BioEM2018

June 25-29, Piran, Portorož, Slovenia

The Joint Annual Meeting of
The Bioelectromagnetics Society and the
European BioElectromagnetics Association

Technical Program and General Information

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Australia

From the Co-chairs of the Local Organizing Committee

The **BioEM2018 Local Organizing Committee** welcomes you to **Piran**, **Portorož, Slovenia** for the Joint Annual Meeting of The Bioelectromagnetics Society (BEMS) and the European BioElectromagnetics Association (EBEA).

As the premier international conference in the area of bioelectromagnetics, BioEM2018 is expected to stimulate further research in this field through the exchange of ideas and invigorating discussions, consolidating the state-of-the-art knowledge, and identifying existing gaps.

The BioEM2018 conference is held in **St. Bernardin Conference Centre** which is located at a tourist resort by the Adriatic Sea, within walking distance to the towns of **Portorož and Piran** – two beautiful towns that offer every visitor a truly authentic cultural remix influenced by the Northern Mediterranean, combining inspiring modernity and fascinating history. The St. Bernardin Conference Centre offers an exceptional venue for meetings and conferences, as well as for leisure and relaxation.

Slovenia is the first country in the world to be declared a **green destination** based on the Green Destinations Criteria. Situated in the heart of Europe, Slovenia is a boutique country between **the Alps, Mediterranean Sea,** mysterious **Karst** with more than 11,000 karst caves and **Pannonian Plain**, rich in healthy water springs. Slovenia also offers many other tourist attractions. Beautiful Ljubljana, the capital city of Slovenia, is 1 hour away by car and the famous Postojna cave, only 45 minutes away. The Lipica Stud farm, the craddle of all Lipizzaner horses in the world, is only 30 minutes away by car. Famous Venice, Italy, could be reached in only 2 hours' drive. And for those who remember Bled which hosted the 2nd EBEA Congress in 1993, this is only 1 h 40 min drive by car.

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 believe that this will be a fruitful scientific meeting in stimulative and relaxing environment by the Adriatic Sea shore.

We are delighted to welcome you all at BioEM2018 in Piran, Portorož, Slovenia!

Peter Gajšek, Institute of Nonionizing Radiation (INIS), LOC Chair
Damijan Miklavčič, University of Ljubljana, LOC co-Chair.

Technical Program Committee


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Co-chair
Switzerland


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Azadeh Peyman
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Micaela Liberti
Italy


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France


Luc Martens
Belgium

From the Co-chairs of the Technical Program Committee

Dear Colleague,

We welcome you to Piran, Portorož, Slovenia for the Joint Annual Meeting of the Bioelectromagnetics Society (BEMS) and European Bioelectromagnetics Association (EBEA), BioEM2018. The Annual Meeting provides a unique opportunity for researchers, experts, and students to meet and interact, share and discuss new research and to renew friendships with colleagues in the bioelectromagnetics field.

We want to thank you for all of the excellent proposals you submitted for the keynote lectures, the tutorials and the workshops. The TECHNICAL PROGRAM COMMITTEE (TPC) MEMBERS also provided interesting and new ideas. We selected four plenary talks with distinguished speakers, three tutorials and five workshops, two of which will take place right before BioEM2018. The plenary sessions will cover most of the key issues in bioelectromagnetics and have some of the most distinguished speakers in each area. Several emerging areas are covered including magnetoreceptor(s) cryptochromes, dielectrophoresis in biomedical applications, and molecular and cellular mechanisms defining prospective medical applications of nanosecond stimuli. The work of the International Commission of Non-Ionizing Radiation Protection (ICNIRP) on future high frequency guidelines will be presented for the first time at our annual meeting. Finally, in the 'hot topic' session on Friday, for the first time results from the international epidemiological COSMOS study on the development of non-specific symptoms in relation to mobile phone use will be presented.

To provide the scientific basis to protect the health of the population is an important objective of bioelectromagnetics research. The program puts a focus on aspects involved in preventing people from unwanted side effects of EMF. Our first tutorial will cover systematic review approaches in biomedical sciences and the third tutorial will provide us with details regarding how to design and evaluate animal cancer studies to be useful for hazard identification. In a workshop on Tuesday afternoon, various stakeholders including governmental organizations will discuss the challenge of transferring evidence from research into policy to be used by society in making decisions. We are convinced that these three sessions together with the ICNRIP plenary will contribute to a better understanding on how to best protect human health. For the public this question has recently become more fundamental with the foreseeable introduction of 5G. The pre-conference workshop on this topic will answer many open questions with respect to the rapid technological development of 5G.

In addition to harm reduction, therapeutical applications of EMF are an important field of research for the health of individuals. A pre-conference workshop will present recent research on nano-electropulse-induced electrochemical signaling and the second tutorial will address the question: what role do scientists play in the development of magnetic nanoparticles as therapeutic agents? The third workshop will deal with advanced approaches for the analysis of biological effects from pulsed electric fields whereas the second workshop will attempt to bridge the hazardous or beneficial effects of EMF.

244 ABSTRACTS FROM 36 DIFFERENT COUNTRIES all over the world were submitted. Many scientists from our community have acted as reviewers; each submitted abstract was scored by at least three referees. After selection of the accepted abstracts, the TPC assigned them into 16

oral Platform Sessions and two Poster Sessions, preceded by Flash Student Poster presentations. A strong participation of students (49 submitted abstracts) demonstrates the ability of our Societies to attract young researchers and it provides hope for a continuous renewal of our vibrant research community.

A number of people will receive awards and recognition during BioEM2018. BioEM2018 continues the tradition of the Chiabrera Lecture for Excellence in Bioelectromagnetics, an honor bestowed on an outstanding young researcher by EBEA. The prestigious d'Arsonval Award from BEMS will be presented next year to Dr. J Patrick Reilly, in recognition of his outstanding achievements in various fields of bioelectromagnetics (he was unable to attend this year's meeting). Finally, we will end with the traditional awards for the students and the third Arthur Pilla Young Scientist Award, awarded to the best presentation by a young scientist at the annual BioEM Meeting.

This meeting would not have been possible without the contribution of many individuals. We thank the members of the TPC for their dedication to helping us design an interesting program, the referees who diligently reviewed and scored all the submitted abstracts, and Astrid Chamson-Reig and Jeff Carson (Lawson Health Research Institute in Canada) who supported us through managing the submission website and the abstract book; all of these efforts were essential to developing a successful program. Furthermore, our personal thanks go to Dr. Peter Gajšek and Professor Damijan Miklavčič and the Local Organizing Committee, to Professor Isabelle Lagroye, EBEA President, and to Professor Andrew Wood, BEMS President for their support.

On behalf of the TPC, we conclude by thanking you for your participation and support to the BioEM2018 conference and we hope that you will enjoy the meeting!

Meike Mevissen and Martin Röösli
Co-Chairs, Technical Program Committee, BioEM2018

Technical Program Review Committee


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China

Sachiko Yamaguchi-Sekino
Japan

Kenichi Yamazaki
Japan

Shengyong Yin
China

Olga Zeni
Italy

Schedule at a Glance

Sunday, June 24, 2018

Time	Session	Name	Location
09:00 - 12:30	M1	BEMS Board Meeting	Pharos
09:00 - 12:30	M2	EBEA Council Meeting	Adria
13:00 - 18:00	PW1	Pre Conference Workshop: EMF exposure from 5G equipment: the state of art of research and standardization	Europa C
13:00 - 16:30	PW2	Pre Conference Workshop: MURI/AFOSR Workshop on Nanoelectropulse-induced electromechanical signaling and control of biological systems	Europa D
18:00 - 20:00		Welcome Reception	Grand Garden Terrace and Cocktail Lounge

Monday, June 25, 2018

Time	Session	Name	Location
09:00 - 09:30		Welcome	Emerald
09:30 - 10:30	P1	Plenary 1: Effects of Static and Oscillatory Magnetic Fields on Cryptochromes: A Mechanistic Perspective	Emerald
10:30 - 11:00		Coffee Break	Foyer
11:00 - 12:30	S01	Human studies I / brain	Europa C
11:00 - 12:30	S02	Dosimetry I - Computational studies	Europa D
12:30 - 13:30		Lunch	Grand hotel Bernardin restaurant
13:30 - 14:30	FA	Student Flash Poster Session A	Emerald
14:30 - 16:00	PA	Poster Session A	Mediteranea
16:00 - 16:30		Coffee Break	Foyer

16:30 - 18:00	S03	In vitro I	Europa C
16:30 - 18:00	S04	MRI studies	Europa D

Tuesday, June 26, 2018

Time	Session	Name	Location
08:30 - 09:30	T1	Tutorial 1: Systematic Review Approaches in Environmental Health Sciences	Emerald
09:30 - 10:30	P2	Plenary 2: The International Commission on Non-Ionising Radiation Protection (ICNIRP) Draft High Frequency (100 kHz – 300 GHz) Guidelines	Emerald
10:30 - 11:00		Coffee Break	Foyer
11:00 - 12:30	S05	Epidemiology	Europa C
11:00 - 12:30	S06	In vitro II	Europa D
12:30 - 13:30		Lunch	Grand hotel Bernardin restaurant
12:30 - 13:30	M3	EBEA Assembly	Europa C
13:30 - 14:30	FB	Student Flash Poster Session B	Emerald
14:30 - 16:00	PB	Poster Session B	Mediteranea
16:00 - 16:30		Coffee Break	Foyer
16:30 - 18:00	S07	Electroporation	Europa D
16:30 - 18:00	W1	Workshop 1: Transferring Evidence from Research and Case Reports into Policy and Society	Europa C
19:00 - 22:00		Conference Dinner	Emerald (with welcome drink on the beach)

Wednesday, June 27, 2018

Time	Session	Name	Location
09:00 - 10:00	T2	Tutorial 2: Magnetic Nanoparticles as Therapeutic Agents: Focusing on the Role of a Scientist and Engineer	Emerald

10:00 - 10:30		Coffee Break	Foyer
10:30 - 11:30	P3	Plenary 3: Exploring Dielectrophoresis and its Applications in the Biomedical Sciences	Emerald
11:30 - 12:30	S08	In vivo	Europa C
11:30 - 12:30	S09	Mechanisms	Europa D
12:30 - 13:30		Lunch	Grand hotel Bernardin restaurant
14:00 - 22:00		Optional tour to Postojna Cave or Miramare Castle	

Thursday, June 28, 2018

Time	Session	Name	Location
08:30 - 09:30	T3	Tutorial 3: Evaluation of Animal Cancer Studies (overview)	Emerald
09:30 - 10:30		Award session	Emerald
10:30 - 11:00		Coffee Break	Foyer
11:00 - 12:30	S10	Human studies II	Europa C
11:00 - 12:30	S11	Dosimetry II - Measurements	Europa D
12:30 - 13:30		Lunch	Grand hotel Bernardin restaurant
12:30 - 13:30	M4	BEMS Business	Europa D
13:30 - 15:00	S12	Nano pulses	Europa C
13:30 - 15:00	W2	Workshop 2: EMF and Cancer: Interaction Mechanisms Leading to Hazardous or Beneficial effects	Europa D
15:00 - 15:30		Coffee Break	Foyer
15:30 - 16:30	S13	Public Policy I	Europa C
15:30 - 18:00	W3	Workshop 3: Advanced Approaches for Analysis of Biological Effects of Pulsed Electric Fields	Europa D
16:30 - 18:00	S14	Dosimetry III - Measurements	Europa C

Friday, June 29, 2018

Time	Session	Name	Location
08:30 - 09:30	P4	Plenary 4: Frontiers of Electroporation, from Mechanisms to Applications	Emerald
09:30 - 11:00	S15	Dosimetry IV - Computational studies	Europa C
09:30 - 11:00	S16	Public Policy II	Europa D
11:00 - 11:30		Coffee Break	Foyer
11:30 - 12:30	P5	Plenary 5: Hot Topic	Emerald
12:30 - 13:30		Student Awards	Emerald
13:30 - 14:00		Closing ceremony	Emerald
14:30 - 18:00	M5	BEMS Board Meeting	Pharos
14:30 - 18:00	M6	EBEA Council Meeting	Adria

Floor Map


Pharos
Adria
Emerald
Mediterranea
Foyer
11th floor
12th floor
Europa C
Europa D

General Information

THE CONFERENCE VENUE

BioEM 2018 conference will be held in the **St. Bernardin Conference Centre** which is located at a tourist resort by the Adriatic Sea, within walking distance to the towns of Portorož and Piran. The St Bernardin Conference Centre offers an exceptional venue for meetings and conferences, as well as for leisure and relaxation.

Portorož, a coastal town in the heart of Europe boasts a large number of comfortable hotels with modern pools, a wide range of restaurants with different varieties of cuisine, and popular events. Portorož is also a well-known convention centre.

Piran is a very special, precious city. It is the best preserved cultural monument of Slovenian Istria and its image is known all over the world. Its architecture is influenced by the former Venetian Republic, which left its mark on most Istrian towns. Throughout time, Piran has maintained the clustered medieval structure with narrow winding streets, houses huddled close together, rising in cascades, the contact with the sea, numerous squares and churches.

Portorož and Piran lie on the Slovenian coast and enjoy a climate that is quite different from other parts of Slovenia. Visitors can expect Mediterranean – style weather in summer with plenty of sunshine and high temperatures. June is mostly hot and dry with up to 11 hours of sunshine a day and the average daytime temperature around 26 ^{o}C. Even at nightime, temperatures usually remain around a comfortable 20 ^{o}C, making it possible to enjoy dining outside in the evening. However, the odd thunderstorsm can sometimes break up the sunshine during the summer.

REGISTRATION AND INFORMATION DESK

When you enter the conference venue through the main entrance, Grand Hotel Bernardin, the Registration and Information Desk will be located to the right – just accross the reception desk of the hotel.

On Sunday, June 24th, the Registration Desk will be open from 3 p.m.

From Monday, June 25th till Friday, June 30th, the Registration Desk will be open from 8 a.m. until the end of the last meeting session of each day.

CONFERENCE BADGE

Badges must be worn at all times during the meeting and during all social events (registered guests as well). Please present a printed version of your ticket (sent to you upon registration) at the Registration Desk to receive your badge and conference bag.

CONFERENCE LUNCH AND COFFEE BREAKS

A buffet lunch will be provided on Monday, June 25th, on Tuesday, June 26th, on Wednesday, June 27th, and on Thursday, June 28th in the **Grand Hotel Bernardin Restaurant on 10th Floor**.

Coffee breaks will take place in front of **EMERALD hall**.

SOCIAL EVENTS

1. WELCOME RECEPTION, Sunday 24.6.2018

Sunday, June 24th, 6:00 p.m. at the conference venue (Grand Garden Terrace and Cocktail Lounge on 11th Floor of the Grand Hotel Bernardin). Expected end time: approximately 9:00 p.m.

2. GUIDED WALKING TOUR TO PIRAN, Monday 25.6.2018

The meeting point for Guided walking tour of Piran will be on Monday, 25th June at 6:30 p.m. at the lower entrance to Grand hotel Bernardin by the hotel's lido (ground floor by the elevator) — comfortable walking shoes are recommended!

Piran is at approx. 10 minutes walking distance from Grand Hotel Bernardin (Congress venue).

3. CONFERENCE DINNER, **Tuesday 26.6.2018.**

Please join us Tuesday, 26.6.2018, 7.30 p.m. for Conference dinner.

The welcome drinks will be served on the beach in the front of the Grand Bernardin Hotel, starting at 7.30 p.m. After some refreshments all the participants will be transfered to the Emerald hall where dinner will be served. Have dancing shoes ready!

4. Optional tour to Postojna Cave or Miramare Castle, Wednesday 27.6.2018

The LOC recommends some social events to some places with special attractions in Slovenia and its surroundings. In collaboration with Unitours travel agency we have prepared some unique tours specifically for the BIOEM 2018 participants.

For further information and booking please visit **http://www.unitours.si/en/bioem2018.htm**.

The most visited tourist cave in Europe is a place where the proteus or olm offspring are once again hatching. The cave railway has been operating at the cave for 140 years.
A legendary tourist train takes you to the underground network of karst tunnels, galleries, and halls. **Postojna Cave** is the only karst cave with a cave railway. For 140 years it has been taking visitors to see stalactites and stalagmites and other features created by water.

Castle Miramare is surrounded by a flourishing park full of precious botanic species, and has a charming panoramic view, given its location on a cliff high above the sea. It stands on the peak of the rocky promontory of Grignanano in the Gulf of Trieste, and is about 10 km from the city itself. Commissioned in the second half of the 19th century by the Archduke Ferdinand Maximilian of Hapsburg as a residence, the castle today's visitors view an example of a luxurious aristocratic residence which has preserved its original furnishings.

ORAL AND POSTER PRESENTATION GUIDELINES

Please find below some potentially useful material to assist you in preparing a presentation for BioEM2018.

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@bioem.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 15-minute time slot. These 15-minutes must include the presentation, questions, and transitioning to the next speaker. It is recommended that speakers plan on an 11 minute presentation to allow for questions and discussion (4 minutes). 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 and familiarize yourself with the audio-visual equipment.

Each meeting room will be equipped with a personal computer to accommodate PowerPoint and PDF presentation formats. Technical support will be present in each meeting room to ensure flawless execution. Authors must upload their presentations onto the designated computer at the conference venue during the break before their session. Presenters will not be allowed to connect their own computer to the projection system. Presentations can be loaded via USB flash memory stick. Authors are urged to try to minimise any potential problems by taking advantage of redundancy whenever possible: save and bring presentations in multiple formats (PowerPoint and Adobe PDF), store presentations in more than one media, and keep the media on your person during travel.

The best student oral presentation(s) will be awarded.

Important information regarding a presentation upload system

All oral presenters are expected to support their presentation with a corresponding slideshow. The slides should be prepared in either PowerPoint (PPT/PPTX) or PDF format to ensure maximum compatibility with the equipment available on-site. Videos should either be embedded into the slides, or, if linked, physically accompany the main presentation document.

There will be a central upload system used for the BioEM conference, whereby from at least one week prior to the beginning of the conference and up to the very end of the last day of oral sessions, it will be **possible and much desirable** to **upload the slides and accompanying material using a centralised online system accessible from the Internet**.

In order to access the system, co-authors of submitted abstracts will **receive a personalised link to the upload system** (keep an eye out for such an email in the days leading up to the conference!). Authors on co-authored papers will be accessing the same repository, so it is the co-authors' responsibility to **designate the presenting author who will be uploading hers or his presentation**.

The email containing the access link will also come with a PDF of complete instructions on step-by-step use of the system.

Presenters are **strongly encouraged** to visit the **Preview Room (Pharos hall)** from **Sunday 1 p.m.** onward and throughout the duration of the conference either in order to

- Verify that their presentation materials uploaded via the Internet display properly on the on-site equipment;
- Seek assistance from a qualified technician present in the Preview Room in order to upload the presentation materials in the eventuality they will not succeed to take care of it over the Internet.

Any questions and inquiries as to the use of the system should be addressed to the contact listed in the Invitation to upload email.

Student Poster Presentations with Flash Presentation

Poster sessions are an important part of the BioEM2018 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 25 at 2:30 PM, and B on Tuesday, June 26 at 2:30 PM, are planned.
- **All student posters** will also be presented as **poster flash presentation.** The two poster flash sessions will take place on Monday, June 25 in meeting room Emerald from

1:30 PM to 2:30 PM (FA), and on Tuesday, June 26 in meeting room Emerald from 1:30 PM to 2:30 PM (FB).

- Please ensure that you plan your communication carefully. The language is English. Each presenter will have **3 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 3 min are over and you have to leave the podium.
- Please upload your presentation at the computer available in the **Pharos hall** on Monday, June 25 before 12:30 PM for the FA session, and on Tuesday June 26 before 12:30 PM for the FB session either in PowerPoint (.pptx) or PDF format, since all flash poster presentations will be uploaded beforehand on the same computer. 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.

Important information regarding a presentation upload system

Authors and Co-authors on those posters who have been selected for a Poster Flash Presentation, will also receive an email invitation to upload their flash presentation of 3 minutes using the online upload system in advance or during the Conference.

Please see the text above under Oral Presentations for more details on the upload system.

Poster Presentations

The poster presentations will be held in room Mediteranea**.**

Poster format and dimensions

The poster display panels that will be available for poster presentations at the Congress measure 1000 × 2000 mm, width by height, however not all of this area is available for your poster(s). The maximum size, as well as the recommended size/format, are therefore given below. Please consider using the recommended format, although you are free to choose any size up to the maximum size. But in any case your poster must adhere to portrait orientation.

Recommended format
Size: 841 × 1189 mm, width × height (A0 according to ISO 216)
Orientation: Portrait

Maximum dimensions format
Size: 900 × 1700 mm, width × height (custom)
Orientation: Portrait

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 1:00 p.m.
There will be help on Sunday afternoon and material ready for mounting.
Removal: Posters must be removed no later than Wednesday 6:00 p.m.
Posters that are left behind and remain mounted on Wednesday evening will not be returned to their authors, but will be disposed of.

CONFERENCE ORGANIZERS

Conference Organizing and Service, Events Planning, Registration and Accommodation Arrangement, Meeting Website Maintenance

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Lawson Health Research Institute
Website and Meeting Support

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

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Sunday June 24, 2018

Session: M1
BEMS Board Meeting
Sunday June 24, 2018 • 09:00 - 12:30
Pharos

Session: M2
EBEA Council Meeting
Sunday June 24, 2018 • 09:00 - 12:30
Adria

Session: PW1
Pre Conference Workshop: EMF exposure from 5G equipment: the state of art of research and standardization
Sunday June 24, 2018 • 13:00 - 18:00
Europa C
Chair: Ken Joyner

PW1-1 [13:00]

Workshop content

Ken Joyner[1]
[1]*Australia*

Although networks utilizing frequency bands below 6 GHz will still constitute the backbone of mobile communications, new wireless access technologies, such as 5G, will operate also in higher bands. This workshop will present the increasing amount of studies addressing millimeter wave EMF exposure. It will also discuss novel compliance assessment methodologies and procedures that have been developed and are being standardized for both base stations and portable devices.

PW1-2 [13:05]

Overview of 5G and the EMF Compliance Standards Development program from the InternationalElectrotechnical Commission

Michael Wood[1]
[1]*Chairman IEC TC106 and Telstra Corporation, Melbourne, Australia*

PW1-3 [13:30]

EMF Exposure limits above 6 GHz

Akimasa Hirata[1]
[1]*Nagoya Institute of Technology, Nagoya, Japan*

PW1-4 [14:00]

EMF exposure of the skin at the mmW

C. K. Chou[1]
[1]*IEEE/ICES TC95 Chairman, USA*

PW1-5 [14:30]

Ocular studies of EMF exposure at the mmW

Masami Kojima[1] & Yaeko Suzuki[2]
[1]*Kanazawa Medical University, Uchinada, Japan*
[2]*Tokyo Metropolitan University, Hachiōji, Japan*

PW1-6 [15:00]

On the averaging time of human exposure at frequencies above 6 GHz

Kenneth Foster[1]
[1]*University of Pennsylvania, Pennsylvania, PA, USA*

PW1-7 [15:30]

In vivo experimental measurements of thermal change due to mmW exposure

Leeor Alon[1]
[1]*New York University School of Medicine, New York, NY, USA*

PW1-8 [16:00]

EMF energy absorption mechanisms at the mmW

Andreas Christ[1]
[1]*Research Consultant, Cabo Frio, Brazil*

PW1-9 [16:30]

Challenges in standardization related to EMF compliance above 6 GHz

Davide Colombi[1]
[1]*Ericsson Research, Stockholm, Sweden*

PW1-10 [17:00]

EMF compliance assessments of 5G devices

Niels Kuster[1]
[1]*IT'IS Foundation, Zurich, Switzerland*

PW1-11 [17:40]

EMF compliance assessment based on a mixed approach of measurements and numerical simulations

Wassim El Hajj[1]
[1]*Intel Corporation, Nice, France*

Session: PW2
Pre Conference Workshop: MURI/AFOSR Workshop on Nanoelectropulse-induced electromechanical signaling and control of biological systems
Sunday June 24, 2018 • 13:00 - 16:30
Europa D
Chairs: Andrei Pakhomov & Bennett Ibey

PW2-1 [13:00]

Workshop content

Andrei Pakhomov[1]
[1]*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA*

Multidisciplinary University Research Initiative (MURI) grants are awarded by the US Air Force Office of Scientific Research (AFOSR) to support fundamental, cutting-edge research that crosses traditional science and engineering boundaries. This Workshop will focus on cellular and molecular mechanisms underlying bioeffects of nanosecond pulsed electric fields (nsPEF). Talks will highlight the impact of bipolar cancellation, a phenomenon which makes bipolar stimuli and emitted EMF less effective. We will summarize experimental and modeling efforts in support of a concept of remote stimulation and electroporation by “cancellation of cancellation” (CANCAN). We will conclude with a first-time introduction and discussion of a synthetic theory which links nanoelectroporation and bipolar cancellation mechanisms.

The workshop welcomes all BioEM participants and does not require registration.

PW2-2 [13:00]

Universality of bipolar cancellation of nanoelectropulse bioeffects

Andrei Pakhomov[1]
[1]*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA*

PW2-3 [13:25]

Direct observation of membrane charging during uni- and bipolar nanosecond pulse exposure

Bennett Ibey[1]
[1]*Air Force Research Laboratory, 711th Human Performance Wing, Airman Systems Directorate, Bioeffects Division, Radio Frequency Bioeffects Branch, Fort Sam Houston, TX, USA*

PW2-4 [13:50]

Bipolar, bidirectional cancellation of electrostimulated molecular transport — Nanoscale and microscale models and measurements

P. Thomas Vernier[1]
[1]*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA*

PW2-5 [14:15]

Break

PW2-6 [14:25]

Nanopore behavior during and after pulsing: General and bipolar cancellation implications

James Weaver[1]
[1]*Institute for Medical Engineering & Science, Massachusetts Institute of Technology, Boston, MA, USA*

PW2-7 [14:45]

Activation of voltage-gated calcium channels by uni- and bipolar nsPEF

Olga Pakhomova[1]
[1]*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA*

PW2-8 [15:10]

Cancellation of Ca2+ signaling by bipolar nsPEF in neural crest-derived bovine adrenal chromaffin cells – Pulse duration is critical!

Normand Leblanc[1]
[1]*Center for Cardiovascular Research, University of Nevada, Reno School of Medicine, Reno, NV, USA*

PW2-9 [15:35]

Break

PW2-10 [15:45]

Open discussion: Synthetic theory of nanoporation and bipolar cancellation

Andrei Pakhomov[1] & Bennett Ibey[2]
[1]*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA*
[2]*Air Force Research Laboratory, 711th Human Performance Wing, Airman Systems Directorate, Bioeffects Division, Radio Frequency Bioeffects Branch, Fort Sam Houston, TX, USA*

Welcome Reception
Sunday June 24, 2018 • 18:00 - 20:00
Grand Garden Terrace and Cocktail Lounge

Monday June 25, 2018

Welcome
Monday June 25, 2018 • 09:00 - 09:30
Emerald

Session: P1
Plenary 1: Effects of Static and Oscillatory Magnetic Fields on Cryptochromes: A Mechanistic Perspective
Monday June 25, 2018 • 09:30 - 10:30
Emerald
Chairs: Meike Mevissen & Azadeh Peyman

P1-1 [09:30]

Cryptochrome-based magnetoreception and the effects of RF-fields on animal orientation

Rachel Muheim[1]
[1]*Department of Biology, Lund University, Lund, Sweden*

Biographical sketch

Rachel Muheim is a researcher at Lund University, Sweden, and part of the Lund Vision Group and the Center for Animal Movement Research, CAnMove. Her research focuses on the behavioural and physiological characterization of the light-dependent magnetic compass and polarized light sensitivity in birds, and on stopover behaviour and the use of different orientation cues in migratory birds. Rachel Muheim received a Master's degree in Zoology from the University of Zürich, Switzerland, and a PhD on magnetic orientation in migratory birds from Lund University. She worked four years as postdoc in the lab of Prof. John Phillips at Virginia Tech, USA, investigating magnetic compass orientation in a variety of organisms, including newts and mice. Upon her return to Lund in 2008, she developed a novel behavioural training assay to study magnetic compass orientation in birds in a non-migratory context. The objectives of her work are to combine the new possibilities that have opened up with this new behavioural approach with the latest molecular genetic, neuroanatomical, and biophysical tools. The goal is to unravel the behavioural, physiological and molecular mechanisms of light-dependent magnetic compass orientation and polarized light sensitivity in birds, identify and describe the interactions between these two sensory cues, and study how birds use the information for orientation during migration and in other spatial orientation tasks.

Five relevant publications

1. Pinzon-Rodriguez A, Muheim R (2017): Wavelength and intensity of light determine magnetic compass orientation in zebra finches. J. Exp. Biol. 220, 1202-1209. DOI 10.1242/jeb.148098
2. Muheim R, Sjöberg S, Pinzon-Rodriguez A (2016): Polarized light modulates light-dependent magnetic compass orientation in birds. PNAS 113, 1654-1659. DOI 10.1073/pnas.1513391113
3. Phillips JB, Youmans PW, Muheim R, Sloan KA, Landler L, Painter MS, Anderson CR (2013): Rapid learning of magnetic compass direction by C57BL/6 mice in a 4-armed "plus" water maze". PLoS ONE 2013, 8:e73112.
4. Phillips JB, Jorge PE, Muheim R (2010a): Light-dependent magnetic compass orientation in amphibians and insects — candidate receptors and candidate molecular mechanisms. J. R. Soc. Interface 7, S241-256. DOI 10.1098/rsif.2009.0459.focus
5. Muheim R, Edgar NM, Sloan KS, Phillips JB (2006): Magnetic compass orientation in C57BL/6J mice. Learn. Behav. 34: 366-373.

Abstract

A wide range of animals can sense the Earth's magnetic field, and there is growing evidence that this is an omnipresent capability of the majority of organisms and thought to play a fundamental role for animals to orient in space in everyday life. Birds and other animals have a light-dependent

magnetic compass, which operates well under UV to green wavelengths, but leads to disorientation or changed orientation at longer wavelengths. This magnetic compass is suggested to be based on a light-dependent process taking place in specialized photopigments, which upon light excitation form radical pairs whose spin states, and thereby the photopigments' response to light, can be affected by an earth-strength magnetic field. Such magnetosensitive photopigments arranged in an ordered array, like the avian retina, would show increased or decreased sensitivity to light, depending on their alignment to the magnetic field. Cryptochromes are the only known animal photopigments that can form persistent, spin-correlated radical pairs upon light excitation and have therefore been suggested to act as the receptor molecules in such a radical-pair-based magnetoreceptor. They have been shown to be expressed in the retinas of various birds, although their exact location is still a matter of debate.

In my talk I will first give an overview of the behavioural, physiological and anatomical evidence for such a cryptochrome- and radical-pair-based magnetic compass in various animals. I will then discuss recent findings from my lab showing that the magnetic compass of zebra finches depends not only on the wavelengths, but also on the polarization of light. I will further show that magnetic compass orientation is affected by low-intensity, oscillating radio-frequency (RF fields at 0.1-10 MHz; <1 μT) electromagnetic fields, which are believed to influence the interconversion between the excited states of the radical pairs, and thereby alter or eliminate the effects produced by the Earth's magnetic field. I will conclude by presenting and discussing the consequences of novel findings on the temporal expression, distribution, and cellular localization of different cryptochromes in the retinas of zebra finches.

P1-2 [10:00]

Cryptochrome and mechanisms related to RF and ELF magnetic fields

Daniel R. Kattnig[1]

[1]*Living Systems Institute and Department of Physics, University of Exeter, Exeter, UK, EX4 4QD*

Biographical sketch

Daniel Kattnig is a Senior Lecturer at the recently established cross-disciplinary Living Systems Institute at the University of Exeter. His current research activity is in the field of quantum biology or, more precisely, theoretical and experimental spin chemistry, an interdisciplinary field dedicated to the effects of weak magnetic fields on chemical reactions and biological processes. The theoretical modelling of avian magnetoreception, which has been hypothesised to rely on quantum phenomena involving transient radical pairs, is at the heart of his current research endeavours. Daniel completed his PhD in Physical Chemistry at the University of Technology Graz, Austria, on studies of photo-induced electron transfer phenomena (Prof. Grampp). It is during this period that he first delved into the study of magnetic field effects on charge recombination reactions. Following a short period in industrial research, Daniel joined the Max Planck Institute for Polymer Research, Mainz, Germany, where he focused on the investigation of soft matter by means of pulsed electron paramagnetic resonance (Prof. Spiess). Returning to Graz, he took on a research position dedicated to magnetic field effects on donor acceptor systems, which he held until 2013 when he joined the group of Prof. Hore at the University of Oxford. In 2017 Daniel eventually moved to the Living Systems institute at Exeter, where he is setting up a group dedicated to the theoretical and experimental investigation of magnetic field effects.

Five relevant publications

1. Kattnig, D. R., Radical-Pair-Based Magnetoreception Amplified by Radical Scavenging: Resilience to Spin Relaxation. J. Phys. Chem. B 2017, 121 (44), 10215-10227.
2. Kattnig, D. R.; Hore, P. J., The sensitivity of a radical pair compass magnetoreceptor can be significantly amplified by radical scavengers. Sci. Rep. 2017, 7 (1), 11640.
3. Hiscock, H. G.; Kattnig, D. R.; Manolopoulos, D. E.; Hore, P. J., Floquet theory of radical pairs in radiofrequency magnetic fields. J. Chem. Phys. 2016, 145 (12), 124117.
4. Kattnig, D. R.; Sowa, J. K.; Solov'yov, I. A.; Hore, P. J., Electron spin relaxation can enhance the

performance of a cryptochrome-based magnetic compass sensor. New J. Phys. 2016, 18, 063007.
5. Kattnig, D. R.; Evans, E. W.; Dejean, V.; Dodson, C. A.; Wallace, M. I.; Mackenzie, S. R.; Timmel, C. R.; Hore, P. J., Chemical amplification of magnetic field effects relevant to avian magnetoreception. Nat. Chem. 2016, 8 (4), 384-391.

Abstract

The rates and yields of radical pair reactions are often sensitive to weak magnetic fields comparable to, or even weaker than, the geomagnetic field (approximately 50 μT). This trait is truly remarkable, because the interaction energies arising from such weak magnetic fields amount to only a tiny fraction of the thermal energy per molecule. The underlying mechanism, the so-called radical pair mechanism (RPM), is of fundamentally quantum-mechanical origin. It has been suggested that migratory birds, among other species, can sense the Earth's magnetic field by means of the RPM dictating the fate of photochemically-formed radical pairs in cryptochrome proteins located in their retinas. Experimental and theoretical support for a radical pair mechanism of compass magnetoreception is accumulating although it is not yet clear whether cryptochrome is actually the sensor. The RPM has also been implicated in the context of possibly adverse effects of weak magnetic fields on human health. The underlying mechanisms are poorly understood, and currently the subject of extensive research. It is, however, hypothesised that the alteration of radical pair recombination rates, due to applied magnetic fields, may interfere with circadian rhythms or cause an increase in free radical concentrations thereby boosting oxidative stress, genotoxic effects and apoptosis.

In this talk, I will give a short introduction to the foundations of the radical pair mechanism. Thereafter I will focus on our recent results in the field: I will describe how, under conditions of continuous excitation, magnetic field effects can be amplified by slow termination reactions of the radical intermediates. Realistic biological environments are turbulent, and the interactions of such environments with the spin systems under considerations give rise to dephasing. With this in mind, I shall discuss the surprising result that certain spin relaxation mechanisms can significantly enhance the anisotropy of magnetic field effects. I will continue by elaborating on the recent hypothesis that three-radical systems can exhibit magnetic field effects vastly exceeding those predicted by the classical RPM. This effect could also provide a new perspective for our understanding of the putative effects of electromagnetic fields on (human) biology.

Coffee Break
Monday June 25, 2018 • 10:30 - 11:00
Foyer

Session: S01
Human studies I / brain
Monday June 25, 2018 • 11:00 - 12:30
Europa C
Chairs: Sarah Loughran & Rene De Seze

S01-1 [11:00]
STUDENT PAPER

Determining the functional consequences of the RF-EMF sleep EEG effect

Sheridan Findlay[1, 2], Rodney Croft[1, 2, 3] & Sarah Loughran[1, 2, 3]

[1]*Australian Centre for Electromagnetic Bioeffects Research, University of Wollongong, Wollongong, Australia, 2522*

[2]*School of Psychology, Illawarra Health & Medical Research Institute, University of Wollongong, Wollongong, Australia, 2522*

Session: S02
Dosimetry I - Computational studies
Monday June 25, 2018 • 11:00 - 12:30
Europa D
Chairs: Teruo Onishi & Akimasa Hirata

S02-1 [11:00]

Effect of vasodilatation on temperature elevation in human brain during localized RF exposure: A computational study

Sachiko Kodera[1], Jose Gomez-Tames[1] & Akimasa Hirata[1]

[1]*Department of Electrical and Mechanical Engineering, Nagoya Institute of Technology, Nagoya, Japan, 466-8555*

Keywords: Dosimetry (computational), RF/Microwaves, Completed (published)
Presented by: Jose Gomez-Tames

[3]*Population Health Research on Electromagnetic Energy, Monash University, Melbourne, Australia, 3800*
Keywords: Human, RF/Microwaves, Work in Progress
Presented by: Sheridan Findlay

Although RF-EMF has been shown to affect sleep spindles (as measured by the sleep EEG), it is not known whether there is a functional consequence of this. This presentation will report on interim results of a sleep EEG study designed to determine whether RF-EMF affects memory consolidation during sleep, a cognitive ability related to sleep spindles.

S01-2 [11:15]

The effect of RF-EMF exposure on the waking EEG: A comparison of effects across eyes open and eyes closed resting EEG derivations

Anna Dalecki[1, 2, 3], Sarah Loughran[1, 2, 4], Adam Verrender[1, 2, 4] & Rodney Croft[1, 2, 3, 4]

[1]*School of Psychology, University of Wollongong, Wollongong, Australia, 2522*

[2]*Illawarra Health and Medical Research Institute, University of Wollongong, Wollongong, Australia, 2522*

[3]*Population Health Research of Electromagnetic Energy, Monash University, Melbourne, Australia*

[4]*Australian Centre for Electromagnetic Bioeffects Research, University of Wollongong, Wollongong, Australia, 2522*
Keywords: Human, RF/Microwaves, Work in Progress
Presented by: Anna Dalecki

RF-EMF (radio-frequency electromagnetic field) exposure is known to affect waking electroencephalogram (EEG) alpha (8-12 Hz) spectral power during exposure. However, there is variability within the literature with respect to the direction of this effect. Resting EEG can be derived under eyes open or closed conditions, with alpha power higher when eyes are closed. Thus, if RF-EMF increases EEG alpha power during exposure, this may be less likely to be detected using the eyes closed endpoint due to ceiling effects. The present study aims to determine whether the effect of RF-EMF exposure on waking EEG alpha power importantly differs between eyes open and closed resting EEG endpoints.

S02-2 [11:15]
STUDENT PAPER

Relationship between transmitted power density and skin temperature elevation for different beam directions from patch antenna arrays at the frequency bands above 10 GHz

Daisuke Funahashi[1], Takahiro Ito[1], Akimasa Hirata[1], Takahiro Iyama[2] & Teruo Onishi[2]

[1]*Electrical and Mechanical Engineering, Nagoya, Japan, 466-8555*

[2]*Research Laboratories, NTT DOCOMO, INC, Kanagawa, Japan, 239-8536*
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Daisuke Funahashi

Incident power density is used as a metric to protect human from excessive heating from electromagnetic field exposures at the frequency bands assigned to the 5th generation wireless system (5G). As presented in GLORE meeting (Washington DC, Dec 2017), one of the possibilities is the transmitted power density averaged over an area as an alternative at higher frequencies to correlate with peak temperature elevation. In this study, we investigated the beam direction and the distance dependence of the relationship between transmitted power density and the skin temperature elevation from patch antenna arrays.

Temperature elevation is suggested to be a dominant effect for exposure at frequencies higher than 100 kHz. No previous studies have evaluated temperature elevation in the human head for local exposure considering thermoregulation. This study aims to discuss the temperature elevation in a human head model considering vasodilation, to discuss the conservativeness of the current limit for protection against localized radio frequency field exposure.

S01-3 [11:30]

Are there differences in possible effects of RF-EMF exposure on the macro- and microstructure of sleep between healthy young men (18-30 years) and healthy elderly women (60-80 years)?

Heidi Danker-Hopfe[1], Torsten Eggert[1], Gernot Schmid[2], Cornelia Sauter[1] & Hans Dorn[1]

[1]*Competence Center of Sleep Medicine, Charité - University Medicine Berlin, Berlin, Germany, 12200*

[2]*Seibersdorf Laboratories, Seibersdorf, Austria, 2444*

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

Presented by: Heidi Danker-Hopfe

The study aims to analyse possible differences in RF-EMF effects on the macrostructure and the microstructure of sleep between healthy young men and healthy elderly women. The results indicate differences in effects of GSM 900 and TETRA exposure in healthy young men (18-30 years) and healthy elderly women (60-80 years). However, the results observed so far are not indicative of a disturbed sleep under RF-EMF exposure.

S01-4 [11:45]
STUDENT PAPER

Frequency specific magnetophosphene thresholds in humans exposed to ELF magnetic fields

Cadence Baker[1, 2], Michael Corbacio[1], Sebastien Villard[1, 4], Daniel Goulet[5], Michel Plante[5], Martine Souques[6], François Deschamps[7], Genevieve Ostiguy[5], Jacques Lambrozo[6] & Alexandre Legros[1, 2, 3, 4, 8]

[1]*Bioelectromagnetics and Human Threshold Research Group, Lawson Health Research Institute, London, ON, Canada*

[2]*School of Kinesiology, Western University, London, ON, Canada*

[3]*Department of Medical Imaging, Western University, London, ON, Canada*

[4]*Department of Medical Biophysics, Western University, London, ON, Canada*

[5]*Hydro Quebec, Montreal, QC, Canada*

[6]*Service des études médicales, EDF, Paris, France*

[7]*Service des études médicales, EDF, Paris, France*

[8]*EuroMov, University of Montpellier, Montpellier, France*

Keywords: Human, ELF/LF, Work in Progress

Presented by: Cadence Baker

Although magnetophosphene perception is the

S02-3 [11:30]

Human modeling by template based registration for evaluating the RF EMF exposure

Congsheng Li[1], Xiaobang Sun[2] & Tongning Wu[1]

[1]*BEMS, CAICT, Beijing, China, 100191*

[2]*biomedical engineering, Dalian university of technology, Dalian, China, 100191*

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

Presented by: Tongning Wu

In the paper, we proposed a method to reconstruct the individualized human model with high efficiency, which were based on template based registration. The torso template was constructed using statistical shape model with computerized tomography (CT) images of 79 healthy Chinese subjects. The numerical studies demonstrated that the model generated by template based registration had very few difference in terms of whole body averaged specific absorption rate and the power absorption in the major tissue layers, compared with the manually segmented model.

S02-4 [11:45]

SAR values in children and adults for real exposures

Blaž Valič[1], Bor Kos[2] & Peter Gajšek[1]

[1]*Institute of Non-ionizing radiation, Ljubljana, Slovenia, 1000*

[2]*Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, Slovenia, 1000*

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

Presented by: Blaž Valič

Based on the personal measurements of radiofrequency electric fields in Slovenia we determined the mean exposure of the children and adults. Results show that the most important frequency bands are FM, 900 MHz, 1800 MHz and 2100 MHz. Based on these mean values SAR values were calculated for child and adult human model. Whole body SAR values are very low for mean exposures, but the exposure of the child model is significantly higher compared to the adult model.

most reliably reported effect of exposure to extremely low frequency (ELF) magnetic fields (MF), its frequency dependence needs to be further documented as an indirect clue of the underlying mechanism. Ten healthy volunteers (60 planned) were exposed to MFs from 20-300 Hz, with a flux density up to 80 mT. Phosphene perception thresholds were reported and electroencephalography (EEG) was recorded. Establishing a reliable magnetophosphene threshold frequency-response curve will allow further understand of the mechanisms involved and will be of instrumental importance for ELF exposure recommendations.

S01-5 [12:00]
STUDENT PAPER

Frequency-dependent and montage-based differences in phosphene perception thresholds via tACS

Ian Evans[1, 2, 3, 4], Stephen Palmisano[1], Sarah Loughran[1, 2, 3, 4], Alexandre Legros[5] & Rodney Croft[1, 2, 3, 4]

[1]*School of Psychology, University of Wollongong, Wollongong, Australia, 2522*

[2]*Illawarra Health & Medical Research Institute, University of Wollongong, Wollongong, Australia, 2522*

[3]*Australian Centre for Electromagnetic Bioeffects Research, Wollongong, Australia*

[4]*Centre for Population Health Research on Electromagnetic Energy, Monash University, Melbourne, Australia*

[5]*Lawson Health Research Institute, Western University, Ontario, Canada*

Keywords: Human, ELF/LF, Work in Progress
Presented by: Ian Evans

This study compared the thresholds for tACS-nduced phosphene perception at fifteen frequencies (2-30 Hz) when applied to either an FPz-Cz montage or an Oz-Cz montage. All combinations of montages and frequencies were tested on the same population (n = 14, 24 upon completion of the study). Repeated measures ANOVAs revealed consistently lower thresholds for the FPz-Cz montage compared to the Oz-Cz montage, and differences in thresholds across frequencies. The lowest stimulation levels required to induce phosphenes was found to occur at a frequency of 16 Hz regardless of montage.

S02-5 [12:00]

Assessment of RF-EMF exposure in LTE heterogeneous networks for VoLTE and data services

Yuanyuan Huang[1] & Joe Wiart[1]

[1]*LTCI, Telecom ParisTech, Paris, France, 75013*
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Yuanyuan Huang

LTE is deployed worldwide with macro- and small cells to fulfill different requirements motivated by numerous mobile services: VoLTE and other data applications. However, the actual human exposure to electromagnetic field from such networks from base station to user equipment is still unknown, hence, needs to be communicated. To do so, people's live traffic usage has to be characterized. This study aims to investigate the realistic LTE-induced exposure, considering both the uplink and downlink radio emissions and various factors, such as traffic variation over a day, cells of different sizes referred to macro- and small cells, different services such as VoLTE and data and different environments respectively, in indoor and outdoor areas.

S01-6 [12:15]

Reconstruction of brain networks involved in magnetophosphene perception using dense electroencephalography

Julien Modolo[1, 2], Mahmoud Hassan[1] & Alexandre Legros[2, 3, 4, 5]

[1]*Univ Rennes, INSERM, LTSI – U1099, F-35000 Rennes, Rennes, France*

[2]*Human Threshold Research Group, Lawson Health Research Institute, London, ON, Canada*

[3]*Departments of Medical Biophysics and Medical Imaging, Western University, London, ON, Canada*

[4]*School of Kinesiology, Western University, London, ON, Canada*

[5]*EuroMouv, Université de Montpellier, France, France*

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

Presented by: Julien Modolo

OBJECTIVE: Characterizing functional brain networks in humans during magnetophosphene perception. **METHODS:** Dense electroencephalography (EEG, 128 channels) was performed in N=3 volunteers during high-level (50 mT) magnetic field (MF) exposure. Functional brain networks were reconstructed, at the cortical level from scalp recordings, using the EEG source connectivity method. **RESULTS:** Magnetophosphene perception appears to consistently activate the right inferior occipito-temporal pathway. **CONCLUSIONS:** This study provides the very first neuroimaging results characterizing magnetophosphene perception in humans. The use of dense-EEG source connectivity is a promising approach in the field of bioelectromagnetics.

S02-6 [12:15]
STUDENT PAPER

Small cell EMF exposure assessment using propagation model based on measurement and statistical method

Amirreza Chobineh[1], Yuanyuan Huang[1], Taghrid Mazloum[1], Emmanuelle Conil[2] & Joe Wiart[1] [1]*Chaire C2M, Télécom Paristech, Paris, France, 75013*

[2]*Agence nationale des fréquences (ANFR), Maisons-Alfort, France, 94704*

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

Presented by: Amirreza Chobineh

Small cells are low-powered base stations installed close to the users. They improve network performance and service quality by offloading from the macrocells. In this paper, the global exposure induced in such networks from the user equipment and base stations has been investigated. As the Small cell is close to the user, the propagation channel becomes highly variable and vulnerable to environmental changes such as the road traffic. An innovative statistical path loss model is constructed based on measurements. This statistical path loss model is then used to assess global exposure of the adult proportion of a population in a Small cell scenario composed of indoor and outdoor data users.

Lunch
Monday June 25, 2018 • 12:30 - 13:30
Grand hotel Bernardin restaurant

Session: FA
Student Flash Poster Session A
Monday June 25, 2018 • 13:30 - 14:30
Emerald
Chairs: Christopher Portier & Niels Kuster

FA-1 [13:30]
STUDENT PAPER

Extremely low frequency-electromagnetic radiation deteriorated the sleep reduction in *Drosophila melanogaster* under heat stress

Xiaomei Huang[1, 2], Ziyan Zhang[1], Hongying Zhang[1, 2], Chuanjun Yang[1], Yongyan Sun[1, 2], Chao Tang[1] & Hui Yu[1]

[1]*Key Laboratory of Urban Environment and Health, Institute of Urban Environment (IUE), Xiamen, China, 361021*

[2]*Chinese Academy of Sciences, Beijing, China, 100049*

Keywords: Behavioural, ELF/LF, Completed (unpublished)
Presented by: Xiaomei Huang

The coupling effects of heat stress and extremely low frequency-electromagnetic field (ELF-EMF, 50 Hz, 3 mT) on sleep and activity were studied using Drosophila (wild-type Canton-Special (CS) and mutant W1118 flies) as a model. The mRNA expressions of circadian clock genes, neurotransmitters related genes, as well as important neurotransmitters were analyzed. Result showed that ELF-EMF deteriorated the sleep reduction in Drosophila under heat stress.

FA-2 [13:33]
STUDENT PAPER

Numerical determination of the risk of cardiac ventricular fibrillation in humans from body currents with frequencies up to 1 MHz using outcomes of animal studies

Pia Schneeweiss[1], Tobias Theiler[1], Kai Jagielski[1] & Dominik Stunder[1]

[1]*Research Center for Bioelectromagnetic Interaction (femu), RWTH Aachen University, Aachen, Germany, 52074*

Keywords: Dosimetry (computational), All Frequencies, Work in Progress
Presented by: Pia Schneeweiss

Cardiac ventricular fibrillation (CVF) is a potential cause of death following electrical accidents occurring when the electrical activity of the heart is disrupted. In order to determine thresholds for CVF, cadaver and animal studies were carried out in the past, which are however limited e.g. in tissue's electric properties and the utilized probes properties. Currently executed simulations with high resolution anatomical body models traversed by body currents with frequencies up to 1 MHz will be used for the derivation of CVF thresholds and can therefore help to prevent injuries caused by electrical currents in the future.

FA-3 [13:36]
STUDENT PAPER

Industrial indoor massive MIMO human EM-exposure evaluation

Sergei Shikhantsov[1], Arno Thielens[1, 2], Gunter Vermeeren[1], Emmeric Tanghe[1], Piet Demeester[1], Guy Torfs[1], Luc Martens[1] & Wout Joseph[1]

[1]*Department of Information Technology, Ghent University/IMEC, Ghent, Belgium, 9000*

[2]*Department of Electrical Engineering and Computer Sciences, University of California Berkeley, Berkeley, CA, USA, 94704*

Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Sergei Shikhantsov

We present a numerical method of estimating human exposure to the electromagnetic fields (EMF)

of a massive MIMO base station (BS) in an industrial indoor environment e.g., an assembly line or a warehouse. The method relies on a massive MIMO channel model derived from ray-tracing simulations with stochastically generated environments. Incoming rays at the receiver location are used as the input for Finite-Difference Time-Domain plane-wave simulations with a realistic human phantom to obtain EM-exposure estimate.

FA-4 [13:39]
STUDENT PAPER

MRI patient exposure - characterization and sequence-comparisons

Jennifer Frankel[1], Kjell Hansson Mild[1] & Jonna Wilen[1]

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Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)
Presented by: Jennifer Frankel

The unique mixture and intensity of magnetic fields experienced by the patient during an MRI exam are quite complex from an exposure perspective. We measured the RF- and gradient magnetic fields inside a 3T MRI scanner and extracted several exposure parameters to give a comprehensive description of the exposure of each sequence. We found significant differences between sequences for each of the exposure parameters studied. We also found within-sequence variation. This means that MRI exposure is not only sequence-specific but also specific to the individual patient and exam occurrence, a complexity which must be kept in mind when performing exposure assessment for epidemiological studies on MRI.

FA-5 [13:42]
STUDENT PAPER

Measurement and health assessment of electromagnetic fields by electric vehicles during road traffic operation using driving characteristics

Kai Jagielski[1], Pia Schneeweiss[1], Dominik Stunder[1] & Thomas Kraus[1]

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Keywords: Dosimetry (measurements), Pulsed, Work in Progress
Presented by: Kai Jagielski

This contribution introduces a measurement system which enables magnetic field measurements in the frequency range between 1 Hz and 400 kHz on electric vehicles during vehicle operation. The additional recording of the driving style, with acceleration sensor, gyroscope and GPS module, allows a detailed investigation of the influence of various vehicle components on the magnetic field spectrum. First measurement results of electric cars and the evaluation possibilities are presented. In future, measurements will be carried out for example at wireless charging systems or electric buses.

FA-6 [13:45]
STUDENT PAPER

Enhancement of *in vitro* gene electrotransfer using gold nanoparticles

Tjasa Potocnik[1], Tina Batista Napotnik[1], Tamara Pezić[1], Matej Reberšek[1] & Damijan Miklavčič[1]

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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Tjaša Potočnik

Gold nanoparticles when added to cell suspension prior to electroporation significantly increased transfection rate using monopolar pulses in vitro. When bipolar pulses were used for gene electrotransfer, the presence of gold nanoparticles had no effect on transfection rate. Our results show the possibility of providing sufficient transfection rate with lower voltage applied to cells in presence of gold nanoparticles.

FA-7 [13:48]
STUDENT PAPER

Repeated long term exposure of Mesenchymal Stem Cells to electric fields using a new pulse generator

Shirmone Botha[1], Borja Lopez[2], Óscar Lucía[2], Héctor Sarnago[2], Alejandro Naval[2], José-Miguel Burdio[2], Adeline Muscat[1], Tomás García-Sánchez[1], Franck Andre[1] & Lluis M. Mir[1]

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Keywords: Human, Pulsed, Work in Progress
Presented by: Shirmone Botha

In mesenchymal stem cells (MSCs), numerous studies describe the spontaneous oscillations of cytosolic calcium at various concentrations. We demonstrate that the application of one high voltage micro second pulse disrupts natural calcium oscillations making it possible to insert an additional synthetic calcium oscillation pattern over several hours. This study strengthens the perception that pulsed electric fields can be used as a tool to manipulate calcium oscillations in human adipose derived MSCs using a novel pulse generator as the one specifically developed. These manipulations might be used as a tool to improve MSC engineering.

FA-8 [13:51]
STUDENT PAPER

A novel method for estimation of brain tissue electrical conductivity: from *in silico* to *in clinico* results

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Keywords: Human, ELF/LF, Completed (unpublished)
Presented by: Andres Carvallo

OBJECTIVE: Estimating brain tissue electrical conductivity using low-intensity pulse stimulation. METHODS: We derived an analytical model of the electric potential generated by SEEG electrodes. We coupled the electric potential with an electrode-electrolyte interface model to i) derive an analytical expression of brain tissue response to biphasic pulses and ii) estimate conductivity. RESULTS: We validated our biophysical model using i) saline solutions calibrated for electrical conductivity, ii) rat brain tissue, and iii) intracerebral electrophysiological data recorded in epileptic patients during pre-surgical evaluation. CONCLUSIONS: Rapid and reliable brain tissue electrical conductivity estimation is achieved using the proposed method.

FA-9 [13:54]
STUDENT PAPER

Local thermal dosimetry applied to in vitro studies at millimetre waves

Rosa Orlacchio[1], Maxim Zhadobov[1], Stanislav Alekseev[2], Ronan Sauleau[1], Yann Le Page[3] & Yves Le Dréan[3]

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Keywords: In vitro, RF/Microwaves, Work in Progress
Presented by: Rosa Orlacchio

This study investigates the role of thermal convection arising from high SAR gradients during in vitro

exposure to millimetre waves (MMW). The impact of the liquid volume and exposure duration on initiation of convective currents is investigated. Water and a convection-free medium with water-equivalent electromagnetic properties have been exposed to continuous wave (CW) and amplitude modulated MMW. Continuous and pulsed heating were recorded using a microthermocouple. Our results suggest that convection plays an important role in MMW-induced heating in in vitro experiments, and its initiation depends both on the volume of the exposed liquid and the duration of exposure.

FA-10 [13:57]
STUDENT PAPER

Effect of high frequency electric field on growth factor of cultured osteoblasts

Shunsuke Yamaguchi[1], Masatake Akutagawa[1], Hiromichi Yumoto[2], Kouji Hirao[2], Takahiro Emoto[1], Hiroo Tarao[3], Toshihiko Tominaga[4], Toshitaka Ikehara[5] & Yohsuke Kinouchi[1]

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Keywords: In vitro, IF, Work in Progress

Presented by: Shunsuke Yamaguchi

In this experiment, high frequency AC voltage was applied to cultured osteoblasts. The voltage waveform used is a sinusoidal wave of 500 kHz 20 V. Temperature, voltage, osteoblastic VEGF, VEGFmRNA and ALP were measured. VEGF and VEGFmRNA were measured 1 day after voltage application and ALP was measured 7 days after. Durations of voltage application were 30, 60, 90 and 120 s. As results of them, it is obvious that it affects the osteogenesis of osteoblasts by electrical factors. Although it depends on the initial state (cycle) of the cells, VEGF was significantly increased at 90 seconds and VEGFmRNA at 120 seconds. Change of ALP by application of the elecrical field was not observed in our experiment.

FA-11 [14:00]
STUDENT PAPER

Effect of long-term RF-EMF exposure on microglia activation in 5xFAD mice

Ye Ji Jeong[1, 2], Hyung-Do Choi[3], Jeong-Ki Pack[4], Nam Kim[5], Yun-Sil Lee[6] & Hae-June Lee[1]

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

Presented by: Ye Ji Jeong

To explore the long-term RF-EMF effect on Alzheimer's disease, we performed 6 months RF-EMF exposure to 5xFAD mice (SAR 5W/kg, 2 h/day, 5 days/week) and investigated behavioral changes and neuroinflammatory response. 5xFAD mice exposed to long-term RF-EMF showed mild decrease in Aβ deposition, memory improvement, and decrease in expressions of Iba-1 and microglia regulator genes compared to sham exposed group. Our finding suggests possible mechanism of beneficial effect of long-term RF-EMF on AD mice.

FA-12 [14:03]
STUDENT PAPER

Steepest-entropy-ascent quantum thermodynamic approach to scaling the electric field parameters and criticality related to cell signaling in electrically perturbed cells: Experimental evidence and rationale

Ishan Goswami[1], Scott S. Verbridge[2] & Michael R. von Spakovsky[1]

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress
Presented by: Ishan Goswami

A successful coupling of standard cancer treatment modalities with electric field-based tumor ablation techniques requires a general understanding of the mechanism of action of each modality to evaluate synergistic effects for better treatment efficacies. The caveat, however, is that the electric field parameter space and the molecular pathways are so large that understanding the mechanism of action of electric fields via exploring all possible combinations is prohibitive from a cost and time standpoint. To solve this parameter space problem, this work introduces a new computational approach that takes advantage of thermodynamic scaling laws applicable to bio-membranes. We report experimental evidence and the rationale behind this approach.

FA-13 [14:06]

WITHDRAWN

Session: PA
Poster Session A
Monday June 25, 2018 • 14:30 - 16:00
Mediteranea

Coffee Break
Monday June 25, 2018 • 16:00 - 16:30
Foyer

Session: S03
In vitro I
Monday June 25, 2018 • 16:30 - 18:00
Europa C
Chairs: Olga Zeni & Mats-Olof Mattsson

S03-1 [16:30]

Real-time detection of neuronal activity induced by time-varying magnetic field or electric field exposure in *in vitro*

Masateru Ikehata[2], Keiji Wada[3], Kei Makino[3], Yukihisa Suzuki[3], Atsushi Saito[1], Sachiko Yoshie[2] & Satoshi Nakasono[1]

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Keywords: In vitro, All Frequencies, Work in Progress

Presented by: Masateru Ikehata

Rat primary cortical neuron culture and human iPS cell-derived neurons were used to investigate threshold of magnetic/electric stimulation of nerve cells in in vitro.Originally developed live cell imaging system for real-time detection of neuronal activity without disturbing by interference of magnetic field was used. In magnetic field exposure experiment, it seemed that response of neuron cell that synchronized with magnetic field in some cases but observed neuronal activity was not necessarily synchronized with magnetic field exposure. Improvement of cell direction, orientation of neuronal network and other factors may need to observe neuronal cell response certainly. Further results will be presented in the Congress.

S03-2 [16:45]

50 Hz 1 mT field exposure does not affect DNA global methylation of an *in vitro* model for Parkinson's Disease

Barbara Benassi[1], Stefania Santangeli[2], Caterina Merla[1], Letizia Tarantini[3], Valentina Bollati[3], Carmela Marino[1] & Claudia Consales[1]

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Session: S04
MRI studies
Monday June 25, 2018 • 16:30 - 18:00
Europa D
Chairs: Manuel Murbach & Marthinus Van Wyk

S04-1 [16:30]
STUDENT PAPER

Occupational exposure to MRI-related magnetic stray fields and sleep quality among radiographers - A cross-sectional study in the Netherlands

Emre Ozdemir[1], Kristel Schaap[1], Anke Huss[1] & Hans Kromhout[1]

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Keywords: Epidemiology, Static, Review, Commentary, Recommendation, Evaluation

Presented by: Emre Ozdemir

Summary: In this cross-sectional study, we investigated the potential association between occupational exposure to MRI-related magnetic stray fields and sleep quality among Dutch radiographers. We observed decreased sleep quality among radiographers who worked with or near MRI scanners.

S04-2 [16:45]

Survey of the facilities' policies on allocating pregnant staff for MRI site and an attitude survey to non-ionizing radiation in Japan

Sachiko Yamaguchi-Sekino[1], Shuhei Izawa[1], Humio Maeyatsu[2], Tsukasa Doi[3], Takeo HIkichi[4], Hideki Fujita[5], Shinya Imai[6], Manabu Akahane[7] & Rui-Sheng Wang[1]

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Health, University of Milan, Milan, Italy, 20122
Keywords: In vitro, ELF/LF, Completed (unpublished)
Presented by: Claudia Consales

Epigenetic modifications are dynamic processes reflecting a complex interplay between an organism and its environment. Over the last years, ELF-MFs exposure have been shown to affect cell epigenome [1-3]. On this topic, we have shown that 50 Hz 1 mT field induces a decrease of miR-34 b/c expression in neurons, with consequent increase of one of its gene target, α-synuclein, whose overexpression is one of the hallmark of Parkinson's disease [4]. In this work, we analyzed if 50 Hz 1mT field could alter global DNA methylation of neuronal like cells, dopaminergic neuroblastoma cell line SH-SY5Y, exposed up to 72 hours, or exposed for 24 hours and then administrated with Parkinson neurotoxin 1-methyl-4-phenylpyridinium (MPP^+).

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Keywords: Occupational, Static, Completed (unpublished)
Presented by: Sachiko Yamaguchi-Sekino

In this study we surveyed policies on allocating MRI scan duties to pregnant employees and investigated the influence of respondents' level of awareness of non-ionizing radiation. The results revealed inconsistent handling within Japan, and that although duties may be restricted in some situations, 7.8% of facilities increase the opportunity of allocation to MRI duties proactively compared with the current situation while 51.8% of facilities opt to reduce the allocation to MRI duties. And it was also observed that the level of awareness of non-ionizing radiation influences the policy on the allocation of MRI scan duties for pregnant employees.

S03-3 [17:00]

Biological effect of the 50 Hz Magnetic Field in a three-dimension (3D) in vitro experimental model of SH-SY5Y human neuroblastoma cells

Claudia Consales[1], Alessio Butera[2], Mariateresa Mancuso[1], Emanuela Pasquali[1], Vanni Lopresto[1], Rosanna Pinto[1], Carmela Marino[1] & Barbara Benassi[1]

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Keywords: In vitro, ELF/LF, Work in Progress
Presented by: Barbara Benassi

Given the reported limitations of the conventional 2D in vitro cultures of neuronal cells in terms of response to drugs and radiations, we here aimed at evaluating the effects elicited by the 50-Hz magnetic field (MF) on the human neuroblastoma SH-SY5Y cells grown in a new three-dimension (3D) scaffold in vitro. We demonstrate that (i) no change in proliferation, distribution of cell cycle phases and viability, and no induction of apoptosis is triggered by the MF in the SH-SY5Y cells if cultured in the 3D scaffolds; (ii) the intracellular

S04-3 [17:00]

Risk assessment for workers with pacemakers working in the near-field of a high-frequency EMF source

Carsten Alteköster[1] & Marc Wittlich[1]

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Keywords: Occupational, RF/Microwaves, Completed (unpublished)
Presented by: Carsten Alteköster

An important task of the Institute of Occupational Safety and Health (IFA) is to carry out risk assessments at workplaces in order to protect workers with active implantable medical devices exposed to electromagnetic fields. For this purpose the induced voltages at the input stage of these devices must be determined. A problem in the high-frequency range arises from the fact that the formulae used to calculate these voltages are derived under far-field conditions. However, this is often not the case. Therefore, we investigated the induced voltage level during a near-field exposure in a high-frequency electromagnetic field.The results suggest that the measuring of the power density could be sufficient in the scope of a risk assessment.

GSH content, as well as the expression of both the gamma-GCS (responsible for the GSH biosynthesis) and SOD1 genes are impaired by the MF exclusively in cells grown in the 3D culture conditions.

S03-4 [17:15]

8-oxoG DNA glycosylase-1 inhibition sensitizes Neuro-2a cells to oxidative DNA base damage induced by 900 MHz radiofrequency electromagnetic radiation

Zhou Zhou[1, 3], Lei Zhang[2, 3], Chuan Liu[2, 3], Qin-Long Ma[2, 3] & Zheng-Ping Yu[2, 3]

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

Presented by: Zhou Zhou

This study provided information about the in vitro putative genotoxicity during cell exposure to radiofrequency electromagnetic fields (RF-EMFs) with or without 8-oxoG DNA glycosylase-1 (OGG1) siRNA using Neuro-2a cells. Exposure to 900 MHz RF-EMFs with insufficient energy could induce oxidative DNA base damage in Neuro-2a cells. These increases were concomitant with similar increases in the generation of reactive oxygen species (ROS). With OGG1 siRNA, RF-EMFs could cause DNA base damage in Neuro-2a cells as low as 1 W/kg. This suggested that OGG1 is involved in the process of DNA base repair and may play a pivotal role in protecting DNA bases from RF-EMF induced oxidative damage.

S03-5 [17:30]

Do GSM-1800 induce DNA damage and genomic instability in nerve cells?

Isabelle Lagroye[1, 2], Emmanuelle Poque-Haro[2], Rémy Renom[2], Florence Poulletier De Gannes[2], Corinne El Khoueiry[2], Yann Percherancier[2] & Bernard Veyret[1, 2]

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S04-4 [17:15]

Novel mechanistic model for implant safety assessment at WPT and MRI frequencies

Ilaria Liorni[1], Esra Neufeld[1], Sven Kuehn[1] & Niels Kuster[1, 2]

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Keywords: Mechanistic/Theoretical, All Frequencies, Completed (unpublished)

Presented by: Ilaria Liorni

Current safety guidelines for exposure to electromagnetic fields (EMF) exclude medical implant wearers, and there is further no established method for assessing risks posed by EMF in this group. We propose a new mechanistic model for determining local exposure in the presence of implants based on incident field values valid over a wide frequency range. To validate the approach, predictions of the mechanistic model were compared to results of numerical simulations. The effects of parameters such as tissue properties, tip shape, and insulation thickness were studied. The findings support the formulation of safety standards for implant wearers exposed to EMF over a wide range of frequencies, including those used in wireless power transfer.

S04-5 [17:30]
STUDENT PAPER

Integration of big-data analytics in safety assessment of patients with medical implants during MRI exposure

Aiping Yao[1, 2], Earl Zastrow[1], Pedro Crespo-Valero[3] & Niels Kuster[1, 2]

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Keywords: In vitro, RF/Microwaves, Completed (unpublished)
Presented by: Isabelle Lagroye

DNA damage was investigated in rat primary neurons and SH-SY5Y human neuroblastoma cells exposed to a GSM-1800 signal for 24 hr at SAR levels of 0.375, 1.5 and 6 W/kg, with or without menadione and methylmethane sulfonate. Both the alkaline comet assay and the micronuclei assay were used. We found no indication that GSM-1800 could lead to immediate DNA damage nor delayed DNA damage indicative of genomic instability. Coexposure experiments with chemicals in neuroblastoma cells showed that a specific combination of GSM-1800 at 6 W/kg and Menadione could transiently lead to increased micronuclei. Further investigation is needed to determine the underlying mechanism, although this type of exposure is unlikely in the daily life.

S03-6 [17:45]

Cellular internalization and intratumoral distribution of prospectively therapeutic magnetic nanoparticles clusters submitted or non-submitted to pulsed electric fields

Jelena Kolosnjaj-Tabi[1], Slavko Kralj[2], Laure Gibot[1], Geraldine Gasc[1], Isabelle Fourquaux[3], Muriel Golzio[1] & Marie-Pierre Rols[1]

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Keywords: In vitro, Pulsed, Work in Progress
Presented by: Jelena Kolosnjaj Tabi

The intracellular localization and the (therapeutic) effects of nanoparticles might depend on the processes by which the nanoparticles had entered the cell. In order to evaluate different internalization patterns, cultured cells have been incubated with superparamagnetic iron oxide nanoclusters. Different incubation protocols have been applied, including the application of sub-permeabilizing and permeabilizing pulsed electric fields, and the efficiency and impact of the applied cell labeling protocol has been assessed.

CH-8092

[3]*Schmid & Partner Engineering AG, Zurich, Switzerland, CH-8004*

Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Aiping Yao

The RF-induced heating of the patient with implant under MR exposure is a complex function of multi-factors, e.g., implant characteristic, patient anatomy, imaging position, RF coil, etc. A comprehensive safety assessment cannot be derived from limited clinical scenarios and in silico trials are usually required to assist the evaluation process. To address further needs for in silico trials, we have established a safety assessment workflow comprises a data library and toolset to perform a comprehensive evaluation in a timely and traceable manner. We demonstrate the proposed workflow through an evaluation of RF-induced heating of a spinal cord stimulator. More than 39 million unique clinical scenarios were emulated in silico.

S04-6 [17:45]

Novel MRI RF safety assessment of orthopedic implants via bone surface tangential E-fields

Manuel Murbach[1], Earl Zastrow[1], Esra Neufeld[1], Bryn Lloyd[1], Wolfgang Kainz[3] & Niels Kuster[1, 2]

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Manuel Murbach

Orthopedic implant manufacturers produce a large portfolio of on-bone devices. Current implant radiofrequency (RF) safety standards (e.g., ASTM F2182-11a, TS/ISO 10974), however, do not take advantage of very well-defined data on relevant RF exposures of these devices. In this study, we used the bone-surface-averaged tangential E-field as a close approximation of the incident field impacting an on-bone orthopedic device. Results show that the relevant surface-averaged tangential E-fields are less than half of the corresponding peak volume-averaged E-fields, which allows conservative but not overly conservative assessment of RF implant safety in magnetic resonance imaging.

Tuesday June 26, 2018

Session: T1
Tutorial 1: Systematic Review Approaches in Environmental Health Sciences
Tuesday June 26, 2018 • 08:30 - 09:30
Emerald
Chairs: James Lin & Gunnhild Oftedal

T1-1 [08:30]

Systematic review approaches in environmental health sciences

Kristina Thayer[1]

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Biographical sketch

Kristina Thayer is the Integrated Risk Information System (IRIS) Division Director, located within the US Environmental Protection Agency (EPA) National Center for Environmental Assessment (NCEA). IRIS assessments identify the potential for a chemical to cause cancer or non-cancer health effects in people and are considered the top tier source of toxicity information used by EPA and other agencies to inform national standards, clean-up levels at local sites, and set advisory levels. IRIS uses systematic review methods to conduct assessments. Prior to joining EPA, Dr. Thayer was Deputy Division Director of Analysis at the National Toxicology Program (NTP) and Director of the NTP Office of Health Assessment and Translation (OHAT) located on the campus of the National Institute for Environmental Health Sciences (NIEHS). She is considered an expert on the application of systematic review methods to environmental health topics and the use of specialized software and automation approaches to facilitate conducting reviews.

Five relevant publications

1. NAS February 1-2, 2018 Workshop: “Review of Advances Made to the IRIS Process” (agenda and meeting materials)
2. Howard BE, Phillips J, Miller K, Tandon A, Mav D, Shah MR, Holmgren S, Pelch KE, Walker V, Rooney AA, Macleod M, Shah RR, Thayer KA. 2016. SWIFT-Review: a text-mining workbench for systematic review. Systematic reviews 5(1):87. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4877757/
3. Rooney AA, Cooper GS, Jahnke GD, Lam J, Morgan RL, Boyles AL, Ratcliffe JM, Kraft AD, Schunemann HJ, Schwingl P, Walker TD, Thayer KA, Lunn RM. 2016. How credible are the study results? Evaluating and applying internal validity tools to literature-based assessments of environmental health hazards. Environment international 92-93:617-629. https://www.sciencedirect.com/science/article/pii/S0160412016300058?via%3Dihub
4. National Toxicology Program (NTP). 2015. Handbook for Conducting a Literature-Based Health Assessment Using NTP Office of Health Assessment and Translation (OHAT) Approach for Systematic Review and Evidence Integration. http://ntp.niehs.nih.gov/go/38673.
5. Rooney AA, Boyles AL, Wolfe MS, Bucher JR, Thayer KA. 2014. Systematic review and evidence integration for literature-based environmental health science assessments. Environ Health Perspect. 122(7):711-718. https://ehp.niehs.nih.gov/1307972/

Abstract

Adapting a systematic approach on scientific revision of EMF/health related evidence in order to bring more transparency to evaluations has become an important priority as the WHO RF EHC document and ICNIRP new guidelines are being prepared. The tutorial will provide an overview of implementation of systematic review methods to environmental health topics, to include the basic tenants of identifying relevant literature, approaches used to assess study quality, use of structured frameworks to convey confidence conclusions for a body of evidence, and approaches to integrate epidemiological, toxicological, and mechanistic evidence.

Session: P2
Plenary 2: The International Commission on Non-Ionising Radiation Protection (ICNIRP) Draft High Frequency (100 kHz – 300 GHz) Guidelines
Tuesday June 26, 2018 • 09:30 - 10:30
Emerald
Chairs: Andrew Wood & Carl Blackman

P2-1 [09:30]

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) Draft Radiofrequency (100 kHz – 300 GHz) Guidelines

Rodney Croft[1, 2]

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Biographical sketch

Rodney Croft is Professor of Health Psychology within the School of Psychology, University of Wollongong, where he leads a bioelectromagnetics research group at the Illawarra Health and Medical Research Institute (IHMRI). His doctoral research was in neurophysiology methodology, where he assessed and improved models for accounting for ocular voltage contamination of the electroencephalogram (EEG), followed by postdoctoral work utilizing his EEG expertise to explore the relation between neurochemistry and psychological/psychiatric function. Croft began researching effects of radiofrequency fields on humans in 2000, with the focus on potential detrimental effects on humans using the EEG. His bioelectromagnetics work now includes a range of methodologies, with as the unifying theme an attempt to understand the effect of non-ionizing radiation on human health and well-being. Croft has led Australian government-funded Centres of Research Excellence in this area since 2005, has been on the Main Commission of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) since 2014, and chairs the ICNIRP Project Group developing its new radiofrequency guidelines.

Abstract

ICNIRP's current guidelines for the radiofrequency (RF; 100 kHz – 300 GHz) portion of the electromagnetic spectrum were published in 1998. These have been very influential and form the basis of numerous international radiation Standards. However, given the large body of relevant research that has been generated since those 1998 guidelines and the associated development of knowledge, ICNIRP is now revising these guidelines.

The revision of the guidelines has been underway since 2014. ICNIRP takes the RF-health scientific literature as the basis for these guidelines, and from this is developing a system of limits that will protect people from all health effects arising from RF exposure (including both thermal and non-thermal effects). ICNIRP aims to make the rationale behind the guidelines as transparent as possible, and to this end will release a public consultation version of the guidelines to encourage input that will help inform the final guidelines. This will ensure that relevant literature is not missed and that all perspectives are appropriately considered. ICNIRP plans to release its public consultation document in 2018, and as part of this process it believes that BioEM 2018 would be an ideal forum for the initial dissemination of the draft document. Accordingly, this presentation will describe the ICNIRP RF Guidelines setting process, including its rationale, and the draft limits themselves. It would also outline the consultation process, how interested parties can contribute to this, and provide considerable opportunity for discussion with the floor.

Coffee Break
Tuesday June 26, 2018 • 10:30 - 11:00
Foyer

Session: S05
Epidemiology
Tuesday June 26, 2018 • 11:00 - 12:30
Europa C
Chairs: Geza Benke & Ximena Vergara

S05-1 [11:00]

Validation of self-reported mobile phone use in the smartphone era: Findings from the SCAMP cohort

Mireku MO[1], William Mueller[1], Charlotte Fleming[1], Irene Chang[1], Iroise Dumontheil[2], Michael Thomas[2], Marloes Eeftens[3], Paul Elliott[1], Martin Röösli[3] & Mireille Toledano[1]

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Keywords: Epidemiology, RF/Microwaves, Completed (published)
Presented by: Mireille Toledano

Although adolescents' self-reported mobile phone use contains inaccuracies with differential agreement, our findings demonstrate that self-reported usage adequately distinguishes between high and low use in the Study of Cognition, Adolescents and Mobile Phones (SCAMP) cohort.

S05-2 [11:15]

Large area mapping of general public radiofrequency power density exposure in Sweden during the years 2012-2017

Jimmy Estenberg[1] & Torsten Augustsson[1]

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
Presented by: Jimmy Estenberg

We have developed a system] for mobile, car based, isotropic spectral measurements of power densities within the frequency range of 30 MHz to 3 GHz. The system can quickly

Session: S06
In vitro II
Tuesday June 26, 2018 • 11:00 - 12:30
Europa D
Chairs: Guangdi Chen & Carmela Marino

S06-1 [11:00]

Weak static magnetic fields induce changes in fibrosarcoma cell growth, hydrogen peroxide, membrane potential and mitochondrial calcium

Hakki Gurhan[1], Rodolfo Bruzon[1], Sahithi Kandala[1], Yanyu Xiong[1] & Frank Barnes[1]

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Keywords: In vitro, Static, Work in Progress
Presented by: Sahithi Kandala

Fibrosarcoma cells are exposed to weak static magnetic fields between 0.5 mictoT and 600 microT. Changes in cell growth, hydrogen peroxide, membrane potential and mitochondrial calcium are observed.

S06-2 [11:15]

WITHDRAWN

cover large areas and the high sampling rate results in extensive data that allows computation of robust medians and means. 225'000 measurements were performed over the last five years. The median power densities were within 0.00087 - 2.6 mW/m^2 for different types of areas. The highest power density that we found was 690 mW/m^2. We have found a clear relation between population density and exposure level. Specific cumulative distribution functions of power densities will be presented for different sources and types of areas.

S05-3 [11:30]
STUDENT PAPER

Computer/internet use and console gaming: The effect on cognitive function in Australian primary school students

Christopher Brzozek[1], Kurt Benke[2, 3], Berihun Zeleke[1], Michael Abramson[1] & Geza Benke[1]

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Keywords: Behavioural, Static, Work in Progress

Presented by: Christopher Brzozek

Computer/internet use and console gaming has greatly increased over the last two decades with children and adolescents becoming frequent users of these technologies at younger ages. The aims of this study were to investigate any potential associations between computer/internet use and console gaming with cognitive function in a cohort of primary school children. There were 412 participants from a representative sample of 36 state, private and Catholic schools. Overall computer/internet use and total screen time were found to have no associations, but console gaming was found to have significant associations with many of the cognitive functions by either shortening the response times or reducing the accuracy of responses.

S05-4 [11:45]

Assessment of workers EM exposure during 50 Hz welding process

Mélina Bouldi[1]

[1]*Electromagnetism, Vibration and Optics*

S06-3 [11:30]
STUDENT PAPER

The effects of 50 Hz magnetic fields and low dose cadmium co-exposure on cell viability in JAR cells

Yumin Jin[1], Aziguli Yimaer[1], Chuan Sun[1], Liling Su[1], Zhengping Xu[1] & Guangdi Chen[1]

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

Presented by: Yumin Jin

In this study, we used JAR cells as main research cell model, and found that 50 Hz MF exposure enhanced cell viability in JAR cells in a time dependent way and could attenuate cadmium inhibited cell viability. Exposure to MF or cadmium, or co-exposure to MF and cadmium changed protein expression profile, and the differentially expressed proteins were enriched for signal transduction, protein translation and stress related pathways. Our data suggest that MF exposure enhanced cell viability and attenuated cadmium inhibited cell viability may be through changes of proteome profiling.

S06-4 [11:45]

Microwave electric field at 2.45 GHz modulates the β-adrenergic response of human embryonic stem cell-derived cardiomyocytes

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Keywords: Occupational, ELF/LF, Work in Progress
Presented by: Melina Bouldi

The low frequency magnetic field radiated from a spot-welding gun, commonly used in French industries, was experimentally characterized using an automated 3D mapping method. A numerical model of this source was also developed, and tuned for getting good concordance between simulated and experimental magnetic fields. For a first risk's assessment, the volume in which the 2013/35/UE limit is exceeded was determined. Coupling between the numerical source and body model was then validated, using an analytical approach. New simulations were finally performed to calculate the electric field induced in the F-VHP human model. This two steps study allows a complete evaluation of the risk's area, leading to preventive actions.

S05-5 [12:00]
STUDENT PAPER

Proximity to overhead power lines and childhood leukemia: An international pooled analysis

Aryana Amoon[1], Catherine M. Crespi[2], Anders Ahlbom[3], Megha Bhatnagar[1], Issy Bray[4], Katherine Bunch[5], Jacqueline Clavel[6, 7], Maria Feychting[3], Denis Hemon[6], Christoffer Johansen[8, 9], Christian Kreis[10], Carlotta Malagoli[11], Fabienne Marquant[6], Camilla Pedersen[8], Ole Raaschou-Nielsen[8, 12], Martin Röösli[13, 14], Ben Spycher[10], Madhuri Sudan[1, 15, 16], John Swanson[17], Andrea Tittarelli[18], Deirdre Tuck[19, 20], Tore Tynes[21], Ximena Vergara[1, 22], Marco Vinceti[11, 23], Victor Wünsch-Filho[24] & Leeka Kheifets[1]

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Catrin Williams[1], Catherine Hather[2], Adrian Porch[1], Heungjae Choi[1], Rhodri Williams[3], David Lloyd[1, 4] & Christopher George[5]

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Keywords: In vitro, RF/Microwaves, Completed (unpublished)
Presented by: Catrin Williams

Human embryonic stem cell-derived cardiomyocytes were exposed to pulsed microwave electric field (5.47 kV/m, 10 ms pulses at 50% duty cycle for 60 s, T_{max}=37°C) in a TM_{010} mode resonant cavity. This had a long-lasting effect on intracellular calcium signalling, caspase-3 and -7 activity and apoptotic cell death, as compared to a conventional heating control. Membrane poration did not play a role in the non-thermal mechanism of action. Future work will investigate the effects of non-thermal microwave electric field on voltage-gated calcium channels.

S06-5 [12:00]

Study on the non-thermal effects of exposing cells to 0.07-0.3 THz using a widely tunable source

Noriko Yaekashiwa[1], Sato Otsuki[1], Shin'ichiro Hayashi[1, 2] & Kodo Kawase[1, 3]

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Keywords: In vitro, THz, Work in Progress
Presented by: Noriko Yaekashiwa

This study investigated the effects of Terahertz (THz) wave irradiation on the cell activity of normal human fibroblast (NTI-4) cells. Our research examined non-thermal effects on cells exposed to radiation at low power (below 10 μW) with tunable frequencies from 0.07 THz to 0.3 THz. Cells were exposed to THz wave for either 70 or 94 h. We found no difference in cell proliferation and cellular activity between THz-exposed cells and sham cells.

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

Presented by: Aryana Amoon

The association between childhood leukemia risk and distance to power lines has been examined in numerous studies with inconsistent results. In this paper, we provide a comprehensive assessment of this association and evaluate whether the association is due to magnetic fields or other factors associated with distance from overhead power lines. We present a pooled analysis combining individual-level data (29,049 cases and 68,231 controls) from 11 record-based studies. A series of subgroup, confounder, and sensitivity analyses were performed to evaluate whether bias, confounding, or other methodologic challenges inherent in these studies have substantial influence on the results.

S05-6 [12:15]

Residential mobility and childhood leukemia in California Power Lines Study

Aryana Amoon[1], Sona Oksuzyan[2], Catherine M. Crespi[3], Onyebuchi Arah[1], Myles Cockburn[4], Ximena Vergara[5] & Leeka Kheifets[1]

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

Presented by: Aryana Amoon

Studies of environmental exposures and childhood leukemia do not usually account for residential mobility. In addition to being a potential risk factor, mobility can induce selection bias, confounding, or measurement error in such studies. We attempt to disentangle this using stratified logistic regression, case-only analysis, and propensity-score adjustments to assess predictors of residential mobility between birth and diagnosis, and account for potential confounding due to it. Mobility varied by several sociodemographic characteristics, but not distance to the nearest power line nor calculated magnetic fields. Mobility appears to be an unlikely explanation for observed associations between power lines exposure and childhood leukemia.

Lunch
Tuesday June 26, 2018 • 12:30 - 13:30
Grand hotel Bernardin restaurant

S06-6 [12:15]

Effects of combined exposure of 0.3 THz with ionomycin on cytokine production in human keratinocyte cells

Shin Koyama[1], Eijiro Narita[1], Yoko Shimizu[1], Kensuke Sasaki[2], Maya Mizuno[2], Soichi Watanabe[2], Masao Taki[3], Naoki Shinohara[1] & Junji Miyakoshi[1]

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Keywords: In vitro, THz, Work in Progress

Presented by: Shin Koyama

The cellular effects of 24-hour combined exposure to 0.3 terahertz (THz) with ionomycin in human keratinocyte (HaCaT) cells were investigated. There was no significant increase on three kinds of cytokine production in the cells exposed to 0.3 THz with ionomycin compared with the ionomycin-treated cells alone. This result indicates that the combined exposure to 0.3 THz with ionomycin would be considered to have no or very little effect on the three kinds of cytokine production in HaCaT cells.

Session: M3
EBEA Assembly
Tuesday June 26, 2018 • 12:30 - 13:30
Europa C

Session: FB
Student Flash Poster Session B
Tuesday June 26, 2018 • 13:30 - 14:30
Emerald
Chairs: Christopher Portier & Niels Kuster

FB-1 [13:30]
STUDENT PAPER

Development and evaluation of microwave antenna for transcatheter denervation

Shohei Matsuhara[1], Kazuyuki Saito[1], Hiroshi Kawahira[1], Nobuyoshi Takeshita[2] & Tomoyuki Tajima[3]

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

Presented by: Shohei Matsuhara

In this study, a catheter, which ablates extravascular nerve by the thermal effect of microwave, is introduced. In addition, heating characteristics of the catheter are evaluated by the numerical calculation and the experimental investigation. As a result, temperature distributions around the catheter were revealed and the usefulness of a denervation catheter using microwave was suggested.

FB-2 [13:33]
STUDENT PAPER

Numerical analysis of a three-compartment head model subjected to variation of input parameters

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

Presented by: Anna Šušnjara

A stochastic framework for the assessment of the induced electric field in the three-compartment model of human head is presented. The relative permittivity and conductivity of scalp, skull and brain are modelled as random variables. The statistical moments are calculated by means of a stochastic collocation method. The sparse grid interpolation in the multidimensional random space resulted in a small number of simulations. The sensitiy analysis of input parameters indicate the higher overall impact of relative permittivity over the tissue conductivity on the induced field in the brain. When considering the induced field along head axis, the results show the impact of parameters' variability to be distributed unevenly.

FB-3 [13:36]
STUDENT PAPER

Investigation of E-field strength from mobile phone base stations and transmitted power from 4th generation mobile phones

Shota Kurosaki[1], Masaki Hagiwara[1], Masao Taki[1], Atsuko Aimoto[1], Miwa Ikuyo[1], Kaoru Esaki[1] & Kanako Wake[2]

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

Presented by: Shota Kurosaki

We measured 4G Tx power and the total downlink E-field strengths during drive around Tokyo and Chiba area in Japan for about 8 hours. The association between 4G Tx power and the downlink E-field strengths was investigated. The total downlink E-field strength was high and 4G Tx power is low in the Center of the Capital while the total downlink E-field strength was low and the 4G Tx power is high in residential/rural area.

FB-4 [13:39]
STUDENT PAPER

Flexible conductive polymer microelectrode arrays for electropulsation, neurostimulation and electroporation in vitro and in vivo

Gerwin Dijk[1], Hermanus Ruigrok[2] & Rodney P. O'Connor[2]
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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Gerwin Dijk

Organic conductive polymers are highly versatile materials that have been widely adopted in commercial electronics as display technology, transistors, LEDs and solar cells. Our research is exploring their use for interfacing biology with electronics. We have developed microelectrode array devices using the conductive polymer PEDOT:PSS for electropulsation, neurostimulation and electroporation investigations in vitro and in vivo. Here we will present our work using plastic bioelectronics to develop multiwell electrode arrays for in vitro studies using live cell imaging and flexible, implantable electrodes that are suitable for studying electropulsation effects with in vivo imaging and electrophysiology.

FB-5 [13:42]
STUDENT PAPER

Cell electroporation enhanced by conductive nanoparticles

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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Amina Ghorbel

In order to optimize the outcome of Electroporation , a novel approach based on the use of conductive nanoparticles, is proposed to enhance locally the efficacy of the electric field intensity in the targeted biological sample.

FB-6 [13:45]
STUDENT PAPER

Does Extremely Low Frequency Magnetic Fields stimulations of the vestibular system modulate postural control in humans?

Nicolas Bouisset[1, 2], Sebastien Villard[1, 3], Daniel Goulet[7], Michel Plante[7], Martine Souques[6], François Deschamps[5], Genevieve Ostiguy[7], Jacques Lambrozo[6] & Alexandre Legros[1, 2, 3, 4, 8]
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Keywords: Human, ELF/LF, Work in Progress
Presented by: Nicolas Bouisset

Exposure to extremely low frequency magnetic fields (ELF-MF) induces electric fields and currents within the human body that modulate nervous system functions. Although still a matter of debate, there are evidences that the vestibular system could respond to ELF-MF. It is well established however that specific electrical stimulations of the vestibular system trigger specific postural outcomes. This work investigates the vestibular response to ELF-MF and alternating electrical currents through their impact on human postural sway.

FB-7 [13:48]
STUDENT PAPER

Alpha band analysis in resting EEG after exposure to radiofrequency signal (900 MHz): EEG/MEG study combined with an anatomic MRI

Jasmina Wallace[1, 2], Lydia Yahia-Cherif[3, 4], Laurent Hugueville[3, 4], Christophe Gitton[3, 4] & Brahim Selmaoui[1, 2]

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Keywords: Human, RF/Microwaves, Work in Progress
Presented by: Jasmina Wallace

With the extensive use of mobile phones (MP) several studies have been realized to understand the effects of radiofrequency exposure on brain activity. The results show changes in the alpha band spectral power. To better understand the cortical structures involved in these changes after MP exposure (900 MHz), we carried out electroencephalography and magnetoencephalography recording followed by the anatomical magnetic resonance imaging on healthy volunteers. Participants were selected according to inclusion criteria. They were healthy males or females, aged between 18 and 35, non-smokers and with regular sleep habits. Data analyses of 10 subjects are still under process and ready results will be presented at the conference.

FB-8 [13:51]

WITHDRAWN

FB-9 [13:54]

WITHDRAWN

FB-10 [13:57]
STUDENT PAPER

Effects of RF-EMF on APP-processing and cell death in mouse hippocampus cell line

Kyeonghee Yoon[1], Sojeong Choi[1], Nam Kim[2], Hyung Do Choi[3], Hae June Lee[4] & Yun-Sil Lee[1]

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Keywords: In vitro, RF/Microwaves, Work in Progress
Presented by: Kyeonghee Yoon

In vitro experiments were performed after exposure of LTE RF-EMF (1745 GHz) because currently,

the spread of LTE mobile communication network has increased. The LTE type RF-EMF was exposed to the cells for 24 hours at an intensity of 8 W/kg, which is the maximum intensity of our exposure system and Amyloid precursor protein (APP) processing and cell death effects were examined. RF-EMF exposure showed no significant changes of ADAM10 and BACE1 as well as expression of CTFβ and CTFα. RF-EMF, no significant cell death was induced. Even though more detailed experiments is needed, unlike to IR, exposure of 8 W/kg LTE type RF-EMF for 24 hours did not affect APP processing and cell death in HT22 hippocampus cells.

FB-11 [14:00]
STUDENT PAPER

Magnetic field effects on H2O2 and possible biological implications including cancer

Sahithi Kandala[1], Rodolfo Bruzon[1], Hakki Gurhan[1] & Frank Barnes[1]
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Keywords: In vitro, Static, Work in Progress
Presented by: Sahithi Kandala

The links between Reactive oxygen species, Electromagnetic Fields and Biological Implications are explored. Experimental data is used as background to show the changes that are observed due to static magnetic fields on fibrosarcoma cells.

FB-12 [14:03]

WITHDRAWN

FB-13 [14:06]
STUDENT PAPER

Design of a triple band monopole antenna using parasitic elements with SAR reduction for WLAN and WiMAX Applications

Hanul Bong[1], Niamat Hussain[1], Min-Joo Jeong[1], Ji Woong Park[1], Seungwoo Lee[2] & Nam Kim[1]
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Keywords: Public Health Policy, RF/Microwaves, Work in Progress
Presented by: Hanul Bong

A triple band antenna consists of a dipole, a monopole and parasitic elements is presented. The aimed frequency band is WLAN (2.4/5.8 GHz) and WiMAX (3.5 GHz) applications. The parasitic elements around feed line is introduced for improving the performance of the antenna. The antenna shows acceptable radiation pattern along with - 10 dB return loss at all three bands. Moreover, the proposed antenna with reflector got reduction of 85.12 %, 50.06 % and 36.87 % in 1g SAR value at 2.4 GHz, 3.5 Ghz and 5.8GHz, respectively when compared with international standard value.

FB-14 [14:09]

WITHDRAWN

Session: PB
Poster Session B
Tuesday June 26, 2018 • 14:30 - 16:00
Mediteranea

Coffee Break
Tuesday June 26, 2018 • 16:00 - 16:30
Foyer

Session: S07
Electroporation
Tuesday June 26, 2018 • 16:30 - 18:00
Europa D
Chairs: Olga Pakhomova & Richard Nuccitelli

S07-1 [16:30]
STUDENT PAPER

Guidelines for data collection and follow-up reporting for early stage health technology assessment of electrochemotherapy of skin melanoma and basal-cell carcinoma

Eva Pirc[1], Leandro Pecchia[2], Matej Reberšek[1], Gregor Serša[3], Marko Snoj[4], Aleš Grošelj[5] & Damijan Miklavčič[1]

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Keywords: Electroporation, Pulsed, Completed (published)

Presented by: Eva Pirc

In this paper, two Markov models are presented that will be used for cost-effectiveness analysis of electrochemotherapy for treatment of basal cell carcinoma and skin melanoma. Few cost-effectiveness analyses of electrochemotherapy have already been done, but with a lack of information about the intervention effect on the quality of life of the treated patients, which may result in inaccurate or even inadequate conclusions. For this reason, guidelines for data collection and follow-up reporting are suggested in this paper. A simple table is presented that will simplify the data collection process. More realistic cost-effectiveness

Session: W1
Workshop 1: Transferring Evidence from Research and Case Reports into Policy and Society
Tuesday June 26, 2018 • 16:30 - 18:00
Europa C
Chair: Jürg Kesselring

W1-1 [16:30]

Workshop content

Stefan Dongus[1] & Jürg Fröhlich[2]

[1]*Swiss TPH, Switzerland*

[2]*Fields at Work, Switzerland*

Potential health effects of electromagnetic fields are not only debated by scientists, but also by interested lay people, affected individuals, medical practitioners and policy makers. While hundreds of scientific studies are published worldwide each year investigating a wide range of related aspects and topics, the challenge is not only to continuously assess the potential implications for existing and future regulatory limits, but also to translate the results for a wider public, in order to meet the need for reliable, balanced and comprehensive information. This workshop will provide examples for existing approaches of synthesizing research for policy and society, experiences from policy makers providing guidelines for regulatory limits, and insights from medical practitioners, closing with a roundtable discussion.

analysis will most likely enable easier equipment purchase and clinical practice implementation.

S07-2 [16:45]

Point source electroporation for local, rapid and minimal invasive treatment of brain tumors

Shirley Sharabi[2], David Last[2], David Guez[2], Dianne Daniels[2], Sharona Salomon[2], Muhammad Hjouj[3] & Yael Mardor[1, 2]

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Keywords: Electroporation, Pulsed, Completed (unpublished)

Presented by: Shirley Sharabi

Existing treatments offer poor prognosis for glioblastoma multiforme patients. We have developed a unique minimally-invasive setup for treating brain tumors employing a single intracranial electrode placed within the tumor and an external surface electrode. This setup provides intratumoral irreversible-electroporation with surrounding blood-brain-barrier disruption, enabling efficient delivery of systemically administered drug to the residual tumor and surrounding infiltrating zone. An efficacy study conducted with this setup and systemic Cisplatin on glioma bearing rats demonstrated significantly increased survival rates, decreased tumor growth rates and significant activation of the immune system compared to control groups.

S07-3 [17:00]

Electroporation detection with THz time-domain spectroscopy

Stefania Romeo[1], P. Thomas Vernier[2] & Olga Zeni[1]

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[2]*Frank Reidy Research Center for Bioelectrics), Old Dominion University, Norfolk, Virginia, USA, 23508*

Keywords: Electroporation, THz, Completed (unpublished)

Presented by: Stefania Romeo

We report here a new procedure for THz time-domain spectroscopic analysis of mammalian cell samples exposed to electroporating pulsed electric fields. Suspensions of human monocytes, Mono-Mac 6 (MM-6), were

W1-2 [16:35]

EU-level risk assessment by SCHEER – the Scientific Committee on Health, Environmental and Emerging Risks, European Commission

Theodoros Samaras[1]

[1]*Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece*

W1-3 [16:45]

Country-level risk assessment in France by ANSES – the French National Agency for Food Safety, Environment and Labor

Johanna Fite[1]

[1]*Department of Risk Assessment, ANSES (French National Agency for Food Safety, Environment and Labor), Maisons-Alfort, France*

W1-4 [16:55]

The perspective of the European Academy for Environmental Medicine (EUROPAEM)

Michael Kundi[1]

[1]*Center for Public Health, Department of Environmental Health, Medical University of Vienna, Viena, Austria*

exposed to 8, 100 µs, 400 V (100 kV/m between the cuvette electrodes) pulses at 5 kHz, and then their spectral response between 0.2 and 1.5 THz was recorded with a commercial THz time-domain spectrometer. Pulse-exposed cells absorb more THz radiation than sham-exposed cells, suggesting that THz spectroscopy can be used as a powerful, label-free method for characterization of electroporation.

S07-4 [17:15]

Imaging using terahertz radiation; modelling of melanoma with computational phantoms

Zoltan Vilagosh[1], Alireza Lajevardipour[1] & Andrew Wood[1]

[1]*Department of Health and Medical Sciences, Swinburne University of Technology , Hawthorn, Australia, 3122*

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

Presented by: Zoltan Vilagosh

The capacity to gauge skin hydration levels gives the terahertz band (THz) an imaging potential different to Optical Coherence Tomography and Confocal microscopy. The capability to detect THz is improving, but imaging needs to meet a clinical need. Finite-difference time-domain skin computational phantoms aid the analysis of skin interaction with THz radiation. The presented phantoms have accurate anatomical layering and electromagnetic properties. Simulations have shown that the increased water content of melanomas and the freezing of the associated skin region can produce penetration to a depth of 4 mm. No current modality can image skin to 4 mm, thus THz imaging aids therapeutic decision making, such as the size of excision of melanoma.

S07-5 [17:30]
STUDENT PAPER

Analysis of effective pulsed power excitation for intracellular electropermeabilization

Farzan Zare[2], Lakshitha Naranpanawe[2] & Negareh Ghasemi[1]

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[2]*University of Queensland (UQ), Brisbane, Australia, 4069*

Keywords: Electroporation, Pulsed, Completed (unpublished)

W1-5 [17:05]

Values and Evidence in Risk Assessment: Results from a Comparative Analysis

Gregor Durrenberger[1]

[1]*Swiss Research Foundation on Mobile Communication - FSM, ETH Zurich, Zurich, Switzerland*

W1-6 [17:15]

Insights from 30 years of medical practice in a neurology clinic

Jürg Kesselring[1]

[1]*Rehabilitation Centre, Clinics of Valens, Valens, Switzerland, 7317*

W1-7 [17:25]

Round Table Discussion

Jürg Kesselring[1]

[1]*Rehabilitation Centre, Clinics of Valens, Valens, Switzerland, 7317*

Presented by: Farzan Zare

Pulsed electric field induced electroporation for biomedical and agricultural purposes is becoming increasingly ubiquitous. However, the efficacy of various pulse characteristics and stimulation techniques are widely debated. A Jurkat T Lymphocyte cell is chosen as a model cell for finite element simulation analysis where the significance of membrane pore density and rotation of the cell is examined. The impact of these parameters on the spatial distribution of current density and the transmembrane potential are investigated as a function of frequency (1Hz to 1 GHz) based on a sinusoidal voltage excitation. A modulated pulse train combining low and high frequency excitation is proposed allowing for maximum intracellular electromanipulation.

S07-6 [17:45]

Improved cell permabilization by synergistic interaction between gold nanoparticles and electromagnetic fields

Matej Kranjc[1], Vitalij Novickij[2], Tamara Pezić[1], Saša Haberl[1], Tina Batista Napotnik[1] & Damijan Miklavčič[1]

[1]*Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, Slovenia, 1000*

[2]*Institute of High Magnetic Fields, Vilnius Gediminas Technical University, Vilnius,, Lithuania, 03227,*

Keywords: Electroporation, Pulsed, Work in Progress

Presented by: Matej Kranjc

Pulsed Electromagnetic Field (PEMF) induced cell membrane permeabilization is an emerging technique of contactless increase of membrane permeability. The inferior efficacy of PEMF permeabilization compared to conventional electroporation is currently identified as a major drawback of the methodology. To address the problem, we decided to enhance the PEMF induced electric field by adding highly conductive gold nanoparticles (Au NPs) to enhance the induced electric field. We have determined, that the addition of Au NPs enhanced PEMF electroporation and allowed increase of the contactless permeabilization efficacy over PEMF electroporation alone with no effect on cell survival.

Conference Dinner
Tuesday June 26, 2018 • 19:00 - 22:00
Emerald (with welcome drink on the beach)

Session: T2
Tutorial 2: Magnetic Nanoparticles as Therapeutic Agents: Focusing on the Role of a Scientist and Engineer
Wednesday June 27, 2018 • 09:00 - 10:00
Emerald
Chairs: Antonio Sarolic & Lluis M. Mir

T2-1 [09:00]

Magnetic nanoparticles as therapeutic agents: Focusing on the role of a scientist and engineer

Theodoros Samaras[1]
[1]*Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, GR-54124*

Biographical sketch

Theodoros Samaras is Professor of Bioelectromagnetics at the Department of Physics, Aristotle University of Thessaloniki, Greece. He is a trained Medical Physicist specializing in the non-ionizing spectrum. He is working with computational multiphysics/multiscale methods for applied electromagnetics. His research interests include exposure assessment (both numerical and experimental) to electromagnetic fields and radiation; applications of electromagnetic fields in cancer therapy (hyperthermia, thermal ablation techniques); non-invasive brain stimulation with transcranial techniques; patient monitoring with electrical impedance tomography. In recent years, he has been active in the area of biomedical uses of magnetic nanoparticle, where he is attempting to transfer knowledge in dosimetry from other areas of bioelectromagnetics He has been serving as a reviewer for several journals and funding organizations and as the national representative to European research co-ordination actions (BM0704, BM1309, TD1104, EMF-NET) and standardization committees (IEC TC106). He is currently member of the European Commission's Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) and has been elected twice in the Council of the European Bioelectromagnetics Association (EBEA) and in the Board of the European Society for Hyperthermic Oncology.

Five relevant publications

1. Maniotis, N., Makridis, A., Myrovali, E., Theopoulos, A., Samaras, T., Angelakeris, M. “Magneto-mechanical action of multimodal field configurations on magnetic nanoparticle environments” (2017) Journal of Magnetism and Magnetic Materials. Article in Press.
2. Simeonidis, K., Martinez-Boubeta, C., Rivera-Gil, P., Ashraf, S., Samaras, T., Angelakeris, M., Tresintsi, S., Mitrakas, M., Parak, W.J., Monty, C., Balcells, L. “Regeneration of arsenic spent adsorbents by Fe/MgO nanoparticles” (2017) Journal of Chemical Technology and Biotechnology, 92 (8), pp. 1876-1883.
3. Myrovali, E., Maniotis, N., Makridis, A., Terzopoulou, A., Ntomprougkidis, V., Simeonidis, K., Sakellari, D., Kalogirou, O., Samaras, T., Salikhov, R., Spasova, M., Farle, M., Wiedwald, U., Angelakeris, M. “Arrangement at the nanoscale: Effect on magnetic particle hyperthermia” (2016) Scientific Reports, 6, art. no. 37934.
4. Makridis, A., Tziomaki, M., Topouridou, K., Yavropoulou, M.P., Yovos, J.G., Kalogirou, O., Samaras, T., Angelakeris, M. “A novel strategy combining magnetic particle hyperthermia pulses with enhanced performance binary ferrite carriers for effective in vitro manipulation of primary human osteogenic sarcoma cells” (2016) International Journal of Hyperthermia, 32 (7), pp. 778-785.
5. Chalkidou, A., Simeonidis, K., Angelakeris, M., Samaras, T., Martinez-Boubeta, C., Balcells, L., Papazisis, K., Dendrinou-Samara, C., Kalogirou, O. “In vitro application of Fe/MgO nanoparticles as magnetically mediated hyperthermia agents for cancer treatment” (2011) Journal of Magnetism and Magnetic Materials, 323 (6), pp. 775-780.

Abstract

The tutorial addresses the use of magnetic nanoparticles (MNP) in medical therapy with a brief review of existing and envisaged techniques. Since nanotechnology is a multidisciplinary field, the tutorial focuses on the role of scientists and engineers in this emerging field of biomedicine. This role is not restricted to the manufacturing and physical characterization of MNP, using techniques like electron microscopy, magnetization measurements, etc. It extends to their in vitro and in vivo dosimetry, where dosimetric quantities, like specific absorption rate (SAR) or specific loss power (SLP), familiar to the bioelectromagnetics audience are used. However, new dosimetric concepts, like force per cell, may need to be introduced for the medical applications of MNP. Scientists and engineers working in this field are also challenged by uncertainty quantification and the reporting of MNP properties, which can vary a lot. Another area of interest is the design of appropriate magnetic fields and devices, reaching to other disciplines of computational multiphysics, like computational fluid dynamics. In this tutorial I will discuss, with the appropriate examples, the involvement of scientists and engineers in turning MNP to therapeutic agents.

Coffee Break
Wednesday June 27, 2018 • 10:00 - 10:30
Foyer

Session: P3
Plenary 3: Exploring Dielectrophoresis and its Applications in the Biomedical Sciences
Wednesday June 27, 2018 • 10:30 - 11:30
Emerald
Chairs: Myles Capstick & Caterina Merla

P3-1 [10:30]

Dielectrophoresis: present and potential biomedical applications

Ronald Pethig[1]
[1]*School of Engineering, The University of Edinburgh, Edinburgh, UK, EH9 3JF*

Biographical sketch

Ronald Pethig is Emeritus Professor of Bioelectronics at the School of Engineering, University of Edinburgh. He received training in electrical engineering and physical chemistry and has enjoyed many years working with cell biologists and biomedical engineers (e.g., as an adjunct scientist since 1982 at the Marine Biological Laboratory, Woods Hole; adjunct professor of physiology at the Medical University of Charleston, 1984-88). His main research interest has been the dielectric and electrochemical properties of biological materials, and in particular the development of the electrokinetic method of dielectrophoresis for characterizing and manipulating cells and other bioparticles for biomedical applications. In 2001 he received the Herman P Schwan Award for work in biodielectrics, and in 2017 the Lifetime Achievement Award of the American Electrophoresis Society (AES). Amongst other activities he currently serves as Editor-in-Chief of IET Nanobiotechnology and enjoys beekeeping.

Five relevant publications

1. Muratore, M., Srsen, V., Waterfall, M., Downes, A. and Pethig, R. (2012) Biomarker-free dielectrophoretic sorting of differentiating myoblast multipotent progenitor cells and their membrane analysis by Raman spectroscopy, Biomicrofluidics 6, 034113.
2. Velugotla, S., Pells, S., Mjoseng, H. K., Duffy, C. R. E., Smith, S., De Sousa, P. and Pethig, R. (2012) Dielectrophoresis based discrimination of human embryonic stem cells from differentiating derivatives, Biomicrofluidics 6, 044113.
3. Pethig, R. (2017) Review - Where is dielectrophoresis (DEP) going? J. Electrochem. Soc., 164 (5): B3049-55.
4. Pethig, R., (2017) Dielectrophoresis: Theory, Methodology and Biological Applications, John

Wiley & Sons, Chichester.
5. Chung, C., Pethig, R., Smith, S. and Waterfall, M. (2017) Intracellular potassium under osmotic stress determines the dielectrophoresis cross-over frequency of murine myeloma cells in the MHz range, Electrophoresis, doi: 10.1002/elps.201700433.

Abstract

Dielectrophoresis (DEP) manifests itself as the motion of a particle induced by exposing it to an electric field gradient. More than 50 years ago Pohl and Hawk (Science, 152: 647-9, 1966) demonstrated that this purely physical effect can be used to simultaneously distinguish and separate live and dead cells. Since then DEP manipulations of DNA, proteins, viruses, bacteria, blood cells, cancer cells and stem cells have been demonstrated. In this talk an outline will be given of the relationship between the DEP behavior of a bioparticle and its physico-chemical properties and, where appropriate, its physiological state. The present status and possible ongoing trends of biomedical applications of DEP will also be outlined. At least six commercial products incorporating DEP can be cited (Panasonic's bacteria counter; Shimadzu's nanoparticle analyzer; the DEPArray™ system developed by Silicon Biosystems; DEPtech's 3DEP system; ApoStream™ technology for isolating tumor cells from peripheral blood; devices developed by Biological Dynamics for isolating nanoparticulate biomarkers from blood).

The cells themselves will "do the talking" for most of this presentation - by way of real-time videos - to reflect the intention of making the talk amenable to a multi-disciplinary audience.

Session: S08
In vivo
Wednesday June 27, 2018 • 11:30 - 12:30
Europa C
Chairs: Florence Poulletier De Gannes & John Tattersall

S08-1 [11:30]

Neuroinflammation promotes brain cell responses to 1800 MHz GSM electromagnetic fields

Julie Lameth[1], Florian Occelli[2], Severine Boillée[1], Delia Arnaud-Cormos[3], Philippe Leveque[3], Jean-Marc Edeline[2] & Michel Mallat[1]

[1]*INSERM U 1127, Sorbonne Université, CNRS, ICM, Paris, France, F-75013*

[2]*UMR 9197 CNRS, Paris Saclay Institute of Neuroscience, Neuro-PSI, Université Paris-Sud, Orsay, France, F-9197*

[3]*UMR-7252, Univ. Limoges, CNRS, XLIM, Limoges, France, F-87000*

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

Presented by: Michel Mallat

We have investigated brain cell responses to a two-hour head exposure to GSM-1800 MHz in rats undergoing neuroinflammation. In the dorso-medial area of the cerebral cortex (Cx), GSM exposure (mean SAR of 2.94 W/kg) led to transient reduction in Interleukin-1ß gene expression, increase in the length of cell processes emitted by microglia and post translational modifications of glutamate receptors. In the auditory Cx, GSM exposure

Session: S09
Mechanisms
Wednesday June 27, 2018 • 11:30 - 12:30
Europa D
Chairs: Michal Cifra & Francis Hart

S09-1 [11:30]

How can 10-100 µT, 10-100 Hz magnetic field influence human cardiovascular regulation?

Joel J Niederhauser[1]

[1]*Bioelectromagnetics, InnoClever GmbH, Liestal, Switzerland, 4410*

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

Presented by: Joel J Niederhauser

Since 1896, studies exposing human subjects to 10-100 µT, 10-100 Hz magnetic fields (MF) have recurrently shown acute influence on cardiovascular regulation. MF exposures above 100-200 µT have not shown an influence. Unlike magnetophosphenes, known to appear at 5-10 mT, mechanisms for influence of MF on human cardiovascular regulation have received little attention. Based on magnetophosphene knowledge and baroreceptor sensor geometry of 5 mm diameter and 10 mm length, baroreceptor MF sensitivity threshold is expected to be in the order of 10-20 µT. We present a simple converging neural network model demonstrating amplitude window behaviour as possible explanation for observed MF influence on human cardiovascular regulation.

(1.55 W/kg) resulted in both extension of microglial cell processes and altered responses of neurons to auditory stimuli, including reduced firing rate and enhanced duration of evoked responses. Comparisons with GSM-exposed healthy rats showed that neuroinflammation promoted cortical cell responses to GSM signals.

S08-2 [11:45]

Effect of 835 MHz radiofrequency radiation exposure on glucose metabolism in aging mice model

Hye-Ryoung Lee[1], Ju-Hwan Kim[1], Hakrim Kim[1], Hyung-Gun Kim[1] & Jin-Koo Lee[1]

[1]*Department of Pharmacology, Dankook University, Cheonan, Korea, 31116*

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

Presented by: Hye-Ryoung Lee

Chronic exposure to RFR in aging animal models can lead to hypoglycemia by causing abnormalities in glucose metabolism. The resulting hypoglycemia can aggravate the survival rate in aging mice model.

S08-3 [12:00]
STUDENT PAPER

Interleukin-6 plays an essential role in pulsed electromagnetic field improving cartilage and subchondral bone in mice with osteoarthritis

Xiaotian Yang[1, 2], Hongchen He[1, 2], Siyi Zhu[1, 2] & Chengqi He[1, 2]

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[2]*Key Laboratory of Rehabilitation Medicine in Sichuan, Chengdu, China, 610041*

Keywords: In vivo, Pulsed, Completed (unpublished)

Presented by: Xiaotian Yang

PEMF therapy preserves cartilage degeneration and subchondral bone microstructure in mice with knee OA by inhibiting IL-6/Stat3 signaling. Interleukin-6 gene knockout alleviate cartilage degradation in mice with OA.

S09-2 [11:45]

A molecular sensor for extremely low frequency magnetic fields: Stromal interaction molecules (STIM1 and STIM2) as candidate(s) for intracellular sensing of ELF-MF

Myrtill Simko[1] & Mats-Olof Mattsson[1]

[1]*SciProof International AB, Östersund, Sweden, 83132*

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

Presented by: Myrtill Simko

Our hypothesis is that ELF-MF induce strongly localized temperature increases or electric fields within cells and activates STIM1, leading to Ca^{2+} concentration changes and/or ROS production. The alternative hypothesis is that ELF-MF activate STIM1 by oxidative stress or electric fields leading to the activation of downstream effects.

S09-3 [12:00]

***In Silico* electromagnetic and electrophysiological modelling of ultra-low field nuclear magnetic resonance based neuronal current imaging**

Antonino Mario Cassara[1], Jan Storm[2], Nora Hofner[2], Esra Neufeld[1], Rainer Koerber[2] & Niels Kuster[1]

[1]*IT'IS Foundation, Zurich, Switzerland, 8004*

[2]*Physikalish-Technische Bundesanstalt, Berlin, Germany, 10587*

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

Presented by: Antonino Mario Cassara

Neuronal current imaging' (NCI) implemented via ultra-low-field magnetic resonance imaging technologies is a promising candidate for direct, non-invasive detection and imaging of brain electrical activity. We address effects related to the practical implementation of NCI techniques, e.g., spatio-temporal patterns of local neuro-magnetic fields, effects of source location, and the influence of tissue inhomogeneities,

relaxation times, anatomy of the human head, etc., combining multi-disciplinary data from bioelectromagnetics, MRI, computational neuroscience and experimental efforts to acquire the missing knowledge and promote technological developments for in silico design of NCI sequences for future in vivo imaging and clinical trials.

S08-4 [12:15]

Effects of extremely low frequency electromagnetic field (50 Hz) exposure on the bone marrow cells of mice

Isabelle Lagroye[1, 2], Emmanuelle Poque-Haro[2], Rémy Renom[2], Yves Le Dréan[3], Florence Poulletier De Gannes[2], Annabelle Hurtier[2], Yann Percherancier[2], Denis Habauzit[3] & Bernard Veyret[1, 2]

[1]*EPHE, PSL, Paris, France, 75014*
[2]*IMS laboratory UMR5218, Bordeaux University, Talence, France, 33405*
[3]*Inserm U1085, Institut de Recherche sur la Santé, l'Environnement et le Travail – IRSET, Rennes, France, 35000*
Keywords: In vivo, ELF/LF, Completed (unpublished)
Presented by: Isabelle Lagroye

BDF1 mice (up to 12 litters per group) were exposed 8 h/d, 5d/w for up to 8w of age at 1000 µT, beginning at conception. We tested a multi-hit model by irradiating fathers (X-rays) to induce genomic instability in the pups and further treatment with the genotoxic agent MNU in the young mice. In the bone marrow cells, genomic instability was evaluated as the presence of DNA damage, while the presence of gamma-H2AX and micronuclei was also assessed in the peripheral blood cells. Exposure to MF did not induce nor promote genomic instability in critical tissues. To our knowledge, this is the first in vivo study focusing on prenatal exposure and bone marrow in the context of a possible relationship between 50 Hz MF and childhood leukaemia.

S09-4 [12:15]

o^2S^2PARC – Open Online Simulations for Stimulating Peripheral Activity to Relieve Conditions

Esra Neufeld[1], Nicolas Chavannes[1], Antonino Mario Cassara[1], Bryn Lloyd[1], Pedro Crespo-Valero[1], Manuel Guidon[1], Odei Maiz[1], Tobias Oetiker[1] & Niels Kuster[1, 2]

[1]*IT'IS Foundation for Research on Information Technologies in Society, Zürich, Switzerland, 8004*
[2]*Swiss Federal Institute of Technology (ETHZ), Zürich, Switzerland, 8092*
Keywords: Mechanistic/Theoretical, All Frequencies, Work in Progress
Presented by: Niels Kuster

The NIH SPARC initiative aims to understand nerve-organ interactions and "advance the neuromodulation field towards precise treatment of diseases". The aim of o^2S^2PARC is to establish an innovative, open online platform to host, connect, and execute computational models. It is centered on enhanceable, neuro-, physiology-, and data-functionalized computational anatomical models and uses a mechanistic, electrophysiological perspective to investigate PNS influence on organ physiology and device-driven neuromodulation. The final software will be a crucial contribution towards open source simulation platforms for the investigation of electroceuticals, neuroprosthetics research, and other neuromodulation-based therapies.

Lunch
Wednesday June 27, 2018 • 12:30 - 13:30
Grand hotel Bernardin restaurant

Optional tour to Postojna Cave or Miramare Castle
Wednesday June 27, 2018 • 14:00 - 22:00

Session: T3
Tutorial 3: Evaluation of Animal Cancer Studies (overview)
Thursday June 28, 2018 • 08:30 - 09:30
Emerald
Chairs: Isabelle Lagroye & Christopher Portier

T3-1 [08:30]

Evaluation of animal cancer studies

Chad Blystone[1]
[1]*National Toxicology Program (NTP), NIEHS, National Institute of Health, Durham, NC, USA, 27709*

Biographical sketch

Dr. Chad Blystone is a Toxicologist with the National Toxicology Program (NTP) located within the National Institute of Environmental Health Sciences (NIEHS). His expertise includes designing and interpreting animal cancer studies. He leads the NTP's Chronic Toxicity and Carcinogenicity Technical Reports, a program that has evaluated chemicals and other agents in the two-year bioassay for over 30 years. These studies have contributed a significant amount of data for identifying potential human health hazards and NTP's nearly 600 studies have provided an extensive database for researchers and international risk assessment organizations.

Abstract

In order to protect human health, rodent cancer studies have been used for decades to identify potential carcinogens. These studies are specifically designed to identify carcinogenic activity of tested agents, identify target organs, and characterize the exposure-response relationship after a long term exposure. Various health regulatory agencies may require rodent cancer studies during the development of new pharmaceuticals, pesticides, or other agents of potential concern. In the risk assessment of the tested agent, no observed adverse effect levels (NOAELs) or benchmark dose (BMD) will often be used to extrapolate the results to typically low human exposure levels. This tutorial will go through the various elements in designing, conducting, and interpreting rodent cancer studies to provide a background on these prominent evaluations of possible human health hazards.

Award session
Thursday June 28, 2018 • 09:30 - 10:30
Emerald

Coffee Break
Thursday June 28, 2018 • 10:30 - 11:00
Foyer

Session: S10
Human studies II
Thursday June 28, 2018 • 11:00 - 12:30
Europa C
Chairs: Alexandre Legros & Heidi Danker-Hopfe

S10-1 [11:00]
STUDENT PAPER

Investigating the determinants of IEI-EMF: Is the nocebo effect a normal response?

Adam Verrender[1, 2], Sarah Loughran[1, 2, 3], Anna

Session: S11
Dosimetry II - Measurements
Thursday June 28, 2018 • 11:00 - 12:30
Europa D
Chairs: Wout Joseph & Sam Aerts

S11-1 [11:00]

Personal exposure to radio-frequency electromagnetic fields in Europe: is there a generation gap?

Marloes Eeftens[1, 2], Benjamin Struchen[1, 2], Laura

Dalecki[1, 2, 3], Frederik Freudenstein[1, 2, 3] & Rodney Croft[1, 2, 3]

[1]*Australian Centre for Electromagnetic Bioeffects Research, University of Wollongong, Wollongong, Australia*

[2]*School of Psychology, Illawarra Health & Medical Research Institute, University of Wollongong, Wollongong, Australia*

[3]*Population Health Research on Electromagnetic Energy, Monash University, Melbourne, Australia*

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

Presented by: Adam Verrender

While there has been consistent evidence that the symptoms experienced by IEI-EMF sufferers are likely the result of a nocebo response, much remains to be understood. The present study investigated whether perceived EMF exposure would elicit symptoms in a healthy population, and assessed whether messages that emphasize 'adverse health effects of EMF exposure' can alter this nocebo response. The results revealed 1) the crucial role of awareness and belief of exposure in the presentation of symptoms during perceived exposure to EMF; 2) that healthy participants exhibit a similar nocebo response to those who suffer from IEI-EMF; and 3) that alarmist media reports raise concerns about EMF and may contribute to a symptomatic nocebo response.

S10-2 [11:15]

Extremely low frequency electric and magnetic stimulations on the vestibular performance in humans

Sebastien Villard[1, 2], Nicolas Bouisset[1, 3], Daniel Goulet[4], Michel Plante[4], Martine Souques[5], Birks[3, 4, 5], Elisabeth Cardis[3, 4, 5], Peter Gajšek[6], Anke Huss[7], Leeka Kheifets[8], Inger Kristine Meder[9], Jorn Olsen[10], Tomaž Trček[6], Blaž Valič[6], Roel Vermeulen[7, 11], Martine Vrijheid[3, 4, 5], Luuk van Wel[7], Mònica Guxens[3, 4, 5, 12] & Martin Röösli[1, 2]

[1]*Swiss Tropical & Public Health Institute, Basel, Switzerland*

[2]*University of Basel, Basel, Switzerland*

[3]*IS Global, Barcelona, Spain*

[4]*Pompeu Fabra University, Barcelona, Spain*

[5]*Spanish Consortium for Research on Epidemiology and Public Health (CIBERESP), Institute of Health Carlos III, Madrid, Spain*

[6]*Institute of Non-ionizing Radiation (INIS), Ljubljana, Slovenia*

[7]*Institute for Risk Assessment Sciences (IRAS), Utrecht, the Netherlands*

[8]*Danish of Epidemiology, University of California, Los Angeles, USA*

[9]*Danish National Birth Cohort, Statens Serum Institute, Copenhagen, Denmark*

[10]*Department of Public Health, Aarhus University, Aarhus, Denmark*

[11]*Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, Utrecht, the Netherlands*

[12]*Department of Child and Adolescent Psychiatry/Psychology, Erasmus University Medical Centre–Sophia Children's Hospital, Rotterdam, the Netherlands*

Keywords: Behavioural, Static, Completed (published)

Presented by: Marloes Eeftens

We conducted a personal measurement study of radiofrequency electromagnetic field exposure among 294 parent child pairs from 5 different European countries, and found that parents had a slightly higher exposure than their children, especially for uplink and DECT. Exposure was correlated between parents and their children, especially for exposure resulting from fixed site transmitters (e.g. broadcast and downlink). Correlations between family members are also higher during the night and for the time spent at home.

S11-2 [11:15]
STUDENT PAPER

Concepts for innovative measuring methods to monitor EMF exposure evolution

Sascha Schiessl[1], Thomas Kopacz[1], Christian Bornkessel[2], Matthias Hein[2] & Dirk Heberling[1]

François Deschamps[6], Genevieve Ostiguy[4], Jacques Lambrozo[5] & Alexandre Legros[1, 2, 3, 7, 8]
[1]*Human Threshold Research Group, Lawson Health Research Institute, London, Ontario, Canada*
[2]*Medical Biophysics, Western University, London, Ontario, Canada*
[3]*Kinesiology, Western University, London, Ontario, Canada*
[4]*Hydro-Québec, Montréal, QC, Canada*
[5]*Service des Études Médicales, EDF, Paris, France*
[6]*Service Environnement Réseaux, RTE, Paris, France*
[7]*Medical Imaging, Western University, London, ON, Canada*
[8]*EuroMov, Université de Montpellier, Montpellier, France*
Keywords: Behavioural, ELF/LF, Work in Progress
Presented by: Sebastien Villard

The study of magnetophenes suggests that sensory systems interact with induced electric fields generated by time-varying magnetic stimulation. Postural control literature, also suggests that the vestibular system is sensitive to induced electric fields. Yet, postural control is an indirect indicator of the vestibular performance. We are proposing to probe the vestibular function through the measurement of the Subjective Visual Vertical (SVV). Participants were exposed to 4 frequencies of stimulation (20, 60, 120 and 160 Hz) at constant maximum dB/dt of 14.2 T.s-1 in the Magnetic Field condition and 2 mA in the electric condition. No effects of the stimulations on SVV are reported so far.

S10-3 [11:30]

Collaborative development of an innovative provocation protocol in studying electrohypersensitivity

Maryse Ledent[1], Maël Dieudonné[2], Jimmy Bordarie[3], Willy Pirard[4], Benjamin Vatovez[4], Christophe Geuzaine[5], Veronique Beauvois[5] & Luc Verschaeve[1]
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Keywords: Human, All Frequencies, Work in

S11-3 [11:30]

Exposure to electromagnetic fields from smart meter technologies in Great Britain (Phase 3): On-site measurements in homes

Nishtha Chopra[1], Darren Addison[1], Carolina Calderon[1], Myron Maslanyj[1] & Azadeh Peyman[1]
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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
Presented by: Nishtha Chopra

Real-life electromagnetic field measurements were performed for smart meter devices installed in residential properties across Great Britain, to determine power densities and duty factors associated with the Home Area Network signals. Of all devices measured, the maximum

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Keywords: Dosimetry (measurements), RF/Microwaves, Concept
Presented by: Sascha Schiessl

Monitoring the evolution of exposure to EMF caused by mobile communication systems is a continuous requirement for a responsible operation of these networks. However, measurements performed by qualified personnel with professional equipment are expensive and time-consuming and can only be carried out for a limited number of discrete points in space and time. In this paper, we suggest two innovative concepts for exposure monitoring. The first is based on a software-defined dosimeter whose parameters can be easily adapted to the needs of future network standards. The second employs a crowd sourcing approach using usual mobile phones and their on-board capability of monitoring relevant network parameters for generating immission-related data.

Progress
Presented by: Maryse Ledent

Electrohypersensitivity syndrome (EHS) is characterised by a variety of non-specific symptoms that are attributed to electromagnetic fields (EMF) by electrohypersensitive people (EHP). However, despite the great distress of certain individuals, symptoms cannot be objectively attributed to EMF so far: results of provocation studies converge to the conclusion that EHP do not perceive and do not respond physiologically to EMF. However, a critical review of these studies reveals that several parameters have not been controlled or considered. An original provocation test is being developed. To meet acceptability criteria an iterative co-creation process involving EHP, researchers and technical experts is implemented.

S10-4 [11:45]
STUDENT PAPER

Modeling of electrocardiogram generation based on electric field analysis with numerical human model

Tatsuhito Nakane[1], Takahiro Ito[1], Akimasa Hirata[1], Nobuaki Matsuura[2] & Hiroyoshi Togo[2]
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Keywords: Human, Static, Work in Progress
Presented by: Tatsuhito Nakane

In this study, we proposed an electrocardiogram (ECG) generation model by electric field analysis to develop a performance evaluation of wearable devices. The propagation of the electrical excitation in the conduction pathway of the heart can be approximated by sequentially-placed small electric dipole. We conducted computer simulations that solve potentials based on the scalar-potential finite-difference (SPFD) method with one electric dipole placed as a source. Post-processing is then applied to simulate the ECG waveforms for multiple computations. Our computational results demonstrated the effectiveness of ECG modeling using electric dipoles.

S10-5 [12:00]

Probability of Injury from Radio Frequency Exposure (PIRE): A program to summarize and expand our knowledge of potential

exposure was less than 0.003% of the ICNIRP public reference level and the duty factors were less than 1.2%. The results suggest that smart meters are likely to contribute less to overall exposure than WLAN access points in the homes. Exposures were also evaluated around a bank of smart meters in a test facility. The results showed that the total combined exposure was less than 0.0006% of the ICNIRP public reference level and the combined duty factor was less than 5.2%.

S11-4 [11:45]

Statistical RF exposure analysis for multiple massive MIMO antennas

Maarouf Al Hajj[1], Yuanyuan Huang[1] & Joe Wiart[1]
[1]*Chaire C2M, Télécom ParisTech, Paris, France, 75013*
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)
Presented by: Joe Wiart

This paper presents a statistical analysis of the human exposure linked to multiple M-MIMO antennas emissions. The aim of this study is to better estimate the compliance boundary around 5G base stations utilizing M-MIMO antennas without complex estimation methods for different transmission and traffic characteristics, and for different power ratios between the antennas. The statistical estimation is obtained by representing the exposure as a beta distribution with parameters depending on each configuration. The exposure induced by different scenarios of multiple transmitters is statistically performed. Based on that, the ratios of the quantile of total exposure to the theoretical maximum are studied and presented.

S11-5 [12:00]

Exposure assessment of 60 GHz communication antenna and 79 GHz automotive radar

damage produced by RF exposure

Jeffrey Whitmore[1] & Jason Payne[1]
[1]*Radio Frequency Bioeffects Branch, United States Air Force, Fort Sam Houston, Texas, USA, 78232*
Keywords: Human, RF/Microwaves, Work in Progress
Presented by: Jeffrey Whitmore

The potential for humans to receive a high power RF exposure is increasing as RF source technology continues to advance. Currently there is no comprehensive model relating the parameters of a RF exposure (e.g., power density, exposure duration, and frequency) to the nature and severity of an injury. This work intends to establish a model driven, empirically-validated description of thermal damage produced in tissue by RF exposure.

S10-6 [12:15]

Optimization of an on-skin lens-into-the-body for implantable medical devices

Christopher Trampel[1]
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Keywords: Human, RF/Microwaves, Work in Progress
Presented by: Christopher Trampel

This abstract describes the optimization of a novel wearable metasurface sensor, the lens-into-the-body, for implantable medical devices (IMDs). The lens-into-the-body is an on-skin device designed to focus the electromagnetic fields from an RFID reader on an implant. The function of the lens is to increase the read-range of an RFID communication system for medical implants. Full-wave simulations of the optimized lens are discussed.

Gunter Vermeeren[1], Sven Kuehn[2], Björn Debaillie[3], Guy Torfs[4], Niels Kuster[2], Piet Demeester[4], Wim Van Thillo[3], Luc Martens[1] & Wout Joseph[5]
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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)
Presented by: Gunter Vermeeren

We measured the exposure, in terms of spatial-averaged power density, of a 60 GHz wireless communication module and 79 GHz automotive radar at distances less than 30 mm of the antenna. We assessed the upper limit on the exposure by transmitting maximum power and at 100 % duty-cycle and compared this upper limit to the ICNIRP and FCC basic restrictions. The upper limit complied with ICNIRP basic restrictions, but exceeded FCC basic restrictions at short distances of the antennas. This difference in compliance is mainly due to the difference in averaging area and limits specified by both guidelines.

S11-6 [12:15]

Microwave hyperthermia treatments of palms: a promising tool of control against *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae)

Rita Massa[1], Daniele Pinchera[2], Marco Donald Migliore[2], Fulvio Schettino[2], Emilio Caprio[3], Raffaele Griffo[4], Manuela Martano[5], Paola Maiolino[5] & Gaetano Panariello[2]
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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
Presented by: Rita Massa

This work is aimed at demonstrating the feasibility of the microwave heating as a tool to contrast the Red Palm Weevil (RPW) Rhynchophorus ferrugineus pest, which is currently affecting many palm species all over the world. Microwave technology is effective and eco-compatible, and suitable for use within an Integrated Pest Management (IPM) strategy. In this work we demonstrate the microwave heating allows to reach insect lethal temperature, without affecting the internal palm tissues, when an electromagnetic-thermal protocol specially developed is applied.

Lunch
Thursday June 28, 2018 • 12:30 - 13:30
Grand hotel Bernardin restaurant

Session: M4
BEMS Business
Thursday June 28, 2018 • 12:30 - 13:30
Europa D

Session: S12
Nano pulses
Thursday June 28, 2018 • 13:30 - 15:00
Europa C
Chairs: P. Thomas Vernier & Francesca Apollonio

S12-1 [13:30]

Nanosecond Pulsed Stimulation study of intracellular organelle changes in liver tumor cells *in vivo* using electron microscopy

Richard Nuccitelli[1], Snjezana Anand[1], Holly Hartman[1] & Darrin Uecker[1]

[1]*Biology Group, Pulse Biosciences, Hayward, CA, USA, 94545*

Keywords: Electroporation, Pulsed, Work in Progress

Presented by: Richard Nuccitelli

The intracellular effects of Nano-Pulse Stimulation (NPS) on rat liver tumors cells directly observed by EM shows that NPS treatment doubles the size of mitochondria and induces swelling and fragmentation of the endoplasmic reticulum. The Golgi apparatus vesiculates at 5 min after NPS treatment and is no longer visible at later time points. The nucleus shrinks and the nuclear envelope appears less distinct by 2h after NPS treatment.

Session: W2
Workshop 2: EMF and Cancer: Interaction Mechanisms Leading to Hazardous or Beneficial effects
Thursday June 28, 2018 • 13:30 - 15:00
Europa D
Chairs: Antonio Sarolic & Olga Zeni

W2-1 [13:30]

Workshop content

Mirjana Moser[1]

[1]*Bern, Switzerland*

While EMFs in the extremely-low frequency and radiofrequency ranges are classified as possible carcinogens for humans, there are also an increasing number of clinical applications of these EMFs, including for cancer treatment. The aim of the workshop is to present and discuss available knowledge on possible EMF interaction mechanisms that are leading to risk of cancer, vs. interaction mechanisms that are leading to “beneficial” effects that can be used for therapeutical purposes. A change of view from the risk perspective only, to a scenario with possible benficial effects as well may be the beginning of a pradigm change. Is it also so that these novel insights provide a better understanding of the interaction mechanisms?

S12-2 [13:45]

Nanosecond bipolar cancellation of action potentials in nerve fibers

Maura Casciola[1] & Andrei Pakhomov[1]

[1]*Frank Reidy Research Center for Bioelectrics , Norfolk, Virginia, USA, 23508*

Keywords: Electroporation, Pulsed, Completed (unpublished)

Presented by: Maura Casciola

Advancements in pulsed power technology allow to deeply focus sub nanosecond electric pulses (nsEP) in tissues, opening opportunities for non-invasive, targeted electrical stimulation. Our recent publication [1] showed that 12-nsEP can elicit thousands of action potentials in sciatic nerves without electroporative damage. However, the stimulation threshold for bipolar (BP) pulses, such as the emitted ones, is higher than for unipolar (UP) already in the µs scale [2]. Here, using pulses in the ns-µs range, we show for the first time that the shorter the pulse the higher the ratio between BP and UP stimulation threshold, challenging the possibility to use sub-nsEP for remote stimulation.

S12-3 [14:00]

Detecting the structural changes of planar lipid bilayer exposing to nanosecond electric field

Peter Kramar[1], Damijan Miklavčič[1] & P. Thomas Vernier[2]

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[2]*Old Dominion University, Norfolk, Virginia, USA*

Keywords: Electrochemistry, Static, Work in Progress

Presented by: Peter Kramar

Planar lipid bilayers are often used to study electroporation phenomena. In this study, preliminary experiments were carried out to measure changes in planar lipid bilayer resistance and capacitance resulting from exposure to nanosecond pulsed electric fields. We also looked at the effects of calcium and magnesium ions on bilayer electrical properties. The results raise several new questions that challenge our basic understanding of membrane responses to nanosecond pulsed electric fields.

W2-2 [13:40]

Research on environmental EMF as possible carcinogens in relation with interaction mechanisms also leading to beneficial effects

Isabelle Lagroye[1]

[1]*Ecole Pratique des Hautes Etudes, Paris, France*

W2-3 [14:05]

Research on use of EMF in cancer treatment from the point of view of the COST Action EMF-MED

Mats-Olof Mattsson[1, 2]

[1]*AIT Austrian Institute of Technology, Tulln, Austria, 3430*

[2]*SciProof International AB, Östersund, Sweden, 83132*

The COST Action BM1309 (European network for innovative uses of EMFs in biomedical applications, EMF-MED) provides a cooperative framework to support research on beneficial biological effects of non-ionizing electromagnetic fields and their use in biomedical applications. One of the Working Groups of the Action focuses on “Cancer-EMF interactions and applications”, where a platform for research dealing with diagnosis and treatment of cancer using EMF and/or EMF-based technologies has been established. This presentation has the focus on interaction mechanisms and will summarize past and present Action activities related to these objectives, and indicate promising future research activities that have been identified by the Action.

S12-4 [14:15]
STUDENT PAPER

Ion models and ion transport in molecular simulations of electrically stressed biological membranes

Federica Castellani[1, 2] & P. Thomas Vernier[2]
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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Federica Castellani

Standard ion models in the widely used CHARMM36 force field for molecular dynamics simulations are not properly optimized for systems representative of biological membranes. For simulations of Ca^{2+} interactions with lipid bilayers we have implemented ion parameters that result in more realistic interactions between Ca^{2+}, water, and phospholipids. With this improved model we have characterized lipid pore-mediated ion transport in these systems by tracking the electric field- and diffusion-driven passage of ions and other species through field-stabilized pores over time, calculating the resulting currents and conductances, and relating these transport properties to the pore geometry.

S12-5 [14:30]

Biocontrol of skin infections causative *Pseudomonas aeruginosa* using nanosecond pulsed electric fields: an *in vivo* study

Vitalij Novickij[1], Auksė Zinkevičienė[2], Eglė Lastauskienė[3], Jurgita Švedienė[4], Algimantas Paškevičius[4], Svetlana Markovskaja[5], Jurij Novickij[1] & Irutė Girkontaitė[2]
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Keywords: Electroporation, Pulsed, Completed (unpublished)

W2-4 [14:30]

Protective effects of non-ionizing radio frequency fields in mammalian cells damaged by mutagens

Maria Scarfi[1]
[1]*CNR-Institute for Electromagnetic Sensing of the Environment (IREA), Naples, Italy*

Presented by: Vitalij Novickij

New in vivo data of successful eradication of skin bacterial contamination using nanosecond range electroporation (EP) (20 kV/cm x 500 ns x 1000 pulses, 15 kHz) separately and in combination with 1% acetic acid (AA) is presented. Bioluminescent Pseudomonas aeruginosa and BALB/C mice were used as a model. Combination of EP and AA 1% resulted in full eradication of bacteria in the contaminated area. In all cases the muscle contractions were minimal due to ultrashort pulsing protocols. The results are useful for the development of new methods for treatment of extreme cases of wound infections when the chemical treatment is no longer effective.

S12-6 [14:45]

Remarkable differences in the response of voltage-gated Na^+ current to a single or pair of high intensity nanosecond electric pulses in adrenal chromaffin cells

Lisha Yang[1], Sophia Pierce[1], P. Thomas Vernier[2], Indira Chatterjee[3], Gale Craviso[1] & Normand Leblanc[1]

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[3]*Department of Electrical and Biomedical Engineering, University of Nevada, Reno, NV, USA, 89557*

Keywords: Electroporation, Pulsed, Work in Progress

Presented by: Normand Leblanc

This study explored the effect of pairs of 5 ns electric pulses (NEP) on Na^+ current (I_{Na}) in adrenal chromaffin cells. Cell exposure to two NEP separated by a 1 s interval produced a transient inhibitory effect on I_{Na} (8% at 5 MV/m; 15% at 8 MV/m). The recovery of I_{Na} following inhibition was not seen with a single NEP. Reducing the time interval between the two pulses from 1 s to 0.1 s led to similar effect on I_{Na}. A further reduction of the time interval to 10 ms abolished the inhibition of I_{Na} at 5 MV/m. At 8 MV/m, I_{Na} could still be inhibited by a pulse pair but the current fully recovered and even exceeded baseline. These results suggest that NEPs can modulate I_{Na} to allow for fine tuning of excitability in chromaffin cells.

Coffee Break
Thursday June 28, 2018 • 15:00 - 15:30
Foyer

Session: S13
Public Policy I
Thursday June 28, 2018 • 15:30 - 16:30
Europa C
Chairs: Peter Gajšek & Frederik Freudenstein

S13-1 [15:30]
STUDENT PAPER

Design of a low specific absorption rate microstrip patch antenna for WLAN applications

Niamat Hussain[1], Min-Joo Jeong[1], Ji Woong Park[1], Hanul Bong[1], Uktam Azimov[1] & Nam Kim[1]

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Keywords: Public Health Policy, RF/Microwaves, Work in Progress
Presented by: Niamat Hussain

We presented the design of a microstrip patch antenna with low Specific Absorption Rate (SAR) for WLAN applications. The antenna consists of a diagonally truncated patch and a ground plan, which were patterned on both sides of RO4003 substrate. The antenna provided, good impedance matching and radiation pattern with stable gain for the bandwidth of 5.1–6.06 GHz. Moreover, the antenna showed 88% reduction in SAR_{1g} and 75% in SAR_{10g} values without using any extra back reflector compared to the international SAR standards.

S13-2 [15:45]

Analytical determination of maximal power-density averaging areas for conservative 5G exposure assessment and computational validation

Esra Neufeld[1], Eduardo Carrasco[1, 4], Manuel Murbach[1], Quirino Balzano[1, 3], Andreas Christ[1] & Niels Kuster[1, 2]

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Keywords: Standards, RF/Microwaves, Completed (published)
Presented by: Niels Kuster

Exposure thresholds for 5G frequencies are mostly formulated in terms of surface averaged incident power density. For localized exposure, critical heating can occur when the averaging area is too large. An analytical model of the antenna distance-, aperture-, and frequency-dependence of the maximal averaging area was derived and validated against simulations of a wide range of single element antennas and antenna arrays, resulting in recommendations for standardization.

S13-3 [16:00]

Levels of environmental non-ionizing electromagnetic radiation in children´s home with Acute Leukemia in the Metropolitan Area of Guadalajara and current situation of the regulatory framework in Mexico

Leonardo Soto-Sumuano[1], Emanuel Abundis-Gutierrez[1], Roberto Garibaldi-Covarrubias[2], Alberto Tlacuilo-Parra[3] & Yuridia Salazar-Galvez[3]

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Keywords: Public Health Policy, All Frequencies, Work in Progress
Presented by: Leonardo Soto-Sumuano

Exposure to electromagnetic radiation has caused an environmental imbalance both for the preservation of health and life itself. This article describes original results obtained from the intradomiciliary measurement of ELF and RF in homes of pediatric patients with acute leukemia in the metropolitan area of Guadalajara, presents a discussion of the possibility that RF be a risk factor either in the development of leukemia or in preventing its cure or worsening the patient's condition, analyzes international regulation and examines the impact of the lack of regulations in Mexico even though the current legal framework recognizes the electromagnetic radiation as a pollutant and a possible threat to human health.

S13-4 [16:15]

Research programme "Radiation Protection in the Process of Power Grid Expansion"

Blanka Pophof[1], Cornelia Egblomassé-Roidl[1], Dirk Geschwentner[1], Jens Kuhne[1], Christiane Pölzl-Viol[1], Janine-Alison Schmidt[1] & Gunde Ziegelberger[1]

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Keywords: Public Health Policy, ELF/LF, Concept
Presented by: Blanka Pophof

In Germany, the existing electric power transmission and distribution grids will be expanded. In order to improve risk assessment and to reduce scientific uncertainties, the Federal Office for Radiation Protection (BfS) will conduct an accompanying research programme "Radiation Protection in the Process of Power Grid Expansion". Eight research topic areas will be investigated. The research programme started in 2017.

Session: W3
Workshop 3: Advanced Approaches for Analysis of Biological Effects of Pulsed Electric Fields
Thursday June 28, 2018 • 15:30 - 18:00
Europa D
Chairs: Michal Cifra & Lluis M. Mir

W3-1 [15:30]

Workshop content

Michal Cifra[1] & Lluis M. Mir[2]

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[2]*Laboratory of Vectorology and Anticancer Therapies, UMR 8203, CNRS, Univ.Paris-Sud, Université Paris-Saclay, Gustave Roussy, Villejuif, France, 94805*

The proposed workshop is dedicated to presentation and discussion of advanced technologies and methods to study the effects of pulsed electric fields on living cells mainly at the cellular and molecular levels, for improving the knowledge and applicability of future medical applications. The focus will be on technologies based on advanced chemiluminescence techniques, advanced linear and nonlinear optical and imaging techniques (Raman, CARS and THz microspectroscopy), numerical microdosimetry and molecular dynamics modeling.

W3-2 [15:40]

Endogenous biological chemiluminescence for probing oxidative effects of electric pulses

Michal Cifra[1], Djamel E. Chafai[1], Daniel Havelka[1] & Lluis M. Mir[2]

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[2]*Laboratory of Vectorology and Anticancer Therapies, UMR 8203, CNRS, Univ.Paris-Sud, Université Paris-Saclay, Gustave Roussy, Villejuif, France, 94805*

Oxidative reactions in biological systems generate endogenous chemiluminescence. We report how this endogenous light is affected by intense electric pulses. It was found that a train of several short pulses tends to induce a stronger response of endogenous chemiluminescence from cells than the single long pulse while total duration and other conditions are the same. We suggest that that the endogenous biological chemiluminescence can be used for label-free real time monitoring of biological oxidation initiated by intense electric pulses.

W3-3 [16:00]

Molecular models used in the interaction between nanosecond pulses electric fields and biomolecules

Paolo Marracino[1], Elena della Valle[1], Maura Casciola[2], Micaela Liberti[1] & Francesca Apollonio[1]

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[2]*Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA*

When dealing with the interaction of electric fields and bio-systems, the very first mechanism is observed at molecular level; therefore, the need for accurate and reproducible models able to describe the time evolution of the target in presence of the external fields are needed.

W3-4 [16:20]

Speaker 3

Mounir Tarek[1]

[1]*Centre National de La Recherche Scientifique (CNRS), Université de Lorraine, Nancy, France*

W3-5 [16:40]

Shared knowledge, gaps and challenges of microdosimetry: Importance of realistic models at the cellular and subcellular level

Agnese Denzi[1], Caterina Merla[2], Francesca Apollonio[1], Lluis M. Mir[3] & Micaela Liberti[1]

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[2]*SSPT - Division of Health Protection Technologies, ENEA, Rome, Italy*

[3]*Gustave Roussy, CNRS, Univ. Paris-Sud, Université Paris-Saclay, Villejuif, France*

In the study of the biophysical mechanisms at the basis of the EM field interaction leading to biomedical applications, one needs also to know the field strength at the microscopic scale to establish a quantitative relation between the field and the observed effect. Aim of this work is to establish the shared scientific bases of microdosimetry and main results, and to identify the needs for future research. In particular, a recent important improvement is represented by taking into account the irregularly shaped cells and internal organelles.

W3-6 [17:00]

Characterization of the interaction between pulsed electric fields and live cells by confocal Raman microspectroscopy

Lluis M. Mir[1], Antoine Azan[1], Valérie Untereiner[2, 3], Caterina Merla[1, 4], Cyril Gobinet[2], Marie Breton[1], Ali Tfayli[5] & Olivier Piot[2, 3]

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Part of the workshop on "Advanced approaches for analysis of biological effects of pulsed electric fields", this presentation deals with the characterization of the interaction between pulsed electric fields and live cells by confocal Raman microspectroscopy.

W3-7 [17:20]

A wide-field CARS setup for spectroscopy under electropulsation of biological media

Caterina Merla[1, 2], Brigitte Attal-Trétout[3], Michaël Scherman[3], Martina Nardoni[4], Amina Ghorbel[1], Micaela Liberti[5], Francesca Apollonio[5], Stefania Petralito[4] & Lluis M. Mir[1]

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To understand basic phenomena of electropulsation of biological media, a new experimental setup is used. It combines a wide field CARS microscope with a wide band coplanar waveguide. This setup allows to acquire CARS hyper-spectra of specific Raman bands of small unilateral vesicles (i.e. liposomes) and cells contemporary exposed to high amplitude ultra-short (microsecond or nanosecond duration) electric pulses. Being the physico-chemical bases of electropermeabilization still debated, our setup allows the experimental assessment of the role of water molecules and phospholipids during and after the delivery of the electric pulses.

W3-8 [17:40]

Terahertz spectroscopy to monitor the leakage of molecules from live cells exposed to pulsed electric fields: comparison to fluorescent video-microscopy experiments

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For the first time, a Terahertz-Attenuated Total Reflection (THz-ATR) experimental device was used to investigate the effects of electroporation electric fields on live cells. The THz signal, generated and detected by a classical Terahertz time-domain spectroscopy (THz-TDS) setup, was compared to fluorescence microscopy data (Yo-Pro1 uptake).

Session: S14
Dosimetry III - Measurements
Thursday June 28, 2018 • 16:30 - 18:00
Europa C
Chairs: Luc Martens & Blaž Valič

S14-1 [16:30]
STUDENT PAPER

RF exposure in the vicinity of small cell base stations

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

Presented by: Thomas Kopacz

In the course of the evolution of mobile radio networks and the increasing high-capacity needs, operators have started to deploy small-cell base stations. To account for possible concerns about the RF exposure, we investigate the exposure for two types of small-cell base stations embedded into street furniture: 1. A phone box (PB) and 2. a service-area interface (SAI). We have found that in public areas the highest exposure amounts to 17.9 % of the electrical field reference level (%E) for the PB and 53.0 %E for the SAI. Downlink exposure and uplink transmit power have been assessed for typical and worst-case user scenarios in the vicinity of the SAI proving that higher downlink field strength leads to lower uplink transmit power values.

S14-2 [16:45]
STUDENT PAPER

Human exposure assessment in indoor environments using a 60 GHz personal exposure meter

Reza Aminzadeh[1], Abdou Khadir Fall[2], Jerome Sol[2], Arno Thielens[1, 3], Philippe Besnier[2], Maxim Zhadobov[4], Nele De Geeter[5], Prakash Parappurath Vasudevan [1, 6], Luc Dupré[5], Roel Van Holen[6], Luc Martens[1] & Wout Joseph[1]

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

Presented by: Reza Aminzadeh

This paper presents the first mm-wave personal exposure meter (mm-PEM) to assess human exposure to the 5th generation of mobile networks (5G) in indoor environments. The mm-PEM consists of 9 elements of an antenna array and is calibrated on a skin-equivalent phantom in a reverberation chamber at 60 GHz. The designed mm-PEM has a response of 1.043 (0.17 dB) at 60 GHz which is very close to the desired response of a PEM i.e. 1 (0 dB). The mm-PEM measured an incident power density of 41 $mW.m^{-2}$ at 60 GHz for an input power of 1 mW in the empty chamber.

S14-3 [17:00]

Microenvironmental personal and head exposure measurements of radio-frequency electromagnetic fields in Melbourne, Australia

Arno Thielens[1, 2], Matthias Van Den Bossche[2], Christopher Brzozek[3], Chhavi Bhatt[3], Michael Abramson[3], Geza Benke[3], Luc Martens[2] & Wout Joseph[2]

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Keywords: Epidemiology, RF/Microwaves, Completed (published)
Presented by: Wout Joseph

The aim of this study was to simultaneously measure personal radio frequency-electromagnetic fields (RF-EMFs) exposure using two measurement devices. A body-worn personal exposimeter and a head-worn personal distributed exposimeter were used for measuring body and head exposures, respectively, in 15 microenvironments in Melbourne. The summary statistics obtained for total RF-EMF exposure showed a high representativeness ($r^2 > 0.87$ for two paths in the same area). The results obtained during simultaneous measurements using the two devices showed high correlations: $r^2 = 0.94$ for the median along the measured paths.

S14-4 [17:15]

Long-term spatio-temporal RF-EMF exposure assessment in sensor network

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)
Presented by: Sam Aerts

Our exposure to environmental radiofrequency (RF) electromagnetic fields (EMF) at a given location is inherently dynamic due to the constantly-changing nature of both our environment as well as the telecommunications networks present in it. More than a year of measurement data was collected in a fixed low-cost urban exposimeter network and analysed to build a spatio-temporal surrogate model of the exposure to environmental telecommunications signals. We observed that by taking into account the moment of the measurement in the modelling the accuracy of the resulting surrogate model in the area under study was improved by up to 50% compared to models that neglected the daily temporal variability of the RF signals.

S14-5 [17:30]

Personal Exposimeter to monitor EMF Up-Link exposure from daily-usages of mobile phone

Serge Bories[1], David Dassonville[1], Sébastien Brulais[1], Saifeddine Aloui[1], Yenny Pinto[2], Taghrid Mazloum[2] & Joe Wiart[2]
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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
Presented by: Serge Bories

The cellular Up-Link (UL) exposure has been identified as the main contributor for the mobile phone user. However current personal exposimeters don't estimate it properly because they don’t assess the real transmit (Tx) power and the distance between this EMF source and the user’s body. A novel non-invasive system monitors both of these parameters (power, usage) during daily usages. It is integrated on a shell around the user’s mobile. Covering 5 cellular UL frequency bands, the probe is able to log the Tx RF power from 100 Hz sampling. The usage estimation is assessed through three small sensors worn in the user pockets. The variations of the Tx power at different time-scale are demonstrated.

S14-6 [17:45]

Characterization of the exposure due to smart-home devices and other residential RF sources

Sam Aerts[1], Leen Verloock[1], Matthias Van Den Bossche[1], Ximena Vergara[2], Luc Martens[1] & Wout Joseph[1]
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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
Presented by: Sam Aerts

Current Internet-of-Things (IoT) trends such as home automation and smart metering may raise concerns about the human exposure to radiofrequency (RF) electromagnetic fields (EMF) due to new wireless devices installed in residences. As signals transmitted by smart devices are usually non-continuous, a new measurement methodology was developed to assess their exposure levels, using the spectrogram mode of a spectrum analyzer to capture changes in frequency and/or amplitude of the assessed signals over time. Here, the assessment of 94 residential RF sources is presented. It was found that, in the smart home, wireless access points, smartphones, and other personal communication devices continue to represent the bulk of our RF-EMF exposure.

Friday June 29, 2018

Session: P4
Plenary 4: Frontiers of Electroporation, from Mechanisms to Applications
Friday June 29, 2018 • 08:30 - 09:30
Emerald
Chairs: Micaela Liberti & Damijan Miklavčič

P4-1 [08:30]

Advances in electroporation and activation of cells by nanosecond stimuli

Andrei Pakhomov[1]
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Biographical sketch

Andrei Pakhomov is a Research Professor and an Interim Director of the Center for Bioelectrics. He has broad interest in nanosecond pulsed electric fields (nsPEF), from molecular and cellular mechanisms to prospective applications in cancer ablation, deep tissue stimulation, and defibrillation. He leads research on nanoelectropore opening and life cycle, conduction properties, cell stimulation and activation, membrane repair, and cell death mechanisms and pathways. Pakhomov's lab recently uncovered bipolar cancellation, a phenomenon that challenges existing electroporation paradigms and may enable targeted remote biostimulation. His ongoing research is supported by a multi-university MURI grant from AFOSR and an RO1 grant from NIH.

Five relevant publications

1. Pakhomov AG, Semenov I, Casciola M, Xiao S: Neuronal excitation and permeabilization by 200-ns pulsed electric field: An optical membrane potential study with FluoVolt dye. Biochim Biophys Acta 2017, 1859(7):1273-1281.
2. Gianulis EC, Labib C, Saulis G, Novickij V, Pakhomova ON, Pakhomov AG: Selective susceptibility to nanosecond pulsed electric field (nsPEF) across different human cell types. Cell Mol Life Sci 2017, 74(9):1741-1754.
3. Casciola M, Xiao S, Pakhomov AG: Damage-free peripheral nerve stimulation by 12-ns pulsed electric field. Sci Rep 2017, 7(1):10453.
4. Pakhomov AG, Gianulis E, Vernier PT, Semenov I, Xiao S, Pakhomova ON: Multiple nanosecond electric pulses increase the number but not the size of long-lived nanopores in the cell membrane. Biochim Biophys Acta 2015, 1848(4):958-966.
5. Pakhomov AG, Semenov I, Xiao S, Pakhomova ON, Gregory B, Schoenbach KH, Ullery JC, Beier HT, Rajulapati SR, Ibey BL: Cancellation of cellular responses to nanoelectroporation by reversing the stimulus polarity. Cell Mol Life Sci 2014, 71(22):4431-4441.

Abstract

Early research into nsPEF bioeffects focused primarily on cell killing and cancer ablation. More recently, interest shifted towards utilizing unique properties of nsPEF for activation and stimulation, including targeted stimulation remotely from electrodes. Cell activation is accomplished by nanoelectroporation and Ca^{2+} mobilization, which mimics opening of Ca^{2+} channels even in cells which do not express them. If voltage-gated channels are present, they can be activated by either membrane depolarization due to nanoelectroporation or directly, without membrane injury. However, the latter mechanism is challenging since stimuli are much shorter than the time needed for translocation of the molecular voltage sensor domain which opens the channel. On many occasions, stimulation thresholds were equal to or above electroporation thresholds. Nonetheless, we accomplished peripheral nerve stimulation by 10-ns PEF without observable membrane injury, even after 50,000 stimulation cycles. This stimulation is subject to strong bipolar cancellation, which (a) can be utilized to reveal ion channel kinetics, (b) explains, at least in part, why emitted microwaves and RF have low biological efficiency even at high peak power, and (3) underlies a new paradigm of science-based targeted remote stimulation, with broad medical applications.

P4-2 [09:00]

Unraveling new key molecular level aspects using computational chemistry

Mounir Tarek[1]

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Biographical sketch

Mounir Tarek is a Senior Research Director at the CNRS-Université de Lorraine. His research involves the use of computational chemistry methods to study membranes, proteins, ion channels and membrane transport proteins. Over the last few years, he studied many aspects of electroporation of cell membranes subject to high electric fields. M. Tarek is a founding member and a member of the Scientific Council of the Europeen Associated Laboratory EBAM 'Pulsed Electric Fields Applications in Biology and Medicine'.

Five relevant publications

1. Casciola, M.; Kasimova, MA.; Rems, L.; Zullino, S.; Apollonio, F.; Tarek, M. Properties of lipid electropores I: Molecular dynamics simulations of stabilized pores by constant charge imbalance. Bioelectrochemistry 109, (2016) 108-116
2. Casciola, M.; Tarek, M. A molecular insight into the electro-transfer of small molecules through electropores driven by electric fields Biochim. Biophys. Acta. Biomembranes, 1858, 2278-2289 (2016)
3. Polak, A.; Bonhenry, D.; Dehez, F.; Kramar, P.; Miklavčič, D. and Tarek, M. On the Electroporation Thresholds of Lipid Bilayers: Molecular Dynamics Simulation Investigations. J. Membr. Biol. 246, 843-850 (2013)
4. M. Breton, L. Delemotte, A. Silve, L.M. Mir, M. Tarek, Transport of siRNA through Lipid Membranes Driven by Nanosecond Electric Pulses: An Experimental and Computational Study, J. Am. Chem. Soc. 134 (2012) 13938–13941.

Abstract

The application of short and intense electric pulses enables to transiently alter the properties of cell membranes, making them permeable to a wide range of chemical species. This phenomenon is routinely used in medical applications as well in biotechnology and industrial processing. Most investigations to date of the processes involved have focused on the ability of intense electric fields to create pores within the lipid bilayers, allowing us to better understand and control the phenomenon termed "electroporation". Our knowledge on the other hand, about the chemical processes enhanced as a consequence of the application of electric fields to cells is still sketchy. In this contribution we harness the capabilities of computational resources and the predictive power of advanced atomistic and quantum level molecular dynamics techniques to decipher key steps in several chemical and biophysical processes occurring during and following Electric field stimulations of cell membranes. We show that under low-voltage conditions, and predict that under sub-nanosecond pulse electroporation conditions, peroxidation of model cell membranes by potent reactive oxygen species (OH• and OOH•) is significantly enhanced. We quantify the permeability of the peroxidized membranes to a host of species including ions and molecules, to demonstrate that electrically mediated chemical effects may play a significant role in several processes following exposure of cells to high electric fields. We discuss the relevance of these effects for cells subject to radio-frequency electromagnetic fields (RF-EMF) as well as for excitable cells subject to electro-stimulation.

Session: S15
Dosimetry IV - Computational studies
Friday June 29, 2018 • 09:30 - 11:00
Europa C
Chairs: Bor Kos & Kenichi Yamazaki

S15-1 [09:30]

NEUROMAN: Reference computational human anatomical models for therapeutic peripheral nerve stimulation and safety investigations

Bryn Lloyd[1], Antonino Mario Cassara[1], Silvia Farcito[1], Esra Neufeld[1], Jin Seo Park[4], Beom Sun Chung[3], Min Suk Chung[3] & Niels Kuster[1, 2]

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

Presented by: Bryn Lloyd

Therapeutic electrical stimulation of peripheral nerves is a promising technique with a wide range of treatment applications. At the same time, the trend towards stronger magnetic fields and/or faster gradient switching in magnetic resonance imaging poses safety risks for patients, e.g., due to tissue heating and unwanted neurostimulation. To this end, we are developing reference human anatomical models with unprecedented details in the peripheral nervous system, connectivity to organs and muscles, and functionalized with compartmental nerve models to investigate interactions with neuronal electrophysiology. We employ these phantoms to investigate current safety guidelines.

S15-2 [09:45]

Enabling LF dosimetry starting from the knowlege of the magnetic flux density

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

Session: S16
Public Policy II
Friday June 29, 2018 • 09:30 - 11:00
Europa D
Chairs: Azadeh Peyman & Theodoros Samaras

S16-1 [09:30]

Understanding and overcoming 'Risk Communication Traps'

Frederik Freudenstein[1, 2, 3, 4], Peter Wiedemann[1, 2, 4], Rodney Croft[1, 2, 3, 4] & Sarah Loughran[1, 2, 3, 4]

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

Presented by: Frederik Freudenstein

In the presented research we analyse the effects of a special class of problems, called 'risk communication traps'. These traps hinder the proper understanding of risk assessments, leading to misunderstandings of both the very existence of and magnitude of a risk. We focus on a set of five traps related to RF EMF (radio frequency electromagnetic fields) risk assessments. As an example, research on the 'framing trap' is presented. This trap becomes relevant to risk communication when hazard identifications (being just the fist step in risk assessment) are misunderstood as risk assessments. An online survey investigates wether this effects RF EMF risk perception and higher confidence that cancer risks will occur from cell phone usage.

S16-2 [09:45]

Post-Normal Science and the management of uncertainty in bioelectromagnetic controversies

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Keywords: Public Health Policy, All Frequencies, Review, Commentary, Recommendation, Evaluation

Presented by: Luca Giaccone

LF dosimetry is commonly assessed by evaluating the electric field in the human body using the scalar potential finite difference method. This method is effective only when the sources of the magnetic field are completely known and the magnetic vector potential can be analytically computed. This paper presents a rigorous method to characterize the source term when only the magnetic flux density is available at discrete points. The proposed method is validated and also proved to be useful and effective when applied to a real-world scenario, where the magnetic flux density is measured in proximity of a power transformer.

S15-3 [10:00]

Estimation of electric fields and eddy currents induced by an AC electromagnetic field in human subjects

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

Presented by: Hideyuki Okano

This study focuses on computational estimation of the induced electric fields (EFs) and eddy currents induced by an AC electromagnetic field (EMF; 50 Hz, B_{max} 180 mT) in human subjects. The induced EFs were numerically calculated using the finite-element method. The left forearm was exposed to heterogeneous EMF generated by double coils. For the EF intensity at the skin surface as well as in muscle and tendons, the simulation results indicated that the highest EF was located in the regions in and around the first coil. The EF intensity at the artery was higher near the second coil than the first coil. The present numerical analysis may contribute to the understanding of physiological mechanisms of AC EMFs for hemodynamic responses.

Presented by: Andrew Wood

The incorporation of scientific findings into public policy continues to present significant challenges in many areas of environmental protection, including bioelectromagnetics. At the same time public trust in 'experts' has diminished and science faces what some regard as a crisis. Uncertainty is often acknowledged but rarely dissected. This paper will suggest ways in which uncertainties can be properly managed, with particular reference to the work of Funtowicz and others on 'Post-Normal Science' and more recently 'What is science's crisis really about?'

S16-3 [10:00]

Quarterly newsletters synthesizing research for policy and society: an innovative approach piloted by the interdisciplinary Swiss expert group on electromagnetic fields and non-ionising radiation (BERENIS)

Stefan Dongus[1], Peter Achermann[2], Jürg Fröhlich[3], Jürg Kesselring[4], Meike Mevissen[5], David Schuermann[6], Edith Steiner[7] & Martin Röösli[1]

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

Presented by: Stefan Dongus

In 2014, the interdisciplinary Swiss expert group on electromagnetic fields and non-ionising radiation (BERENIS) started to continuously assess newly published human experimental and epidemiological studies, mammalian in vivo and in vitro studies, as well as exposure and dosimetry studies. Based on defined criteria, BERENIS identifies publications most relevant for health risk. During the 3-years pilot phase of BERENIS, ten quarterly newsletters have been published, providing short summaries and evaluations of

55 publications. Topics of particular relevance identified by BERENIS include 1) oxidative stress, 2) cryptochrome as EMF sensor, 3) cancer promotion, and 4) neurodegeneration.

S15-4 [10:15]

Extended numerical modelling of cortical electrostimulation

Jose Gomez-Tames[1] & Akimasa Hirata[1]
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Keywords: Dosimetry (computational), ELF/LF, Review, Commentary, Recommendation, Evaluation
Presented by: Jose Gomez-Tames

Computational models have been used to understand local brain stimulation. However, no a computational model revealing the stimulation process from the cortex to MNs has not yet been proposed. The aim of the current study was to develop a corticomotoneuronal (CMN) model to investigate intraoperative stimulation during surgery

S16-4 [10:15]

Revision of IEEE Standards C95.1-2005 and C95.6-2002

C. K. Chou[1], Ron Petersen[2], Kenneth Foster[3], Akimasa Hirata[4], Marvin Ziskin[5], J. Patrick Reilly[6], Richard Tell[7], Antonio Faraone[8], B. Jon Klauenberg[9], Robert Kavet[10], Kevin Graf[11], Robert Cleveland[12], Artnarong Thansandote[13], Jerrold Bushberg[14], William Bailey[15], John Osepchuk[16], Alexandre Legros[17], Kenichi Yamazaki[18] & Ralf Bodemann[19]
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[11]*Exponent Inc., Menlo Park, CA, USA, 94025*
[12]*EMF Consulting , Portland, OR, USA, 97219*
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[16]*Full Spectrum Consulting, Concord, MA, USA, 01742*
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Keywords: Standards, All Frequencies, Completed (unpublished)
Presented by: C-K. Chou

C95.1 was first published as a radiofrequency (RF) protection standard in 1966 by the United States of America Standards Institute. Major

revisions of C95.1 were published in 1974, 1982, 1991, 1999, 2005, and 2014. This latest revision, a merging and updating of IEEE Std C95.1-2005 (3 kHz – 300 GHz) and C95.6-2002 (0 – 3 kHz), also relies upon C95.1-2345-2014 (military workplaces and personnel protection), which also combined and updated C95.1 and C95.6. In this presentation, similarities and differences of this draft revision with previous standards are discussed. New limits for exposures between 6 GHz and 300 GHz are proposed based on thermal modeling studies. The current draft revision is presently undergoing IEEE voting procedures.

S15-5 [10:30]

Patient semi-specific computational modeling of electromagnetic stimulation applied to regenerative treatments in acute ischemic stroke

Micol Colella[1], Francesca Camera[1], Fioravante Capone[2], Stefania Setti[3], Ruggero Cadossi[3], Francesca Apollonio[1], Vincenzo Di Lazzaro[2] & Micaela Liberti[1]

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

Presented by: Micaela Liberti

Specific pulsed electromagnetic field (PEMF) have been shown to be effective in producing changes in the excitability of human cerebral cortex and to have neuroprotective potential on animal models of brain ischemia and on in-vitro studies. For this reason, the interest of validating the PEMF stimulation as non-invasive, safe and effective tool to promote recovery in acute ischemic stroke patients is spreading. In such a context, an accurate dosimetry that can be patient semi-specific and, so, describe the electrical and magnetic quantities induced in each treatment, is clearly a powerful tool to understand brain magnetic stimulation and the related interaction mechanisms with biological tissues.

S16-5 [10:30]

Safety in electromagnetic fields - *Simplifying risk assessments using exposure zones*

Peter Jeschke[1], Hannah Heinrich[2], Claudine Neumann[3], Ingo Bömmels[3], Stephan Joosten[4], Mathias Hoffmann[5], Hannelore Neuschulz[1] & Erik Romanus[1]

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Keywords: Occupational, All Frequencies, Work in Progress

Presented by: Peter Jeschke

The European Directive 2013/35/EU has been implemented into German legislation by the EMF Ordinance. To improve the comprehensibility and usability of the EMF Ordinance, Technical Rules are currently developed to assist employers, particularly in small and medium sized enterprises, to implement state of the art occupational safety and health measures. Using the information and measures given in the Technical Rules ensure compliance with the EMF Ordinance. “Exposure Zones”, which link exposure conditions at workplaces with Action Levels and associated protective measures, provide a simple and guided approach for employers to fulfil the requirements of the EMF Ordinance.

S15-6 [10:45]

Development of the 0.16THz in vivo exposure system for evaluating acute ocular damages with the high power gyrotron electromagnetic wave source

Yukihisa Suzuki[1], Masami Kojima[2], Takafumi Tasaki[2], Yoshinori Tatematsu[3], Masafumi Fukunari[3], Maya Mizuno[4], Kensuke Sasaki[4], Soichi Watanabe[4], Masao Taki[1], Masahiko Tani[3] & Hiroshi Sasaki[2]

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Keywords: In vivo, THz, Work in Progress

Presented by: Yukihisa Suzuki

In this study, a new in vivo exposure system for 0.16 THz exposure has developed to investigate the threshold level of power density inducing thermal ocular damage. To realize this system, the gyrotron FU CW GV was used for the 0.16THz high power EM wave source. When the irradiated power density was 500mW/cm2, the maximum temperature elevation at 6min from the onset of exposure became 26.4ºC and 19.8ºC for an agar phantom and a cornea of rabbit eye, respectively. Consequently, we have achieved the sufficient temperature elevation to observe acute cornea damages due to the thermal effect at 0.16THz

S16-6 [10:45]

An analytical model to derive safety limits for pulsed/modulated 5G radiation exposure

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

Presented by: Niels Kuster

5G technology foresees data transmission in short bursts. Signals with high peak-to-average ratios can lead to critical tissue heating even when time- and area-averaged power density values respect current safety guidelines. An analytical model of heating due to plane-wave and localized pulsed exposure was developed and has been used in combination with thermal dose limits to derive propositions for the adaptation of current standards.

Coffee Break
Friday June 29, 2018 • 11:00 - 11:30
Foyer

Session: P5
Plenary 5: Hot Topic
Friday June 29, 2018 • 11:30 - 12:30
Emerald
Chairs: Martin Röösli & Isabelle Deltour

P5-1 [11:30]

Does amount of mobile phone use affect headache, tinnitus and hearing? Results from the Cohort Study of Mobile Phone use and Health (COSMOS)

Anssi Auvinen[1]

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Student Awards
Friday June 29, 2018 • 12:30 - 13:30
Emerald

Closing ceremony
Friday June 29, 2018 • 13:30 - 14:00
Emerald

Session: M5
BEMS Board Meeting
Friday June 29, 2018 • 14:30 - 18:00
Pharos

Session: M6
EBEA Council Meeting
Friday June 29, 2018 • 14:30 - 18:00
Adria

Session: PA
Poster Session A
Monday June 25, 2018 • 14:30 - 16:00
Mediteranea

PA-1 [14:30]

The influence of electromagnetic field from microwave range on honeybees – acoustic and thermal analysis

Pawel Bienkowski[1], Pawel Cala[1], Urszula Libal[2], Piotr Nowakowski[3], Przemyslaw Plaskota[4], Krzysztof Rudno-Rudzinski[4] & Bartlomiej Zubrzak[1]

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Keywords: Behavioural, RF/Microwaves, Work in Progress
Presented by: Pawel Bienkowski

The paper presents the results of research on the influence of the electromagnetic field from microwave range on the population of honeybees, analyzing changes in the sounds from hives and changes in temperatures in the hive.

PA-3 [14:30]
STUDENT PAPER

Extremely low frequency-electromagnetic radiation deteriorated the sleep reduction in *Drosophila melanogaster* under heat stress

Xiaomei Huang[1, 2], Ziyan Zhang[1], Hongying Zhang[1, 2], Chuanjun Yang[1], Yongyan Sun[1, 2], Chao Tang[1] & Hui Yu[1]

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Keywords: Behavioural, ELF/LF, Completed (unpublished)
Presented by: Xiaomei Huang

The coupling effects of heat stress and extremely low frequency-electromagnetic field (ELF-EMF, 50 Hz, 3 mT) on sleep and activity were studied using Drosophila (wild-type Canton-Special (CS) and mutant W1118 flies) as a model. The mRNA expressions of circadian clock genes, neurotransmitters related genes, as well as important neurotransmitters were analyzed. Result showed that ELF-EMF deteriorated the sleep reduction in Drosophila under heat stress.

PA-5 [14:30]

Biological tissue characterizations by HF band electromagnetic field

Kazuyuki Saito[1] & Takashi Yakubo[1]

[1]*Chiba University, Chiba, Japan, 2638522*

Keywords: Clinical (diagnostics), IF, Work in Progress
Presented by: Kazuyuki Saito

Characteristics of biological tissues were considered by measurement of their electrical properties in the high frequency (HF) band. “Detection of tissue coagulation” and “inspection of tissue freshness” were introduced as examples.

PA-7 [14:30]

Is it biologically plausible to use millimetre and terahertz waves for therapeutic applications?

Mats-Olof Mattsson[1], Olga Zeni[2] & Myrtill Simko[1]

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[2]*CNR-IREA, Naples, Italy, 80124*

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

Presented by: Mats-Olof Mattsson

There are many diagnostic and therapeutic situations where presently available tools (physical, chemical, biological) are insufficient. The search for improved approaches includes investigations of the usefulness of millimetre (MMW) and terahertz waves (THz). Here we investigated if published in vivo and in vitro studies provide support for the use of these waveforms in therapeutic applications, during conditions that do not cause tissue heating. Our conclusion is that there is some evidence for that both MMW and THz can influence biological systems in a manner that is not obviously driven by tissue heating. However, the number of relevant studies is very low which limits the drawing of any far-reaching conclusions.

PA-9 [14:30]

WITHDRAWN

PA-11 [14:30]

QGIS calculation method for evaluation of ELF electromagnetic field exposure of general public due to overhead power lines

Wout Joseph[1], Kris Vanhecke[1], Christophe Geuzaine[2], Leen Verloock[1], Matthias Van Den Bossche[1], Mart Verlaek[3], Michel Goethals[3] & Luc Martens[1]

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

Presented by: Wout Joseph

A calculation model (applying Gmsh and GetDP) and QGIS plug-in for simulating magnetic field contours of overhead power lines is presented. This model enables the estimation of the ELF exposure of the general population, relevant to environmental and urban planning, and can take into account future changes in the power grid. Simulations are validated with measurements and demonstrated for the region of Flanders, Belgium.

PA-13 [14:30]

Dielectric parameters for THz study of biological entities

Alireza Lajevardipour[1, 2], Zoltan Vilagosh[1, 2] & Andrew Wood[1, 2]

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[2]*Australian Centre for Electromagnetic Bioeffects Research, Melbourne, Australia*

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

Presented by: Alireza Lajevardipour

In order to accurately predict THz energy absorption in skin or microbial entities, well-known simulation method FDTD can be employed. The accuracy of results is depend on precision of dielectric parameters in the range 0.1 – 100 THz.The Gabriel database uses best-fit parameters in up to four Debye terms, to predict dielectric parameters up to 0.1 THz. Above taht, the Debye approach to predicting dielectric values is inadequate.In the case of lipid, there are no specific data sets available, however, analogous data for fat and oil is available. The lack of experimental data for

lipids, is exacerbated by some of absorption data being reported in arbitrary units.

PA-15 [14:30]

An investigation of key factors for the simplified compliance assessment of a millimeter-wave base station

Young Seung Lee[1], Haeng-Seon Lee[2], Sangbong Jeon[1] & Hyung Do Choi[1]

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[2]*Department of Electronic Engineering, Sogang University, Seoul, Korea, 04107*

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

Presented by: Sangbong Jeon

This study presents several key factors for the convenient compliance test of a millimeter-wave (mmWave) base station (BS). By using the ray-tracing simulation, we analyzed the power density (PD) output profiles from a mmWave BS installed at an urban area. Several important points which have a significant influence on the maximum PD levels are found from numerical simulations. The derived key factors indicate that the convenient compliance assessment of a mmWave BS can be performed based on the simplified model of the installation site instead of the present mandatory procedure at the actual complex environmental profile.

PA-17 [14:30]

Numerical evaluation of SAR and temperature increase due to dipole antenna in human fetus models representing actual fetal growth

Tomoaki Nagaoka[1] & Soichi Watanabe[1]

[1]*Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795*

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

Presented by: Tomoaki Nagaoka

In this study, we estimate the specific absorption rate (SAR) and temperature increase in human fetuses exposed to EM waves from a half-wavelength dipole antenna at 900 MHz and 2 GHz irradiated around the abdomen of women using pregnant female models including fetuses representing actual fetal growth.We confirmed that the peak 10g-averaged SAR in the fetus tends to slightly increase with fetal growth and the peak 10g-averaged SAR in the fetus does not exceed the SAR in the maternal body. We also found that the core temperature increase in the fetus is sufficiently smaller than the peak fetal temperature increase.

PA-19 [14:30]

Electromagnetic field exposure level using equivalent model of actual wireless power transfer system

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

Presented by: SangWook Park

Accurate dosimetry for a real wireless power transfer system requires an accurate description of the field formed by the system. In particular, the electromagnetic field depends on factors such as the construction of the transmitting and receiving coils, the circuit configuration, the input source of the front end of the transmitting coil, and the input impedance of the rear end of receiving coil. However, both circuit and electromagnetic simulations need to be performed to analyze the entire system, which is a difficult task. In order to overcome this difficulty, a method using an equivalent circuit model is proposed.

PA-21 [14:30]
STUDENT PAPER

Numerical determination of the risk of cardiac ventricular fibrillation in humans from body currents with frequencies up to 1 MHz using outcomes of animal studies

Pia Schneeweiss[1], Tobias Theiler[1], Kai Jagielski[1] & Dominik Stunder[1]

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Keywords: Dosimetry (computational), All Frequencies, Work in Progress
Presented by: Pia Schneeweiss

Cardiac ventricular fibrillation (CVF) is a potential cause of death following electrical accidents occurring when the electrical activity of the heart is disrupted. In order to determine thresholds for CVF, cadaver and animal studies were carried out in the past, which are however limited e.g. in tissue's electric properties and the utilized probes properties. Currently executed simulations with high resolution anatomical body models traversed by body currents with frequencies up to 1 MHz will be used for the derivation of CVF thresholds and can therefore help to prevent injuries caused by electrical currents in the future.

PA-23 [14:30]
STUDENT PAPER

Industrial indoor massive MIMO human EM-exposure evaluation

Sergei Shikhantsov[1], Arno Thielens[1, 2], Gunter Vermeeren[1], Emmeric Tanghe[1], Piet Demeester[1], Guy Torfs[1], Luc Martens[1] & Wout Joseph[1]

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Sergei Shikhantsov

We present a numerical method of estimating human exposure to the electromagnetic fields (EMF) of a massive MIMO base station (BS) in an industrial indoor environment e.g., an assembly line or a warehouse. The method relies on a massive MIMO channel model derived from ray-tracing simulations with stochastically generated environments. Incoming rays at the receiver location are used as the input for Finite-Difference Time-Domain plane-wave simulations with a realistic human phantom to obtain EM-exposure estimate.

PA-25 [14:30]

Influence of anatomical skin thickness of children on the whole-body SAR for future 5G-frequencies

Richard Überbacher[1] & Stefan Cecil[1]

[1]*EMC & Optics Division, Seibersdorf Laboratories, Seibersdorf, Austria*

Keywords: Dosimetry (computational), RF/Microwaves, Completed (published)
Presented by: Richard Überbacher

In this work we investigate the influence of the anatomical skin thickness on the whole body SAR of children regarding to the ICNIRP 1998 (gen.pub.) guidelines. Especially for the new upcomming 5G-frequencies, a closer realistic look and anatomical modelling of the border layers (e.g. skin and SAT) is recommended.

PA-27 [14:30]

Numerical RF dosimetry in 2D and 3D *in vitro* skin cell cultures

Rosanna Pinto[1, 2, 3], Stefania Romeo[2, 3] & György Thuroczy[3]

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[3]*Department of Non-Ionizing Radiation , National Public Health Institute, Budapest, Hungary*
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: György Thuroczy

The new developments of wireless devices operate at higher radiofrequencies with respect to the past therefore larger exposure of the human skin to such electromagnetic fields is expected. In the present work, a numerical dosimetry analysis was carried out to identify the optimal exposure conditions, in terms of efficiency and uniformity of SAR distribution of 2D and 3D in vitro skin cell cultures to 1950 MHz and 2450 MHz. At 2450 MHz the RF exposures were simulated in Wire Patch Cell (WPC) exposure system, at 1950 MHz a standard waveguide exposure system was used. Both WPC and waveguide systems provide a good efficiency, in terms of induced SAR in the skin samples to incident power.

PA-29 [14:30]

Microenvironmental RF exposimetry in kindergartens

Peter Necz[1], Noemi Nagy[1] & György Thuroczy[1]
[1]*Department of Non-Ionizing Radiations, National Public Health Institute, Budapest, Hungary, 1221*
Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
Presented by: György Thuroczy

The aim of present study was to determine RF exposure the level in the microenvironment of kindergartens in Hungary. Our assumption was that the RF exposures emitted by indoor wireless devices (DECT, WiFi) in kindergartens or in nurseries' (office) rooms are usually higher than the RF radiation from base stations. Because the Wi-Fi routers and DECT telephones are usually placed in the offices, the exposure coming from wireless sources in nurseries' room are significantly higher than the RF exposure from outdoor sources. The level of RF exposure in children's room is similar to the indoor residential exposure of general public if the indoor wireless devices are placed out of their room.

PA-31 [14:30]

WITHDRAWN

PA-33 [14:30]

A novel magnetic field sensor for the compliance with EMF Directive 2013/35/EU

Valerio De Santis[1], Tommaso Campi[1], Silvano Cruciani[1] & Mauro Feliziani[1]
[1]*Department of Industrial and Information Engineering and Economics, University of L'Aquila, Italy, Italy, 67100*
Keywords: Dosimetry (measurements), ELF/LF, Work in Progress
Presented by: Valerio De Santis

In July 2016, the Directive 2013/35/EU has become in force posing new requirements on European Union (EU) employers to evaluate the exposure of workers to electromagnetic fields (EMFs). Current instrumentation used for the EMF evaluation is insufficient to fully demonstrate compliance with exposure limits. This is particularly true in the low frequency (LF) range, where existing commercial field sensors have large probe dimensions making the measurement of near-field magnetic field sources not reliable. The aim of this study is to develop a novel magnetic field sensor to facilitate the compliance assessment against the EMF Directive limits in the LF range.

PA-35 [14:30]

Development of solutions to reduce workers exposure to ELF-EMF in live line conditions

Luis Domingues[1], Athanasio Mpalantinos[1], Carlos Barbosa[1] & Paulo Oliveira[1]
[1]*Transmission Lines and Equipment Department, Electric Energy Research Center - CEPEL, Rio de Janeiro,*

Brazil, 21941-911
Keywords: Dosimetry (measurements), ELF/LF, Work in Progress
Presented by: Luis Domingues

There are situations, in the operation of an electrical transmission network, when, either routine or emergency maintenance activities, must be performed without disconnecting the transmission line (live line work). Those activities are necessarily executed at short distances from electrically energized parts, where electric and magnetic fields are presumably high. This article presents the sequence of studies - computational modeling, laboratory and field measurements - developed in order to control occupational exposure of electricians performing maintenance activities on energized transmission lines and substations.

PA-37 [14:30]
STUDENT PAPER

MRI patient exposure - characterization and sequence-comparisons

Jennifer Frankel[1], Kjell Hansson Mild[1] & Jonna Wilen[1]
[1]*Department of Radiation Sciences, Umeå University, Umeå, Sweden, 90187*
Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)
Presented by: Jennifer Frankel

The unique mixture and intensity of magnetic fields experienced by the patient during an MRI exam are quite complex from an exposure perspective. We measured the RF- and gradient magnetic fields inside a 3T MRI scanner and extracted several exposure parameters to give a comprehensive description of the exposure of each sequence. We found significant differences between sequences for each of the exposure parameters studied. We also found within-sequence variation. This means that MRI exposure is not only sequence-specific but also specific to the individual patient and exam occurrence, a complexity which must be kept in mind when performing exposure assessment for epidemiological studies on MRI.

PA-39 [14:30]

Exposure assessment of commercially available Infrared (IR) Panels

Peter Gajšek[1], Tomaž Trček[1] & Blaž Valič[1]
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Keywords: Dosimetry (measurements), Optical, Completed (unpublished)
Presented by: Peter Gajšek

In this study, exposure assessment of different commercially available IR panels was done. We have investigated exposure to power frequency magnetic field and far infrared radiation. The results showed that the measured values were below the current ICNIRP guidelines. For the worst case scenario, when standing closer than 0.5 m directly in front of the IR panel of 1000W and 1400 W, respectively, and continuously staring at it for at least 1000 seconds at an outside temperature of 22 °C, the limit values for cornea and lens damage of 190 W/m^2 according to ICNIRP guidelines were exceeded.

PA-41 [14:30]
STUDENT PAPER

Measurement and health assessment of electromagnetic fields by electric vehicles during road traffic operation using driving characteristics

Kai Jagielski[1], Pia Schneeweiss[1], Dominik Stunder[1] & Thomas Kraus[1]
[1]*Research Center for Bioelectromagnetic Interaction (femu), RWTH Aachen University, Aachen, Germany, 52074*
Keywords: Dosimetry (measurements), Pulsed, Work in Progress
Presented by: Kai Jagielski

This contribution introduces a measurement system which enables magnetic field measurements in

the frequency range between 1 Hz and 400 kHz on electric vehicles during vehicle operation. The additional recording of the driving style, with acceleration sensor, gyroscope and GPS module, allows a detailed investigation of the influence of various vehicle components on the magnetic field spectrum. First measurement results of electric cars and the evaluation possibilities are presented. In future, measurements will be carried out for example at wireless charging systems or electric buses.

PA-43 [14:30]

Spatial variations of personal exposure to radiofrequency electromagnetic fields at the University of Castilla-La Mancha (Spain)

Alberto Juárez-Castillo[1] & Alberto Nájera[1]

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

Presented by: Alberto Nájera

Summary: We measured personal exposure to RF-EMF in 4 different microenvironments of 7 buildings of the University of Castilla-La Mancha in Albacete (Spain). Exposure to WiFi 5G was predominant in all the buildings. Mobile telephone signals represented a small percentage of the total exposure.Regarding the correlation study, only the average exposure of some centres was statistically significant, but in all cases less than 0.550. Exposure varies from each microenvironment and building.

PA-45 [14:30]

Exposure to radiofrequency electromagnetic fields (RF-EMF) assessment: comparison between spot and personal exposimeter measurements in Taracón (Spain)

Alberto Nájera[1], Jesus Alpuente-Hermosilla[2], Jesus Gonzalez-Rubio[1], Rocio Sanchez-Montero[2] & Pablo Luis[2]

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

Presented by: Alberto Nájera

Summary: In this paper, we compare RF-EMF exposure levels determined by this two equiment: a broadband isotropic probe (NARDA EMR-300) and personal exposimeter (Satimo EME Spy 140) in 38 different locations for 6 minutes covering the whole urban area of Tarancón (Spain).

PA-47 [14:30]

A study on the verification of the exposure system and the SAR values of the exposed cells in in vitro experiments

Jaesung Lee[1], Hyungsang Ahn[1], Junoh An[1], Sangbong Jeon[2] & Jeong-Ki Pack[3]

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

Presented by: Jaesung Lee

This study was conducted to verify the SAR values of the exposed cells in an in vitro experiment. In this study, the signal output power and the temperature change in the Petri Dish were measured, and the exposure level of the electromagnetic wave was derived based on the measurement data. The results show that power of 3.09W is estimated as the appropriate source input for 1W/kg of 1g-averaged SAR and 24.72W for 8W/kg of 1g-averaged SAR.

PA-49 [14:30]

The response of magnetotactic bacteria suspensions to radiofrequency in the UHF & SHF ranges: A prospective study

Simona Miclaus[1], Cristina Moisescu[2], Ioan I. Ardelean[2], Lucian Barbu-Tudoran[3], Ioan Ardelean[4], Lourdes Farrugia[5], Charles Sammut[5] & Paul Bechet[1]

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

Presented by: Simona Miclaus

As biogenic magnetite nanoparticles encapsulated in a membrane forming magnetosomes inside magnetotactic bacteria are excellent competitors of magnetic nanoparticles obtained by chemical synthesis, their study over a wide frequency band in the upper part of radiofrequency spectrum may provide knowledge for new technological applications. On the other hand, impact of power loss production and deposition in magnetite crystals due to the magnetic component of the absorbed field is not yet studied in case of various communication devices worn near the head (case of tissues contain magnetite). In this regard a set of experiments were carried out to follow the energetic response of magnetite at hundreds-thousands of MHz.

PA-51 [14:30]

WITHDRAWN

PA-53 [14:30]

EMF measurement probes are prone to errors for modulated signals

Antonio Sarolic[1] & Pawel Bienkowski[2]

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[2]*Technical University of Wroclaw, Wroclaw, Poland, 50-370*

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

Presented by: Antonio Sarolic

Electromagnetic field (EMF) measurement probes are commonly used for performing health hazard assessments. EMF waveforms are rarely purely sinusoidal, leading to measurement errors of diode-based EMF probes. The existence of such errors is known to researchers, but their accurate magnitude with respect to the signal waveform is less known. This study shows that the error magnitude depends on the individual probe, and can be surprisingly significant.

PA-55 [14:30]

ELF measurements around powerlines for validation with operator data

Fabian Schneider[1], Philipp Bachmann[1], Marco Zahner[1, 2] & Jürg Fröhlich[1]

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[2]*Institute of Electromagnetic Fields (IEF), ETH Zurich, Zürich, Switzerland, 8092*

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

Presented by: Fabian Schneider

Field strength measurements of specific configurations of powerlines at different maximum current patterns are difficult to estimate in reality. Therefore, different measurement methods are proposed and compared to an analytical field calculation based on actual grid data.
With the long term measurement results changes in the field strength due to load regulation can be clearly recognized. The ground measurements show a good agreement between the simulation and the measurements. Aerial measurements using a Quadro copter are a viable solution. However, due to movement artifacts, position uncertainties and simulation inaccuracies a direct comparison of the

two is difficult to achieve.

PA-57 [14:30]

Versatile RF electromagnetic fields exposure meter

Marco Zahner[1, 2], Fabian Schneider[1] & Jürg Fröhlich[1]

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

Presented by: Marco Zahner

To cope with the variety and complexity of today's wireless communication systems and standards, flexible exposure assessment instrumentation is necessary. The state of the art approach of measuring the average field strength in a predefined set of frequency bands does not provide the granularity required to discern the contributions from different mobile standards and devices operating in the same frequency band, and it can also miss important contributions when new frequency bands are allocated or modified. A measurement approach allowing to solve these problems has been tested and implemented in a handheld prototype device.

PA-59 [14:30]

Multi-modal measurements of occupational exposure to extremely low frequency fields in a 110 kV substation

Lei Zhang[1, 2], Peng Gao[1, 2], Feizhou Zheng[1, 2] & Zheng-Ping Yu[1, 2]

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

Presented by: Lei Zhang

This study described the characteristics of ELF-EMF in a typical 110 kV substation in China using a multi-mode measurement protocol. The geometric means of electric field (E field) strengths in different working areas ranged from 0.42 V/m to 2458.31 V/m. The geometric means of magnetic field (H field) flux densities ranged from 0.12 μT to 16.29 μT. This study provides a comprehensive description of occupational exposures to ELF-EMF in a typical Chinese 110 kV substation. In addition, the multi-mode measurement protocol provides a scenario of EMF distribution both in time and space-dependent manner.

PA-61 [14:30]

Novel and versatile instrumentation for electro-manipulation of cancer stem cells

Ilan W. Davis[1, 2], Caterina Merla[3], Alessandro Zambotti[4], Arianna Casciati[3], Mirella Tanori[3], Jonh Bishop[2], Cristiano Palego[1], Mariateresa Mancuso[3] & Christofer P. Hancock[1, 2]

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Keywords: Electroporation, Pulsed, Work in Progress

Presented by: Caterina Merla

This paper presents novel instrumentation combined with an artificial 50 Ω buffer for possible fast neutralization of cancer stem cells. The results from an initial bench study investigates the performances of a developed electroporation generator capable of delivering non-thermal treatments in combination with an original cuvette housing unit containing suitable solutions of cancer stem cells. Initial investigation for electropermeabilization threshold of cancer stem cells was conducted, indicating that the developed devices and protocols have a strong potential in achieving

electro-manipulation of this biological target.

PA-63 [14:30]

A stripline system for the exposure of ex-vivo samples to nanosecond pulsed electric fields

Alessandra Paffi[1], Alessandro Banin[1], Agnese Denzi[1], Maura Casciola[2], Micaela Liberti[1] & Francesca Apollonio[1]

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Keywords: Electroporation, Pulsed, Work in Progress

Presented by: Alessandra Paffi

We present an exposure system, based on a slotted stripline, to stimulate frog nerves with the use of nanosecond and sub-nanosecond pulsed electric fields (nsPEFs). The system guarantees the electromagnetic compatibility with laboratory equipment and exhibits a very good impedance matching up to 3 GHz, thus allowing the undistorted propagation of nsPEFs. Through a hole (3 mm of diameter) on the outer enclosure, the system permits a localized exposure of the nerve to a maximum |E| field of 0.8 kV/m for 1 W of input power. This is compatible with conventional electrical stimulation of nervous systems using much longer pulses; however experimental studies are needed to identify a stimulation threshold for such short pulsed signals.

PA-65 [14:30]
STUDENT PAPER

Enhancement of *in vitro* gene electrotransfer using gold nanoparticles

Tjasa Potocnik[1], Tina Batista Napotnik[1], Tamara Pezić[1], Matej Reberšek[1] & Damijan Miklavčič[1]

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Keywords: Electroporation, Pulsed, Work in Progress

Presented by: Tjaša Potočnik

Gold nanoparticles when added to cell suspension prior to electroporation significantly increased transfection rate using monopolar pulses in vitro. When bipolar pulses were used for gene electrotransfer, the presence of gold nanoparticles had no effect on transfection rate. Our results show the possibility of providing sufficient transfection rate with lower voltage applied to cells in presence of gold nanoparticles.

PA-67 [14:30]

Ablate orthotopic pancreatic cancer in animal model with repetitive nanosecond pulsed electric field

Shengyong Yin[1], Guanlei Deng[2], Zhen Liu[2], Chao Zheng[2], Keping Yan[2] & Shusen Zheng[1]

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Keywords: Electroporation, Pulsed, Completed (unpublished)

Presented by: Shengyong Yin

A homemade R-nsPEF can ablate tumor detectable tumor safely and effectively. It had been investigated that the potential clinical application of this pulsed electric field energy supply by ablating large volume tumor with the pulse duration less than 100 nanoseconds. It indicated that more accurate targeted and minimally invasive focal ablation modality could be achieved by nsPEF with less energy.

PA-69 [14:30]

Maternal exposure to high levels of magnetic field non-ionizing radiation during pregnancy and the risk of preeclampsia: A large prospective cohort study

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Keywords: Epidemiology, ELF/LF, Work in Progress
Presented by: De-Kun Li

In this prospective cohort study, maternal exposure to high levels of magnetic field (MF) non-ionizing radiation during pregnancy was found to be associated with increased risk of preeclampsia. The observed association showed a dose-response relationship with increasingly higher MF levels being associated with a greater risk of preeclampsia. The presence of other risk factors for preeclampsia appears to exacerbate the risk associated with MF exposure. The finding provides new evidence that MF may impact immunological function.

PA-71 [14:30]

WITHDRAWN

PA-73 [14:30]
STUDENT PAPER

Repeated long term exposure of Mesenchymal Stem Cells to electric fields using a new pulse generator

Shirmone Botha[1], Borja Lopez[2], Óscar Lucía[2], Héctor Sarnago[2], Alejandro Naval[2], José-Miguel Burdio[2], Adeline Muscat[1], Tomás García-Sánchez[1], Franck Andre[1] & Lluis M. Mir[1]
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Keywords: Human, Pulsed, Work in Progress
Presented by: Shirmone Botha

In mesenchymal stem cells (MSCs), numerous studies describe the spontaneous oscillations of cytosolic calcium at various concentrations. We demonstrate that the application of one high voltage micro second pulse disrupts natural calcium oscillations making it possible to insert an additional synthetic calcium oscillation pattern over several hours. This study strengthens the perception that pulsed electric fields can be used as a tool to manipulate calcium oscillations in human adipose derived MSCs using a novel pulse generator as the one specifically developed. These manipulations might be used as a tool to improve MSC engineering.

PA-75 [14:30]
STUDENT PAPER

A novel method for estimation of brain tissue electrical conductivity: from *in silico* to *in clinico* results

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Keywords: Human, ELF/LF, Completed (unpublished)
Presented by: Andres Carvallo

OBJECTIVE: Estimating brain tissue electrical conductivity using low-intensity pulse stimulation. METHODS: We derived an analytical model of the electric potential generated by SEEG electrodes. We coupled the electric potential with an electrode-electrolyte interface model to i) derive an analytical expression of brain tissue response to biphasic pulses and ii) estimate conductivity. RESULTS: We validated our biophysical model using i) saline solutions calibrated for electrical conductivity, ii) rat brain tissue, and iii) intracerebral electrophysiological data recorded in epileptic patients during pre-surgical evaluation. CONCLUSIONS: Rapid and reliable brain tissue electrical conductivity estimation is achieved using the proposed method.

PA-77 [14:30]

Risk perceptions of mobile communication in Japan: A 2017 survey

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

Presented by: Ayumi Masuchi

This study was conducted to reveal average person's knowledge and risk perceptions related to mobile communication in Japan. A Web survey was completed by 300 teenagers and 2,000 adults. The results were compared to our 2013 survey results. While most used mobile phones more frequently, respondents' information and knowledge level about the risks of electromagnetic fields radiating from mobile phones and base stations was about the same or lower than in 2013. Their concern level was slightly lower. Most respondents did not consider the risk as serious and did not have a clear opinion. Young people use mobile phones longer, feel more physical discomfort and worry more about the health effects when using mobile phones than older adults.

PA-79 [14:30]

Effect of Radio Frequency Radiation (RFR) emitted from cell phone on human health

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Keywords: Human, RF/Microwaves, Work in Progress

Presented by: Dr. Radhey Shyam Sharma

No conclusive data available so far on the adverce effect of RFR emitted from cell phone. Even epidemiological evidences generated so far are inadequate for a comprehensive evaluation of risk caused by RFR. To address the above issue, the ICMR is undertaking a multi-disciplinary prospective cohort study in Delhi to find out adverse effects of RFR, if any, emitted from cell phone on adult Indian population. The details of the protocol, the current status of the study and other ongoing research activates in this area of public importance going on in the country will be presented during the conference.

PA-81 [14:30]

Effect of the 1800 MHz-RF exposure on in vitro neuronal networks activity: role of the modulation frequency

Corinne El Khoueiry[1], Thinhinane Yebda[1], Audrey Giremus[1], Rémy Renom[1], Florence Poulletier De Gannes[1], Emmanuelle Poque-Haro[1], Isabelle Lagroye[1], Bernard Veyret[1] & Noëlle Lewis[1]

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Keywords: In vitro, Pulsed, Work in Progress

Presented by: Isabelle Lagroye

In a previous study, we reported a clear decrease in bursting rate of neuronal cultures under RF-1800 MHz exposure. The amplitude of the effect was greater with the GSM-1800 MHz signal compared to the CW signal. The present work aimed at assessing the contribution of the modulation frequency of the pulsed RF signal in the elicitation of the effect. We tested different multiples of the GSM modulation frequency (108.5; 217; 434 and 868 Hz) at the same averaged SAR level (2.4 W/kg). The preliminary results show that the effect was present for the GSM frequency (217 Hz) but not for other frequencies. Further work is ongoing to elucidate the mechanism of this effect.

PA-83 [14:30]

The BBEMG research program - A multidisciplinary approach in studying long-term effects

of ELF-EMF

Maryse Ledent[1], Maurice Hinsenkamp[2], Jean-Francois Collard[2], Catherine Bouland[3], Christophe Geuzaine[4], Veronique Beauvois[4] & Luc Verschaeve[1]

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

Presented by: Maryse Ledent

Since 1995, the Belgian BioElectroMagnetics Group (BBEMG) investigates health effects of ELF-EMF. In the current 2017-2021 project, six research teams from three universities (Liège, Gent, Brussels) and one research institute (Brussels) work together in a multidisciplinary way. Three main topics are considered: (1) Epidemiological reviews and meta-analysis of childhood leukaemia; (2) EMF exposure modelling from the HV network; (3) Long-term occupational and residential ELF-EMF exposure. This paper is focusing on the latter topic. A collaborative research combining a cytogenetic biomonitoring study of EMF-exposed workers, an analysis of gene expression profiles and a survey on cumulative environmental nuisances is being set up.

PA-85 [14:30]

The effect of radiofrequency electromagnetic field at 1.7 GHz LTE on human adipose-derived stem cells and liver cancer stem cells

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Keywords: In vitro, Static, Work in Progress

Presented by: Kiwon Song

Due to the technology of mobile phone, we are daily exposed to LTE RF-EMF, but its biological effects have not been clarified. In particular, in spite of the physiological importance of adult stem cells and cancer stem cells, their response to LTE RF-EMF is not much studied. In this study, we investigated the cellular effect of 1.7 GHz RF-EMF (LTE) on adult and cancer stem cells. When continuously exposed to 1.7 GHz RF-EMF at 1 W/kg for 72 h, the proliferation of both adipose stem cells (ASC) and cancer stem cells of Huh7 was decreased: 8% in ASC and 30% in cancer stem cells of Huh7 compared to unexposed controls. These results suggest that the cancer stem cells are highly more sensitive to 1.7 GHz RF-EMF than normal adult stem cells.

PA-87 [14:30]

Development of intermediate frequency band exposure apparatus and its effect on cultured cells

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Keywords: In vitro, IF, Work in Progress

Presented by: Eijiro Narita

We developed an exposure apparatus that generates an intermediate frequency at 85 kHz. We carry out various cell experiments in pursuit of the possibility that the intermediate frequency exerts a non-thermal effect. We examined the cell proliferation test, the colony forming ability test, and the cell cycle distribution test using HCE-T cells, which is derived from human cornea. We confirmed that this device retains a normal culture environment without any artefact. Exhaustive gene expression analysis of human cells will be carried out by standard cell experiment method widely used as safety evaluation in future.

PA-89 [14:30]

Effects of ultraviolet radiation on full thickness human skin model *in vitro* (SKIN-RF project)

Zsuzsanna Nemeth[1], Györgyi Kubinyi[1], Jozsef Bakos[1], Brahim Selmaoui[2] & György Thuroczy[1]

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Keywords: In vitro, Optical, Work in Progress

Presented by: Zsuzsanna Nemeth

The aim of this study was to examine whether the solar ultraviolet (UV) radiation has any effect on cytokine (IL-1α, IL-6, IL-8) and MMP-1 enzyme secretion on human skin model in vitro. The full thickness skin models were exposed by a sun simulator lamp to UV radiation (1.5 SED, 3 SED). The IL-1α, IL-6, IL-8 and MMP-1 concentrations were measured 24 hours after UV exposure from the culture medium by the ELISA method. In this study we managed to show that UV radiation doses of 1.5 SED, 3 SED did not alter the level of these factors. This experiment was done as a preliminary study for the project named “Cellular response to co-exposure of radiofrequency (RF) and solar ultraviolet (UV) radiation in human in vitro skin model (SKIN-RF)”.

PA-91 [14:30]
STUDENT PAPER

Local thermal dosimetry applied to in vitro studies at millimetre waves

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

Presented by: Rosa Orlacchio

This study investigates the role of thermal convection arising from high SAR gradients during in vitro exposure to millimetre waves (MMW). The impact of the liquid volume and exposure duration on initiation of convective currents is investigated. Water and a convection-free medium with water-equivalent electromagnetic properties have been exposed to continuous wave (CW) and amplitude modulated MMW. Continuous and pulsed heating were recorded using a microthermocouple. Our results suggest that convection plays an important role in MMW-induced heating in in vitro experiments, and its initiation depends both on the volume of the exposed liquid and the duration of exposure.

PA-93 [14:30]

Radiofrequency radiation (RFR) induces Bad, p-Bad activation leading to cell apoptosis on DLD1 human colon carcinoma cell lines

Elcin Ozgur[1], Fatih Senturk[1], Gorkem Kismali[2], Tevhide Sel[2] & Goknur Guler[1]

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

Presented by: Fatih Senturk

In this study, radiofrequency radiation (RFR) effects investigated on Bad and p-Bad the pro-apoptotic member of the Bcl-2 family inhuman colon cancer cell, DLD1.We evaluated the effects of intermittent RFR exposure (digitally modulated 3GPP signals at 900, 1800, 2100 MHz) for 1 hr and 4 hrs (15 min on, 15 min off). Bad, p-Bad expressions determined by ELISA increased due to 900 and 2100 MHz RFR exposure for 1h. However, 4 hours of RFR exposure lead to decrease in all parameters ($p<0,05$ and less). Overexpression of Bad has been shown to induce apoptosis, so it is

concluded that intermittent exposure of RFR might induce apoptosis by Bad and p-Bad expression on DLD-1 cancer cells.

PA-95 [14:30]

Evaluation of biological effects induced by electromagnetic radiation waves

Flavien Pillet[1], Jelena Kolosnjaj-Tabi[1], Rene Vezinet[2] & Marie-Pierre Rols[1]

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Keywords: In vitro, Pulsed, Completed (unpublished)

Presented by: Marie-Pierre Rols

We developed a set of micro applicators to study the potential effect of electromagnetic fields on biological samples. The applicators allow a real-time observation.Different signals were used: electromagnetic waves and square-wave monopolar electric field pulses causing electroporation. The biological effects were assessed on giant unilamellar vesicles and mammalian cells, and compared to results obtained at full scale with signals generated by antennas.

PA-97 [14:30]

50 Hz MF exposure has no significant DNA damage effect on ATM deficient MEFs

Yumin Jin[1], Chuan Sun[1], Xiaoxia Wei[1], Aziguli Yimaer[1], Zhengping Xu[1] & Guangdi Chen[1]

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

Presented by: Yumin Jin

The genotoxicity of ELF-ME exposure has been widely studied, however, the results are inconsistent. In our study, we investigated the effect of 2.0 mT 50 Hz MF exposure on a DNA repair factor (ATM) proficient and deficient MEFs. The results showed that, in either wide type or ATM deficient MEFs, 50 Hz MF exposure did not significantly induce DNA damage, and could not affect cell apoptosis and cell viability, suggested that the 50 Hz MF exposure enhance DNA damage in ATM deficient MEFs.

PA-99 [14:30]
STUDENT PAPER

Effect of high frequency electric field on growth factor of cultured osteoblasts

Shunsuke Yamaguchi[1], Masatake Akutagawa[1], Hiromichi Yumoto[2], Kouji Hirao[2], Takahiro Emoto[1], Hiroo Tarao[3], Toshihiko Tominaga[4], Toshitaka Ikehara[5] & Yohsuke Kinouchi[1]

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Keywords: In vitro, IF, Work in Progress

Presented by: Shunsuke Yamaguchi

In this experiment, high frequency AC voltage was applied to cultured osteoblasts. The voltage waveform used is a sinusoidal wave of 500 kHz 20 V. Temperature, voltage, osteoblastic VEGF, VEGFmRNA and ALP were measured. VEGF and VEGFmRNA were measured 1 day after voltage application and ALP was measured 7 days after. Durations of voltage application were 30, 60, 90 and 120 s. As results of them, it is obvious that it affects the osteogenesis of osteoblasts by electrical factors. Although it depends on the initial state (cycle) of the cells, VEGF was significantly increased at 90 seconds and VEGFmRNA at 120 seconds. Change of ALP by application of the elecrical field was not observed in our experiment.

PA-101 [14:30]

Impact of microwave irradiation on enzyme activities, cell membrane properties and bacterial growth at constant temperatures

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Keywords: In vitro, RF/Microwaves, Other

Presented by: Tony Yan

Exposure of trypsin, but not amylase or phosphatase, to microwave at constant temperature leads to a significant increase in its apparent activity. The membrane properties of PC3 prostate cancer cells were found perturbed when the cell culture was subjected to 10 W microwave at 37°C. Lastly, bacterium E. coli growth was slowed down under non-lethal microwave irradiation, again, at constant 37°C. Proteomic analysis revealed subtle changes to E. coli under these conditions.

PA-103 [14:30]

Localized intracellular temperature increase and ROS formation in immune relevant cells under ELF-MF exposure: exposure set-up and procedures for real-time and post-exposure measurements

Olga Zeni[1], Anna Sannino[1], Maria Rosaria Scarfi[1], Stefania Romeo[1], Mats-Olof Mattsson[2, 3] & Myrtill Simko[3]

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

Presented by: Olga Zeni

In this study we address the question if there is a possible correlation between reactive oxygen species formation and intracellular localized temperature increase (“hot spots”) in immune relevant cells under ELF magnetic field exposure. A specific in vitro experimental procedure has been established for real-time and post-exposure measurements of ROS formation and intracellular temperature change.

PA-105 [14:30]

Mobile phone radiation induces mode-dependent DNA damage in a mouse spermatocyte-derived cell line: a protective role of melatonin

Lei Zhang[1, 2], Chuan Liu[1, 2], Qin-Long Ma[1, 2], Zhou Zhou[2, 3] & Zheng-Ping Yu[1, 2]

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

Presented by: Zheng-Ping Yu

This study evaluated whether exposure to mobile phone radiation (MPR) can induce DNA damage in male germ cells. The levels of DNA damage were significantly increased following exposure to MPR in the listen, dialed and dialing modes. Moreover, there were significantly higher increases in the dialed and dialing modes than in the listen mode. However, the DNA damage effects of MPR in dialing mode were efficiently alleviated by melatonin pretreatment. These results regarding mode-dependent DNA damage have important implications for the safety of inappropriate mobile phone use by males of reproductive age and the protective role of melatonin.

PA-107 [14:30]

Characterization of the suppressive effects of extremely-low-frequency electric fields on a stress-induced increase in the plasma glucocorticoid level in mice

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

Presented by: Takuya Hori

Recently, we found that in male BALB/c mice, the immobilization-induced increase in serum glucocorticoid (GC) was reduced by exposure to an electric flied (EF) of 50 Hz, when the voltage was applied via the upper electrode of a parallel plate electrode system. This effect was dependent on both intensity (kV/m) and exposure time. The present study aimed to assess the anti-stress effect of the EF in 3 scenarios with the experimental system: the use of either 50 or 60 Hz, which are the standard power frequencies in most regions; varying levels of environmental brightness; complete or partial shielding of the mouse from the EF. We compared the GC levels among control, EF-alone, immobilization-alone, and co-treatment groups.

PA-109 [14:30]
STUDENT PAPER

Effect of long-term RF-EMF exposure on microglia activation in 5xFAD mice

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

Presented by: Ye Ji Jeong

To explore the long-term RF-EMF effect on Alzheimer's disease, we performed 6 months RF-EMF exposure to 5xFAD mice (SAR 5W/kg, 2 h/day, 5 days/week) and investigated behavioral changes and neuroinflammatory response. 5xFAD mice exposed to long-term RF-EMF showed mild decrease in Aβ deposition, memory improvement, and decrease in expressions of Iba-1 and microglia regulator genes compared to sham exposed group. Our finding suggests possible mechanism of beneficial effect of long-term RF-EMF on AD mice.

PA-111 [14:30]

The effect of exposure to radiofrequency-electromagnetic field on serotonin metabolism in rat

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

Presented by: Young Hwan Ahn

The study investigated whether exposure to the radiofrequency identification signal could affect on serotonin metabolism in rat. The preliminary results showed that RF-EMF exposure for 8 hours daily for 2 weeks at whole-body SAR of 2 W/kg to the adult Sprague-Dawely rats caused a significant reduction of urinary level of 5-methoxyindole-3-acetic acid, although urinary levels of serotonin and 5-hydroxyindoleacetic acid were not change significantly.

PA-113 [14:30]

Brain sensitivity to electromagnetic fields (4G) at various ages in the rat: memory persistence and associated genetic programs

Anne Pereira de Vasconcelos[1], Aurélie Bonelli-Salvadori[1], Marie-Muguet Klein[1], Brigitte Cosquer[1], Niels Kuster[2], Myles Capstick[2] & Laurette Boutillier[1]

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

Presented by: Anne Pereira de Vasconcelos

We studied, in young, adult and aged rats, the effects of a 3-month exposure to a 4G signal (LTE, 900 MHz, $SAR_{whole\ body}$ 0.33 W/kg, ~ 61 V/m) in a reverberation chamber (4 h/day, 5 d/week). Chronic RF exposure did not affect acquisition or long-term retention of a spatial memory in the Morris water maze, whatever the age. Anxiety and locomotion were also not changed by RF. In adult rats and in resting conditions, RF exposure induced a significant number of differentially expressed genes (RNA Seq) in the prefrontal cortex. The 47 up-regulated genes were functionally associated with myelination, while the 33 down-regulated genes were associated with different isoforms of collagen. These gene expression data are currently under validation.

PA-115 [14:30]

Effect of rotating magnetic field on oocytes maturation

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Keywords: In vivo, Static, Completed (unpublished)

Presented by: Tianying Zhan

key word: rotary non-uniform magnetic fields; in vivi; oocytes; ovarian; ATP content; mitochondrial respiratory chain; completed(unpulished). Presented by: Tianying Zhan.

PA-117 [14:30]

Investigation of high frequency electromagnetic field component of cold microwave argon plasma - Effects of modulation of skin microcirculation wound healing and regeneration in mice in vivo

Lubomir Traikov[1], Todor Bogdanov[1], Nicoll-Ellen Kafozoff[1], Radka Hadjiolova[2], Liubina Vesselinova[3], Margarita Kouzmanova[4], Gabriela Atanasova[5] & Nikolai Atanasov[5]

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

Presented by: Lubomir Traikov

Current work present results of health effects of Cold Microwave Argon Plasma-CMAP over stimulation of processes of skin wound healing and regeneration. In order to explore the influence of

all physical and chemical factors of this physical complex system we separated high frequency electromagnetic field component from net argon gas flow. In order to evaluate biological effects of high frequency electromagnetic field HF-EMF, we investigate micro-vessel tone response, using Laser Doppler Flowmetry-LDF. After HF-EMF action, no significant increase of surface body temperature of investigated animals was detected using high-resolution FLIR-camera, but an increase of the skin blood flow was measured by LDF.

PA-119 [14:30]

Molecular dynamics simulations of the A2A adenosine receptor in presence of magnetic field

Elena della Valle[1], Federico Del Signore[1], Paolo Marracino[1], Davide Cocco[1], Stefania Setti[2], Ruggero Cadossi[2], Micaela Liberti[1] & Francesca Apollonio[1]

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Keywords: Mechanistic/Theoretical, Static, Work in Progress

Presented by: Francesca Apollonio

In this paper, we present the implementation of an external static magnetic field with the Velocity Verlet algorithm for performing Molecular Dynamics simulations. Molecular Dynamics simulations allow to understand at molecular level the interaction mechanisms between atoms under specific conditions. Here MD simulations of a receptor protein have been performed in presence of an external magnetic field in order to try to elucidate specific endpoints of interaction with the field.

PA-121 [14:30]
STUDENT PAPER

Steepest-entropy-ascent quantum thermodynamic approach to scaling the electric field parameters and criticality related to cell signaling in electrically perturbed cells: Experimental evidence and rationale

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Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

Presented by: Ishan Goswami

A successful coupling of standard cancer treatment modalities with electric field-based tumor ablation techniques requires a general understanding of the mechanism of action of each modality to evaluate synergistic effects for better treatment efficacies. The caveat, however, is that the electric field parameter space and the molecular pathways are so large that understanding the mechanism of action of electric fields via exploring all possible combinations is prohibitive from a cost and time standpoint. To solve this parameter space problem, this work introduces a new computational approach that takes advantage of thermodynamic scaling laws applicable to bio-membranes. We report experimental evidence and the rationale behind this approach.

PA-123 [14:30]

Down-regulated miR-30a induced promotes neuronal autophagy by activating the AMPK signaling pathway after microwave exposure

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

Presented by: Ruiyun Peng

miR-30a is involved in the pathogenesis and progression of multiple diseases by affecting

autophagy, however, the mechanism under the regulation of autophagy by miR-30a has not been elucidated. In this study, the regulation mode of autophagy by miR-30a in neurons after microwave exposure was explored. The result found that microwave exposure reduced the expression of miR-30a in neurons, which could promote autophagy via activating the AMPK signaling pathway.

PA-125 [14:30]

Experimental platform for measurement of biological response of cells to weak low frequency magnetic fields

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

Presented by: Michal Teplan

The goal of our research is to design a complex experimental platform enabling efficient scanning through magnetic field parameters, while searching for specific response of investigated biosystem. The methods are focused on the impedance spectroscopy in order to determine the response in growth rate of cell cultures as well as in the electrical characterization of cell structures.

PA-127 [14:30]

EMF exposures near the electrical gastronomy devices – low and radiofrequency evaluation

Krzysztof Gryz[1], Jolanta Karpowicz[1] & Patryk Zradziński[1]

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Keywords: Occupational, All Frequencies, Work in Progress

Presented by: Krzysztof Gryz

The aim is to identify and evaluate combined EMF near electric gastronomy devices (common private and business use) - ELF magnetic and RF electric components, both covered by IARC 2B classification. Both components recorded near microwave ovens significantly exceed average level of population exposure - ELF up to 10μT; RF up to 14V/m. Special attention during EMF measurements and evaluation is needed for exposure time-pattern - devices of continues EMF emission, as well as pulsed (keyed) were found. Results shown that professional activities near electrical gastronomy devices may play dominant role in the EMF cumulative exposure.

PA-129 [14:30]

Single nucleotide polymorphisms in 5-HTR and GRIN2B associated with risk of cognition dysfunction in electric workers?

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

Presented by: Xiangjun Hu

There were some abnormal characterizations of the brain and cardiac function in workers engaged in electric company for long time.The latency of N2 and P3 in TT genotype of rs6313, the N2 latency and the contents of LENK in GG genotype of rs6295, the N2 latency in CC genotype of ENS10557853 were prolonged, with the increase of exposure dosage respectively compared to CC, CG and TT genotypes. 5-HT1AR in rs6295 G allele, GRIN2B in ENS10557853 C allele and 5-HT2AR in rs6313 T allele might increase the risk of cognition retardation in the electric workers.

PA-131 [14:30]

A systematic review on biological effects of magnetic, electric and electromagnetic fields in the intermediate frequency range (300 Hz–1 MHz)

Lambert Bodewein[1], Kristina Schmiedchen[1], Dagmar Dechent[1], Dominik Stunder[1], David Graefrath[1], Lukas Winter[1], Thomas Kraus[1] & Sarah Driessen[1]

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Keywords: Public Health Policy, IF, Completed (published)

Presented by: Dagmar Dechent

The aim of this systematic review was to provide an update of the state of research on effects of electromagnetic fields in the intermediate frequency range on biological systems. Fifty-six experimental studies were eligible with only few human studies and no epidemiological study. Included studies examined several in vivo and in vitro systems and different endpoints and found inconsistent evidence for field effects. No indications for effects of specific applications using intermediate frequency fields were found. Weak intensity fields and frequencies >100 kHz have been scarcely investigated. Methodological limitations lowered the credibility of studies. Future work should consider the identified shortcomings and gaps of knowledge.

PA-133 [14:30]

Specific absorption rate reduction design of dual-band planar monopole antenna with defected ground structure for WLAN applications

Min-Joo Jeong[1], Ji Woong Park[1], Byeong-Nam Kang[1], Niamat Hussain[1], Hanul Bong[1] & Nam Kim[1]

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

Presented by: Niamat Hussain

In this paper, we proposed a planar monopole antenna with dual band characteristics that can be used in 2.4 GHz band and 5 GHz band of WLAN. We also calculated the Specific Absorption Rate (SAR) for 1 g tissue at 0 mm distance from head instead of 10 mm, which is stricter than the international standard, and compared it with SAR values with and without reflector at 2.4 GHz and 5.8 GHz. Compared with the international standard 1 g tissue SAR value (1.6 W/kg), the proposed antenna with reflector reduces about 86.38 % (@ 1.382 W/kg difference) at 2.4 GHz and 81.18 % (@ 1.299 W/kg difference) at 5.8 GHz.

PA-135 [14:30]

Risk perception of manufacturing industry labors exposure to ELF-MF at work

M.D Rajitha Kawshalya[1], Yun Jin Lee[2] & Seung-Cheol Hong[1, 2]

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

Presented by: M.D Rajitha Kawshalya

The questionnaire survey was conducted among the industrial labors to investigate the risk perception of exposure to extremely low-frequency magnetic fields (ELF-MF) at the workplace. The study subject was the foreign labors who currently occupied in Korea as labors under the employee permits system by the Korean government. These workers are involved with heavy industrial work that rejected by many locals to do due to the dangerous, dirty and difficulty. There have been very fewer studies conducted to investigate the safety measurement of these works in non-ionizing radiation. This study is to collect valuable information of perspective to the exposure of ELF-MF.

PA-137 [14:30]

Development and operation of movable EMF experience camp for efficient risk communication to general publics

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Keywords: Public Health Policy, ELF/LF, Work in Progress
Presented by: Seungwoo Lee

We developed and managed new type of experience house which is called Movable EMF Experience Camp for movable and easy access. The movable EMF experience camp which consists of experience contents in the container house. The size of a camp is 7m x 3m x 2.5m, and it contained 10 kinds of contents in 4 areas.We are operating the camp in the places of civil complaint, public relations, construction of electric power facilities, etc.

PA-139 [14:30]

Measurements of magnetic fields generated by home electric appliances

Kiyotaka Hayashi[1], Shigeru Ootsubo[1], Toshihisa Kadoya[1], Chiyoji Ohkubo[1] & Yukio Mizuno[2]
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Keywords: Standards, ELF/LF, Completed (published)
Presented by: Kiyotaka Hayashi

We conducted measurements of magnetic flux density generated at more than one frequency by the latest home electric appliances (total of 131 models of 42 products) within the frequency range of 10 Hz - 400 kHz.All the measurement results were well below the reference levels for the general public of ICNIRP Guidelines (2010).

PA-141 [14:30]

Enhanced method for caculating the area of protection in the vicinity of radio base stations

Werner Wiesbeck[1], Mario Pauli[3], Thorsten Kayser[3] & Josef Opitz[2]
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Keywords: Standards, RF/Microwaves, Completed (published)
Presented by: Josef Opitz

The method presented in this poster for calculating the area of protection in the near field of a mobile radio transmitting antenna is based on a field theoretical method. It works for any antenna, without having to know the structure or details of the antenna. Only one data set is needed with the near field data of the antenna on an envelope surface (e.g. sphere). It is thus suitable for both current and future antenna designs.

Session: PB
Poster Session B
Tuesday June 26, 2018 • 14:30 - 16:00
Mediteranea

PB-2 [14:30]

Effect of Transcranial Magnetic Stimulation in a model of rat´s Hemiparkinson

Leticia Verdugo-Diaz[1], Idalia Medina-Salazar[1] & David Elias-Viñas[2]
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Keywords: Behavioural, ELF/LF, Work in Progress
Presented by: Leticia Verdugo-Diaz

The effectiveness of Transcranial Magnetic Stimulation (TMS) experiments depends on TMS coil position and frequency of stimulus. This work presents results with a device and a coil constructed especially for the head size of the animals used. We tested repetitive TMS at two frequencies in the rat model of Parkinson's disease. Significant differences were found in different motor behaviors if the stimulation was either inhibitory (1Hz) or stimulatory (5Hz).

PB-4 [14:30]

Early exposure of rotating magnetic fields promotes central nervous regeneration in planarian Girardia sinensis

Xiaomei Wang[1] & Xiaoyun Zhang[1]
[1]*Physiology Department, Shenzhen , China, 518060*
Keywords: Behavioural, Static, Completed (published)
Presented by: Xiaomei Wang

Key words: rotary non-uniform magnetic fields; in vivi; planarian; neural regeneration; stimulating effect; window effect; completed(pulished). Presented by: Xiaomei Wang

PB-6 [14:30]

Electromagnetic interference with medical devices due to radio waves of TD-LTE using 3.5 GHz band and candidate frequencies for 5G

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Keywords: Clinical (diagnostics), RF/Microwaves, Completed (unpublished)
Presented by: Teruo Onishi

Examination of EMI with medical devices is conducted due to radio waves of TD-LTE using 3.5 GHz band and candidate frequencies for 5G. As frequency increase, EMI tends to be less occurred and category of EMI tends to decrease. At 28.5 GHz, all medical devices do not cause EMI in this examination.

PB-8 [14:30]

Device development for application of pulsed electromagnetic fields for hand arthritis therapy

Andrea Fernandez[1], Marco Rivera-Gonzalez[1], Nazario Felix-Gonzalez[1] & Ceferino Maestu[1]
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Keywords: Clinical (therapy), Pulsed, Work in Progress
Presented by: Ceferino Maestu

Arthritis defines hundreds of musculoskeletal disorders, such as Rheumatoid Arthritis (RA) and

Osteoarthritis (OA). Nowadays, Pulsed electromagnetic Fields (PEMFs) are being applied within the field of Rheumatology due to its promising results in tissue regeneration, joint damage and pain relief. This work reflects the obtained results that identified the optimal parameters of PEMF, which enhance cell proliferation; and the development and results of a new and effective musculoskeletal treatment based on a portable therapeutic device.

PB-10 [14:30]
STUDENT PAPER

Development and evaluation of microwave antenna for transcatheter denervation

Shohei Matsuhara[1], Kazuyuki Saito[1], Hiroshi Kawahira[1], Nobuyoshi Takeshita[2] & Tomoyuki Tajima[3]
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Keywords: Clinical (therapy), RF/Microwaves, Work in Progress
Presented by: Shohei Matsuhara

In this study, a catheter, which ablates extravascular nerve by the thermal effect of microwave, is introduced. In addition, heating characteristics of the catheter are evaluated by the numerical calculation and the experimental investigation. As a result, temperature distributions around the catheter were revealed and the usefulness of a denervation catheter using microwave was suggested.

PB-12 [14:30]

The multi-phase procedure for EMF limit values excesses verification

Cestnik Breda[1] & Karol Grabner[1]
[1]*Elektroinštitut Milan Vidmar, Ljubljana, Slovenia*
Keywords: Dosimetry (computational), ELF/LF, Completed (published)
Presented by: Breda Cestnik

A multi-phase procedure to determine the area of exceeding EMF limit values in the living environment of overhead electric power lines is explained. We present a detailed micro location analysis with combining the EMF calculation results and geo-referenced data graphic components in AutoCAD Map 3D. It enables a good visualisation of the field at the micro location.

PB-14 [14:30]

Numerical estimation of SAR enhancement due to implantable medical device inside human body exposed to external electromagnetic waves - 5G cellular candidate frequency bands -

Takashi Hikage[1], Keita Sakakibara[1], Toshio Nojima[1], Takahiro Iyama[2] & Teruo Onishi[2]
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[2]*NTT DOCOMO inc., Yokosuka, Japan*
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Takashi Hikage

The RF exposure guidelines do recognize that an increased local SAR (Specific Absorption Rate) due to metallic implants is possible. In this study, the effect of implantable medical device in human torso region is examined. A simple layer flat torso phantom is used which the implantable cardiac pacemaker is implanted in. The local SAR dependencies due to exposure frequency bands were presented. Here, we estimate localized SAR at several candidate frequency bands for 5th generation wireless systems (5G).

PB-16 [14:30]

Simulating the power deposition in a simple brain model loaded with magnetite macrospheres and exposed in the near field of a 440 MHz monopole antenna

Cora Iftode[1] & Simona Miclaus[2]
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[2]*Department of Technical Sciences, "Nicolae Balcescu" Land Forces Academy, Sibiu, Romania*
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Simona Miclaus

In order to observe power deposition differences between a pure dielectric tissue and a tissue containing magnetic material when exposed in the near field of a monopole antenna, we designed an approach in ANSYS HFSS software. SAR was computed based not only on electric power deposition, but also taking into account the magnetic absorption. Organs like human brain contain minute quantities of magnetite nanocrystals whose role and presence in connection to RF field exposure is still completely neglected. Although available computational dosimetric tools offer just macroscopic description of magnetic power dissipation, it is worth analyzing simplified situations like an ellipsoidal dielectric brain containing small magnetite spheres.

PB-18 [14:30]

Analysis of the core temperature distribution of the organs exposed to LTE signals

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Sangbong Jeon

In this paper, we simulated the thermal effects for rats in order to investigate the core temperature elevation due to whole body averaged specific absorption rate of 4 W/kg at 1.76 GHz long term evolution (LTE) RF signal bands. The temperature rise due to RF exposure depends on the location of the organ, even the same organ. Therefore, the core temperature distribution of the organs in RF exposure was calculated, and the average temperature and the standard deviation were obtained.

PB-20 [14:30]

Alvar: Adult whole-body anatomic phantom for computational dosimetry

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Keywords: Dosimetry (computational), All Frequencies, Work in Progress
Presented by: Ilkka Laakso

This paper presents an anatomically realistic voxel model of an adult male and its application to modelling power-frequency electric and magnetic field exposure. The phantom, Alvar, is based on anatomic atlases, weights 72 kg, and is 176 cm tall. Alvar and three other anatomic adult male phantoms were used for dosimetric analysis of uniform electric and magnetic field exposure at the frequency of 50 Hz, and the induced electric fields were shown to be in good agreement. Alvar is directly compatible with freely available BodyParts3D anatomic atlas, which allows easy identification of anatomic structures for dosimetry modelling.

PB-22 [14:30]

Evaluation of heating effects due to millimeter wave exposure in oblique incidence

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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
Presented by: Kun Li

In order to realize the ultra-high data wireless communication, millimeter wave frequencies over 6 GHz are anticipated to be used in many applications, such as 5G terminals, wireless gigabit and automotive radar. As the basic restriction in safety guideline, power density needs to be related with the temperature elevation of skin tissue exposed to electromagnetic waves at MMW bands. In this

work, we analyzed the heat potential of incident and absorption power density from 6 GHz to 1 THz for cases of oblique incidence. The results show that absorption power density indicates a high correlation with skin surface temperature elevation regardless of frequency, incident angle and polarization effects.

PB-24 [14:30]

Ad hoc simplified dosimetry analysis of in-vivo EMF exposure of rats and mice in reverberation chamber

Antonio Sarolic[1]

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

Presented by: Antonio Sarolic

We previously proposed a novel method for calculating the whole-body SAR of biological objects in reverberating environment, based on reverberation chamber and power balance theory. This method is applied here to demonstrate an alternative approach to dosimetry analysis of the setup described in recent publications on the study conducted by the National Toxicology Program of the National Institute of Environmental Health Sciences (two-year cancer bioassay study on rodents exposed in reverberation chambers), as an interesting example where this method perfectly fits to the problem.

PB-26 [14:30]

Realistic EMF exposure assessment of 5G massive MIMO base stations

Bo Xu[1], Björn Thors[1], Davide Colombi[1], Elif Degirmenci[1], Paramananda Joshi[1] & Christer Tornevik[1]

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

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

Presented by: Bo Xu

The traditional approach to assess RF EMF exposure, which uses the theoretical maximum output power, would lead to very conservative compliance boundaries for a 5G base station (BS) employing massive MIMO. Here, we start by giving the analytical box-shaped compliance boundary for theoretical maximum output power. Then, a statistically-conservative power reduction factor is introduced considering TDD downlink/uplink ratio, BS utilization, and scheduling time. As an example, the theoretical compliance boundaries of a 5G massive MIMO BS product are given. Considering the proposed power reduction factor, the actual compliance boundaries are also given for the 95th percentile of all possible exposure scenarios, according to IEC 62232:2017.

PB-28 [14:30]

Evaluation of exposure to electromagnetic field emitted by RFID HF desktop readers

Patryk Zradziński[1], Jolanta Karpowicz[1] & Krzysztof Gryz[1]

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

Presented by: Patryk Zradziński

Radio frequency identification (RFID) is the most common and the fastest evolving wireless identification technology. The thermal effects of exposure to electromagnetic field were evaluated by numerical simulations focused on the specific absorption rate (SAR) values in virtual phantom present in the vicinity of RFID HF desktop readers operating at 13.56 MHz, at various reading ranges. The results of numerical simulations showed that SAR values from RFID HF desktop readers may exceed general public and occupational exposure limits, during at least 6 minute exposure, near the readers operating at maximum reading range of 150 cm.

PB-30 [14:30]
STUDENT PAPER

Numerical analysis of a three-compartment head model subjected to variation of input parameters

Anna Šušnjara[1], Mario Cvetkovic[1], Dragan Poljak[1] & Hrvoje Dodig[2]

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

Presented by: Anna Šušnjara

A stochastic framework for the assessment of the induced electric field in the three-compartment model of human head is presented. The relative permittivity and conductivity of scalp, skull and brain are modelled as random variables. The statistical moments are calculated by means of a stochastic collocation method. The sparse grid interpolation in the multidimensional random space resulted in a small number of simulations. The sensitiy analysis of input parameters indicate the higher overall impact of relative permittivity over the tissue conductivity on the induced field in the brain. When considering the induced field along head axis, the results show the impact of parameters' variability to be distributed unevenly.

PB-32 [14:30]

Quantification of thermoelastic phenomena generated from high peak power radio frequency exposure utilizing the probe beam deflection technique (PBDT)

Ronald Barnes[1], Kaitlin Nelson[1], Samuel Johnson[1], Jeffrey Whitmore[1], Jason Payne[1] & Bennett Ibey[1]

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

Presented by: Ronald Barnes

High average power (HAP) radio frequency exposures illicit a thermal response in tissue. High peak power microwave (HPPM) exposures with pulse durations less than a few μs have been shown to produce thermoelastic responses. In HPPM exposure conditions, the use of piezoelectric transducers becomes difficult as the transducer is susceptible to EMI and perturbs the electromagnetic field to be measured. An all optical sensor is desired to provide passive EMI immune measurement of HPPM induced thermal and acoustic responses. In this work, we have demonstrated the use of an optical dosimetry technique, namely the probe beam deflection technique (PBDT), to measure and quantify the acoustic phenomena generated by HPPM exposure.

PB-34 [14:30]

Electromagnetic field in the environment - measurements and monitoring in Poland

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

Presented by: Pawel Bienkowski

The brief overview of legal bases and EMF measurements in the environment presented in the work shows that in Poland this issue has been known for years, research is conducted on a large scale. The their results are widely available. The authors assail with questions about the impact of base stations on the environment, the legal basis of measurements or even the duty to take measurements.Analysis of the results of research presented or referred in the article indicates that the level of electromagnetic background is well below the EMF acceptable levels in the environment. This does not mean, that in places accessible to the public, there is no EMF intensity close to or even exceeding the admissible values.

PB-36 [14:30]

Comparison between numerically and experimentally assessed skin temperature elevations for localized RF exposure at frequencies above 6 GHz

Davide Colombi[1], Bo Xu[1], Christer Tornevik[1], Björn Thors[1], Andreas Christ[2], Marvin Ziskin[3], Kenneth Foster[4] & Quirino Balzano[5]

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

Presented by: Davide Colombi

Frequency bands above 10 GHz are key components of the next generation mobile networks, 5G, which are expected to be commercially available before 2020. Such frequencies have been the target of the ongoing revision of the IEEE C95.1 exposure standard. In this study the draft exposure limits are evaluated in terms of skin temperature elevation both numerically and experimentally. The results indicate that simple thermal models can be successfully used to evaluate temperature elevation in the investigated frequency range although they might overestimate the skin temperature value for longer exposure time.

PB-38 [14:30]

EMPIR European project Vector SAR on SAR measurement using vector probes

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

Presented by: Joe Wiart

Specific absorption rate (SAR) must be evaluated during the production of mobile telecommunication devices. Vector SAR project will provide the methods, software tools and datasets required for traceable calibration and uncertainty analysis of vector probe array systems that automatically determine the 3D electromagnetic field and SAR mapping using amplitude and phase information through a 3D reconstruction algorithm. This work will also contribute to the international standard IEC 62209-3 and future standardisation of fifth generation (5G) devices within IEC Technical Committee TC 106.

PB-40 [14:30]

WITHDRAWN

PB-42 [14:30]

Attempt for determination the power absorption of nanomagnetic materials by reflectometry

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

Presented by: György Thuroczy

Nanomagnetic hyperthermia is intensively studied with the prospect of cancer therapy. A major challenge is to determine the heat absorbed during in vivo conditions and conventional methods are either invasive or inaccurate. We present a method which yields directly the heat absorbed during hyperthermia: it is based on accurately measuring the quality factor change of a resonant radiofrequency (RF) circuit which is employed for the irradiation.

PB-44 [14:30]

Improving the accuracy of personal radiofrequency measurements using a novel body-worn measurement device and comparison with measurements using exposimeters

Anke Huss[1], Stefan Dongus[2], Reza Aminzadeh[3, 4], Arno Thielens[3, 5], Sam Agneessens[3, 4], Patrick Van Torre[3, 4], Rene De Seze[6], Elisabeth Cardis[7], Marloes Eeftens[2], Wout Joseph[3, 4], Roel Vermeulen[1] & Martin Röösli[2]

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

Presented by: Anke Huss

The aim of this study is to compare measurement results of a newly developed prototype of a multi-band body-worn distributed-exposimeter (BWDM) with two commercially available personal exposimeters (EXPOM and EME SPY 200).We are currently conducting field measurements in various indoor and outdoor microenvironments in Belgium, Spain, France, Netherlands and Switzerland.Our data will allow the comparison of the measurements of the three different exposimeters and will be informativebetter understanding and interpretation of existing epidemiological research results.

PB-46 [14:30]

A comparison of the RF-EMF in educational facilities and its surrounding areas in South Korea

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

Presented by: Taewook Hwang

This paper is described the RF-EMF levels in/around kindergartens and elementary schools.The RF-EMF of kindergarten and elementary school was average 0.09 V/m, which was much lower than the ICNIRP reference levels in South Korea. In addition, the RF-EMF of roads approaching these facilities was average 0.19 V/m, higher than the RF-EMF of kindergartens and elementary schools, but below the ICNRIP guidelines. This result is expected to be due to the high density of mobile communication base stations in South Korea.This paper is considered very important with its high reliability to use in epidemiological researches and prediction model for EMF exposure including researches on EMF health effects.

PB-48 [14:30]
STUDENT PAPER

Investigation of E-field strength from mobile phone base stations and transmitted power from 4th generation mobile phones

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

Presented by: Shota Kurosaki

We measured 4G Tx power and the total downlink E-field strengths during drive around Tokyo and Chiba area in Japan for about 8 hours. The association between 4G Tx power and the downlink E-field strengths was investigated. The total downlink E-field strength was high and 4G Tx power is low in the Center of the Capital while the total downlink E-field strength was low and the 4G Tx power is high in residential/rural area.

PB-50 [14:30]

A method to analyze isotropy of electric field probe consisting of identical small dipoles

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

Presented by: Sang-Hwa Yi

A method is presented to analyze the isotropy of electric field probe consisting of a number of identical small dipoles whose radiation patterns are torus shapes and which are arbitrarily positioned and oriented.

PB-52 [14:30]

Reduction methods of ELF-MF radiated by high-voltage underground transmission lines

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

Presented by: Seungwoo Lee

We suggested the reduction methods of ELF-MF exposed by high-voltage underground transmission lines in this research. To avoid the ELF-MF exposure from the underground cables, we analyzed the effect according to the reduction methods which are the cable phase array, shielding materials, shunt effect or eddy current effect, etc.

PB-54 [14:30]

Near-field power density for MPE evaluation of 5G wireless devices

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

Presented by: Maryna Nesterova

The evaluation of a new generation of 5G wireless devices requires advanced methods in the near-field measurement technologies. The high-speed and high- intensity modulated signal have to be measured in the close proximity to a device to evaluate power density for safety matters. Because the near-field zone processes have complex formation the testing methodologies should consider the electric E and magnetic H field vector orientations and the beam-forming factors. The authors present a new two-probe method as a solution for the 5G power density evaluation.

PB-56 [14:30]

Vortical motion of liquid medium in small, shallow, containers with different end wall temperatures

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
Presented by: Alessandra Paffi

Using mica microparticles to detect liquid flow, curvilinear mass flow was observed in a shallow liquid medium using a rectangular chamber with end walls held at a 2 K temperature difference, resembling conditions in some in vitro RF biological studies. Thermal and fluid dynamics simulations of the velocity field gave a maximum velocity of about 6×10^{-4} m/s. These observations indicate that vortices could occur in some in vitro RF experiments. Prolonged non-Brownian motion in the cell microenvironment might bias biological outcomes because nutrient flow in RF-exposed medium cannot be replicated in controls. Future work for detection of liquid motion in Petri dishes is planned.

PB-58 [14:30]

Development of 28 GHz band exposure equipment for studies on thermal perception thresholds of biological effects exposed to millimeter-wave at 5th generation wireless systems candidate frequency band

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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
Presented by: Keita Sakakibara

Authors developed a radio-wave exposure equipment for studies on thermal perception thresholds of biological effects exposed to millimeter-wave at 28 GHz band that is 5th generation wireless systems (5G) candidate frequency band. To achieve high duty RF exposure on living body at 28 GHz required, we newly designed a lens antenna that can irradiate focused beam. In order to obtain basic exposure performance of the developed equipment, we used physical phantom that simulated human's skin and achieved exposure experiments of temperature rise measurements during at 28 GHz band millimeter-wave exposure.

PB-60 [14:30]

Non-sinusoidal magnetic field exposure: Comparison of time domain assessment methods proposed in the Non-binding guide for practical implementation of EU directive 2013/35/EU

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Keywords: Dosimetry (measurements), ELF/LF, Work in Progress
Presented by: Gernot Schmid

Non-sinusoidal magnetic fields at common workplaces were measured and exposure was comparatively assessed by the Weighted Peak Method in time domain (WPM-TD) and an alternative time domain assessment method (TDA method) published in the non-binding guide for practical implementation of the "workers directive" 2013/35/EU. It could be demonstrated that the TDA method systematically and substantially (up to 11.7 dB) underestimates exposure compared to the WPM-TD (indicated as the reference method in 2013/35/EU). We therefore recommend to remove this method from the non-binding guide as soon as possible.

PB-62 [14:30]

Radio frequency electromagnetic fields exposure assessment in different environments in Slovenia

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
Presented by: Blaž Valič

In this study, we investigated exposure to Radio frequency (RF) electromagnetic fields (EMF) in different environments in Slovenia (urban areas, smaller towns, rural areas). In total, we performed 60 measurements, 20 for each environment. Measurements were band selective, this means 11 most important frequency bands, where most of the systems operate were measured (FM, DVB-T, GSM ...). The measured values were compared with the reference values according to ICNIRP guidelines for general public. The results showed that the measured values are quite low and generally comparable with the results of similar studies [2]. The highest total RF-EMF exposure was below 0.7 percent according to ICNIRP guidelines for general public.

PB-64 [14:30]

Measurement of EMF exposure around small cell base station installations

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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
Presented by: Marthinus Van Wyk

Small cell base stations are used frequently as a mobile network deployment method. A measurement program was conducted to perform EMF exposure measurements around small cell base station installations. Results are compared to available data around base stations in general.

PB-66 [14:30]

Cancellation effect is present in high-frequency bipolar pulse treatments and depends on electroporation buffer composition

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Keywords: Electroporation, Pulsed, Completed (unpublished)
Presented by: Janja Dermol-Cerne

In electrochemotherapy and irreversible electroporation as ablation technique, 100 µs long pulses are applied at 1 Hz which causes muscle contractions and pain. Recently, bursts of short bipolar pulses (H-FIRE) were suggested as an ablation technique with no muscle contractions. Independently of H-FIRE studies, cancellation effect was observed with nanosecond pulses, where the effect of the first pulse is partially canceled by the second pulse of reverse polarity. In our study, we focused on cancellation effect in the range of pulses, usually used in HFIRE treatments. We varied pulse duration and delay between pulses. Our results show that cancellation effect is also present with HFIRE pulses, and is electroporation buffer dependent.

PB-68 [14:30]
STUDENT PAPER

Flexible conductive polymer microelectrode arrays for electropulsation, neurostimulation and electroporation in vitro and in vivo

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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Gerwin Dijk

Organic conductive polymers are highly versatile materials that have been widely adopted in commercial electronics as display technology, transistors, LEDs and solar cells. Our research is exploring their use for interfacing biology with electronics. We have developed microelectrode array

devices using the conductive polymer PEDOT:PSS for electropulsation, neurostimulation and electroporation investigations in vitro and in vivo. Here we will present our work using plastic bioelectronics to develop multiwell electrode arrays for in vitro studies using live cell imaging and flexible, implantable electrodes that are suitable for studying electropulsation effects with in vivo imaging and electrophysiology.

PB-70 [14:30]
STUDENT PAPER

Cell electroporation enhanced by conductive nanoparticles

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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Amina Ghorbel

In order to optimize the outcome of Electroporation , a novel approach based on the use of conductive nanoparticles, is proposed to enhance locally the efficacy of the electric field intensity in the targeted biological sample.

PB-72 [14:30]

Cells modeling and design characterization of electropulsation microchambers for linear and non-linear optical microspectroscopy

Caterina Merla[1, 2], Micaela Liberti[3], Paolo Marracino[3], Adeline Muscat[2], Francesca Apollonio[3] & Lluis M. Mir[2]
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Keywords: Electroporation, Pulsed, Work in Progress
Presented by: Caterina Merla

Mechanisms underlining the cell membrane permeabilization and consequent cellular and intracellular effects are still debated. To shed light on the involvement of phospholipids and water molecules rearrangements in this phenomenon, linear and non-linear optical imaging and microspectroscopy seem particularly appropriate. To combine optical detection with electric pulses used for cell permeabilization, an optimal delivery setup is presented in this paper. The dosimetry of the fabricated microchamber was analyzed in time domain. Mesodosimetry was also performed to study electric field distribution at cell level. These data give interesting information for interpreting cellular microspectroscopic results.

PB-74 [14:30]

Time-domain finite-element modeling for analysis of *in vivo* electroporation-based treatments

Matevz Pintar[1], Janez Langus[1], Matej Kranjc[2], Erik Brecelj[3], Ibrahim Edhemovic[3], Gregor Serša[3], Tomaz Rodic[1], Tomaz Sustar[1], Damijan Miklavčič[2], Tadej Kotnik[2] & Bor Kos[2]

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Keywords: Electroporation, Pulsed, Completed (unpublished)

Presented by: Bor Kos

Electrochemotherapy and irreversible electroporation are two methods which rely on the mechanism of electroporation to achieve their clinical goal. For successful treatment, coverage of the target tissue with sufficiently strong electric field is the most important prerequisite. Here we present a time-dependent model of electroporation, which takes into account the complex time course of conductivity change due to tissue electroporation and apply the model to a case of in vivo electroporation treatment.

PB-76 [14:30]

Calcium ions with nanosecond pulsed electric fields in human colon adenocarcinoma cells with drug resistance

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Keywords: Electroporation, Pulsed, Completed (unpublished)

Presented by: Nina Rembiałkowska

Calcium is one of the most important factors in cell proliferation, differentiation and cell death (apoptosis or necrosis). Manipulation of calcium levels using electroporation can cause different effect on normal and malignant cells. Efficiency and safety of electroporation combined with Ca^{2+} ions was examined in two human colon adenocarcinoma cell lines: sensitive- LoVo and drug resistant-LoVo/DX. As normal control CHO-K1 cells were applied. The results show that nsPEF supported by Ca^{2+} is cytotoxic in particular for resistant LoVo/DX cells, less cytotoxic in case of LoVo cells and simultaneously safe for normal cells. These results may potentially be important for treatment of colon adenocarcinoma using calcium nsPEF.

PB-78 [14:30]

Does RF exposure increase delivery of lead from maternal blood to fetus?

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Keywords: Epidemiology, RF/Microwaves, Work in Progress

Presented by: Yong-Han Lee

We measured individually maternal RF exposure during pregnancy and lead concentration of umbilical cord blood and maternal blood at delivery. The more RF exposure during pregnancy, the greater likelihood that more lead was transferred from mother to fetus through the placenta. This result suggest that RF affects function of placenta or causes conditions that more lead deliver to fetus. In addition, RF exposure more affected pregnant women with null type of GSTT1 gene involved in metabolism of toxic substances. This finding supports that RF exposure during pregnancy can be hazardous in women vulnerable to toxic materials.

PB-80 [14:30]

Electroconvulsive therapy and amyotrophic lateral sclerosis

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Keywords: Epidemiology, ELF/LF, Work in Progress

Presented by: Gabor Mezei

To evaluate a potential association between exposure to electric shocks and development of amyotrophic lateral sclerosis (ALS), we conducted a cohort study using a systematic sample of approximately one million beneficiaries enrolled in the U.S. Medicare health insurance program from 1997 to 2015. Using time-varying proportional hazards modelling, we compared ALS occurrence among patients receiving electroconvulsive therapy (ECT), a source of exposure to electric currents in the brain without significant exposure to magnetic fields, given as a treatment for some psychiatric conditions, to ALS occurrence among patients receiving no ECT, but diagnosed with the same psychiatric conditions.

PB-82 [14:30]

Modelling the exposure of children to extremely low frequency magnetic fields in the ELFSTAT project

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

Presented by: Paolo Ravazzani

ELFSTAT project, founded by the French ANSES (2015-2019, Grant agreement n. 2015/1/202), aims at characterizing children's exposure to extremely low frequency magnetic fields (ELF-MF) in real exposure scenarios using stochastic approaches. In this paper, a stochastic approach for extracting information from dataset of recorded ELF-MF signals is presented. The aim is to obtain a better characterization and description of the phenomenon and to investigate on possible correlations or different features between various data subsets

PB-84 [14:30]
STUDENT PAPER

Does Extremely Low Frequency Magnetic Fields stimulations of the vestibular system modulate postural control in humans?

Nicolas Bouisset[1, 2], Sebastien Villard[1, 3], Daniel Goulet[7], Michel Plante[7], Martine Souques[6], François Deschamps[5], Genevieve Ostiguy[7], Jacques Lambrozo[6] & Alexandre Legros[1, 2, 3, 4, 8]

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Keywords: Human, ELF/LF, Work in Progress
Presented by: Nicolas Bouisset

Exposure to extremely low frequency magnetic fields (ELF-MF) induces electric fields and currents within the human body that modulate nervous system functions. Although still a matter of debate, there are evidences that the vestibular system could respond to ELF-MF. It is well established however that specific electrical stimulations of the vestibular system trigger specific postural outcomes. This work investigates the vestibular response to ELF-MF and alternating electrical currents through their impact on human postural sway.

PB-86 [14:30]

Determination of external voltage level for causing heart fibrillation in human body

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Keywords: Human, ELF/LF, Completed (unpublished)
Presented by: Stefan Cecil

In this project the current flow through the human body on two different paths was investigated. Simulations with the body model "Duke" were done, to determine the flowing electric current through the heart. The results of the simulations were compared to the results from the corresponding measurements with rabbit hearts, where the fibrillation threshold was evaluated. With the results of the simulations and measurments the external voltage level for heart fibrillation in the human body could be determined.

PB-88 [14:30]

Effects of electromagnetic fields from Long Term Evolution on awake electroencephalogram in healthy humans

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Keywords: Human, RF/Microwaves, Completed (unpublished)
Presented by: Setsu Nakatani-Enomoto

We analyzed the effects of Long Term Evolution (LTE)-like EMW for 30 min on awake electroencephalogram (EEG) in healthy adult humans. The maximum local SAR averaged over 10 g mass was 2.0 W/kg. Thirty-eight subjects aged 20 to 36 years old participated in this study. The power spectra of θ, α and β frequency ranges at eight cortical sites were analyzed. We showed enhancement of θ and α waves after both real and sham exposures. The results may be consistent with the drowsiness of the subjects. However, EEG power spectra were not affected by the stimulation condition. We conclude that LTE-like exposure for 30 min has no detectable effects on awake EEGs in healthy humans.

PB-90 [14:30]
STUDENT PAPER

Alpha band analysis in resting EEG after exposure to radiofrequency signal (900 MHz): EEG/MEG study combined with an anatomic MRI

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Keywords: Human, RF/Microwaves, Work in Progress
Presented by: Jasmina Wallace

With the extensive use of mobile phones (MP) several studies have been realized to understand the effects of radiofrequency exposure on brain activity. The results show changes in the alpha band spectral power. To better understand the cortical structures involved in these changes after MP exposure (900 MHz), we carried out electroencephalography and magnetoencephalography recording followed by the anatomical magnetic resonance imaging on healthy volunteers. Participants were selected according to inclusion criteria. They were healthy males or females, aged between 18 and 35, non-smokers and with regular sleep habits. Data analyses of 10 subjects are still under process and ready results will be presented at the conference.

PB-92 [14:30]

Antenna with directional radiation pattern used in microwave ablation

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Keywords: In vitro, RF/Microwaves, Work in Progress
Presented by: Pawel Cala

Microwave (MWA) ablation with a double slot constructed on the basis of a coaxial antenna with a matching load. Simulations were carried out in the CST environment. It has been shown that it is possible to contruct a microwave ablation antenna with a directional radiation pattern providing a VSWR <1.5 for the ISM 2.4GHz band. Directionality of the antenna will allow heating only selected tissues without overheating neighboring ones. Such a solution can definitely improve the treatment process and not expose the patient to postoperative complications (burns). In further work, the authors will focus on producing a prototype of one antenna and performing a simulation of an antenna system consisting of at least three microwave antennas

PB-94 [14:30]

Visualisation of an nsPEF induced calcium wave using the genetically encoded calcium indicator GCaMP in U87 human glioblastoma cells

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Keywords: In vitro, Pulsed, Completed (published)
Presented by: Lynn Carr

This study looks at the application of genetically encoded calcium indicators (GECIs), to investigate the spatiotemporal nature of nsPEF-induced calcium signals, using fluorescent live cell imaging. GECIs can be targeted to different cellular locations and, by using a plasma membrane expressed GECI, we demonstrate calcium entry into the cell as a wave, initiated at the cathode side, following nsPEF treatment. This wave was masked by commercially available chemical, cytosolic, calcium indicators.

PB-96 [14:30]

Local high frequency electromagnetic field, nanoparticles and piezoelectric acoustic

exposition: a potential therapeutic approach in glioblastoma treatment

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

Presented by: Flavia Del Vecchio

Our aim was to study the possible therapeutic effects of a co-exposition for 72h to nanoparticles (SWCNTs), electromagnetic field (EMF, 100kHz, 10V square signal) at non-thermal level and piezoelectric acoustic emission to have a synergic local toxic effect on an in vitro model of Glioblastoma. C6 rat glioma cells were randomly assigned to four groups: Sham/Sham, Sham/Nano exposed Sham/Field exposed, and Nano/Field exposed. Results showed a decrease in the number of the cells co-exposed compared to the control group. However, the average survival rate of the cells was still high over the whole sample; and this combination could be interpreted either as all or nothing local effect, or more diffuse inhibition of the cell proliferation.

PB-98 [14:30]

In-vitro study of current induced ventricular fibrillation in rabbits

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

Presented by: Michael Koch

Ventricular fibrillation due to an electric current is one of the most dangerous incident which can occur in an electrical system. In this paper results on the investigation of current induced ventricular fibrillation at different frequencies (up to 100kHz) are reported. One of the main targets was to develop a flexible and adaptable experimental system based on in-vitro experiments of the isolated rabbit heart within a working heart model approach. In the chosen setup the heart can be electrically stimulated, driven into a sustained fibrillation state and can be defibrillated afterwards. The research project is funded by the Austrian Government (FFG, project no. 841285).

PB-100 [14:30]

Protective effects of radiofrequency on β-amyloid-induced toxicity in human neuroblastoma cells

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

Presented by: Stefania Romeo

This study aims to investigate the capability of pre-exposure to 1950 MHz to protect from the amyloid beta (Aβ)-induced cytotoxicity in human neuroblastoma SH-SY5Y cells. Pre-exposure to radiofrequency (RF) reduced of about 30% the Aβ-induced DNA damage, while RF exposure alone did not affect DNA integrity, as assessed by the alkaline comet assay. Moreover, pre-exposure to RF increased microRNA 107, affecting the enzyme responsible for the Aβ plaques deposition BACE1 and decreased the expression of microRNAs related to long term potentiation and excito-toxicity (miRNA335 and miRNA26b). On the woole, RF seems to induce a protective effect against the damage induced by Aβ in human neuroblastoma cells.

PB-102 [14:30]

WITHDRAWN

PB-104 [14:30]

5 ns electric pulses evoke Ca^{2+} responses in adrenal chromaffin cells that are longer in duration than those evoked by a physiological stimulus

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Keywords: In vitro, Pulsed, Work in Progress

Presented by: Normand Leblanc

A 5 ns, 5 MV/m electric pulse (NEP) causes a rapid rise in intracellular Ca^{2+} in bovine adrenal chromaffin cells that takes much longer to return to pre-stimulus levels relative to Ca^{2+} responses evoked by nicotinic receptor stimulation. Although Ca^{2+} uptake into mitochondria is the main mechanism by which Ca^{2+} is rapidly removed from the cytoplasm to achieve baseline levels, we found that 5 or more NEPs are required to see any evidence of a change in mitochondrial membrane potential. Understanding the mechanism underlying the slow clearance of Ca^{2+} from the cytoplasm following NEP exposure is important since the ability of a chromaffin cell to rapidly clear the cytoplasm of Ca^{2+} by a nicotinic receptor agonist is also affected.

PB-106 [14:30]

Nanosecond bipolar pulse cancellation below 10 ns — Looking for mechanisms in an expanding bioelectric puzzle

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Keywords: In vitro, Pulsed, Work in Progress

Presented by: Thomas Vernier

We present studies of unipolar and bipolar electropermeabilization with 2 ns pulses. Some of our observations are consistent with previous reports of bipolar cancellation with longer pulses, but we report also new, unexpected effects of bipolar exposures and discuss mechanistic explanations.

PB-108 [14:30]

An ELF magnetic field exposure system for real-time cell monitoring under controlled temperature conditions

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

Presented by: György Thuroczy

The aim of present work is to allow real-time microscopic monitoring of cellular and molecular changes during ELF magnetic field exposure at different temperatures. For this purpose an in vitro exposure system was designed to expose living cells to ELF magnetic fields under controlled temperature conditions.

PB-110 [14:30]
STUDENT PAPER

Physical chemical analysis of tomato seeds (*Solanum lycopersicum L.*) under magnetic treatment

Javier Torres Osorio[2], Laura Maria Echeverry-Cardona[1], Elisabeth Restrepo-Parra[1], Nelson Ceballos Aguirre[3] & Diana Carolina Galvez-Coy[4]

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Keywords: In vitro, Static, Completed (unpublished)

Presented by: Javier Torres Osorio

Physical chemical analysis of magnetic treatment tomato seeds that exhibited reduction in the mean germination time (MGT) was carried out for knowing the mechanisms that generate biophysical and biochemical modifications of the seeds because the magnetic field. The experiment was performed using a set of dipolar toroidal magnets, 8 doses of stimulation and a control for germination tests. The seeds with lower MGT were chosen. The chemical and the surface morphology characterization was performed. Seeds with lower MGT showed an increase of functional groups of lipid molecules, increase in the free water for reactions and expressions of potassium ions of the seed coat, that can be related to the increment in the membrane transport.

PB-112 [14:30]

Effects of microwave radiation on distribution of dendritic spines and SNK-SPAR pathway in primary hippocampal neurons

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

Presented by: Lifeng Wang

In the study, we found that 30mW/cm2 microwave radiation could result in the density of dendritic spines and percentage of mature spines decreased in cultured primary hippocampal neurons; the increased SNK which led to the decrease of SPAR and PSD-95; low expression of Calcineurin which induced the decrease of CREB, the increase and nuclear translocation of p-CREB, then lifted the transcription level of SNK; the phosphorylated modification site in GKBD, which is the specific binding structure domain with PSD-95 of SPAR, transformed from ser-1567 and ser-1472 to ser-1603, and the interaction of SPAR and MAP2. It might lead to obstacle in spine maturation and debilitate synaptic connections.

PB-114 [14:30]
STUDENT PAPER

Effects of RF-EMF on APP-processing and cell death in mouse hippocampus cell line

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

Presented by: Kyeonghee Yoon

In vitro experiments were performed after exposure of LTE RF-EMF (1745 GHz) because currently, the spread of LTE mobile communication network has increased. The LTE type RF-EMF was exposed to the cells for 24 hours at an intensity of 8 W/kg, which is the maximum intensity of our exposure system and Amyloid precursor protein (APP) processing and cell death effects were

examined. RF-EMF exposure showed no significant changes of ADAM10 and BACE1 as well as expression of CTFβ and CTFα. RF-EMF, no significant cell death was induced. Even though more detailed experiments is needed, unlike to IR, exposure of 8 W/kg LTE type RF-EMF for 24 hours did not affect APP processing and cell death in HT22 hippocampus cells.

PB-116 [14:30]

Effect of chronic RF-EMF exposure on aging-induced oxidative stress and neuroinflammation in C57BL/6 mice

Ye Ji Jeong[1], Hyung-Do Choi[2], Jeong-Ki Pack[3], Nam Kim[4], Yun-Sil Lee[5] & Hae-June Lee[1]

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

Presented by: Hae-June Lee

In this study, we determine whether chronic RF-EMF exposure affect oxidative stress and inflammatory response of the brain in aging mice. The middle aged C57BL/6 mice (14 months old) were exposed to 1,950 MHz electromagnetic fields for 8 months (SAR 5W/kg, 2 h/day, 5 days/week). No changes were observed in the protein levels of DNA damage, apoptosis, GFAP, Iba-1 and heat shock proteins by long-term RF-EMF exposure.

PB-118 [14:30]
STUDENT PAPER

Magnetic field effects on H2O2 and possible biological implications including cancer

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Keywords: In vitro, Static, Work in Progress

Presented by: Sahithi Kandala

The links between Reactive oxygen species, Electromagnetic Fields and Biological Implications are explored. Experimental data is used as background to show the changes that are observed due to static magnetic fields on fibrosarcoma cells.

PB-120 [14:30]

Generation of a syngeneic orthotopic graft murine model of peritoneal carcinomatosis for studying *in vivo* nsPEF anticancerous effects

Abdelkader Taibi[1], Marie-Laure Perrin[2], Lynn Carr[2], Catherine Yardin[1], Sylvaine Durand-Fontanier[1] & Sylvia M. Bardet[2]

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Keywords: In vivo, Pulsed, Work in Progress

Presented by: Sylvia M. Bardet

Colorectal cancer (CRC), a common cancer with poor prognosis, affects the peritoneum by metastasis, leading to an incurable peritoneal carcinomatosis (CPc). High-intensity nanosecond pulsed electric fields (nsPEF) have emerged as a promising tool for tumor ablation. We have developed 4 models of CPc suitable for in vivo nsPEF studies, by syngeneicintravenous, subcutaneous, intraperitoneal or laparotomygraft of CT-26 cells in immunocompetent mice, and compared growth by bioluminescence. Tumoral tissue was observed by multiphoton microscopy. In vitro CT-26 cells were analyzed for their sensitivity to nsPEF (survival, mitochondrial potential, permeabilization). Our CPc models will enable robust experiments for future in vivo nsPEF analysis.

PB-122 [14:30]

WITHDRAWN

PB-124 [14:30]

Effect of radiofrequency electromagnetic fields on in vivo C6 brain tumors in Wistar rats

Anne-Sophie Villegier[1] & Nihal Ouadah[1]

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

Presented by: Anne-Sophie Villegier

Previous literature suggested that brain cancer patients with heavy cell phone use showed reduced survival. Here we aimed to test survival and tumor aggressiveness in the C6 cells glioblastoma model in Wistar rats subjected to controlled brain averaged specific absorption rate (BASAR) induced by radiofrequency electromagnetic field (RF-EMF) exposures. For the first time, BASAR-dependent effects were reported in vivo by the reduction of apoptosis and by the reduction of inflammation in the tumor micro-environment. In accordance with the literature, our data did not suggest any impact on survival or tumor volume. Further replication studies are needed to confirm these observations.

PB-126 [14:30]

WITHDRAWN

PB-128 [14:30]

Effects of radiofrequency fields on RAS and ERK kinases activities in live cells using the real-time Bioluminescence Resonance Energy Transfer technique (BRET)

Emmanuelle Poque-Haro[1], Delia Arnaud-Cormos[2], Hermanus Ruigrok[1], Florence Poulletier De Gannes[1], Annabelle Hurtier[1], Rémy Renom[1], Isabelle Lagroye[1], Bernard Veyret[1], Philippe Leveque[2] & Yann Percherancier[1]

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

Presented by: Isabelle Lagroye

Using ERK and RAS molecular probes based on the Bioluminescence Resonance Energy Transfert technique, we assessed the effect of 1800 MHz exposure (CW and GSM signals) at two different levels: 6W/kg and 1.5 W/Kg, on ERK and RAS activities in HuH7 cells.

PB-130 [14:30]

Alterations in photosynthetic system key factors after exposure of Microcystis aeruginosa to 1.8GHz electromagnetic field

Chao Tang[1], Ziyan Zhang[1], Hui Yu[1] & Xiaomei Huang[1]

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Keywords: Mechanistic/Theoretical, RF/Microwaves, Work in Progress

Presented by: Chao Tang

Electromagnetic radiation played a crucial role in the phycoerythrin content regulation. M. aeruginosa may alleviate the electromagnetic radiation damage of photosynthetic system by adjusting the content of phycobiliprotein.

PB-132 [14:30]

Study on the effects of oxidative stress of Microcystis aeruginosa under the exposure of electromagnetic radiation

Hui Yu[1], Chao Tang[1], Xiaomei Huang[1] & Chuanjun Yang[1]

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

Presented by: Hui Yu

The effect of the activities of Antioxidant enzyme systems (SOD, MDA) of Microcystis aeruginosa were studied under the exposure of three kinds of typical electromagnetic radiations. The results showed that oxidative stress of M.aeruginosa could be induced under the exposure of electromagnetic radiation.

PB-134 [14:30]

Wide-band evaluation of EMF emitted by portable computer devices

Krzysztof Gryz[1], Jolanta Karpowicz[1] & Patryk Zradziński[1]

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Keywords: Occupational, All Frequencies, Work in Progress

Presented by: Krzysztof Gryz

The aim is identifying and evaluating the electromagnetic field (EMF) emitted by portable computer devices (e.g. laptops, tablets). The electronic components of portable devices (external AC/DC power supply, internal graphic card and processor interfaces, wireless communication modules etc.) are wide-band sources of EMF, currently from static field up to microwave of approximately 6 GHz frequency. The broadband and selective measurement of EMF near laptops housing were performed. Obtained results shown that dominant components of EMF exposures near portable computers are: ELF magnetic field emitted by AC/DC adapters and RF electric field emitted by WiFi interfaces (2G or 5G).

PB-136 [14:30]
STUDENT PAPER

Design of a triple band monopole antenna using parasitic elements with SAR reduction for WLAN and WiMAX Applications

Hanul Bong[1], Niamat Hussain[1], Min-Joo Jeong[1], Ji Woong Park[1], Seungwoo Lee[2] & Nam Kim[1]

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

Presented by: Hanul Bong

A triple band antenna consists of a dipole, a monopole and parasitic elements is presented. The aimed frequency band is WLAN (2.4/5.8 GHz) and WiMAX (3.5 GHz) applications. The parasitic elements around feed line is introduced for improving the performance of the antenna. The antenna shows acceptable radiation pattern along with - 10 dB return loss at all three bands. Moreover, the proposed antenna with reflector got reduction of 85.12 %, 50.06 % and 36.87 % in 1g SAR value at 2.4 GHz, 3.5 Ghz and 5.8GHz, respectively when compared with international standard value.

PB-138 [14:30]

Trends in scientific research on mobile communications: Temporal and geospatial analysis based on data of the EMF-Portal

Dagmar Dechent[1], Anne-Kathrin Petri[1], Lambert Bodewein[1], Tanja Emonds[1], David Graefrath[1], Thomas Kraus[1] & Sarah Driessen[1]

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Keywords: Public Health Policy, RF/Microwaves, Work in Progress
Presented by: Dagmar Dechent

The EMF-Portal (www.emf-portal.org) summarizes systematically scientific research data on the effects of electromagnetic fields (EMF) and provides all information free of charge in English, German and Japanese. The core of the EMF-Portal is an extensive literature database with an inventory of about 26,000 publications and 6,100 summaries of individual scientific studies. Using the database of the EMF-Portal we analyzed the global scientific efforts in publications on medical/biological effects of exposure to mobile phone related radiofrequency EMF. We present temporal trends in number of publications and analyzed the mostly investigated research topics, authors with most publications, funding and origin of the publications.

PB-140 [14:30]

Scientific knowledge changes people's RF-EMF risk perception

Alberto Nájera[1] & Judith Maciá[1]

[1]*Medical Sciences Department, University of Castilla-La Mancha, Albacete, Spain*
Keywords: Public Health Policy, Static, Completed (published)
Presented by: Alberto Nájera

We analyzed if providing scientific information about personal exposure to RF-EMF and possible health effects prior to the placement of a new mobile base station, could minimize citizen mobilizations.

PB-142 [14:30]

New technologies of the smart cities and public exposure of extremely low frequency electromagnetic fields

Rauno Pääkkönen[1] & Leena Korpinen[2]

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Keywords: Public Health Policy, ELF/LF, Completed (unpublished)
Presented by: Leena Korpinen

New technology brings more and more extremely low frequency electromagnetic fields around us. These fields can be more complex than before; therefore, exposure to these fields must be evaluated. We have performed this work for example with smart electric meters, electric cars, or work related electromagnetic exposures. The fields have generally been less than 10% of the recommendation values.

PB-144 [14:30]

WITHDRAWN

PB-146 [14:30]

WITHDRAWN

PB-148 [14:30]

WITHDRAWN

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