that worst-case exposure for the mother leads to low exposure of the fetus, and vice versa, while the outcome for CP mode is between these two cases.

Keywords: Mechanistic/Theoretical, Static, Work in Progress

This work describes the formation of electropores in lipid bilayers with mechanical constraints applied to selected phospholipids. Four constraint conditions (no constraint, cathodic, anodic, and both sides) are analyzed for their effects on pore structure and initiation time.

10-5 [11:35]

Novel Effects of Nanosecond Pulsed Electric Fields on Proteins and Immune Responses

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

Well-known effects of electroporation on cell membranes cause lipid structural rearrangements that allow transport of ions and facilitate delivery of DNA/RNA to the cell interior. Nanosecond pulsed electric fields (nsPEFs) also affect intracellular membranes in this same way. Recent findings suggest that nsPEFs may have more far reaching consequences. Consistent with charging effects on a rod-shaped protein, nsPEF inactivated catalytic activity of protein kinase A. In vivo, after nsPEFs successfully ablated liver tumors, a protective vaccine affect prevented growth of addition liver tumors. These responses suggest unexpected nsPEF actions that extend our understanding of bioelectric effects on cells, tissues and immune mechanisms.

Lunch

Wednesday June 17, 2015 • 12:00 - 13:00
Crocker Dining Hall

Open afternoon

Wednesday June 17, 2015 • 13:00 - 18:00
Buses to Monterey and Carmel

Dinner (not banquet attendees)

Wednesday June 17, 2015 • 18:00 - 19:00
Crocker Dining Hall

Banquet - Sponsor recognition

Wednesday June 17, 2015 • 19:00 - 22:45
Monterey Bay Aquarium

NOTE: Afternoon shuttles to Carmel shopping, Monterey Cannery Row and Aquarium will run this afternoon...see schedule on p. 105

Thursday June 18, 2015

Breakfast
Thursday June 18, 2015 • 07:30 - 08:30
Crocker Dining Hall

Session: P4
Plenary 4: Electrohypersensitivity (Idiopathic environmental intolerance to EMF)
Thursday June 18, 2015 • 08:45 - 09:45
Merrill Hall
Chairs: John Bolte & Andrew Wood

P4-1 [08:45]

Electrohypersensitivity – a moving target from VDT to Wi-Fi

Kjell Hansson Mild¹

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Keywords: Human, All Frequencies, Review



Biographical sketch

Kjell Hansson Mild is a former president of the Bioelectromagnetics Society (1995-96). He has also served on the board of both BEMS and EBFA. He was associate editor for the Bioelectromagnetics journal during 1988 to 1996. His present position is senior consultant at Department of Radiation Physics, University of Umeå, Sweden. He has been working as researcher at the National Institute for Working Life from 1976 until it was closed down in 2007. His education is in physics and theoretical physics. He presented his PhD Theses in 1974 at Umeå University, Sweden.

He has served on many international commissions, such as the EU commission expert group on mobile telephony, 1997, COST 244 bis expert group for update of the EU document on mobile telephony, COST BM0704 management committee and member of the WG on health effects from MRI, 2009. He was a member of the IARC expert group for magnetic field-cancer, 2001. Recently he has served as external expert in the Scientific

Committee on emerging and newly identified health risks (SCENIHR), Potential health effects of exposure to electromagnetic fields, 2012-2013. Hansson Mild has been author or co-author of more than 300 publications and 250 conference abstracts.

Abstract

It all started as facial skin symptoms experienced by persons working with video display terminals (VDT). Later health problems were also reported when located near sources such as power lines, household appliances, mobile telephones, mobile phone base stations, visual display terminals (VDTs) and fluorescent lights. The reported sensitivity reactions include a wide range of nonspecific symptoms, which afflicted individuals attribute to exposure to electromagnetic fields. The EMF exposure levels are typical of those encountered in normal environments. The symptoms has been during the years given different names, from the start as VDT sickness it went to electrical hypersensitivity since it was not only VDT involved. It even took a turn to be Electric allergy, but since we know that this is not an allergy it did never catch on too much.

In 2004 the WHO EMF project housed a seminar in Prague entitled Electromagnetic Hypersensitivity (Hansson Mild et al, 2004). The term Idiopathic environmental intolerance (Electromagnetic field attributed symptoms), or IEI-EMF, was proposed to replace terms that imply an established causal relationship between symptoms and electromagnetic fields (e.g. electromagnetic hypersensitivity, electrosensitivity and hypersensitivity to electricity).

Recently European committee working group of scientist within the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR, 2015, KHM member) has reviewed the new literature from 2009 and up to mid 2014 and they state in their conclusions that RF EMF exposure is not causally linked to these symptoms.

References

Hansson Mild K, Repacholi M, van Deventer, and P Ravazzani, Eds. Electromagnetic Hypersensitivity. Proceedings from an international workshop on EMF Hypersensitivity, Prague, Czech Republic, Oct 27-27, 2004. WHO Library Cataloguing-in-

SCENIHR (2015). Scientific Committee on Emerging and Newly Identified Health Risks. Opinion on Potential health effects of exposure to electromagnetic fields (EMF).

Keywords: skin rashes, Idiopathic environmental intolerance, electric, magnetic, microwave, base stations

**P4-2 [09:15] -
Truths about electromagnetic hypersensitivity?**

Gunnhild Oftedal¹

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Biographical sketch

Gunnhild Oftedal is Associate Professor at the Faculty of Technology, Sør-Trøndelag University College, Trondheim, Norway. In 1977 she earned an M.Sc. in Biophysics, and in 1985 she completed her Ph.D. in the area of psycho-physioacoustics. From the early 90s, she has conducted research on health effects and electromagnetic fields, with a primary focus on symptoms attributed to exposure. She has been a member of several Norwegian expert groups and has been engaged internationally in COST Actions and as member of the council of EBFA. Currently Oftedal is a member of the Core Group in the preparation of WHO's Environmental Health Criteria Monograph on Radiofrequency Fields.

Abstract

What to trust, the stories told by people experiencing symptoms in connection with exposure to electromagnetic fields (EMF) or science concluding that the exposure is not the reason for the complaints? Incorrect conclusions may be drawn based on experience as well as on science. To ensure the best scientific basis for drawing conclusions, we have to identify what types of studies and what criteria to apply. We have to consider the endpoints tested, the study groups included, the design and other study characteristics that determine whether the study is relevant and trustworthy to add information. Furthermore, we should base our conclusions on all relevant studies with a sufficient quality. When doing so, we do not find evidence that EMF exposure is responsible for the health complaints. Should we then distrust people telling their stories about symptoms in connection with EMF exposure? There is no doubt that their symptoms are real, and it is possible to explain why they attribute symptoms to EMF. Therefore, people are telling the truth about their experience even if science has not confirmed their belief about EMF being the reason for the complaints.

**Coffee Break
Thursday June 18, 2015 • 09:45 - 10:15**

Session: 11
EMF Safety 3: SAR (Standards, Mechanisms, Policy)
Thursday June 18, 2015 • 10:15 - 11:55
Fred Farr Room
Chairs: Nam Kim & Gernot Schmid

11-1 [10:15]

Age-dependent exposure of the brain in cell phone users

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

This study uses state-of-the-art anatomical head models of adults and children considering age dependent changes of the dielectric tissue properties to assess age-dependencies of the exposure of the brain in cell phone users considering different phone designs operating at frequencies from 450 MHz to 2100 MHz and age dependent changes of the dielectric tissue properties.

11-2 [10:35]

Surrogate-based fast peak mass-averaged SAR assessment

Gunter Vermeeren¹, Prashant Singh¹, Sam Aerts¹, Dirk Deschrijver¹, Tom Dhaene¹, Wout Joseph¹ & Luc Martens¹

¹Information Technology, iMinds / UGent, Ghent, Belgium, 9050

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

We propose a fast peak mass-averaged SAR assessment methodology based on surrogate modeling techniques to reduce the number of measurement points in a compliance test. The sampling algorithm is crucial to solving the problem at hand. For the surface scan, we used a generalized Probability of Improvement criterion, while for the zoom scan we selected the LOLA-Voronoi algorithm. We applied this method to determine the peak SAR_{10g} induced by a dipole antenna in the flat phantom. The total number of measurement points for both surface and zoom scan was 80 with a root relative squared error of less than 1.04 for both scans. Current measurement standards specify a zoom scan which consists of at least 5x5x7 or 175 measurement points.

Session: 12
Neuroplasticity *in vivo* and *in vitro* I
Thursday June 18, 2015 • 10:15 - 11:55
Kiln Room
Chairs: Carmela Marino & Zhengping Xu

12-1 [10:15]

STUDENT PAPER

Effects of 50 Hz magnetic fields on neuronal plasticity in the hippocampus of young mice

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²Department of Pharmacology, University of Oxford, Oxford, UK, OX1 3QT

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

The effects of single or repeated exposure to magnetic fields on hippocampal neurogenesis and the expression of genes associated with neuronal plasticity were investigated in young C57BL/6j mice. A significant increase in bdnf expression in the hippocampus was found after exposure to a 50 Hz field at 100 μ T for 2 h, but not after repeated exposure at 300 μ T. grin1 expression was altered with both exposures but in different directions. Effects on neuronal proliferation were investigated and a possible increase in neurogenesis was seen after repeated 300 μ T exposure. These results suggest that molecular signalling may be susceptible to magnetic fields. Further work is underway to understand and clarify these results.

12-2 [10:35]

STUDENT PAPER

Study of potential millimeter-wave-induced modifications in protein expression and neurite outgrowth of PC12 cells during neuronal differentiation

Alexis Haas¹, Yann Le Page¹, Maxim Zhadobov², Ronan Sauleau² & Yves Le Dréan¹

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

Millimeter waves (MMW), in particular the 60-GHz band, are increasingly used for wireless communications. To evaluate potential modifications at the cellular level due to a MMW exposure, we exposed a neuron-like differentiating cell line at 60.4 GHz, during 24h with an average incident power density of 5 mW/cm². Using a semi-high throughput immunocytochemistry imaging system, we did not find any difference in the protein expression of several markers involved in nociception, neuronal differentiation and proteotoxic stress. However, an upward trend in neurite outgrowth, although not significant, was found in exposed cells. Controls showed that this increase was related to a thermal effect of MMW.

11-3 [10:55]

STUDENT PAPER

Evaluation of MRI exposure in patients using the Virtual Population 3.0 and 1.0 anatomical models

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

The anatomical human models of the Virtual Population version 1.0 (VIP 1.0) are commonly used in the evaluations of RF-induced fields during MR exposure. In this study, we aim to quantify the effects that differences in the model entities have on MRI exposure assessment. A generic RF body coil was considered and the adult female model 'Ella' from the ViP 1.0 and ViP 3.0 were compared both from an anatomical and a dosimetrical point of view. We found that models yield sufficiently similar absorption in the brain and significantly different absorption in the vertebrae. Future study shall investigate the extent of applications the V1.0 models are sufficient for, and to what extent of applications necessitate the use of V3.0 models.

11-4 [11:15]

Validation of emerging fast SAR measurement technologies

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¹ETH, Foundation for Research on Information Technologies in Society, Zurich, Switzerland, 8004

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³Information Technology and Electrical Engineering, Swiss Federal Institute of Technology, Zurich, Switzerland, 8092

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

Innovations in Specific Absorption Rate (SAR) measurement technology are dramatically improving the time needed to fully test wireless devices for regulatory approval. Standards and national regulations addressing these innovations need to be built on a strong foundation of measurement validation to ensure consistency and to maintain confidence that the assessed SAR is a conservative estimate of exposure in the majority of users.

12-3 [10:55]

ELF-MFs exposure drives epigenetic changes in the SH-SY5Y human dopaminergic neuroblastoma cell line

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

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

Parkinson's Disease (PD) is thought to have a multifactorial aetiology, including both genetic and environmental factors. They have been proposed to interplay by epigenetic mechanisms to drive irreversible neuronal damage. Electromagnetic Fields have been recently associated with an increased risk of neurodegenerative diseases, therefore we aimed at evaluating whether the response to Extremely Low Frequency (ELF) Magnetic Fields (MFs) may imply epigenetic modifications in the SH-SY5Y dopaminergic cells and eventually contribute to the increased sensitivity to the MPP⁺, a synthetic compound routinely used to mimic PD symptoms.

12-4 [11:15]

Neurostimulation with nanosecond pulsed electric fields: A combined electrophysiology and multiphoton imaging approach in intact ganglia

Sergii Romanenko¹, Delia Arnaud-Cormos¹, Sylvia M. Bardet¹, Philippe Leveque¹ & Rodney P. O'Connor¹

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Keywords: Electroporation, Pulsed, Completed (unpublished)

The effect of high power nanosecond pulsed electric fields (nsPEF) was examined on the complex neuronal assemblies of intact leech ganglia. The medicinal leech midbody ganglion is a convenient experimental preparation that represents a real neuronal network with neuronal diversity and glial cells. 10 ns pulses of different intensities ranging from 22.5 to 47 kV/cm were applied to the ganglia body and alterations in natural electrical activity of Retzius cells were recorded with sharp glass electrode in a current-clamp mode or multiphoton whole-ganglia imaging with calcium indicators. The lowest nsPEF intensity tested resulted in stimulation of a single action potential (AP) whereas all higher intensities used led to bursts of APs.

11-5 [11:35]

Calibration of the CAD model of a commercial mobile phone for SAR compliance

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

The specific absorption rate (SAR) compliance of mobile phones is based on measurement procedures developed by international standardization bodies. Although electromagnetic simulation tools may be readily available, the SAR compliance of a commercially available mobile phone based on numerical simulation is still a challenging task. The main difficulty yet to be fully addressed is to evaluate the uncertainty related to the SAR calculation. An important contribution to the overall uncertainty budget of the SAR calculation arises from the numerical model of the mobile phone itself, described as the model uncertainty. A reference SAR value obtained experimentally may be employed for the validation of the numerical simulation.

12-5 [11:35]

miR-219 down-regulating NMDAR signaling pathway is essential in the synaptic plasticity injury induced by microwave exposure

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

This study aimed to investigate how the miR-219 regulated NMDAR signaling pathway in the synaptic plasticity injury induced by microwave exposure in vivo and in vitro. The results showed that: (1) 30mW/cm² microwave exposure induced the synaptic plasticity impairment, and the activation of NMDAR pathway participated in the process. (2) The down-regulation of miR-219 induced by 30mW/cm² microwave exposure could enhance the injury of synaptic plasticity through increasing the expression of miR-219 target gene. (3) MiR-219 down-regulation could enhance the activation of NMDAR pathway via up-regulating the expression of CaMKII α , which might be a crucial mechanism about the synaptic plasticity impairment induced by microwave.

Lunch
Thursday June 18, 2015 • 12:00 - 13:00
Crocker Dining Hall

Session: M4
BEMS Business Meeting
Thursday June 18, 2015 • 12:00 - 13:00
Woodlands Dining Room

Session: W2
Workshop 2 - Contemporary issues relevant to EMF/RF guidelines & standards
Thursday June 18, 2015 • 13:15 - 14:45
Merrill Hall

W2-1 [13:15] - Workshop Organizer

Robert Kavet¹

¹Environment Sector, Electric Power Research Institute, Palo Alto, CA, USA

W2-2 [13:15] - A perspective on stimulus-response relationships and dosimetric uncertainty

Robert Kavet¹

¹Senior Technical Executive, Environment Sector, Electric Power Research Institute, Palo Alto, CA, USA

Magnetic field guidelines and standards for 1-100 kHz recommend exposure limits whose purpose is to protect virtually all persons against electrostimulation. The most cited limits are those issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 2010) and the Institute of Electrical and Electronic Engineers (IEEE, 2002, 2014). Below 400 Hz (ICNIRP) and 759 Hz (IEEE), the limits protect against synaptic activation in the central nervous system, as represented by the induction of magnetophosphenes. Above these frequencies the exposure limits address peripheral nerve stimulation (PNS), which is the subject of this paper. Despite apparently similar objectives, ICNIRP's exposure limit from ~3 kHz to 100 kHz is about 7.7 times lower than IEEE's with respect to PNS, despite the fact that ICNIRP's basic restriction (BR) is only 1.57 times lower than IEEE's in the same frequency range. A large part of the discrepancy in their exposure limits is that ICNIRP builds an additional safety (or reduction) factor to account for "dosimetric uncertainties." ICNIRP relies on anatomical dosimetry for estimating in situ electric fields as a function of external magnetic fields (V/m per mT per Hz). Up to this point dosimetric studies have used the electric fields in skin and fat as surrogates for peripheral

nerve (PN). With the additional uncertainty factor included, ICNIRP's exposure limits do not correspond by a wide margin to its *BR*, which can introduce compliance issues. IEEE has used an ellipsoidal model to represent a person, and has used closed form solutions to estimate the relationship of external field to induced electric field. IEEE's exposure limits and *BR*s do correspond to one another, but the use of an ellipsoid might be questioned as less preferable than anatomic dosimetry. This paper illustrates that using empirical data of PNS in human subjects exposed to magnetic fields, uncertainties with respect to both *in situ* electric field PNS thresholds and coupling coefficients to PN (indices of dosimetric relationships) are limited by the log-range over which the external field produces sensory responses. This approach permits one to more accurately estimate the fraction of the population responsive over a range of induced electric fields and external exposures, and to revisit limits and safety factors while assuring protection to virtually all persons.

W2-3 [13:15] -

Role of computational dosimetry when setting the limits in safety standards/guidelines

Akimasa Hirata¹

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Computational dosimetry for human exposure to low- and radio-frequency fields is reviewed. The ICNIRP guidelines and IEEE standard set limits for human protection from established health effects caused by electromagnetic fields. The adverse health effect at low-frequency exposures is electrostimulation, which is caused by nerve activation, and the *in-situ* electric field is then used a metric. For radio-frequency exposures, the specific absorption rate (SAR) is used as a metric, which is a surrogate of the temperature elevation, to prevent thermal effect. In order to clarify the relationships, multi-physics modeling is needed using anatomically based human model. The relationships obtained by the computational dosimetry are useful to confirm the rationale of the limits in the international safety guidelines, contributing to their harmonization.

W2-4 [13:15] -

Recent studies of human subjects to characterize acute responses relevant to standards and guidelines

Alexandre Legros^{1, 2}

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²Associate Professor, Depts of Medical Biophysics, Medical Imaging and School of Kinesiology, Western University, London, ON, Canada

A clear threshold for acute human neurophysiological responses to ELF magnetic fields (MF) is still needed to further document ICNIRP and IEEE recommendations' rationale. Magnetophosphene perception and associated electroencephalographic (EEG) activity are studied in response to 20/50/60/100 Hz MF exposure up to 50 mT. Results indicate a magnetophosphene perception threshold at 15 mT at power frequencies (50/60 Hz), and decreased EEG alpha (8-12 Hz) activity above this threshold. Beyond addressing a guidelines gap, results from these two recent experiments (n=51 and n=80 respectively) will improve understanding of basic mechanisms originating magnetophosphenes, and provide grounded bases supporting potential neuromodulation translations.

W2-5 [13:15] -

Possible basis for RF effects on alpha waves

Sarah Loughran¹

¹Research Fellow, Australian Centre for Electromagnetic Bioeffects Research, Illawarra Health and Medical Research Institute, University of Wollongong, Wollongong, Australia

There is now evidence that low level radiofrequency electromagnetic field (RF EMF) exposure within international exposure limits influences brain activity. Effects on the electroencephalograph (EEG) occur both during awake and sleep conditions and have been replicated repeatedly, however the underlying mechanisms remain unknown. Given that these effects are not predicted by current thermal mechanisms and that RF safety standards are based on such mechanisms, this brings into question the adequacy of the standards. By testing whether RF EMF exposure causes thermoregulatory change, this study addresses the thermal/non-thermal mechanism debate, adding to our understanding and providing assurance that current safety standards are sufficient.

Session: W3
Workshop 3 - Safety of wireless transmitting devices
Thursday June 18, 2015 • 15:00 - 18:00
Merrill Hall
Chairs: Devra Davis & Mary Redmayne

**W3-1 [15:00] -
Environmental Health Trust - Workshop Organizers**

Devra Davis

¹*Environmental Health Trust*

In 2014, it's estimated that there will be 16 billion wireless transmitting devices as part of the Internet of Things—digitally linking escalating numbers of devices in homes and workplaces. Projections are that up to 50 billion wireless transmitting devices will be in use by 2020. A growing number of applications involve direct human contact with wireless radiation, including infants and toddlers. This workshop will explore industry innovations in hardware and software design of wireless transmitting devices that can extend battery life and reduce exposures, modelling of exposures, efforts to understand and monitor the potential impact on public health and the environment of this growth in direct wireless radiation exposures, and opportunities for marketing of innovative programs and devices.

Those in urban environments can expect to be surrounded by several thousand trackable devices. A growing number of applications and devices emitting wireless radiation are produced specifically to monitor infants and children, some requiring use against the body. This workshop will explore industry innovations in hardware and software for wireless transmitting devices, evolving methods to track real time emissions and exposures, the need for standardization of EMF metrics of emissions and exposures, modeling of those exposures especially for young children and efforts to understand and monitor the potential impact on public health and the environment of this growth in direct wireless radiation exposures.

This workshop will include talks, demonstrations, individual participation using own-phones, break-away small group discussion, and Q & A time.

**W3-2 [15:00] -
Part I: Exposure modeling and measurements**

Chair: Mary Redmayne

Monash University, Melbourne, Australia. Participating Member of Standards Australia Committee on Human Exposure to Electromagnetic Fields, Technical Committee TE-007

**W3-3 [15:00] -
Simulating Multi-Media Wireless Exposures—art imitating life**

R Blank¹ & Robert D. Morris²

¹*CEO, SYB Inc., CA, USA*

²*Senior Medical Advisor, Environmental Health Trust, USA*

**W3-4 [15:00] -
Measuring and Reducing Multi-media exposures to wireless transmitting devices in the university environment—a demonstration of work in progress including attendee participation using own mobile phones or other wireless transmitting devices**

Saleh Faruque¹

¹*Associate Professor, Department of Electrical Engineering, University of North Dakota, ND, USA*

**W3-5 [15:00] -
Estimating age-specific exposures to laptops and cell phones with anatomically-based models**

Claudio Fernández, Sergio M Racini, Alvaro de Salles, Robert D. Morris & Devra Davis

**W3-6 [15:00] -
Work in progress to estimate and reduce operating exposures within a mobile device**

Dariusz Leszczynski

W3-7 [16:40] -
16:40 - 17:00 BREAK with light refreshments, non-alcoholic and wine, beer, fruit and cheese

W3-8 [17:00] -
Part II: Evaluating Possible Health Impacts & Policy Options

Chair: Devra Davis
Environmental Health Trust

W3-9 [17:00] -
In Vitro and In Vivo evaluation of developmental impacts of wireless transmitting devices—Gazi Biophysics Laboratory experiences, 1992-2015
Nesrin Seyhan

W3-10 [17:00] -
Methods developed to evaluate biomarkers in cell phone users—an Indian national cohort
Radhey Shyam Sharma
¹*Deputy Director General Indian National Medical Research Council*

W3-11 [17:00] -
Crafting appropriate policy responses to evolving science—the Canadian model
Frank Clegg
¹*Former President Microsoft Canada*

W3-12 [17:00] -
BREAK Into Workgroups with speed priority setting exercise: what are the top two data gaps and research priorities in the field

Chairs of Workgroups on Priority Data Gaps and Research Priorities

Lloyd Morgan—public health studies
Saleh Faruque—phone operating, network and hardware innovations
Frank Clegg—fruit on the ground for policy development
A policy group
Other topics may emerge

Reporters from Workgroups will take notes onto laptops for display at wrap up

Chris Portier/Robert Morris—public health studies
Lloyd Morgan—phone operating, network and hardware innovations
Darius Leszczynski—fruit on the ground

*Note we will run into the 'free-time' and provide light refreshments at the break

Free time
Thursday June 18, 2015 • 16:30 - 18:00

Dinner
Thursday June 18, 2015 • 18:00 - 19:00
Crocker Dining Hall

Session: W4
Workshop 4 - Submitting papers for publication in Bioelectromagnetics
Thursday June 18, 2015 • 19:00 - 20:00
Merrill Hall

**W4-1 [19:00] -
Workshop Organizer**

James Lin¹

¹*Professor, University of Illinois, Chicago, Editor-in-Chief, Bioelectromagnetics, USA*

**W4-2 [19:00] -
Writing and submitting papers for publication in Bioelectromagnetics**

James Lin¹

¹*Professor, University of Illinois, Chicago, Editor-in-Chief, Bioelectromagnetics, Chicago, USA*

**W4-3 [19:30] -
Publishing research papers with Wiley**

Mia Ricci¹

¹*Global Research Editor, Wiley, USA*

Poster Party
Thursday June 18, 2015 • 20:00 - 22:00
Fireside Underground

Friday June 19, 2015

Breakfast
Friday June 19, 2015 • 07:30 - 08:30
Crocker Dining Hall

Session: P5
Plenary 5: Electric fields and calcium signaling
Friday June 19, 2015 • 08:45 - 09:45
Merrill Hall
Chairs: Lluís M. Mir & Olga Pakhomova

**P5-1 [08:45] -
Physiological significance of calcium in cellular responses to nanosecond pulsed electric fields**

Ken-ichi Yano¹

¹Professor, Department of Bioelectronics, Institute of Pulsed Power Science, Kumamoto University, Kumamoto, Japan, 860-8555



Biographical sketch

Ken-ichi Yano has received the Ph. D. degree in biology from Tokyo Metropolitan University. He has worked in the field of radiation biology at JFCR Cancer Institute, Lawrence Berkeley National Laboratory, and University of Texas Southwestern Medical Center. Since 2008, he has been a professor at the Department of Bioelectronics, Kumamoto University, Japan. His major research interest is molecular mechanisms of signal activation and cell death caused by nanosecond pulsed electric fields.

Abstract

Nanosecond pulsed electric fields (nsPEFs) are recently regarded as a novel and unique means for life sciences. Relatively mild nsPEFs activate multiple intracellular signaling pathways, while intense nsPEFs induce either apoptotic or necrotic cell death in a cell-type dependent manner. Furthermore, nsPEFs generate small membrane pores that cause elevated cytosolic Ca²⁺, mainly owing to the influx of extracellular Ca²⁺. We analyzed how extracellular Ca²⁺ affects intracellular events induced by nsPEFs. In this talk, we will

present experimental evidence for the direct involvement of Ca²⁺ in the intracellular signaling and cell death in nsPEF-exposed human cells.

**P5-2 [09:15] -
New imaging tools for studying calcium signaling and bioelectric effects in vitro and in vivo**

Rodney P. O'Connor¹

¹LabEx Chair in Bioengineering, XLIM Research Institute, CNRS UMR 7252/Université de Limoges, Limoges, France



Biographical sketch

Rod O'Connor completed his BSc and MSc in the Neuroscience Research group of Michael Persinger at Laurentian University in Canada, where he studied the biological effects of weak, extremely low frequency, pulsed electromagnetic fields. He received a PhD from the University of Cambridge in the Calcium Signalling group of Sir Michael Berridge and Martin Bootman for his research using fluorescent imaging tools to study the effects of visible light and pulsed radiofrequency electromagnetic fields on cellular signalling. Thereafter, he was awarded a Marie Curie fellowship to explore the use of multiphoton microscopy for in vivo imaging and developed methods for femtosecond-pulsed laser manipulation of the brain in vivo (Pavone Biophotonics lab, LENS, Italy). He pursued further postdoctoral training in electrophysiology and fiber photonic tools for electrically stimulating the brain in vivo with light using optogenetics (Janelia Farm HHMI, Ashburn, VA) and later investigated sensory signalling mechanisms in marine organisms with electrophysiology in Woods Hole (Atema Group, Boston University & WHOI, Woods Hole, MA). He currently holds the SigmaLim LABEX Excellence Chair in

Bioengineering at the XLIM Research Institute in Limoges, where his lab is applying imaging, electrophysiology and optogenetic tools to investigate the biological effects of electromagnetic fields.

Abstract

Calcium is a universal signalling molecule that regulates a wide range of cellular processes and thus remains an important measure of biological responses to electromagnetic fields. A brief review of recent developments in calcium imaging technology will be presented in the context of our recent research at XLIM studying the effects of ultrashort pulsed electric fields and radiofrequency electromagnetic fields. In particular, the potential of the new generation of genetically encoded calcium indicators (GECIs) will be highlighted, given their ability to report calcium signals under in vivo conditions with a high dynamic range.

Coffee Break Friday June 19, 2015 • 09:45 - 10:15

Session: 13
EMF Safety 4: SAR (Standards, Mechanisms, Policy)
Friday June 19, 2015 • 10:15 - 11:15
Fred Farr Room
Chairs: Eric Van Rongen & John Bolte

Session: 14
Neuroplasticity in vivo and in vitro 2
Friday June 19, 2015 • 10:15 - 11:15
Kiln Room
Chairs: Alexandre Legros & James Lin

13-1 [10:15] Dosimetry of infant's exposure to 2.45 GHz electromagnetic field by considering the physical contact with the adult

Tongning Wu¹, Congsheng Li¹ & Chen Zhang¹

¹Bioelectromagnetics, China Academy of Telecommunication Research, Beijing, China, 100191

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

Infant's exposure to the electromagnetic fields has not been analysed in detail due to the lack of the infant model. However, the features of the infant necessitate the study of this kind. One feature for the infant is the physical contact with the adult body due to its dependence on the mother. Recently, we reconstructed a whole-body infant model from the magnetic resonant images. In this work, we will perform the simulation for the case of the infant in the arm of the adult female. The influence of the existence of the adult body to the specific absorption rate (SAR) of the infant will be discussed.

13-2 [10:35] Exposure assessment of one-year old child to 3G tablet device using Polynomial Chaos decomposition

Ilaria Liorni^{1,2}, Marta Parazzini¹, Serena Fiocchi¹, Nadege Varsier³, Pierrick Kersaudy³, Paolo Ravazzani¹ & Joe Wiart³

¹Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni IEIIT, Consiglio Nazionale delle Ricerche CNR, Milano, Italy, 20133

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

³Whist Lab, Orange, Issy Les Moulineaux, France

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

14-1 [10:15] Experimental validation of combined induction and electrostimulation model

Ilkka Laakso¹ & Akimasa Hirata¹

¹Dept. of Computer Science and Engineering, Nagoya Institute of Technology, Nagoya, Japan, 466-8555

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

Magnetic stimulation enables us to investigate the function of the human nervous system non-invasively. However, it is difficult to determine which internal sites are actually affected by it. Here we describe a computational model that combines a finite-element induction model with electrostimulation models. The model predictions are compared with responses recorded experimentally for magnetic spinal nerve root stimulation. We show that the model can quantitatively reproduce experimental data, leading to improved understanding of the physics and basic mechanisms of non-invasive stimulation. Our work shows that computer-based modeling is a promising new approach to evaluate and improve the accuracy of non-invasive stimulation.

14-2 [10:35] Single axon measurement setup based on *Lumbricus Terrestris* as a convenient animal model for studying waveform effect on nerve excitability

Antonio Sarolic¹ & Zlatko Zivkovic¹

¹Chair of Applied Electromagnetics, FESB, University of Split, Split, Croatia, 21000

Keywords: In vivo, IF, Completed (unpublished)

A single axon is still a primary target for excitability studies when it comes to isolating the effect of stimulus parameters, or to verify an excitation model. *Lumbricus terrestris* was chosen as a convenient animal model, with a simple nervous system enabling single axon measurements. The study produced a set of results that nicely agree both with the theory and with SENN model, proving that this

The exposure to Radio-Frequency electromagnetic fields (RF-EMF) is still a hot topic due to the spread of new RF devices usage among very young population. An assessment of the exposure to these devices, which would take into account the variability of real exposure scenarios, is therefore needed. In this work the study of the exposure of a 1-year-old child to 3G tablet emitting at 1940 MHz has been carried out. In order to estimate the variability of the exposure due to the position of the tablet respect to the child, advanced stochastic tools, based on the Polynomial Chaos (PC) method, have been used to build PC expansions of the whole-body SAR and the SAR in the brain of the child at a low computational cost.

13-3 [10:55]

The interdisciplinary Swiss expert group on electromagnetic fields and non-ionising radiation (BERENIS) – an innovative approach for regularly updating the public about new scientific insights by assessing them in quarterly newsletters

Stefan Dongus¹, Peter Achermann², Jürg Fröhlich³, Jürg Kesselring⁴, Meike Mevissen⁵, David Schuermann⁶, Edith Steiner⁷ & Martin Roosli¹

¹*Environmental Exposures and Health Unit, Swiss Tropical and Public Health Institute, Basel, Switzerland, 4002*

²*Institute of Pharmacology and Toxicology, University of Zurich, Zurich, Switzerland, 8006*

³*Fields at Work GmbH, Zurich, Switzerland, 8006*

⁴*Rehabilitation Centre, Clinics of Valens, Valens, Switzerland, 7317*

⁵*Vet-Pharmacology & Toxicology, Vetsuisse Faculty University of Bern, Bern, Switzerland, 3012*

⁶*Department of Biomedicine, University of Basel, Basel, Switzerland, 4058*

⁷*Ärztinnen und Ärzte für Umweltschutz, Basel, Switzerland, 4019*

Keywords: Public Health Policy, All Frequencies, Work in Progress

The interdisciplinary Swiss expert group on electromagnetic fields and non-ionising radiation (BERENIS) has commenced its work in 2014. The experts have been nominated by the Swiss Federal Office for the Environment. BERENIS is continuously assessing newly published human experimental and epidemiological studies, in vivo and in vitro studies, as well as exposure and dosimetry studies. Based on defined criteria, BERENIS identifies the most relevant publications regarding health risk assessment and scientifically new data. The evaluations are published in quarterly newsletters in English, German and French. This approach provides an innovative way of informing the public and governmental authorities on new scientific insights.

setup can be conveniently used for studies of waveform effects on nerve excitability.

14-3 [10:55]

Role of phosphorylated synapsin I and related kinases in the impairment of amino acid neurotransmitter release after microwave radiation

Xiangjun Hu¹, Lifeng Wang¹ & Simo Qiao¹

¹*Department of pathology, Beijing Institute of Radiation Medicine, Beijing, China, 100039*

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

Central nervous system is one of the most sensitive targets of microwave radiation. Abnormal release of neurotransmitter after microwave radiation can cause the injury of learning and memory ability, but the mechanisms are still unclear. In presynaptic membrane, phosphorylated synapsin I regulates the release and transmission of neurotransmitters. Our research found microwave radiation induced GABA release impaired, decreased expression of Cdk5-dependent p-Syn I (ser-553), elevated expression of MAPK/ERK-dependent p-Syn I (ser-62/67). The increased activity of p-ERK after radiation elevated expression of p-Syn I (ser-62/67) and increased activity of Cdk5 causing the suppression of p-Syn I (ser-553) which induced GABA release impairment.

Session: SA
Student Awards
Friday June 19, 2015 • 11:30 - 11:50
Merrill Hall
Chairs: Alexandre Legros & Heidi Danker-Hopfe

Session: CC
Closing Ceremony
Friday June 19, 2015 • 11:50 - 12:00
Merrill Hall
Chairs: Richard Nuccitelli, Eric Van Rongen & Philip Chadwick

Lunch
Friday June 19, 2015 • 12:00 - 13:00
Crocker Dining Hall

Session: M5
BEMS Board Meeting
Friday June 19, 2015 • 13:00 - 18:00
Marlin

Session: M6
EBEA Council Meeting
Friday June 19, 2015 • 13:00 - 18:00
Curlew

Session: PA
Poster Session A
Monday June 15, 2015 • 19:00 - 22:00
Fireside Underground
Chairs: P. Thomas Vernier & Meike Mevissen

PA-1 [19:00]

Human Short-Term Exposure to Cell Phone Radiation Causes Changes in Blood Cell Morphology

Beverly Rubik¹

¹*President and Founder, Institute for Frontier Science, Oakland, CA, USA, 94611*

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

A pilot study was conducted to look for changes in blood cell morphology following human exposure to a smart phone under controlled conditions. Fresh blood samples were collected, microphotographed, and scored before and after subjects wore a smart phone for 45 min followed by actively using the phone for another 45 min. Nine of 10 subjects showed significant changes including rouleaux and echinocyte formation. Older subjects showed more substantial changes than young. We used this same bioassay to investigate possible protective effects from various devices and materials. The results of these studies will be presented along with recommendations and prospects for the future.

PA-3 [19:00]

STUDENT PAPER

IEI-EMF provocation case studies: A novel approach to testing sensitive individuals

Adam Verrender^{1,2}, Sarah Loughran^{1,2}, Vitas Anderson^{1,3} & Rodney Croft^{1,2}

¹*Australian Centre for Electromagnetic Bioeffects Research, ACEBR, Wollongong, Australia*

²*School of Psychology, University of Wollongong, Wollongong, Australia*

³*Two Fields Consulting, Richmond, Melbourne, Australia*

Keywords: Human, RF/Microwaves, Work in Progress

While it has been consistently shown that there is no relationship between RF exposure and self-reported symptoms, the possibility that exposure does play a causal role cannot be completely ruled out due to a number of methodological constraints. The present study will determine whether there is a relationship between RF exposure and self-reported symptoms using a number of individual case studies which incorporate several methodological improvements.

PA-5 [19:00]

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

Jong-Sun Lee¹, Nam Kim² & Myung-Jin Park¹

¹*Division of Radiation Cancer Research, Korea Institute of Radiological and Medical Sciences, Seoul, Korea, 362-763*

²*School of Information and Communication Engineering, Chungbuk National University, Cheongju, Korea, 362-763*

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

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

PA-7 [19:00]

Occupational exposure in vicinity of low power FM transmitters

Peter Gajsek¹ & Blaz Valic¹

¹*Laboratory for dosimetry, Institute of Nonionizing radiation, Ljubljana, Slovenia, 1000*

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

As small power FM transmitters are one of the most common radio frequency (RF) sources and the reference levels for occupational exposure can be exceeded close to them, a detailed analysis and assessment of occupational exposure in their vicinity is presented in the paper. The results show, that the reference levels are very conservative for such exposure situations. However, in some situations, the basic restrictions were also exceeded. The local 10 g averaged value of the SAR can be exceeded if the worker is grounded (in touch with the steel structure), while the whole body basic restriction can be exceeded for exposures at distances of less than 1 m from the transmitting antennas.

PA-9 [19:00]

STUDENT PAPER

Applicator based on printed circuit board *in vitro* at 60 GHz and 120 GHz

Takeo Shiina^{1,2}, Kensuke Sasaki², Soichi Watanabe² & Masao Taki¹

¹*Electrical and Electronic Engineering, Tokyo Metropolitan University, Hachioji, Japan, 192-0397*

²*Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Koganei, Japan, 184-8795*

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

The purpose of this study is to develop a novel *in vitro* Sub-THz exposure apparatus which allows high power efficiency with reasonably good homogeneity of exposure over a sufficient area as well as the easy implementation of temperature control. A applicator for exposure apparatus has a sufficient exposure area, which is fed using post-wall waveguide techniques. Operating frequencies were 120 GHz or 60 GHz. The apparatus operating at 60 GHz was previously reported. Spatial average value of SAR in the bottom of the culture medium were 470 W/kg at 60 GHz and 3200 W/kg at 120 GHz at an input power of 1 W. We found that it was important for avoidance of the artifact to estimate the polarization characteristics.

PA-11 [19:00]

Efficacy of ELF-MF in management of contusion model of spinal cord injury induced osteoporosis in rats

Kaushiki Mukherjee¹ & Rashmi Mathur¹

¹*Physiology, All India Institute of Medical Sciences, Delhi, India, 110029*

Keywords: Behavioural, ELF/ILF, Work in Progress

ELF-MF exposure improves food intake, water intake, locomotion in SCI-OP. Besides, it also improves the phosphorus, calcium and carbon content of the sublesional bones. The osteoblastic markers (Osteoprotegerin, Alkaline phosphatase, osteocalcin) are increased in bone while the osteoclastic marker Receptor activator of nuclear factor-kappaB ligand is decreased. The scanning electron micrographs of femur and tibia also shows improvement.

PA-13 [19:00]

Wireless Safety for Employees (WISE) Software Tool for the Evaluation of Electromagnetic Field Exposure in Industrial Environments

Matthias Van Den Bossche¹, Leen Verloock¹, Kris Vanhecke¹, Davy Gaillot², Martine Lienard², Thierry Demol³, Andre Ghysels⁴, Emmeric Tanghe¹, Luc Martens¹ & Wout Joseph¹

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

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⁴*Algemeen Stedelijk Ziekenhuis ASZ, Aalst, Belgium, 9300*

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

An easy usable web-based software tool for prevention advisors to assess the risk of occupational electromagnetic exposure the company with respect to the European directive is proposed. This "WISE tool" (<http://www.wica.intec.ugent.be/exposure-tool/prevention>) is based on a large database of electromagnetic field exposure values, enabling companies to assess the electromagnetic field exposure of their machines and compliance with EU directive 2013/35/EU without detailed knowledge of fields.

PA-15 [19:00]

Development and evaluation of precautionary control measures for occupational ELF magnetic fields

Joseph Bowman¹

¹*Engineering and Physical Hazards Branch, National Institute for Occupational Safety and Health, Cincinnati, OH, USA, 45226*

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

In order to apply the precautionary principle to possible cancer risks from occupational ELF magnetic fields, low-cost measures to reduce time-weighted average (TWA) exposures were developed in 4 Dutch factories. Occupational hygienists and managers were then asked to implement these measures and train their workers in precautionary work practices. Follow-up measurements in a Dutch paper mill suggest such training can reduce TWA exposures. However, the other factories did not implement our recommended precautions, showing the many barriers to voluntary exposure reductions. Going forward, health communication models will be used to overcome barriers to the adoption of precautionary measures in workplaces.

PA-17 [19:00]

STUDENT PAPER

Assessment of MRI patient exposure for epidemiological studies

Jennifer Frankel¹, Kjell Hansson Mild¹ & Jonna Wilen¹

¹*Department of Radiation Sciences, Umeå University, Umeå, Sweden*

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

It is of interest to perform epidemiological studies on magnetic resonance imaging (MRI) patients to understand possible long-term effects. However, the switched gradient magnetic fields and the radiofrequency magnetic field of the MRI scanner are not well described from an exposure point of view. Our aim is to assess the radiofrequency- and switched gradient magnetic field exposure when varying scanner parameters such as bandwidth, flip angle, and slice thickness. A choice of MRI sequences will be evaluated over a span of internal parameters, to see if and how the exposure is affected by varying these parameters.

PA-19 [19:00]

Study protocol: First German research project to systematically record total exposure to radiofrequency fields in typical everyday situations

Dagmar Wiebusch¹ & Karsten Menzel^{1,2}

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²Chairman IZMF, E-Plus Mobilfunk GmbH & Co. KG, Düsseldorf, Germany, 40472

Keywords: Public Health Policy, RF/Microwaves, Concept

Measuring RF fields plays a key part in making an objective evaluation of the potential risks of mobile communication technology. Whereas public attention used to focus on fixed cellular RF transmitters, recently the focus has been shifting to mobile devices and the total exposure to RF sources. Only a few reliable findings are available to help clarify these questions. With Germany's first study to systematically record the overall exposure to RF fields in real life situations, the IZMF wants to close these knowledge gaps and make the information available to a wider audience. The resulting findings are intended to enable consumers to make a reliable estimate of their individual exposure.

PA-21 [19:00]

STUDENT PAPER

In vitro effect of Extremely Low Frequency Magnetic Field on the sperm motility of Alpacas: A preliminary study

Juana Quispe¹, Andree Valle-Campos¹, Gabriela Ulloa¹, Luis Rodriguez¹, Eduardo Granados¹, Orlando Limaymanta¹, Arturo Liñan¹, Dennis Carhuaricra¹, Pamela Fuentes¹, Victor Cruz² & Martha Valdivia¹

¹Zoology Department, Universidad Nacional Mayor de San Marcos, Lima, Peru, Lima-I

²Telecommunications Engineering Department, Universidad Nacional Mayor de San Marcos, Lima, Peru, Lima-I

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

The alpaca is an economically important Andean livestock with serious reproductive problems. As is well known, there is concern about the effects on animals exposed to magnetic fields from power lines. Is why the effect of this agent on livestock reproduction deserve evaluation. The aim of this study was to evaluate the effect of an acute exposure to ELF-MF (60Hz, 750 μ T) on the sperm motility of alpaca. It was found that, after 3h of exposure, ELF-MF induced a significant reduction on the amount of sperm with fully active mitochondria halfway down, and a consequently decline on their fertilizing capacity. This suggest that the exposure to this strange magnetic field can critically affect the reproductive characteristics of male alpaca.

PA-23 [19:00]

Coupled microstrip lines for the exposure of living cells to nanosecond pulsed electric fields

Maura Casciola^{1,2,3}, Agnese Denzi³, Alessandra Paffi³, Micaela Liberti³ & Francesca Apollonio³

¹Center for Life Nano Science@Sapienza, Istituto Italiano di Tecnologia, Rome, Italy, 00161

²SRSMC, Université de Lorraine, Nancy, France, 7565

³Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome, Rome, Italy, 00184

Keywords: Electroporation, Pulsed, Completed (unpublished)

We designed a coupled microstrip line applicator for the exposure of single/few cells to nanosecond pulsed electric fields (nsPEFs). Our applicator is compliant with the requirement of a good matching of the structure to the generator. Numerical simulations of the device demonstrate that it is well adapted for pulses down to 1 ns and that the nsPEFs are homogeneously applied to the biological cells regardless their position in the gap between the electrodes. The dimensions of the channels and electrodes are in the order of the μ m, thus able to deliver intense (\sim 150 kV/m) electric fields to the target requiring a low voltage from the generator (\sim 10 V), with better efficiency with respect to similar structures.

PA-25 [19:00]

Amoeba motility in electric fields increases after treatment of the cells with neuraminidase

John Palisano¹ & Francis Hart²

¹Biology, The University of the South, Sewanee, TN, USA, 37383

²Physics, The University of the South, Sewanee, TN, USA, 37383

Keywords: *In vitro*, *Static*, *Work in Progress*

The movement of amoeba that are pre-treated in the presence of 20 mU neuraminidase in DC electric fields of ~300 V/m is analyzed by tracking the cells in time-lapse movies in which each amoeba serves as its own control. The motility of amoeba cells that are incubated in neuraminidase but not exposed to DC electrical fields is less than seen in cells only exposed to a ~300 V/M DC electric field. Cells treated with neuraminidase and subjected to ~300 V/m DC fields initially show an increase in motility when they are exposed to the DC field followed by a decline in motility during the last 20 minutes of exposure to the DC field.

PA-27 [19:00]

Magnetic field exposure influences pain in complete spinal cord injured rats

Sajeev Ambalayam¹, Suman Jain¹ & Rashmi Mathur¹

¹Physiology, All India Institute of Medical Sciences, New Delhi, India, 110029

Keywords: *Mechanistic/Theoretical*, *ELF/IF*, *Completed (unpublished)*

Magnetic field (MF) exposure to SCI rats revealed reduction in hyperalgesia. They further showed reduction in secondary injury processes namely; apoptosis and oxidative stress besides increased myelination around the injury site. The lesion volume is reduced and significant neuronal regeneration is observed after MF exposure. These indicate beneficial effects of MF on SCI.

PA-29 [19:00]

Development of a dielectric properties measurement system using a coaxial sensor for biological samples in millimeter-wave band

Kensuke Sasaki¹, Yuta Ishimura^{1,2}, Katsumi Fujii¹, Kanako Wake¹, Soichi Watanabe¹, Ryosuke Suga² & Osamu Hashimoto²

¹Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Koganei, Japan, 1848795

²Department of Electrical Engineering and Electronics, Aoyama Gakuin University, Sagami-hara, Japan, 2525258

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

A non-distractive measurement system for dielectric properties measurement of biological tissues in MMW frequencies up to 110 GHz was developed. Here, the measurement system is validated using a reference liquid, and we also compare the measurement results of biological samples with those using different measurement systems.

PA-31 [19:00]

STUDENT PAPER

Efficacy of ELF-MF in ameliorating oxidative stress in 6-OHDA model of Parkinson disease in rats

Ajay Mohan¹

¹Department of Physiology, All India Institute of Medical Sciences, New Delhi, India, 110029

Keywords: *In vivo*, *ELF/IF*, *Completed (unpublished)*

In unilateral intrastriatal 6-hydroxydopamine rat model, ELF-MF (50 Hz, 17.9 μT for 2h/d for 7days) significantly attenuated the oxidative stress; improved motor and non-motor symptoms and maintained dopamine concentration besides maintaining normal mitochondrial ultrastructure. The beneficial effect of ELF-MF in the progression of PD is mediated by attenuating oxidative stress

PA-33 [19:00]

A typology of EMF physical induction mechanisms

Raymond Neutra¹

¹Retired, Albany, CA, USA, 94706

Keywords: *Mechanistic/Theoretical*, *ELF/IF*, *Concept*

In this presentation I will challenge unacknowledged assumptions that have restricted some investigators' conceptualization of how EMFs might work.

PA-35 [19:00]

Exposure to harmonics in the context of the Expers study of the French population exposure to 50 Hz magnetic field

Isabelle Magne¹, Diana Leguizamon¹, Martine Souques², Jacques Lambrozo², Alain Azoulay³ & Anne Duburcq⁴

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Keywords: *Epidemiology*, *ELF/IF*, *Completed (unpublished)*

Usually, the exposure to the ELF magnetic field is often related only to the 50 or 60 Hz magnetic field. From the data of the EXPERS study, we characterized the exposure to harmonic magnetic field by calculating the total harmonic distortion. This new indicator is analyzed according to the subjects' characteristics

PA-37 [19:00]

Experimental system for early detection of breast cancer

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

The purpose of this study is to develop a cheap and portable breast cancer detection system using microwave. In this paper, an efficient sensing method for the existence of breast tumor in early stage was proposed, and we designed and fabricated experimental system. The performance of the experimental system was tested by measurements. The test results show that the proposed system works well and even the small size of tumor phantom can be detected. We expect that the proposed system can be used for self-diagnosis of the existence of breast tumor in early stage. In the future study, we plan to focus on the reduction of the size of the experimental system, including some more improvements.

PA-39 [19:00]

Magnetic field triggered syncope – From Jaques-Arsène d'Arsonval's first observation in 1896 to car accident injury statistics after power-line motorway crossings in Switzerland

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Keywords: *Human, ELF/ILF, Other*

In 1896 Jaques-Arsène d'Arsonval, a French pioneer in bioelectromagnetics, observed that an alternating magnetic field (110V, 30 A, 42 Hz) triggered syncopes in some persons [d'Arsonval, 1896]. After having observed in the 2012 accident injury statistics a very unusual person damage to non-person damage odds ratio of 18.1 ($p = 0.0005$) localized after a specific 380 kV power-line motorway crossing in Switzerland, a nationwide analysis was conducted. We identified 9 unusual accident hot spots and found that the power-line crossing exposure count on the 2.5 km road segment behind the accidents was factor 8.5 (95% CI[6.6,10.8]) higher compared to matched control settings ahead of the accidents.

PA-41 [19:00]

Computational modeling to bridge the gap between in vitro and in vivo EMF research

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

Despite established clinical benefits of extremely low frequency electromagnetic field (ELF-EMF) stimulation, little is known about how these fields interact with cells. Controlled in vitro studies are needed for unraveling the mechanism of action, but represent a substantial dosimetry challenge. In this paper we use simulations to study how exposure of a submerged cell monolayer actually equates to stimulation of entire body parts. More specifically, we seek to compare how induced current density and heating vary with exposure parameters in vitro and in vivo. Our results will enable designing more realistic in vitro experiments and ultimately advance the quest for optimal EMF dosimetry for clinical applications.

PA-43 [19:00]

Effects of *Boswellia sacra* and Folic Acid on Hippocampus in Electromagnetic Field Exposed Rats

Elfide Gizem Kivrak¹, Berrin Zuhul Altunkaynak¹, Ö. Gülsüm Deniz¹, Gamze Altun¹, Aysin Pinar Türkmen¹, Mehmet Emin Önger¹ & Süleyman Kaplan¹

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Keywords: *In vivo, ELF/ILF, Completed (unpublished)*

In this study it was planned to evaluate the effects of mobile phone exposure that is 900 MHz electromagnetic field (EMF) on the brain of the male *Wistar albino* rats and also we investigated the neuroprotective effects of folic acid (FA) and *Boswellia sacra* (BS) against to EMF exposure. EMF emitting from mobile phone might not only produce biochemical changes

but also oxidative stress in brain of the rats. It may be suggested that FA and BS reduce the degenerative effects of the EMF exposure.

PA-45 [19:00]
STUDENT PAPER

Development of an instrument to measure the amount of RF absorption that takes place in Humans

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Keywords: Human, RF/Microwaves, Work in Progress

As a pilot project, we are examining the phenomenon known as Electron Spin Resonance (ESR) to determine the range of frequencies humans absorb the most. A system has been developed to test various samples pork, beef, chicken, as well as aqueous solutions of salt and sugar. Interpreting the results of this will aid in the development of safe use guidelines for consumer products.

PA-47 [19:00]
STUDENT PAPER

Investigation of the effects of Omega 3 and Melatonin on adult rat brain exposed to electromagnetic field

Gamze Altun¹, Süleyman Emre Kocacan², Ö. Gülsüm Deniz¹, Elfide Gizem Kivrak¹, Aysin Pınar Türkmen¹, Mehmet Emin Önger¹, Berrin Zuhul Altunkaynak¹, Cafer Marangoz² & Süleyman Kaplan¹

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Keywords: In vivo, ELF/ILF, Completed (unpublished)

Aim of the present study was to examine the possible structural and functional effects of 900 MHz electromagnetic field (EMF) on neuronal tissues and reveal the effects of omega 3 fatty acids ($\omega 3$) and melatonin (Mel) against to this exposure. We have demonstrated neuronal loss and low cognitive activity caused by EMF exposure. Mel and $\omega 3$ significantly contributed to prevent the neuronal loss.

PA-49 [19:00]

Computational study on absorption of RF energy from TETRA radio transceivers used close to the body

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

In Germany a nationwide uniform radio network working according to the digital TETRA standard is being set up. The terminal equipment of the new network will change the employees' occupational exposure to RF electromagnetic fields. The present study investigates the distribution of specific absorption rates (SAR) inside the human body when exposed to RF electromagnetic fields from TETRA terminal equipment as well as resulting temperature elevations in sensitive tissues and organs by computational means. Results were compared to the exposure limits recommended by ICNIRP.

PA-51 [19:00]

Nanoknife ablation in vital hepatic structures and follow-up investigation

Xinhua Chen¹, Shengyong Yin¹, Zhigang Ren¹, Tongyin Zhu¹, Lin Zhou¹, Haiyang Xie¹, Xiongxin Zhang¹, Zhiyi Peng¹, Junhui Sun¹ & Shusen Zheng¹

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Keywords: In vivo, Static, Completed (unpublished)

Nanoknife is a FDA approved commercialized medical instrument for soft tissue ablation. But the current reports are short of side effect observation and systemic follow up. This preclinical study observe its feasibility and safety on porcine liver ablation and follow up the vital organ functions, providing the systemic follow-up data. Our study raised different viewpoints on nanopore formation, the basic ablation mechanism and the maximum ablation criteria.

PA-53 [19:00]

Association between mobile phone use and inattention in 7102 Chinese adolescents: A population-based cross-sectional study

Lei Zhang¹, Feizhou Zheng¹, Peng Gao¹, Min Li¹, Mindi He¹, Zhou Zhou¹ & Zheng-Ping Yu¹

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

This cross-sectional study was to investigate the association between MP use and inattention in adolescents using questionnaire. The result showed that inattention in adolescents was significantly associated with MP ownership, the time spent on entertainment on MP per day, the position of the MP during the day and the mode of the MP at night. The strongest association between inattention and the time spent on the MP was among students who spent more than 60 minutes per day playing on their MP. Decreasing MP usage to less than 60 minutes per day may help adolescents to stay focused and centered.

PA-55 [19:00]

STUDENT PAPER

Effects of interaction with electromagnetic field on cell culture of *Saccharomyces cerevisiae*

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Keywords: *In vitro*, ELF/ILF, Completed (unpublished)

In this work, we studied the change in the rate of cell reproduction of *Saccharomyces cerevisiae* and its changes in the pattern of growing of a cell culture when it is stimulated magnetically at frequencies of 60, 100, 800, 1500 and 2450 Hz. Any samples showed an increase in the rate of cell proliferation. For the study about changes in the pattern of growth, it was performed a fractal analysis by box counting method. The results suggest that there are no changes in the pattern of crop growth.

PA-57 [19:00]

Short and middle-term exposure assessments of magnetic fields in 1.5 T MRI system operators

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Keywords: Occupational, Static, Completed (unpublished)

Occupational exposure to the static magnetic field (SMF) is an arising problem in operators of magnetic resonance imaging (MRI) system. The present study demonstrated the short and middle-term occupational exposure assessments of magnetic fields in 1.5 T MRI system operators. The short-term exposure assessment showed that the peak B reached upper than 400 mT and the average peak B was 232±87 mT. The middle-term exposure assessment indicated that significantly higher SMF levels at the MRI operation group compared with no MRI group. Several health complaints were recorded (tiredness, headache, nausea, and loss of the concentration) in MRI system operators while symptoms rarely declared at almost of all no-MRI operation days.

PA-59 [19:00]

Effect of exposure to 915-MHz radiofrequency identification electromagnetic field on circulating blood cells in the healthy adult rat

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

The effects of exposure to 915-MHz radiofrequency identification (RFID) at a whole-body specific absorption rate (SAR) of 2 W/kg on blood cells was examined in rats using a reverberation whole-body exposure system. Rats were exposed to a 915-MHz RFID signal for 8 h daily, five days a week, for two weeks. The numbers of various circulating blood cells and calculated T4/T8 ratios of RFID-exposed rats were compared with those of the control groups. Several profiles of circulating blood cells were altered significantly following RFID exposure. However, because the values within these profiles

remained within the normal physiologic range, these changes in circulating blood cells do not indicate that exposure to RFID is harmful.

PA-61 [19:00]

A survey on people inhabiting urban and rural dwellings proximity to mobile phone base stations - An Indian perspective

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

India has witnessed an unprecedented growth of wireless technology. This has led to people living in close proximity to mobile phone base stations in densely populated metros. The aim of the study was to resort to a questionnaire-based survey of people living around mobile phone base stations in an urban and a rural locality in the state of Tamil Nadu, India. The authors concluded that constant monitoring of rising indoor and outdoor radiofrequency electromagnetic fields in India is essential under the prevailing conditions.

PA-63 [19:00]

Magnetic field effects in the rate growth of Escherichia coli

Juan Carlos Martínez-Espinosa¹, Teodoro Cordova-Fraga², Miguel Vargas-Luna², Oscar Díaz-Medina¹, Pablo Villegas-Molina¹, Aldelmo Israel Reyes-Pablo¹ & Gustavo Basurto-Islas³

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Keywords: Electrochemistry, Static, Completed (unpublished)

Microorganisms are widely used in large-scale production of industrial items; therefore the bacterial growth is a key point in this technology development. In this study *E. coli* cultures were exposed for 6 h, to magnetic field from 1.13 to 4.13 mT, in five different frequencies (100, 800, 1500, 2450 and 2500) Hz at 37 °C. The results have shown that magnetic stimulation has a proliferative effect. The increase in rates of microbial growth could accelerate some of the fermentative processes in the food industry, or allow greater obtaining of biomass of producer strains of molecules high biotechnological value as biopolymers, biopharmaceuticals and nanomaterials of biomedical use.

PA-65 [19:00]

Assessment of electromagnetic field exposure levels from wireless power transmission system based on magnetically coupled resonator

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

Recently, the wireless power transmission technologies are widely applied mobile consumer electronics, automobile, biomedical device and industrial system. In this paper, we investigate electromagnetic field level from wireless power transmission (WPT) system based on magnetically coupled resonance method. The resonance frequency, transmission efficiency, and input power is 1.77 MHz, 72 %, and 10 W, respectively. It shown that electric field and magnetic field level around the WPT system exceed the reference level of ICNIRP's guideline.

PA-67 [19:00]

Optimal dosimeter deployment in an urban area for wideband RF-EMF exposure assessment

Sam Aerts¹, Luis Díez², Laura Rodríguez de Lope², Ramón Agüero², Gunter Vermeeren¹, Luc Martens¹ & Wout Joseph¹

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

A novel methodology is presented to extend an existing sensor network in Santander, Spain, with low-complexity dosimeters able to continuously measure the electric-field strength in multiple radiofrequency bands. The procedure consists in using both simulation and measurement data to achieve an optimal deployment design, i.e., a dosimeter deployment that will provide relevant exposure statistics and will allow the creation of exposure maps. We present here the deployment procedure, while the complete design optimization will be validated later in Year 2015.

PA-69 [19:00]**Biological effects of 6 GHz radio frequency-electromagnetic field (RF-EMF) exposure in vivo**

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

We conducted an experiment using rats in a reverberation chamber that emitted uniform 6 GHz RF-EMFs. On acute or subacute exposure, body temperature rose by approximately 1.5°C compared with baseline. However, no pathological changes were observed in the microglia following acute exposure. Some Hsp genes were significantly upregulated in marginal regions of the brain following subacute exposure at 4 W/kg; however, there was no significant change in body temperature or Hsp gene expression on exposure at 0.4 W/kg. Our results suggest that there could be a threshold for increases in body temperature and for upregulation of Hsp gene expression in rat brain on subacute exposure to 6 GHz RF-EMF at a WBA-SAR of between 0.4 and 4 W/kg.

PA-71 [19:00]**Cell suspension electrical measurements in real time**

Andrew Fairbanks¹, Anand Vadlamani¹, Tylor Whitmer¹, Raji Sundararajan² & Allen Garner¹

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Keywords: *Electroporation, Pulsed, Work in Progress*

Dielectric measurements of the cell membrane and internal organelles often use time domain dielectric spectroscopy (TDDS), which measures the reflection of a low voltage pulse from a cell suspension; however, TDDS does not permit measurement of electrical properties during intense electric pulse (IEP) application due to the sensitive electronics involved. We directly measure the applied voltage and current during submicrosecond IEPs to examine the change of cell suspension conductivity, indicating the transfer of ions across the cell membrane.

PA-73 [19:00]**A portable setup for accurate dielectric spectroscopy based on ad-hoc experimental arrangements**

Caterina Merla¹, Nuzzi Giovanna², Francesca Apollonio², Rosanna Pinto¹, Alessandro Zambotti³, Carmela Marino¹ & Micaela Liberti²

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

A portable setup for measurements of complex permittivity based on ad-hoc arrangements is proposed. The measurement setup consists of a portable spectrum analyzer connected to an open-end coaxial cable for S_{11} acquisitions. Scattering parameters were elaborated with a custom Labview program using a suitable calibration to obtain in real time complex permittivity of liquids. Results demonstrate that the portable setup provides accurate measurements of standard liquids (ethanol, ethanediol, 2-propanol) with errors of around 3% if compared to reference standards. This setup seems useful for dosimetric purposes in bioelectromagnetics.

PA-75 [19:00]**Exposure due to magnetic field radiated by anti-theft store protection gate**

Belinda Lima Herrero¹, Mohammed Serhir¹ & Dominique Picard¹

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

Supermarkets and shops use anti-theft store protection gates to avoid the theft of their products. These devices consist generally in two parallel porticoes containing one or several vertical loop antennas. The customers of the supermarket pass between both porticoes and it results from it an exposure of the customers to the magnetic field radiated by antennas. The study evaluates numerically this exposure in the case of one loop porticoes.

PA-77 [19:00]**Effects of long-term exposure to 0.12 THz in HCE-T cells derived from human eye**

Shin Koyama¹, Eijiro Narita¹, Yoko Shimizu¹, Takeo Shiina², Masao Taki², Naoki Shinohara¹ & Junji Miyakoshi¹

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Keywords: *In vitro, THz, Work in Progress*

The cellular effects of long-term exposure to 0.12 terahertz (THz) in human corneal epithelial (HCE-T) cells were investigated. There is no statistically significant increase in the micronucleus (MN) frequencies of the cells exposed to 0.12 THz compared with sham-exposed controls and incubator controls. The morphological change of the cells also showed no significant difference among the above three treatments. In heat shock protein (Hsp) expression, there is also no significant difference among the above three treatments. These results indicate that the exposure to 0.12 THz would be considered to have no or very little effect on the MN formation, morphological change, and Hsp expression on HCE-T cells.

PA-79 [19:00]

Reverberation chamber for medium scale in-vivo radio frequency exposure experiments

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

Reverberation chambers have been used for large scale animal exposure to radio frequency radiation in studies such as that performed by the NIEHS and for small scale studies such as in the 7th frame work EU projects Seawind and Geronimo. This paper describes a medium size reverberation chamber developed for well controlled exposure of rats or mice over the frequency range 700 – 2200MHz that can be moved through restricted spaces and assembled in the exposure room.

PA-81 [19:00]

Effect of 5 mT magnetic field on the growth of *Chlorella fusca*

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Keywords: In vivo, Static, Completed (unpublished)

The growth of *Chlorella fusca* LEB 111 were evaluated using application of magnetic field (MF). Assays were conducted in vertical tubular photobioreactors, photoperiod 12 h light/dark for 15 days. MF were applied by solenoid around photobioreactors generating 5 mT for 1 h.d⁻¹, and control assays (without exposure to MF) were done. Some parameters were evaluated and MF produced an inhibitory effect on cell concentration, P_{max} and μ_{max}, but T_g increased. Proteins and lipids content not presented significant statistical difference between two conditions. Thus, carbohydrates content was higher in cultures with application of MF.

PA-83 [19:00]

Evaluation of the SAR induced by an antenna in a flat phantom from a free space near-field measurement

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

Indoor base station antennas expose the people to the electromagnetic field radiated by these antennas. The EN50383 standard describes the measurement protocol which allows the experimental determination of the security perimeter of these antennas. The local SAR induced in a flat phantom is evaluated in function of the frequency and the distance between the phantom and the antenna. The number of complete SAR measurement is 51 per frequency band. This study proposes an alternative to the SAR measurement which procures a good accuracy on the SAR value and reduces strongly the SAR evaluation duration.

PA-85 [19:00]

At polar and kinetochore microtubule resonance frequencies (MRF) phanotron antenna radiation induces a notable cell surface tension (CST) in the actomyosin cortical layer of mitotic cells

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

A new non thermal biological mechanism can be considered, which has been termed "L.B.A.R.". The mechanism functions through destabilization of the mitotic spindle microtubules (polar, kinetochore, astral) and by an increasing tension of the actomyosin cortex provided by the energy density radiated by a phanotron antenna. We posit this may be a form of assisted apoptosis, where the cell plasma membrane is weakened possibly by apoptotic processes, and that weakening along with the influence of the phanotron energy radiation at polar microtubule resonance frequencies results in cancer cell destruction. This process has been visualized in vitro.

PA-87 [19:00]

Wireless communication and the Precautionary Principle

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

The IARC review of the scientific evidence and obtained classification of possible carcinogenicity of cell phone radiation, permit implementation of the Precautionary Principle measures, in order to protect the population from the potentially hazardous effects of exposure to radiation emitted by the wireless communication devices

PA-89 [19:00]

STUDENT PAPER

SAR_{wb}-meter in diffuse fields, calibrated in a reverberation room

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

A whole-body absorption meter, calibrated for simultaneous on-body measurements of the incident power density (S_{inc}) and whole-body averaged specific absorption rate (SAR_{wb}) in diffuse fields, is proposed. The meter consists of an on-body, textile antenna tuned to the GSM 900 DL band and is worn by a subject who is exposed to diffuse fields at 942.5 MHz in a reverberation chamber. The set-up allows for measurements of both the subject's absorption cross section (0.32 m²), using measurements of the reverberation time, and the antenna aperture (2.8-3.3 cm²) of an on-body antenna. This antenna can thus be used for a simultaneous on-body measurement of the SAR_{wb} and the S_{inc} .

PA-91 [19:00]

STUDENT PAPER

Calcium-independent disruption of microtubule growth following nanosecond pulsed electric field exposure in U87 human glioblastoma cells

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Keywords: In vitro, Pulsed, Work in Progress

Nanosecond pulsed electric field (nsPEF) exposure causes apoptosis in cancer cells via a currently unknown mechanism. We used live cell imaging to show that 100, 10 ns, 15 kV/cm pulses, applied at 10 Hz to U87 EB3-GFP glioblastoma cells, results in calcium-independent disruption of microtubule growth. Microtubule depolymerization is a key event in apoptosis execution, making the effect we report on the microtubule network a candidate for the mechanism behind nsPEF induced apoptosis.

PA-93 [19:00]

A questionnaire-based survey of a French group self-reporting Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF)

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

In France, a debate around electro-hypersensitivity is growing these last decades. Our objective was to analyze the reported symptoms and the incriminate sources that might induce these symptoms by a questionnaire-based study. From April to November of 2014, Fifty four auto diagnosed EHS across France respond to our questionnaire. Thirty belonged to different French self-help groups or associations and 22 were not attached to any groups. We had a return rate of 61%.

PA-95 [19:00]

STUDENT PAPER

The anti-proliferative effects of RF EMF amplitude-modulated at tumor specific frequencies are mediated by calcium

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

Experimental and clinical evidence suggests that administration of low level radiofrequency electromagnetic fields, amplitude-modulated (AM RF EMF) at specific frequencies ranging from 400 Hz to 21 kHz, elicits therapeutic responses in patients with cancer. Furthermore, modulation frequencies randomly chosen within the same frequency range did not affect the growth of HCC and breast cancer cell lines, demonstrating the frequency specificity of the observed biological effects. Here, we provide the first evidence of tumor inhibition in an *in vivo* setting.

PA-97 [19:00]

STUDENT PAPER

Heart rate variability affected by high frequency electromagnetic field in adolescent students

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Keywords: Human, RF/Microwaves, Work in Progress

This study, on high school students, focused on the effects of high frequency electromagnetic fields (HF EMF) under accepted but limit values of electric field intensity. Group of 13 volunteers had been exposed to HF DCS-1800 frequency band EMF to examine physiological changes in the heart rate variability (HRV) determining functional changes of autonomic nervous system. Rest-to-stand protocols had been done twice, once with EMF and second one with no exposure as verification and comparison of HRV.

PA-99 [19:00]

Creating an ELF Magnetic Field Exposure System for Human Whole Head Threshold Studies Over 50mT.

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Keywords: Human, ELFLF, Completed (unpublished)

Our research group required a whole head exposure system to induce systematic biological effects in humans, such as magnetophosphenes (flickering lights perceived when the retina is exposed to a strong time-varying magnetic field -MF-). Magnetophosphenes perception is used by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) as a basis for its recommendations. The objective was to generate MF exposure between 20 and 100 Hz, at flux densities > 50 mT.

PA-101 [19:00]

Evaluation of magnetic fields generated by induction hob under assumed actual usage conditions

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

Assuming the actual usage, the magnetic fields generated by a household induction hob were measured. The spatial distribution around an induction hob user was roughly determined by scanning three measurement planes at different distances from the hob and parallel or perpendicular to the hob's front. Moreover, measurements were taken with different metallic material types and sizes of cooking pots as well as under the conditions of various position gaps between the

centers of the pot bottom and the coil used for magnetic field generation in the hob. It was confirmed that all results in this study were lower than the magnetic field strength reference levels for general public exposure provided in the ICNIRP 2010 guidelines.

PA-103 [19:00]
STUDENT PAPER

Simulation of PsSAR associated with the use of laptop computers as a function of position in relation to the adult body

Sergio M Racini¹, Alvaro de Salles¹, Sergio LS Severo¹, Johan LT Garzon¹, Robert D. Morris² & Devra Davis²

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

The Specific Absorption Rate (SAR) is estimated in the body of a seated 34 year old male exposed to 2.4 GHz electromagnetic field (EMF) emitted by laptops. The laptop position is varied vertically and horizontally from the seated model in order to estimate the changes in SAR associated with changes in distance from the body. The estimated results are compared to the psSAR (peak spatial SAR) recommended exposure limits. The different SAR simulation situations are calculated using the Finite Difference Time Domain-FDTD employing the SEMCAD X software.

PA-105 [19:00]

Dirty electricity: Residential exposure level and its correlation with magnetic field exposure

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

The level of dirty electricity is relatively stable across rooms in a house. We did not find evidence of a correlation between dirty electricity and MFs.

PA-107 [19:00]

STUDENT PAPER

Design optimization and displacement robustness of dome-shaped coil for transcranial magnetic stimulation

Keita Yamamoto¹, Momoko Suyama¹, Yoshihiro Takiyama¹, Youichi Saitoh² & Masaki Sekino^{1,2}

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Keywords: Clinical (therapy), Pulsed, Completed (published)

Previously, we proposed transcranial magnetic stimulation (TMS) therapy using a dome-shaped coil, which can stimulate a localized but wider area of the brain. The expanded distribution of the induced electric field led to greater robustness of the coil against coil-positioning errors. In the present study, we systematically investigated the design parameters to maximize the stimulus intensity without unnecessarily expanding the stimulated region, based on its head-contact area. In addition, we evaluated its robustness to positioning errors by numerical simulation using a realistic brain model.

PA-109 [19:00]

STUDENT PAPER

In vitro effects of mobile phone Electromagnetic Radiation on neuroblastoma cells: possible role of EMFs in Alzheimer's disease

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

This study has focused on the biological impact of low level EMFs that millions of people, around the world, are faced with. Particularly, we examined the effects of the radiation emitted by a GSM 1800MHz mobile phone in human cells of neuronal origin. Our results have indicated an alteration in the processing of APP (Amyloid Precursor Protein) after irradiation. This observation will require further investigation as our experiments could provide new evidence for the effect of low level Electromagnetic Radiation on A β production and brain deposition, attributing a possible role of EMFs in AD (Alzheimer's disease) pathogenesis.

PA-111 [19:00]**RF exposure dosimetry for testicles of human due to a mobile radio terminal closed to abdominal region**Takashi Hikage¹, Naoki Tanaka¹ & Toshio Nojima¹¹Graduate school of Information Science and Technology, Hokkaido University, Sapporo, Japan, 0600814**Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress**

This study describes local SARs in testicle of human due to mobile radio terminal, such as a smart phone and a tablet PC, which is emitting radio waves and is placed closest to user's abdominal region. Testicle is considered one of the most sensitive organ to heating. By applying FDTD simulation and anatomical male human model, the SAR distributions are obtained in considering with variation of user's posture at 800 MHz and 2GHz band. The maximum values of calculated testicular SAR did not exceed the limits for exposure to radio waves recommended by international guidelines.

PA-113 [19:00]**Scientific review to support public policy regarding exposure to radiation from wireless communications devices**Meg Sears¹¹Adjunct, Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON, Canada, K1H 8L1**Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation**

Exposure standards for radiofrequency signals in telecommunications are rooted in a variety of "authoritative reviews." Methodology and reporting standards for these reviews are not in accordance with standards for clinical medicine, nor with more recently established best practices in environmental health. In the absence of current, comprehensive, methodologically rigorous reviews in support of exposure standards, precautionary approaches with an emphasis on non-wireless and safer alternatives should guide development and applications of communications technologies.

PA-115 [19:00]**A dosimetric study to assess compliance with exposure limit values for workers exposed to multiple frequency electromagnetic sources**Vanni Lopresto¹, Rosanna Pinto¹, Sergio Mancini¹, Edoardo Genovese³, Marco Renzi² & Mauro Cerboni²¹Technical Unit of Radiation Biology and Human Health, ENEA - Italian National Agency for New Technologies, Energy and Sustainable, Rome, Italy, 00123²Technical Division, Tecnorad Italia S.p.A., Rome, Italy, 00144³Application Engineering, CST - Computer Simulation Technology AG, Darmstadt, Germany, 64289**Keywords: Occupational, RF/Microwaves, Completed (published)**

A dosimetric study is presented to assess compliance with exposure limit values (ELVs) of Directive 2013/35/EU for workers exposed to multiple frequency electromagnetic sources. A real site has been investigated, where transmitting stations of both broadcasting and wireless communications services are present. Radiometric measurements were performed to characterize the exposure scenario, which was numerically simulated to calculate the absorption of energy in an anthropomorphic voxel model. Finally, compliance with relevant ELVs was assessed in terms of an index of compliance, defined according to an appropriate metric for combined multi-frequency exposure.

PA-117 [19:00]**The analysis for EMF monitoring at a development stage of urban area**Taewook Hwang¹, Wan-Ki Kim¹ & Yeong-Su Lee¹¹Radio Wave Environment Department, Korea Communications Agency, Seoul, Korea, 520-833**Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress**

As the number of base stations for mobile communication services rapidly grows with development of mobile communications and increase of radio-use devices, there are vague concerns raised on the possible health effects of EMF (Electromagnetic field) radiated from base station antennas. This paper is described the development of a measurement system capable of remotely monitoring the EMF strength for 24 hours(at all times) and the measurement method and the results analyzed using the this system. The data is considered very important with its high reliability to use in epidemiological researches and prediction model for EMF exposure including researches on EMF health effects.

PA-119 [19:00]**STUDENT PAPER****MOSFET-based electroporation system design for experiments from nanoseconds to microseconds**Guangwei Jiang¹, Ming Yuan², Yasir Alfadh¹, Yaohe Wang² & Xiaodong Chen¹¹School of Electronic Engineering and Computer Science, Queen Mary, University of London, London, UK, E1 4NS²Centre for Molecular Oncology, Barts Cancer Institute, Queen Mary, University of London, London, UK, EC1M 6BQ**Keywords: Electroporation, Pulsed, Work in Progress**

A flexible and scalable electroporation pulse generation system has been designed to accommodate the pulse widths from 300ns to 10us. The peak amplitude of the pulse across the designed applicator has shown peak strength of approximately 40kV/cm. The generator is MOSFET-based, with digital manipulation, while the applicator follows the three layers' structure to generate corresponding field. The preliminary biological test based on the designed system is also presented.

PA-121 [19:00]

Novel method for practical SAR determination in indoor exposure scenarios without the need for EMF measurements, based on reverberation chamber theory

Antonio Sarolic¹ & Damir Senic¹

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

We proposed and experimentally verified a novel method for determination of SAR in a dissipative object (such as a human body) exposed to EM waves in reverberating indoor environments. The method is based on power balance theory, treating the indoor environment as a reverberation chamber with a known Q factor. SAR can be determined from the power input to such room, for any object with previously known Absorption Cross Section (ACS), e.g. a typical human body in a predefined posture. Room Q factor can be determined from room characteristics, or measured case by case. This method overcomes the necessity for EMF measurements inside the room, which produce dubious results anyhow in such stochastic environments.

PA-123 [19:00]

A study on the risk communication policy of extremely low frequency electromagnetic fields in Korea

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

In Korea, there are many activities to improve understandings of extremely low-frequency EMF conducted by power facilities. Nevertheless, the conflicts are still in progress. Through the study of more effective risk communication policy to spread the understanding of extremely low-frequency EMF, we want to minimize the health risk controversies about magnetic field exposure and solve the power facilities construction oppositions.

PA-125 [19:00]

SAR Reduction of 5.8 GHz WiFi Signal by using Double-Negative Material Reflector

Seungwoo Lee¹, Jun-Seok Kang¹ & Nam Kim¹

¹College of Electrical and Computer Engineering, Chungbuk National University, Cheongju-si, Korea, 361-763

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

In this paper, we proposed a novel reflector structure, which has a double-negative characteristic, for reducing the specific absorption rate (SAR) at resonance frequency band of 5.8 GHz. The proposed novel reflector is consisted of periodically arrayed unit cells. Each unit cell size is 21 mm x 21 mm and designs on the FR-4 Substrate. A basic dipole antenna is also designed and applied to the reflector for reducing the SAR. As the simulation results, calculated SAR with the reflector is only 0.0017 W/kg over 1g-averaged and 0.0009 W/kg over 10g-averaged. In addition, the antenna performance is increased by two times.

PA-127 [19:00]

Mobile phone exposure for a family inside elevators

Ioanna Karatsi¹ & Stavros Koulouridis¹

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

A dosimetry study for a four member family inside an elevator, when a mobile phone is used, is carried out. Numerically accurate models of a 7th month pregnant woman, an adult male, an 8 years old male child and a 5 years old female child are used. Mobile phone is modelled in three talk positions, vertical, tilt and cheek while two cabin types are employed. As found, the averaged SAR values over 1g and 10g for the three no-phone user passengers are much lower than those of the phone user. Results depend on the relative position of the users, the position of the phone and the elevator cabin type. SAR values for the phone user are not affected from other passengers' relative position.

PA-129 [19:00]**Where is your phone? A survey of where adolescents and women aged 12-40 carry their mobile phone and related risk perception**Mary Redmayne¹ & Peter Wiedemann²¹Dept. of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia, 3141²Wissenschaftsforum EMF, Berlin, Germany, 10178**Keywords: Behavioural, RF/Microwaves, Work in Progress**

Smart phones are now owned by almost three quarter of US adolescents and young adults.¹ Exposure to radiofrequency electromagnetic fields (RF-EMF) from background data traffic during standby can be considerably higher than used to be the case. This is due to ongoing activity from applications running in the background on uplink and downlink. Very little is known about current mobile phone carrying habits of young women. This survey uses an online questionnaire. It asks participants about where they carry, store and hold their mobile phone under a variety of circumstances, and about related risk perception. Results are not yet available and will be reported at the conference.

PA-131 [19:00]**Dosimetry of typical Electronic Article Surveillance (EAS) device with multiple panels**Mai Lu¹ & Shoogo Ueno²¹Key Lab. of Opt-Electronic Technology and Intelligent Control of Ministry of Education, Lanzhou Jiaotong University, Lanzhou, China, 730070²Department of Applied Quantum Physics, Graduate School of Engineering, Kyushu University, Fukuoka, Japan, 812-8581**Keywords: Dosimetry (computational), ELF/IF, Work in Progress**

Dosimetric analysis for an acoustomagnetic (AM) EAS system working at 58 kHz with multiple panels were presented in this work. The magnetic fields and the induced electric fields in realistic human models of an adult and a child were calculated by impedance method, and the results were compared with the ICNIRP guidelines. It was found the exposure level of the magnetic flux density in both adult and child models exceed the ICNIRP reference level. However, the 99th percentile value of the averaged electric field strength (Eavg-99%) in central nervous system were within the ICNIRP basic restriction.

PA-133 [19:00]**Influence of Radiofrequency Radiation on Macromolecular Structure**Ivancica Trosic¹, Ivan Pavicic¹ & AnaMarija Marjanovic¹¹Radiobiology and Dosimetry Unit, Institute for Medical Research and Occupational Health, Zagreb, Croatia, 10000**Keywords: In vivo, RF/Microwaves, Completed (unpublished)**

Aim was to assess the biological activity of radiofrequency radiation on macromolecular structures both in and in vitro. In vivo design included four exposed group of rats and matched controls. First exposed subgroup was irradiated with 2.45 GHz waves for 4 h in total, the 2nd for 16h, the 3rd for 30h, and the 4th for 60h. V79 cell culture was exposed to 915 MHz field. Micronucleus test on polychromatic erythrocytes in vivo and V79 cells in vitro was performed. Microtubule and actin were determined by fluorescent techniques. In vivo and in vitro results confirm the undesired effects of man-made radiofrequency fields at the molecular level.

PA-135 [19:00]**Numerical Dosimetry for the resonance-based power transfer technique for electric vehicles charging**SangWook Park¹, SeaWon Lee¹ & EunHa Kim¹¹EMI/EMC R&D Center, Korea Automotive Technology Institute, Cheonan, Korea, 330-912**Keywords: Dosimetry (computational), IF, Work in Progress**

This paper presents the dosimetry for the resonance-based wireless power transfer system for electric vehicles applications. The compact wireless power transfer system for charging electric vehicles is designed using the resonance phenomenon. The specific absorption rate in the human body model is computed for the two cases. One is the alignment between the transmitter and the receiver, and the other is the misalignment between those. The results are discussed with the international safety guidelines.

PA-137 [19:00]**Polarization-driven thermal events in petri dishes**Alessandra Paffi¹, Micaela Liberti¹, Francesca Apollonio¹ & Quirino Balzano²¹Department of Information Engineering, Electronics and Telecommunications (DIET), Sapienza University of Rome, Rome, Italy, 00184²Department of Electrical & Computer Engineering (ECE), University of Maryland, College Park, MD, USA, 20742**Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress**

Many in vitro experiments have been conducted during the past 50 years to explore the mechanisms of interaction between radiofrequency (RF) energy and living tissue. Most authors have performed measurements and analyses to

determine the Specific Absorption Rate (SAR) and the temperature of the exposed sample. In few cases, the temperature throughout the culture medium has been measured or computed. There has been practically no consideration given to the thermodynamic events taking place in the cell medium, which absorbs the bulk of the incident energy. This abstract explores the different medium thermodynamic conditions that can arise in cell preparations, depending on the polarization of the incident RF energy.

PA-139 [19:00]

Changing of neurochemical gene expression in the striatum of mice after 835MHz radiofrequency exposure

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

The present study applied 835 MHz radiofrequency at a specific absorption rate (SAR) of 4.0 W/kg for 5 hours/day for 4 weeks to determine the systemic effects on gene expression in the striatum of mice. Total RNA from striatum was isolated and cRNA was applied microarray by using Agilent's gene expression hybridization Kit. We found that significant number of gene are affected by exposure of a specific absorption rate (SAR) of 4.0 W/kg for 5 hours/day for 4 weeks. This study is in the beginning stage but the data from microarray suggest the susceptibility of the gene expression in striatal region to 835 MHz RF exposure.

PA-141 [19:00]

STUDENT PAPER

Magnetic field exposure of the hands by deactivators for labels of electronic article surveillance systems – an example case for the assessment of high level limb exposure according to the European directive 2013/35/EU

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Keywords: *Dosimetry (computational)*, ELF/LLF, Completed (published)

A magnetic deactivation device for EAS labels was assessed with respect to the induced in situ electric field strengths inside the hands of the operator. Using common state of the art anatomical models with a single layer skin representation failed to demonstrate compliance. However, using a two layer skin model, taking into account a low conductive cover layer (representing stratum corneum) on top of a dermis layer enables demonstration of the device's compliance with basic restrictions. In general, this clearly indicates that appropriate skin modelling plays a major role in exposure assessment based on in situ electric field strengths inside skin tissue.

PA-143 [19:00]

STUDENT PAPER

Effects of weak static and pulsed magnetic fields on fibroblast and fibrosarcoma cells under a controlled magnetic environment

Julian Cyrus¹, Aditya Kausik¹, Karthik Bangaloreradhakrishna¹, Tosin Feyintola² & Frank Barnes¹

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Keywords: *In vitro*, Pulsed, Work in Progress

Changes in the growth rates of fibrosarcoma and fibroblast cells for exposures to weak extremely low frequency magnetic fields (MF) are reported. Measurements of the oxidative stresses and cell counts show that the pulse repetition rates from once every 7 seconds to once every 20 seconds and magnetic fields in the range from 1 μ T to 200 μ T affect the fibrosarcoma cell to a greater extent than the fibroblast cells.

PA-145 [19:00]

In vivo multiphoton microscopy shows that a single 10 nanosecond pulsed electric field is sufficient to disrupt vasculature in xenografted human glioblastoma

Sylvia M. Bardet¹, Lynn Carr¹, Malak Soueid², Delia Arnaud-Cormos², Philippe Leveque² & Rodney P. O'Connor¹

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Keywords: *In vivo*, Pulsed, Completed (unpublished)

Here we present an *in vivo* exposure system for studying the influence of nanosecond pulsed electric fields (nsPEFs) on tumour microenvironment using multiphoton imaging. We found that a single nsPEF (10ns, 30-50kV/cm) strongly affects the

tumour neovascular network, collapsing micro-capillaries irreversibly but transiently affecting the diameter of larger vessels. Human glioblastoma cells (U87-MG) grafted into the avian chorioallantoic membrane (CAM) were immediately depleted of their blood supplies, showing the early events of nsPEF effects in a complex tissue environment with multiphoton intravital imaging.

PA-147 [19:00]

mmWave Exposure Assessment using Magnetic Resonance Thermal Imaging

Leeor Alon^{1,2,3}, William S. Slovinsky⁴, Gene Y. Cho^{1,2}, Daniel K. Sodickson^{1,2,3}, Christopher M. Collins^{1,2,3}, Marvin Ziskin⁴, Theodore S. Rappaport^{1,3} & Cem M. Deniz^{1,2,3}

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

The energy from millimeter wave (mmWave) is deposited predominantly at the surface of phantoms/tissues. Current electric (E) field probe systems are not capable of measuring mmWave energy deposition accurately. Here, we introduce preliminary results for an alternative method for measuring mmWave energy deposition. Using magnetic resonance (MR) thermal imaging, we present high-resolution 3D quantification of the temperature change induced by mmWave energy deposition in a gel phantom and calf muscle of a human subject.

PA-149 [19:00]

Mitochondrial depolarization and hyperpolarization in healthy and cancer breast cells due to 2.1 GHZ W-CDMA modulated MW radiation

Meric Arda Esmekaya¹ & Nesrin Seyhan²

¹Department of Biophysics, Gazi University Faculty of Medicine, Ankara, Turkey

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

In this study, effects of 2.1 GHz W-CDMA modulated MW Radiation on $\Delta\Psi_m$ and apoptotic level of human breast fibroblast and MCF-7 human breast carcinoma cells were studied. Cells were exposed to MW at 2.1 GHz for 24 hours. The viability of breast fibroblast and MCF-7 were reduced. The apoptotic percentages of cells were increased in both cell types. $\Delta\Psi_m$ was decreased in normal fibroblast cells, however it was increased in MCF-7 cancer cells. Our results showed that MW Radiation caused to activate intrinsic apoptotic pathway with different energization states of mitochondria.

PA-151 [19:00]

Prediction of the exposure to electromagnetic fields from radio base stations for selecting potential maximum field level position

Byung Chan Kim¹, Jonghwa Kwon¹ & Seon-eui Hong¹

¹Radio Technology Research Department, ETRI, Daejeon, Korea

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

In this paper, we developed a highly practical prediction equation. Because the proposed equation accounts for the antenna tilt, length, ground effect, and incident angle into the ground depending on the height of the transmitting and receiving antennas, it is very useful for predicting electromagnetic fields in the far field. Moreover, it does this more accurately than the simple prediction equation generally accepted.

PA-153 [19:00]

Methodological approach for measurement of RF electromagnetic fields in the electromagnetic environment surrounding wireless installations

Byung Chan Kim¹, Kihwea Kim², Hyung-Do Choi¹, Jeong-Ki Park³ & Seon-eui Hong¹

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²Electromagnetic Environment Research Lab, National Radio Research Agency, Seoul, Korea

³Department of Radio Science & Engineering, Chungnam National University, Daejeon, Korea

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

This paper presents a new method for measurement of RF electromagnetic field strength for verification of the human compliance with ICNIRP exposure guidelines, when a wireless installation is put into service in Korea. Before a wireless installation first emits its RF signal, the RF electromagnetic field strength should be measured and the level of exposure inspected as to whether the surrounding electromagnetic environment is disturbed, compared with the condition before the wireless station was installed. In this revised method, the concept of diffraction point is adopted and the guide to choosing measurement paths and positions is described in more detail to ensure consistent selection regardless of who might be making the selection

PA-155 [19:00]**Experimental assessment of mechano- and electrodynamic interactions of static magnetic fields and MRI workers**Jolanta Karpowicz¹¹Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Poland, 00-701**Keywords: Occupational, Static, Work in Progress**

Assessment of static magnetic fields exposure of MRI workers was focused recently on the level of exposure and dynamic changes of exposure caused by workers activities near magnets of magnetic resonance scanners. However discussion triggered by publication of ICNIRP guidelines on movement related hazards from static magnetic field exposure suggests that such assessment is not sufficient. Suggested extended set of exposure parameters is presented to cover both kind of exposure effects caused by mechano- and electrodynamic interactions of static magnetic field to workers.

PA-157 [19:00]**Practical approach to evaluation and management of hazards caused by limb currents in workers exposed to electromagnetic fields**Jolanta Karpowicz¹ & Krzysztof Gryz¹¹Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Poland, 00-701**Keywords: Occupational, ELF/ILF, Review, Commentary, Recommendation, Evaluation**

The evaluation of electromagnetic hazards caused by induced or contact currents (ICC) needs the use of equivalent circuits (phantoms) which allow the respect to bioethical rules. Taking into account that ICC are measured by the same instrumentations it is suggested to combine ICC limits into "limb currents" - distinguish between upper limbs and foot, and between steady-state and transient currents. In practice, management of ICC hazards needs to be based on the protection measures implementation when exposure was identified by electric and magnetic fields measurement, and ICC direct assessment to be reduced to situations when protection may not be sufficient.

PA-159 [19:00]**Effects on Neuroblastoma cells previously exposed to antidepressants and PEMF**Teodoro Cordova-Fraga¹, Adolfo Toledo-Solano², Gloria Barbosa-Sabanero³, Lérida Liss² & Myrna Sabanero-López²¹Ingeniería Física, Universidad de Guanajuato, Leon, Mexico, 37150²Biología Celular, Universidad de Guanajuato, Guanajuato, Mexico, 36050³Ciencias Médicas, Universidad de Guanajuato, Leon, Mexico, 37000**Keywords: Electrochemistry, Pulsed, Completed (unpublished)**

Magnetic field and living systems interactions are inevitable. Pulsed electromagnetic fields (PEMF) are now a Medical alternative in mental illness as depression or schizophrenia. A study on imipramine, a drug for the treatment of depression, and PEMF (50 Hz, 7 mT, 8 h) on cells from the line SHSY5Y is presented. Imipramine at high dosage for a short period (120 mg/mL, for 20 min) shows cell damage on morphology and metabolism. Meanwhile, the PMF shows a cell proliferation and a decrease of their metabolism. The jointly assay indicates that the PMF balances the morphological negative effects from imipramine. These results can impact a therapy that may be more efficient. However, more research is needed in this area.

Session: PB
Poster Session B
Tuesday June 16, 2015 • 19:00 - 22:00
Fireside Underground
Chairs: P. Thomas Vernier & Meike Mevissen

PB-2 [19:00]

Mobile phone radiation and cancer: a current update

Robert D. Morris¹, Christopher Portier², Anthony B. Miller³, Annie J. Sasco⁴, Devra Davis¹ & L. Lloyd Morgan¹

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

Epidemiological and experimental studies published since the IARC/WHO review of 2011, are reviewed. In 2014, the CERENAT found that “heavy use” ≥ 896 cumulative hours combined with 5+ years of use significantly increased the risk of glioma, OR=5.30, 95% CI=2.12-13.23, $p < 0.001$. A 2014 Swedish glioma study reported shorter survival and younger age of diagnosis in mobile phone exposed cases compared to unexposed cases. A 2015 Swedish glioma study reported higher risks from UMTS compared to GSM modulated phones despite lower radiated power in the former. A Swedish (2013) and a Korean study (2014) found larger acoustic neuroma tumors with analog phone use and with greater hours of exposure, respectively.

PB-4 [19:00]

Verification of Whole-Body-Average Specific Absorption Rates in Rats inside a Reverberation Chamber by S-Parameter Measurement

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

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

Small animal experiments using a reverberation chamber (RC) provide valuable insights to investigate the long-term effects of EM field exposure. In Japan, an *in-vivo* project on local and whole-body exposure of rats was started in 2013. A two-step method incorporating FDTD simulations with EM field measurements was used as an evaluation method to determine the whole-body-average specific absorption rates (WBA-SARs) in rats. In order to verify the validity of the two-step method, an S-parameter-based method is employed to derive the WBA-SARs in rat-equivalent phantoms and then compared with the two-step method. The difference of the WBA-SARs between the S-parameter-based method and the two-step method is within 1.63 dB.

PB-6 [19:00]

Applicability of simplified equations for evaluating electric field strength in vicinity of patch array antenna

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

Electric field distributions calculated using the method of moments (MoM) and simplified equations for aperture antennas are compared based on patch array antennas at 3.5 GHz. Simplified equations for aperture antennas can derive conservative results in estimating the electric field distributions of patch array antennas. The equations are applicable to predict the compliance of such base station antennas for RF safety regulations or guidelines.

PB-8 [19:00]

A novel method based on open coaxial probes to measure small sized tissue samples

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Keywords: Mechanistic/Theoretical, RF/Microwaves, Work in Progress

A novel measurement method is presented which is suitable to study small sized tissue samples, such as skin or the wall of blood vessels. The method is based on open coaxial probes, but with modified geometry and algorithms. The material under test is brought to the flange of the open coaxial probe and backed by a metallic mirror. It facilitates the measurement of thin samples, like the individual layers of the human skin.

PB-10 [19:00]**Dielectric parameters of homogeneous head tissue-equivalent liquids for SAR measurements at frequencies from 30 MHz to 300 MHz**Maryna Nesterova¹ & Daniel Brooks¹¹System Research, APREL Inc., Ottawa, ON, Canada, K2K 3J1**Keywords:** *Dosimetry (measurements), Pulsed, Completed (unpublished)*

This article presents an analysis of the dielectric characteristics of biological tissues of the human head focused around frequencies from 30 MHz to 300 MHz and provides a new algorithm for calculations of conductivity and relative permittivity of homogeneous head tissue for SAR measurements. The results of this study raise concerns regarding the accuracy of SAR evaluation for modern wireless devices operating at frequencies under 300 MHz.

PB-12 [19:00]**Real-time temperature measurement for living cells exposed to microwave using a temperature-dependent fluorescent dye**Guoshan Yang¹, Hongmei Zhou¹ & Wei Lu¹¹Department of Health Physics, Beijing Institute of Radiation Medicine, Beijing, China, 100850**Keywords:** *Dosimetry (measurements), RF/Microwaves, Completed (unpublished)*

Rhodamine B, as a temperature-dependent fluorescent dye has been used for temperature measurement in microfluidic system. With this fluorescent dye, we realized a method for real-time temperature measurement for living cells exposing to microwave. Fluorescence emitted by stained cells displayed a good quantitative relation to temperature in the microscope field and a linear formula was fitted to estimate the temperature by fluorescent intensity.

PB-14 [19:00]**STUDENT PAPER****2.1 GHz MW radiation effects in magnetite treated Neuroblastoma cells**Fatih Senturk¹, Meric Arda Esmekaya¹ & Nesrin Seyhan¹¹Biophysics Dept., Gazi University, Ankara, Turkey, 06500**Keywords:** *In vitro, RF/Microwaves, Work in Progress*

The effects of 2.1 GHz MW radiation; on the apoptotic activity of magnetite (Fe₃O₄) treated neuroblastoma cells were research in this study.

PB-16 [19:00]**Effects of 1.8 GHz microwave on protein expression in human lens epithelial cells**Yibo Yu¹, Yidong Zhang¹ & Ke Yao¹¹Eye Center, Second Affiliated Hospital,, Zhejiang University,, Hangzhou, China, 310012**Keywords:** *In vitro, RF/Microwaves, Completed (published)*

The shotgun proteomics technique can be applied to screen the differentially expressed proteins in hLECs exposed to 1.8 GHz RF and three protein biomarker associated with RF radiation were validated by Westernblot assay. The upregulated VCP and USP35 proteins may be involved in the protein quality control reaction of hLECs exposed to RF. The downregulation of SRP68 protein indicated that RF may affect the protein secretion.

PB-18 [19:00]**STUDENT PAPER****Induced electromotive force in human blood stimulated magnetically**Dulce Magdaleno¹, Myrna Sabanero-López², Blanca Murillo-Ortiz³ & Teodoro Cordova-Fraga¹¹Departamento de Física Médica e Ingeniería Biomédica, Universidad de Guanajuato, León, Mexico, 37150²Departamento de Biología, Universidad de Guanajuato, Guanajuato, Mexico, 36050³Unidad de Investigación en Epidemiología Clínica, Instituto Mexicano del Seguro Social, León, Mexico, 37340**Keywords:** *Mechanistic/Theoretical, ELF/IF, Work in Progress*

Changing magnetic fields (CMF) are able to stimulate some kinds of cells, they induce an electromotive force (fem) in the biological system causing a current flux density related to some effects in the cells. In this work is presented theoretical calculations of induced fem in human blood; also the experimental measurements of fem are compared with theoretical calculations. The results shows a compatibility in order of magnitude between theoretical calculations and experimental measurements.

PB-20 [19:00]**Assessment of whether persons with implantable pacemakers and ICDs can be RF-EMF workers**Robert McIntosh^{1,2,3} & Steve Iskra^{1,2,3}¹Department of Biomedical and Health Sciences, Swinburne University of Technology, Hawthorn, Australia, 3122²CTO, Telstra, Melbourne, Australia, 3000³Australian Centre for Electromagnetic Bioeffects Research (ACEBR), Hawthorn, VIC, Australia, 3122**Keywords: Dosimetry (computational), RF/Microwaves, Review, Commentary, Recommendation, Evaluation**

This assessment considers the suitability of persons with a pacemaker or implantable cardioverter defibrillator (ICD) device to work in the vicinity of radio frequency electromagnetic field (RF-EMF) infrastructure, such as a mobile phone base-station. Numerical modelling was used to determine the electromagnetic fields that the devices are subject to at RF exposure limits as specified in the safety standards and compared to the field levels that the devices are subject to when they are tested to ensure electrical immunity.

PB-22 [19:00]**The effect of posture on ELF exposure from domestic and power transmission sources**Myles Capstick¹, Yijian Gong^{1,2}, Mark Douglas¹ & Niels Kuster^{1,2}¹ITIS Foundation, ETH, Zurich, Switzerland, 8004²Information Technology and Electrical Engineering, ETH, Zurich, Switzerland, 8004**Keywords: Dosimetry (computational), ELF/LF, Completed (unpublished)**

This paper describes the ELF magnetic field distributions from domestic and power transmission sources and how posture can modify the induced field intensity and distribution within the human body due to these sources. Where exposure fields are close to homogeneous and postures introduce new current paths exposure can increase by almost an order of magnitude.

PB-24 [19:00]**Experimental assessment of stray electromagnetic fields exposure from a wireless power transfer system prototype**Rosanna Pinto¹, Manuele Bertoluzzo², Caterina Merla¹, Sergio Mancini¹, Vanni Lopresto¹, Antonino Genovese³, Giovanni Pede³ & Giuseppe Buja²¹Technical Unit of Radiation Biology and Human Health, ENEA, Rome, Italy, 00123²Department of Industrial Engineering, University of Padova, Padova, Italy, 35131³Technical Unit for Advanced Technologies for Energy and Industry, ENEA, Rome, Italy, 00123**Keywords: Occupational, IF, Completed (published)**

The wireless power transfer (WPT) technology represents a promising application in contactless electric vehicle battery charging systems. A bench prototype, delivering a power of 560 W at 85 kHz, suitable for charging the batteries of a city car, was designed and realized. Equal transmitting and receiving resonant coils, equipped with ferrite cores, were realized in a spiral configuration. Stray electromagnetic fields (EMFs) emitted by the prototype were measured in terms of electric (E) and induction magnetic (B) fields to assess the exposure of workers operating in proximity of the prototype. Both measured electric (E) and induction magnetic (B) fields were compliant with the European Directive 2013/35/EU.

PB-26 [19:00]**Risk Assessment of Cardiovascular Implantable Electronic Devices (CIED) when Exposed to Homogenous and Inhomogeneous Magnetic Fields in the Intermediate Frequency Range**Tobias Seckler¹, Kai Jagielski¹ & Dominik Stunder¹¹Research Center for Bioelectromagnetic Interaction (femu) at the Institute of Occupational Medicine, Uniklinik RWTH Aachen, Aachen, Germany, 52074**Keywords: In vitro, IF, Review, Commentary, Recommendation, Evaluation**

This study assesses the electromagnetic compatibility between CIEDs and homogenous (Helmholtz Coils up to 27 μT) and inhomogeneous (Qi A13 Design Wireless Charging Board) magnetic fields (111 kHz sine bursts) by measuring the induced interference voltage and comparison with the performance limit of ISO14117. The measuring system with off the shelf CIED leads was placed in a torso phantom at 4 implantation sites. Helmholtz Coils: The lowest flux density at which the performance limit was exceeded is 11 μT. Qi A13 Board: 45.7% of the performance limit was reached at maximum (2.2% at 10 cm distance). A 10 cm distance is suggested to reach a safety margin nearly 50 times smaller than the performance limits.

PB-28 [19:00]

STUDENT PAPER

Modeling military exposures to RF electromagnetic fields for the INTEROCC study

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Keywords: Occupational, RF/Microwaves, Work in Progress

The goal of this study is to estimate RF electromagnetic field exposures of INTEROCC subjects from military sources. Antenna models, device specifications from the U.S. military's RF safety manual, and interview data were combined to estimate RF electric field exposures from army and air force radar antennas for the INTEROCC epidemiologic study of brain cancer. Outcomes of these models provide quantitative estimates of RF electric field levels for the highly exposed military personnel in the INTEROCC study.

PB-30 [19:00]

A comprehensive database of physical tissue properties for computational simulations in realistic virtual anatomies

Christian Baumgartner¹, Esra Neufeld¹, Davnah Payne¹ & Niels Kuster^{1,2}

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Keywords: Human, All Frequencies, Completed (published)

Numerical simulations performed with computational anatomical are becoming increasingly popular as they represent attractive alternatives to *in vivo* and *in vitro* measurements and as industrial R&D cycles need to be shortened. Yet computational simulations of biological, physiological, and physical processes are only meaningful if suitable physical and physiological properties can be assigned to individual body tissues. Here we describe a public database for computational life sciences applications that comprises suitable physical and physiological parameters for a wide range of tissues as well as information about their reported variability.

PB-32 [19:00]

SARs in modified SAM phantom for a bar-type mobile phone

Seon-eui Hong¹, Ae-kyoung Lee¹, Jonghwa Kwon¹ & Hyung-Do Choi¹

¹Radio Technology Research Department, ETRI, Daejeon, Korea, 305-700

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

For the cheek position of a bar type mobile phone model, spatial peak 1 g-and 10 g SARs at 1850 MHz were calculated and compared in the modified SAM phantom and four anatomical head models at different ages. It has an internal planar inverted F antenna at the bottom of the body.

PB-34 [19:00]

STUDENT PAPER

Interpolation in between road measurements in RF-EMF exposure assessment

Sam Aerts¹, Wout Joseph¹, Loek Colussi², Jos Kamer², Luc Martens¹ & John Bolte³

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

We assess the possibility of using the in some European countries existing databases of large-scale radiofrequency (RF) electromagnetic field (EMF) measurements for ether regulation for the assessment of RF exposure over large areas. Using a car-mounted frequency-selective measurement system, signals from mobile-phone base station were measured within and around a residential area. We interpolated the data on the edge (along a closed and an open loop) complemented with increasing amounts of inner data to achieve progressively accurate exposure models. Through analysis of a 50-point validation, we found that 80 inner data points per km² could be sufficient to obtain an accurate interpolation model.

PB-36 [19:00]**Safety model for employees exposed to extremely low frequency electromagnetic fields in the welding industry.**France Raphela¹¹*Department of Clinical Sciences, Central University of Technology, Free State, Bloemfontein, South Africa, 9300***Keywords: Human, ELF/ILF, Completed (unpublished)**

Electromagnetic fields (EMFs) are invisible waves generated by power lines, electrical wiring and electrical equipment. Exposure to extremely low frequency EMFs may pose a serious health risk to workers. This paper describes a safety model with guidelines aimed at reducing the exposure levels to EMFs among employees to in the welding industry.

PB-38 [19:00]**Open-access journal 'Frontiers in Radiation and Health'**Dariusz Leszczynski¹¹*Chief Editor of the Frontiers in Radiation and Health, Frontiers, Lausanne, Switzerland***Keywords: Public Health Policy, All Frequencies, Review, Commentary, Recommendation, Evaluation**

The open-access journal 'Frontiers in Radiation and Health', part of the 'Frontiers in Public Health', is published since spring 2014 by the Swiss Frontiers and by the British Nature publishers. The aim of the 'Frontiers in Radiation and Health' is to provide comprehensive view on health policy and science on which health policy decisions are made.

PB-40 [19:00]**Exposure Assessment of Two Different Types of Wireless Power Transfer Systems at MHz-frequency band**Jerdvisanop Chakarothai¹, Takuya Iwamoto^{1,2}, Kanako Wake¹, Katsumi Fujii¹, Takuji Arima^{1,2}, Soichi Watanabe¹ & Toru Uno²¹*Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Koganei, Japan*²*Graduate School of Engineering, Tokyo University of Agriculture and Technology, Koganei, Japan***Keywords: Dosimetry (computational), IF, Work in Progress**

Wireless power transfer (WPT) systems actually produce high electromagnetic (EM) near-fields. There are public concern about hazards of EM exposure due to WPT systems. Since EM near-field created by WPT systems depends on their shapes, it is necessary to assess exposure level for each type of WPT systems. In this study, we have fabricated two types of WPT systems. We conducted numerical assessment for homogeneous human in vicinity of WPT systems and determined induced electric field strength and specific absorption rate (SAR). As a results, it is shown that whole-body SAR is a constraint factor for the solenoid-type WPT system, whereas local 10g SAR is a constraint factor for the spiral-type WPT system.

PB-42 [19:00]**STUDENT PAPER****Dielectrophoretic single-cell gene expression profiling for breast cancer research**Wadu Wijesinghe¹, Daniel Ewert¹ & Dharmakeerthi Nawarathana¹¹*Electrical and Computer Engineering, North Dakota State University, Fargo, ND, USA, 58108***Keywords: Electrochemistry, ELF/ILF, Completed (unpublished)**

We have developed a high-throughput single-cell gene expression profiling technology. Our technology is based on selective extraction of mRNA molecules from single-cells using dielectrophoresis (DEP). A micropipette was fabricated and DEP was established at its apex. The micropipette is inserted into single-cells to extract mRNA molecules. Extracted molecules are quantified or sequenced using traditional techniques to profile gene expression.

PB-44 [19:00]**Evaluation of exposure to electromagnetic fields from smart utility meters: Phase I laboratory measurements**Azadeh Peyman¹, Terry Mee¹, Darren Addison¹, Mohammed Khalid¹, Cristian Goiceanu¹, Myron Maslanyj¹ & Simon Mann¹¹*Physical Dosimetry Department, Public Health England, Didcot, UK***Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)**

This study aims to quantify exposure of people to radiofrequency signals emitted from smart meter devices operating at 2.4 GHz, and then to compare this with international guidelines and with exposure from other telecommunication sources such as mobile phones and Wi-Fi devices. The angular distribution of the electric fields from 20 selected smart meter devices was measured in a controlled laboratory environment. The angular direction where the power density was greatest was identified and the equivalent isotropically radiated power (EIRP) in that direction was determined. Finally, measurements were carried out as a function of distance at the angles where maximum field strengths were recorded around each device.

PB-46 [19:00]
STUDENT PAPER

Application of a voltage sensitive dye to study the effect of nanosecond pulsed electric fields (nsPEF) on membrane potential in human U87 glioblastoma cells

Ryan Burke¹, Sergii Romanenko¹, David Moreau¹, Delia Arnaud-Cormos¹, Philippe Leveque¹ & Rodney P. O'Connor¹

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Keywords: *In vitro, Pulsed, Work in Progress*

We have applied a fluorescent voltage sensitive dye (VSD) to quantify the influence of nsPEF on membrane potential in U87 glioblastoma cells. Patch-clamp electrophysiology was used to calibrate the VSD, yielding a second order regression equation that was applied in further experiments to monitor the slow changes over time resulting from the application of a single 10ns nsPEF. Cellular voltage imaging revealed a prolonged depolarization of the plasma membrane after a single pulse, similar to that previously reported by other groups with electrophysiology. This voltage imaging approach is promising as it can be combined with other probes that show the effects of nsPEFs on the membrane potential of intracellular organelles.

PB-48 [19:00]
DNA damage in human hair root cells exposed to mobile phone radiation

Semra Tepe Çam¹ & Nesrin Seyhan¹

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

For the first time in the present investigation, the short term effects of RFR exposure on genomic DNA of human hair root cells were analyzed using the comet assay.

PB-50 [19:00]
Performances, functioning principle, and problems induced by the use, of a commercial device devoted to the reduction of the exposure to the electromagnetic radiation of a mobile phone

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¹*Electromagnétisme - GeePs, CentraleSupélec, Gif sur Yvette, France, 91192*

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

The mobile phone is one of the main sources of exposure to radiofrequency electromagnetic radiation. A lot of small setups are proposed to reduce this exposure: the limiting exposure patch (LEP). This study concerns one of these devices, for which the manufacturer indicates the value of the reduction factor on the electromagnetic exposure for several models of mobile phones, and on which a study confirms, at least partially, this reduction.

PB-52 [19:00]
Cell fragmentation and inhibition of proliferation of human leukemia cells in vitro by frequency specific amplitude modulated RF pulsed plasmas

Anthony Holland¹

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Keywords: *In vitro, Pulsed, Work in Progress*

Frequency-specific oscillating pulsed electric fields (OPEF) generated by an amplitude modulated (AM) radio frequency (RF) transmitter utilizing an enclosed gas plasma antenna have demonstrated an ability in vitro to fragment cancer cells and inhibit proliferation in two different human leukemia cell lines.

PB-54 [19:00]
STUDENT PAPER
Behavioral effects of long-term exposure to IF magnetic fields

Kajal Kumari¹, Mikko Herrala¹, Heikki Tanila¹, Matti Viluksela¹, Jonne Naarala¹ & Jukka Juutilainen¹

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Keywords: *Behavioural, IF, Work in Progress*

The summary will describe the experimental study on the behavioural effects of intermediate frequency (IF) magnetic fields. Studies on the biological and health effects of IF magnetic fields are needed, because human exposure is and information on potential health effects is sparse. Groups of 20 male C57BL/6J mice will be exposed continuously for 5 weeks to 7.5 kHz magnetic fields at 12 or 120 μ T. Results of the behavioural tests will be reported in the BioEM 2015 meeting.

PB-56 [19:00]
STUDENT PAPER

Gene expression profile changes in *D. melanogaster* induced by cell phone exposure of adult flies: a microarray analysis of ovarian tissue

Areti Manta¹, Deppie Papadopoulou², Alexander Polyzos², Adamantia Fragopoulou¹, Katerina Skouroliakou³, Issidora Papassideri¹, Dimitris Thanos², Dimitrios Stravopodis¹ & Lukas Margaritis¹

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

Whole body exposure of adult *Drosophila melanogaster* flies to GSM 1800 MHz mobile phone radiation (SAR 0.12 W/kg) for 30 min is capable to provoke gene expression alterations in the early and mid stage ovarian follicles, as revealed by microarray analysis. 168 genes changed their expression; 158 genes were up-regulated (1.25- to 2.1-fold) and 10 genes were down-regulated (0.8- to 0.41-fold). The altered genes are implicated in metabolic processes, endocytosis, phagocytosis, apoptosis, whilst 124 human orthologs were identified to be implicated in human patho-physiology.

PB-58 [19:00]
STUDENT PAPER

Effects of pulsed electric fields on the polyphenols content, antioxidant capacity and juice extraction yield of orange fruit

Barbara Surano¹, Felipe Maglietti¹, Mario Cueto², Cristina dos Santos² & Guillermo Marshall¹

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Keywords: Electroporation, Pulsed, Completed (unpublished)

In this study the polyphenols content, the antioxidant capacity and the yield extraction are investigated in orange fruits treated by Pulsed Electric Fields (PEF). For the analysis, sweet oranges (*Citrus sinensis*) were treated with 50 pulses of 1kV/cm, 100 μ s, at 2.5 and 10 Hz. The yield compared with untreated samples showed an increase of 3.83% at 10 Hz; the polyphenol content increased 27% in PEF treated juice. This study shows that PEF technology can contribute to make juices with higher nutritional quality under gentle conditions.

PB-60 [19:00]
Novel measurement set-up using an electro-optic converter for interference voltage of active implantable medical devices EMI assessment

Takashi Hikage¹, Toshio Nojima¹, Iyama Takahiro², Junji Higashiyama² & Teruo Onishi²

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²Research Laboratories, NTT DOCOMO, INC, Yokosuka, Japan

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

A measurement set-up for active implantable medical devices EMI Assessment is newly developed by applying direct modulated Electrical to Optical (EO) converter. EMI impacts pacemakers when the sensing circuit of the pacemakers receives a signal similar to "an electrocardiogram signal" or "noise," and the signals' strength is higher than the sensing threshold level of the pacemaker. The induced voltage on feed-through filter of the pacemaker sensing circuit by the received external signal is defined as "interference voltage". In this paper, we developed sensor for induced RF voltage on the feed-through filter inside the pacemaker enclosure.

PB-62 [19:00]
The gene expression alterations in the mice brain exposed on the 835 Mhz radiofrequency radiation combined with voluntary exercise

Myeong Ju Kim¹, Jin-Koo Lee², Min-Sun Lee¹, Ju-Hwan Kim², Kwang-Sik Lee³, Hyung-Gun Kim², Yoon-Myoung Gimm³ & Hakrim Kim²

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

In this study, we focus on the physical voluntary exercise, which may be associated with the stressor of 835 Mhz RF effect in the mice brain. Comparing with the control group during 10 weeks, the decrease of total amount of exercise in RF radiation group (RFR) was statistically significant. However, body weight was increased in RFR+Exersise(EXE) group compared to EXE group. The increase of plasma TNF- α , IL-6 and IL-12(p70) by EXE was inhibited by RFR exposure. In the mice striatum and hypothalamus, tyrosine hydroxylase mRNA expression was significantly reduced in RFR+EXE group compared to control group.

PB-64 [19:00]**EMF-Portal goes Japanese: Cooperation between femu and JEIC as a further important step in the advancement of the EMF information platform**

Frank Gollnick¹, Sarah Driessen¹, David Graefrath¹, Yasuhiro Koji², Kazuhiro Takahashi² & Chiyoji Ohkubo²

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Keywords: Public Health Policy, All Frequencies, Work in Progress

The EMF-Portal (www.emf-portal.org) is the world's most comprehensive free EMF literature database. It has been advanced in design and content: homepage redesign with new structure, new field sources database, new study overviews, revised EMF background information part. The Japan EMF Information Center (JEIC) was established in 2008 to promote EMF risk communication including the creation of an EMF research database. Femu and JEIC have started to cooperate in creating a complete version of the EMF-Portal in Japanese that will be integrated step by step into the existing German/English information platform. This effort shall further promote the worldwide recognition of the EMF-Portal. Further languages would be welcome.

PB-66 [19:00]**STUDENT PAPER****Ionomycin-induced changes in transmembrane electric potential alter electroporation outcomes in HL-60 Cells**

Erik Aiken¹, Brian Kilberg¹, Susan Hagness¹ & John Booske¹

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Keywords: Electroporation, Pulsed, Completed (unpublished)

We evaluated changes in electroporation outcomes resulting from modifying the resting transmembrane electric potential of HL-60 cells using ionomycin [1]. At lower electric field strengths, the probability of reversible electroporation increased, while at higher electric field strengths, the probability of irreversible electroporation increased.

PB-68 [19:00]**Comparison of the electric field induced in the brain by transcranial magnetic stimulation using different deep H-coils**

Mai Lu¹ & Shoogo Ueno²

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Keywords: Clinical (therapy), ELF/ILF, Work in Progress

Directly stimulation of deeper brain tissues by transcranial magnetic stimulation (dTMS) plays an important role in the study of reward and motivation mechanisms, which may be beneficial in the treatment of several neurological and psychiatric disorders. The aim of the present study was to investigate the field characteristics of typical HI- and HAC-coils applied to a realistic head model. It was observed that the electrical field distribution in the brain by HAC-coil is wider than that of HI-coil. It suggests the ability of the HI- and HAC-coils to stimulate effectively deeper neuronal structures is obtained at the cost of larger induced electrical fields in superficial cortical tissues.

PB-70 [19:00]**COST EMF-MED (Action BMI309): European network for innovative uses of EMFs in biomedical applications**

Antonio Sarolic¹ & Mirjana Moser²

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²Independent expert, Bern, Switzerland

Keywords: Human, All Frequencies, Other

COST Actions are a flexible, fast, effective and efficient networking instrument for researchers. COST EMF-MED (Action BMI309) provides a cooperative framework to support the research on beneficial biological effects of non-ionizing EMFs and their use in biomedical applications. Research on biological effects of EMFs has traditionally focused on health risks. This Action focuses on useful biological EMF interactions and associated biomedical applications, aiming for breakthrough results, new discoveries and innovative biomedical technologies. COST EMF-MED aims to contribute to development and optimization of innovative EMF-based medical devices and procedures, which will be safer, more efficient and less invasive.

PB-72 [19:00]**Exposure to ELF magnetic fields in cars evaluated with the ICNIRP multiple frequency rule**

Jesus Paniagua¹, Montaña Rufo¹, Antonio Jimenez¹ & Jorge Barbera¹

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

A car's occupants are exposed to ELF magnetic fields due to the rotation of the wheels. To properly evaluate this exposure, it is necessary to determine the characteristics of the complex spectrum of these fields. The low rotation frequency of the wheels means that one must use instrumentation sensitive to frequencies below 20 Hz. Different norms assign different weights to the harmonics, so that dosimetric evaluations vary depending on which norm is used. This communication presents a spectral analysis based dosimetric evaluation for car occupants applying the multiple frequency rule, comparing results using the ICNIRP 1998 norms with those of the more recent 2010 norms.

PB-74 [19:00]

EMF risk perception changes through communication activities by the Japan EMF Information Center (JEIC)

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¹Japan EMF Information Center, Japan Electrical Safety & Environment Technology Laboratories, Tokyo, Japan, 105-0014

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

The surveys were conducted by questionnaires in public seminars organized by the Japan EMF Information Center (JEIC) and through the free service of lending magnetic field meter provided by JEIC. The participants of the seminars were asked to answer their perception levels about the EMF risk before and after listening to the lectures. And the participants of the free service of lending magnetic field meter were also asked to answer them before and after measuring magnetic field by themselves. It has been found that concern levels of both participants groups were reduced through attending seminars or measuring magnetic field.

PB-76 [19:00]

Occupational exposure to magnetic fields caused by magneto-therapeutic applicators

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

Magnetic field near the 190 typical magneto-therapeutic applicators have been measured and assessed with the use of workers exposure limits provided by European directive 2013/35/UE. Additionally virtual model of such exposure and the user of hearing implant have been developed to assess electromagnetic hazards for workers who use such implants. It was found that workers exposure near magneto-therapeutic applicators does not exceed exposure limits provided by the directive, but the use of hearing implants may be the contraindication for employment near this devices.

PB-78 [19:00]

Dielectric properties measurement of skin layers in IF frequency band using two-terminal probe method

Kanako Wake¹, Kensuke Sasaki¹ & Soichi Watanabe¹

¹Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795

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

The skin plays an important role in clarifying the interaction between electromagnetic waves and a biological body. This study presents the measurements of the dielectric properties of the skin with *in vitro* experiments in IF band. In the measurement, porcine skin was fractionated into epidermis and dermis. Then those impedance were measured by two terminal method. The result was compared with Gabriel's data set which is used as de facto database. The result indicated that conductivity of the dermis was higher than that of the epidermis. Those measured values were higher than that of the wet skin reported by Gabriel.

PB-80 [19:00]

STUDENT PAPER

Decreasing SAR and enhancing transmission of an in-body biotelemetry capsule by reducing the near-field coupling with surrounding tissues

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

This study focuses on the reduction of the near-field coupling with surrounding tissues of an *in-body* wireless biotelemetry capsule operating in the 434 MHz ISM band. This allows enhancing through-body transmission performances and reducing exposure levels simultaneously by weakening the local SAR within the tissues adjacent to the capsule.

PB-82 [19:00]**The effects of long-term evolution (LTE) on primary normal rat astrocytes**Tomonori Sakurai¹¹Department of Radiological Technology, Gifu University of Medical Science, Seki, Japan, 501-3892**Keywords:** *In vitro*, RF/Microwaves, Work in Progress

In this study, we evaluated the effects of LTE at 1.95 GHz exposure on primary normal rat astrocytes isolated from the hippocampus according to a previous report that the exposure to 835 MHz radiofrequency altered the GFAP immunoreactivity in murine hippocampus. A LTE exposure at the SAR of up to 4 W/kg for 2 h did not affect the astrocyte morphology or GFAP mRNA expression.

PB-84 [19:00]**STUDENT PAPER****Specific Absorption Rate (SAR) simulations in eyewear and Bluetooth communicating devices operating close to the user's head**Yuli Álvarez¹, Alvaro de Salles¹, Robert D. Morris² & Devra Davis²¹Department of Electrical Engineering, Federal University of Rio Grande do Sul-UFRGS, Porto Alegre, Brazil²Science, Environmental Health Trust, Jackson, WY, USA**Keywords:** *Dosimetry (computational)*, RF/Microwaves, Completed (unpublished)

Two popular wireless communication devices are considered in this paper. Firstly, the Bluetooth which is one of the most popular mobile accessories and the Google glasses which are a representation of the new futuristic vision. The Specific Absorption Rate (SAR) is simulated for three different head models and compared with the available international recommendations. The first model used is the Specific Anthropomorphic Mannequin (SAM phantom), as well as two realistic models of human head (i.e., a 34 years old adult and a 10 years old child). The simulations were performed using the finite difference time domain (FDTD) method and the frequency used to feed the antennas was 2.45 GHz.

PB-86 [19:00]**Preliminary study on temperature elevation analysis by MMW and THz wave exposures using multilayer plane model**Kensuke Sasaki¹, Maya Mizuno¹, Kanako Wake¹ & Soichi Watanabe¹¹Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Koganei, Japan, 1848795**Keywords:** *Dosimetry (computational)*, THz, Completed (unpublished)

Application use of millimeter wave (MMW) and terahertz (THz) wave is recent research topic. However, safety assessment in these frequencies was still few. This is because there are quite few reports of dielectric properties of biological tissues, which compose human body. This paper present temperature elevation analysis of human exposure by MMW and THz frequencies up to 1 THz using multilayer plane model. Here, dielectric data for the dosimetry were typically measured using several measurement systems. The result indicates frequency dependence of the temperature elevation: temperature elevation increases with increasing of frequency from 0.1 THz to 1 THz.

PB-88 [19:00]**STUDENT PAPER****Uniformity of extremely low frequency electromagnetic field functions as a major parameter of its biological effects**YeoJun Yoon¹, Gwan Soo Park², Hae June Lee² & Kiwon Song¹¹Biochemistry, Yonsei University, Seoul, Korea, 120-749²Electrical Engineering, Pusan National University, Pusan, Korea, 609-735**Keywords:** *In vitro*, ELF/ILF, Work in Progress

We investigated the biological effects of a 60 Hz gradient or uniform extremely low frequency electromagnetic field (ELF-EMF) at 6 mT to both cancerous HeLa and normal primary fibroblast IMR90 cells. Gradient ELF-MF induces DNA double strand breaks (DSBs) in both cells, leading to apoptosis. Unlikely to gradient ELF-MF, uniform MF exposure did not show any DNA DSBs and apoptosis in both HeLa and IMR90 cells. Moreover, uniform MF exposure to HeLa cells promotes cell proliferation without any DNA damage. These observations suggest that uniformity of MF is a key factor for the biological effects of MF.

PB-90 [19:00]**Accumulated effects of 100 nsPEF on the plasma membrane enhance cytotoxicity of Cis-platinum to Hepatocellular cell lines**Shengyong Yin¹, Xinhua Chen¹, Danjing Guo¹, Haiyang Xie¹, Lin Zhou¹ & Shusen Zheng¹¹The Institute of Surgical Research, Zhejiang University, Hangzhou, China, 310003**Keywords:** *In vitro*, Pulsed, Completed (unpublished)

It showed that 1 pulse of 40kV/cm 100ns nsPEF is enough to change the status of negative charges on the outside of plasma membrane. With series pulses of more than 60 seconds interval, membrane effects were accumulated. The permeability-increasing of HCC cells' membrane induced with non-lethal dose of nsPEF were detectable within 2 hours. Synergetic proliferation inhibition to pulsed HCC cells with combined treatment of low concentration Cis-platinum disappeared while the detectable permeability-increasing recovered.

PB-92 [19:00]

Effect of Radio Frequency Radiation (RFR) emitted from cell phone on human health

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

The Indian Council for Medical Research has initiated a multi-disciplinary cohort study in Delhi & National Capital Region (NCR) to find out adverse health effects of RFR, if any, emitted from cell phone on adult Indian population. Preliminary results will be presented.

PB-94 [19:00]

Investigation of Terahertz absorption mechanisms in porcine dermis

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Keywords: Behavioural, THz, Work in Progress

The absorption spectra of a naturally dried porcine dermis sheet were measured in a terahertz band and compared with those of a collagen fiber sheet made from bovine skin. The absorption peak frequencies of both sheets showed good agreement and were similar to the collective vibrational frequencies of various functional groups in collagen. Furthermore, the magnitude of absorption in the dermis sheet was approximately 70% of that in the collagen fiber sheet, indicating that the collagen density in the dermis was 70%, while the other substances in the dermis sample have no significant absorption peak. We therefore inferred that the absorption properties of a dermis sheet could be analyzed mainly from those related to collagen.

PB-96 [19:00]

Magnetic fields within fMRI scanners can directly modify the activity of cortical neurons

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

Using a well established model of the auditory cortex we explored the likelihood that rapidly switching magnetic fields present in fMRI scanners could modify neural activity in the human brain. It was found that pairs of E field pulses >5 msec apart could substantially modify AP timing thus causing artifacts in the fMRI recordings and, possibly, adverse metabolic effects.

PB-98 [19:00]

Analysis of dosimetric results for electromagnetic fields radiated by medical devices in hospitals

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

In this paper, the electromagnetic radiation according to the medical devices in the hospitals has to be measured and analyzed. The measured results of electromagnetic field strengths radiated by the medical devices are not very strong except some high power used devices such as the electrosurgical units. However, if these devices show higher strength of EMF, it could be affected to the patients or workers (doctors, nurses, or staffs). For preventing the EMF effect to the workers who is working in the hospitals for a long time, the newest medical devices also have to be verified and analyzed. As the results, the EMF strength of medical devices is satisfied by the ICNIRP guidelines and account for a small portion of guidelines.

PB-100 [19:00]

Effect of ELF-MF on osteoporosis in contusion model of severe spinal cord injury in rat

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

SCI decreased food intake, water intake and body weight. Magnetic field exposure restored it. Sensory -motor deficit was significant after SCI. bladder control was impaired. exposure to magnetic fields reversed the effects. The bone mineral content, bone mineral density, calcium and phosphorus contents of femur , tibia and humerus were significantly reduced after SCI which was restored after MF exposure. The osteoblastic markers also decreased after spinal cord injury while the osteoclastic markers increased. Following ELF-MF exposure all the osteoblastic markers were improved while the osteoclastic markers were reduced. EL_MF improved and restored the impaired effects of SCI

PB-102 [19:00]

Impairment of neuronal cell cytoskeleton after RF irradiation

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

We evaluated activity of modulated radiofrequency radiation on polar and nonpolar cytoskeleton filaments in neuronal cells. Cells were exposed in GTEM Chamber to GSM radiation frequency of 915 MHz for 1, 2, and 3 h. Structures of microtubule, actin and vimentin filaments were determined by means of fluorescence staining. Microtubules and actin microfilaments were significantly impaired after three hour of exposure to 10, 20 and 30 V/m field strength. The structure of vimentin filaments remained unchanged. Impairment of microtubules and actin microfilaments was rather time then dose dependent. Related to the polar properties of filaments cytoskeleton network can be damaged by radiation frequency of 915 MHz in time-dependent manner.

PB-104 [19:00]

Field test for ELF magnetic field mitigation based on Passive Loop for Transmission Lines

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

In order to mitigate magnetic field under power transmission lines, considerable efforts have been made to develop passive loop based, cost-effective mitigation technique of power frequency magnetic field more than ten years. To verify developed power frequency magnetic field mitigation technique based on passive loop, a horizontal(two-wire) type of passive loop was designed and installed for commercially operating 154kV overhead power transmission line for the first time in Korea. The measurement results before and after the installation of passive loop shows that magnetic field could be reduced to about 20 [%].

PB-106 [19:00]

The effect of continuous exposure of 60 Hz magnetic fields on reproductive function through mouse generation

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

We aimed to examine the effect of continuous exposure of 60 Hz magnetic fields(MF) on reproductive function through mouse generation. Mice were continuously exposed at 60 Hz MF of 100 μ T for 8 weeks(male) and 10 week (female). We found that the continuous exposure of 60 Hz magnetic field only on first generation affect the testicular germ cell apoptosis of second and third generation. From the results of generation study, the effects of continuous exposure of 60 Hz magnetic field not only affect 1st generation but also exert the next generation such as the testicular germ cell apoptosis, status of sperm, pregnancy rate, birth rate, and sex ratio.

PB-108 [19:00]

Effects of DNA electrotransfer on endogenous mRNA and protein regulation

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Keywords: Electroporation, Pulsed, Other

Electrotransfer is an efficient means of enhancing plasmid DNA introduction into tissues such as skin, muscle, and tumors. Delivery of therapeutic pDNA has reached clinical trials in the US and in Europe, primarily for cancer therapies and infectious disease vaccines. In preclinical models, several groups have noted antitumor effects after delivery of control DNA to tumors. This effect may be due to the upregulation of endogenous mRNAs and proteins, particularly interferons and inflammatory cytokines and chemokines. This study investigates the biological mechanisms of this upregulation, which may aid or inhibit the therapeutic effectiveness of gene therapy.

PB-110 [19:00]

Simple assessment of non-sinusoidal, pulsed or intermittend exposure to low frequency electric or magnetic fields at workplaces

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Keywords: Occupational, ELF/ILF, Completed (published)

Directive 2013/35/EU obliges the employers to assess the EMF risks at the workplace and to take adequate measures to eliminate or to minimize such risks where necessary. An important issue is the correct assessment of non-sinusoidal, pulsed or intermittend exposure to low frequency electric or magnetic fields at workplaces, for example during welding processes. The described procedure provides a simple and safe method and is based on laws of physics and physiology, especially on the mechanism of electrostimulation. The very practical and useful assessment procedure, included in the German Accident Prevention Regulation, is adapted to the requirements of the Directive 2013/35/EU.

PB-112 [19:00]

Thermal time constant in the human head model for dipole antenna from 1 to 30 GHz

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

This study investigates the time constant of the microwave-induced temperature elevation in human head models for a dipole antenna. The considered frequency band is from 1 to 30 GHz. First, the specific absorption rate distribution in a head model is evaluated using the Finite-Difference Time-Domain method for computational electromagnetics. Then, the temperature elevation in the head model is calculated by solving the bioheat equation. The thermal constant at the point where the peak temperature elevation appears is evaluated. The computational results show that the thermal time constant decreases with the increase of the frequency, which coincides with the tendency reported in an earlier study.

PB-114 [19:00]

Epidemiological study of the residents around the high voltage power lines and the magnetic fields

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

The study performed a basic epidemiological study of the ecological model to see whether there is any relations between magnetic fields from high voltage power lines(HVPL) and health of residents near the lines. It was found from the study that exposure to magnetic fields coming from the installed power lines did not affect the residents' health.

PB-116 [19:00]

STUDENT PAPER

Towards a new correction law for EMF assessment errors at the vicinity of human body

Rodrigues Kwate Kwate¹, Bachir Elmagroud¹, Chakib Taybi¹, Dominique Picard², Christophe Geuzaine³, Veronique Beauvois³, Mohammed Anisse Moutaouekkil⁴ & Abdelhak Ziyat¹

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

We present in this paper a new correction law for overcome the EMF assessment errors due to the presence of exposimeter at the vicinity of human body. The Correction law proposes to use 2, 3 or 4 measuring points of the field, depending on the desired confidence. These measurements are made at regularly goshawks separate points of the body, either in the chest or abdomen or either at the waist. The goal is to propose a useful distributed worn-body exposimeter who can apply a correction law to these separate values compared to the maximum value known beforehand. This correction law is now performed with simulation and shortly by measures in anechoic room for GSM 942 MHz downlink frequency.

PB-118 [19:00]

Evaluation of the Total Human Exposure Levels from Wireless Installations in Population Dense Areas

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

This paper presents the results of measurement for simultaneous human exposure to various RF signals at the population dense areas. Measurements were performed at 1,260 positions across the nation to determine the exposure compliance to electromagnetic fields for general public. The measured exposure levels were very low compared with the international exposure guidelines and Korean human protection notice. The highest total exposure level was $5.1 \cdot 10^{-3}$ (approximately 0.5 % of limits).

PB-120 [19:00]

STUDENT PAPER

Numerical assessment of the induced SAR within humans due to EM radiations from Smart Meters

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

Absorption of electromagnetic waves emitted by smart meters has been investigated by using numerical models representing a sample of the population: namely, a 23-year old female (NAOMI), a 34-year old male (NORMAN) and a 7-year old child (Eartha). Absorption within each of the models has been assessed at two different frequencies representing the ZigBee (2450MHz) and general purpose telemetry (868MHz) band. Frequency-dependent and age-dependent tissue properties have been taken into consideration within each model. The Specific Energy Absorption Rate (SAR) induced inside each heterogeneous voxel model has been calculated with IW input power, fed to an optimised antenna similar to that used in commercial devices.

PB-122 [19:00]

Effects of Radiofrequency Electromagnetic Fields on Amyloid Precursor Protein Processing in 5xFAD mice

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

We investigated the effect of radiofrequency electromagnetic fields (RF-EMFs) on *in vivo* Alzheimer's disease model. We exposed RF-EMF (5W/kg, 2h/day, 5 days/week) for 3 months to wide type and Tg-5xFAD mice and determined amyloid precursor protein (APP) and APP metabolites in brain tissue. Our results indicate that 3 month exposure of RF-EMF dose not affect on Precursor Protein Processing of Alzheimer's disease model.

PB-124 [19:00]

STUDENT PAPER

Electropermeabilization of inner and outer membranes of cells with microsecond pulsed electric fields: Quantitative study with calcium ions

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Keywords: Electroporation, Pulsed, Completed (unpublished)

In our study, calcium was used as a marker of internal or external membrane electropermeabilization in two different types of attached cells exposed to one single 100 microsecond electric pulse. Response curves of DC-3F cells and human adipose mesenchymal stem cells (hAMSC) to different electric field amplitudes were achieved in media with and without calcium

ions. The calcium peaks detected in a medium without calcium demonstrated that “classical” micropulses can permeabilize the inner membranes of the cells, notably those of the endoplasmic reticulum. Viability was fully preserved in the haMSC even though field amplitude were higher than those necessary to permeabilize the plasma membrane of these cells.

PB-126 [19:00]

GSM 900MHz signal affects a spectral power of alpha band in the resting human electroencephalogram

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

The aim of this study was to examine the possible effect of exposure to radiofrequency electromagnetic field (RF EMF) GSM 900 MHz, on brain electrical activity. 26 healthy volunteers aged 18-35 years underwent two experimental sessions in which one session served as control (sham) and second one as exposure session. Subjects were exposed to mobile phone signals at intensity of 0.49 W/kg. In each session, waking EEG was recorded before, during and after an exposure period. These results suggest that GSM-EMFs of a mobile phone affect alpha band within spectral power of resting human EEG.

PB-128 [19:00]

A dosimetric model for real-time E field calculation in TMS clinical applications

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

In clinical applications of Transcranial Magnetic Stimulation (TMS), knowledge of the distribution of the electric (E) field inside the brain is fundamental for the understanding of the exact position and extent of the stimulated region. In this work we propose a computational model, based on the admittance method, for real-time calculation of the E field distribution in a homogeneous brain of realistic shape, taken from MRI images. This allows a fast and accurate evaluation of the stimulated brain targets during the TMS delivery, leading to possible improvement of the efficacy of clinical applications.

PB-130 [19:00]

Enzymatic alteration of rat brain cells chronically exposed to low level microwave radiation

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

Male Wistar rats were exposed 2 h/day for 35 days at different RF radiation. Biochemical changes were measure on brain cells. A significant decrease in PKC activity, an increased ODC activity and DNA damage was observed in exposed group as compared to their control counterpart.

PB-132 [19:00]

Experimental thorax prototype for multistage pneumothorax diagnosis

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Keywords: Clinical (diagnostics), RF/Microwaves, Completed (unpublished)

An experimental rectangular thorax prototype is proposed for multistage pneumothorax diagnosis. Two patch antennas are applied on-body to monitor air layer between the lung and chest wall. The prototype consists of semi-solid and liquid materials corresponding to skin, fat, air and lung layers from 1 to 4 GHz, where the diagnostic sensor operates. Measurements of materials dielectric properties were performed in order to fit the values to the desired dispersion curves. Preliminary measurements of S₂₁ variation within 1-4 GHz have been conducted, providing up to 10 dB difference at 3 GHz,

between healthy and pneumothorax (air: 5 mm) cases. Satisfactory agreement is recorded between simulated and measured results.

PB-134 [19:00]

High frequency electromagnetic field induced hyperthermia for treatment of artificially induced breast cancer in rats- Increasing the effectiveness of magnetic assisted therapy- Pilot study

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

Ferromagnetic-nanoparticles offer many potential benefits for therapy by making specific drugs more efficacious and by decreasing their adverse side-effects. The basic idea of our study is use of glucose-conjugate Fe-MNP(Glc-Fe-MNPs) for targeting and more accurate focusing in order to increase the effect of high-frequency electromagnetic fields induced hyperthermia in solid breast tumors. Assisted RF-EMF hyperthermia induced by glucose conjugated magnetic nanoparticles in high-frequency oscillating magnetic fields, commonly termed magnetic fluid hyperthermia, is a promising form of heat delivery in which thermal energy is supplied at the nanoscale to the tumor.

PB-136 [19:00]

STUDENT PAPER

The impact of extremely low frequency (< 300 Hz) magnetic fields (up to 100 mT) on human standing balance

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Keywords: Human, ELF/ILF, Work in Progress

Studies have found that extremely low-frequency (ELF, < 300 Hz) magnetic fields (MF) can modulate standing balance. However, acute effects of ELF MF on standing balance have not been systematically investigated yet. We aim to establish the threshold for standing balance modulation during ELF MF exposure. 80 participants will be exposed to an ELF MF (0 to 100 mT) and transcranial electric stimulation (DC and AC, 1 mA). The displacement of their center of pressure will be collected and analyzed using validated sway characteristics in order to detect modulations of vestibular system function. Results will contribute to further documentation of the rationale for exposure guidelines aiming to protect power-line workers and the general public.

PB-138 [19:00]

Study of the MF exposure of a sample of people living close to overhead power lines in France

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

We have studied the data concerning the subjects of the EXPERS study living close to the overhead power lines, which we defined in function of the distance and the voltage of the line. The correlation between the magnetic field measured and the current in the line was checked.

PB-140 [19:00]
STUDENT PAPER

How does the accuracy of the RF body coil model affect the analysis of RF-induced electric field with partially implanted wires?

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

Accurate modeling of the electric field is necessary for evaluating medical devices that are partially implanted in the body. Three coil configurations of a 64 MHz birdcage body coil loaded with an ellipsoidal phantom were implemented in this study. The computational results were compared against measurements of a geometrically matching coil. The effect of the different models on the electric field near a 400 mm bare wire partially implanted in the phantom was also assessed. The three numerical models showed less than 4% difference of the magnetic field magnitude compared to the measurements. Conversely, the peak local 1g-averaged SAR near the wire simulated with one of the models was six-fold higher compared to the other two.

PB-142 [19:00]

Moderate magnetic fields upregulate mitochondria in "mice and men"

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Keywords: Clinical (therapy), Static, Completed (published)

This abstract reviews our research concerning insulin resistance associated with fatty liver which accompanies the metabolic syndrome or diabetes from obesity. Until recently, one hypothesis that has received little attention is that mitochondrial defects are the cause of metabolic syndromes or diabetes 2, fatty liver and insulin resistance. Another hypothesis is that moderate magnetic fields change gene expression.

PB-144 [19:00]

Effects of short and long term of electromagnetic field exposure on the human hippocampus

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Keywords: In vivo, ELF/FLF, Completed (unpublished)

Mobile communication has generated intense scientific interest since its exponential growth has been accompanied by a parallel increase in the density of electromagnetic field (EMF). The aim of the study was to evaluate the short and long term EMF effect on the human's hippocampus using the magnetic resonance images (MRI) and neuropsychological tests. Additional experimental studies are necessary to define the effects of long term EMF exposure on central nervous system with different duration. The findings of our current study may encourage researchers to evaluate the chronic exposure of EMF on central nervous system.

PB-146 [19:00]

Mapping the electrostatics of bio-systems subject to exogenous electric fields: a full-atomistic approach

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

Evaluating electrostatic interactions experimentally with nanoscale resolution is still a challenge, thus many theoretical models have been developed in the past decades. Here we use molecular dynamics (MD) simulations to give a general method capable of mapping the electrostatic interactions in complex environments. As an example, we take into account a

complex lipid bilayer with its aqueous environment, using the proposed method to give a detailed picture of the electric field behavior near biological interfaces.

PB-148 [19:00]
STUDENT PAPER

Current uses and public policy issues of radio frequency electromagnetic wave technology

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

New public management and e-governance mantras have supported public administration's use of radio frequency electromagnetic wave transmission devices. The application of invisible technologies is centrally important to numerous federal objectives that impact various sectors of the economy. There are several outstanding key public policy issues related to the widespread societal use of electromagnetism for the benefit of businesses and government, largely at the expense of the public. Specific challenges involve health concerns of subjects and users, privacy rights, regulation, and governance. A review of public policies and political factors governing the new technocracy is yearned-for by communities.

PB-150 [19:00]

Analytical thermal model of a human skin-equivalent phantom for dosimetric assessment in the 60-GHz band

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

This paper reports the first analytical thermal model of a human skin-equivalent 60-GHz phantom with finite dimensions. Heating dynamics, analytically calculated for several phantom thicknesses and heat transfer coefficients at the air/phantom interface, are compared to electromagnetic-thermal co-simulated results computed using CST Microwave Studio. An excellent agreement is demonstrated between analytical and numerical results. The model is validated experimentally using high-resolution infrared thermometry.

PB-152 [19:00]

STUDENT PAPER

Molecular dynamics simulation of plasma reactive species with lipid bilayers

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Keywords: Mechanistic/Theoretical, All Frequencies, Work in Progress

Using Molecular Dynamics (MD) simulations, the stability of past simulations is evaluated by calculation of order parameter for carbon chains that form the lipid tails in a DPPC lipid bi-layer. The calculation results are then compared to experimental data showing stability of the membrane in the simulations.

PB-154 [19:00]

A study on the measurement and analysis of EMF exposure to occupational worked in resistance furnace

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

By using an ELF meter, extremely-low frequency electromagnetic field measurements were conducted near the resistance furnace & control room. The maximum measurement value of magnetic flux density is 217.3 μ T which value is significantly high degree levels (general public: 108.65%, occupational: 21.73%) contrast ICNIRP reference levels.

PB-156 [19:00]

Exposure to 1800 MHz GSM like signals during pregnancy, fetal and childhood periods

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

Adult rabbits, male and female infants were exposed to 1800 MHz RFR (15 min/day, 7 or 14 days; 2 mW/kg, 18 mW/kg). We found increased oxidative stress in exposed adults' brains and in liver tissues of exposed infants. Apoptotic cells found

increased in neurons, glial cells, cornea and lens of exposed adults and newborns. Brain and eyes were found most effected tissues.

Keywords: Radiofrequency, pregnant, fetus, infant, rabbit

PB-158 [19:00]

2.45 GHz radiations exposure effects on reproductive system of male rats

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

In the present investigations the frequency of 2.45 GHz is chosen for its wide ranging use in industry, Radar and is close to 3G and 4G. Wister rats were exposed to this frequency (2h/day x 35days, SAR= 0.11W/kg). The results suggest that a reduction in protein kinase activity may be related to overproduction of reactive oxygen species (ROS). Decrease in sperm count and an increase in apoptosis may be causative factor due to the radiation exposure leading to infertility.

PB-160 [19:00]

Childhood Leukaemia and Magnetic Fields: the CLeMAn project as an in vivo approach

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

50 Hz magnetic fields have been classified as possible human carcinogen for childhood leukaemia, based on epidemiological data that were not supported by carcinogenicity and genotoxicity data. We will search for genomic instability and epigenetic changes, such as histones modification, in the bone marrow of BDF1 mice exposed 8 h/d, 5 d/wk at 1000 µT, beginning at conception. A high-content microscopy screening will allow for the detection of rare epigenetic events at the single cell level.

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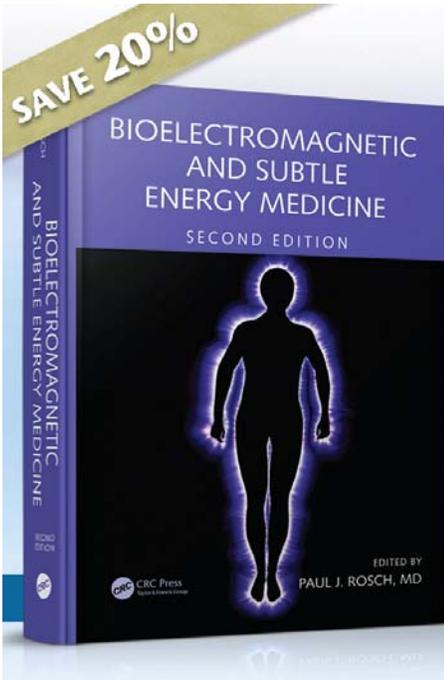


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Shuttles to Carmel shopping, Monterey Cannery Row and Aquarium

Wednesday June 17, 2015

Cannery Row Shuttles
2/28 passenger coaches

Asilomar	Cannery Row
12:30pm	12:45pm
12:45pm	1:00pm
1:00pm	1:15pm
1:15pm	1:30pm
1:30pm	1:45pm
1:45pm	2:00pm
2:00pm	2:15pm
2:15pm	2:30pm
2:30pm	2:45pm
2:45pm	3:00pm
3:00pm	3:15pm

Carmel Shopping Shuttles
2/28 passenger coaches

Asilomar	Carmel Plaza
12:30pm	12:45pm
12:45pm	1:00pm
1:00pm	1:15pm
1:15pm	1:30pm
1:30pm	1:45pm
1:45pm	2:00pm
2:00pm	2:15pm
2:15pm	2:30pm
2:30pm	2:45pm
2:45pm	3:00pm
3:00pm	3:15pm

Carmel to Cannery Row Shuttle
1/28 passenger coach

Carmel Plaza	Cannery Row
3:30pm	3:45pm
4:00pm	4:15pm
4:30pm	4:45pm
5:00pm	5:15pm
5:30pm	5:45pm
6:00pm	6:15pm

Asilomar to Cannery Row Shuttle
1/28 passenger coach

Asilomar	Cannery Row
4:30pm	4:45pm
5:00pm	5:15pm
5:30pm	5:45pm
6:00pm	6:15pm
6:30pm	6:45pm
7:00pm	7:15pm

Aquarium to Asilomar Shuttles
4/28 passenger coaches

Aquarium	Asilomar
8:00pm	8:15pm
8:30pm	8:45pm
9:00pm	9:15pm
9:30pm	9:45pm
10:00pm	10:15pm
10:30pm	10:45pm