BioEM2014

Joint Meeting of The Bioelectromagnetics Society and the European BioElectromagnetics Association

Technical Program and General Information

June 8, 2014 - June 13, 2014

Table Bay Hotel

Cape Town, South Africa
European BioElectromagnetics Association Council

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France

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Marta Parazzini 
Italy

Engineering/Physical Sciences 
Theodoros Samaras 
Greece

At Large 
Jukka Juutilainen 
Finland

At Large 
Mirjana Moser 
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At Large 
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France

At Large 
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United Kingdom

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Engineering/Physical Sciences 
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At Large 
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Italy

At Large 
Jeong-Ki Pack 
Korea
I am very pleased to welcome you all to Cape Town on behalf of the Local Organizing Committee (LOC). Cape Town is a great conference venue and one of the most loved cities in the world.

BioEM2014 will be held in the Victoria and Alfred waterfront. The waterfront started off with a small jetty, built by Jan van Riebeeck in 1654 as part of his task to establish a refreshment station at the foot of Africa for the Dutch East India Company. Today the V&A Waterfront is situated in the heart of Cape Town’s working harbour and offers the visitor an abundance of unforgettable experiences. Indoor shopping and entertainment venues seamlessly merge with ocean vistas and mountain views and the fresh sea breeze and warm African sun add zest to a cosmopolitan, vibrant atmosphere. More than 80 restaurants bring a fusion of international food, from rustic al fresco fish and chips to starched table-cloth cuisine.

The platform presentations and most activities will take place at the Table Bay Hotel in the waterfront, while the poster sessions will be held at the Clock Tower Centre which is located a short walk away. During the meeting there will be sufficient time to meet with old colleagues and make new friends at the tea/coffee breaks and lunch which will be served at the venue.

We are very thankful for the generous support of our sponsors, listed in this booklet and on the meeting website. A word of thanks also to Suné and Dawne from Consultus, who assisted with the numerous details in arranging this conference.

Welcome to Cape Town!

Marnus van Wyk
Chair of the Local Organizing Committee
From the Co-chairs of the Technical Program Committee

Dear colleagues,

Welcome to Cape Town! The trip on the Joint Annual Meeting of the Bioelectromagnetics Society (BEMS) and European Bioelectromagnetics Association (EBEA) continues this year in the southern hemisphere, aboard BioEM2014. The city hosting this year’s meeting is known not only for its cosmopolitan flair but also for its Mediterranean style, thus connecting BioEM2014 with its predecessor in Thessaloniki. We hope that all participants will enjoy both the social as well as the technical program of our annual meeting, which remains the major opportunity for presenting the state-of-the-art in bioelectromagnetics research and stimulating fruitful exchange of ideas, in addition to catching up on old friendships.

According to the long-standing agreement between the two organizing societies, each has provided one technical program co-chair who, together with the Technical Program Committee (TPC) and the Local Organizing Committee (LOC), have planned the content of the meeting, taking into account the input received from society members on suggested workshop and tutorial subjects.

This year we have planned for three plenary sessions. The first one is about the electromagnetic field (EMF) effects on fauna. We believe that this topic bears a great potential on revealing the mechanisms of interaction between EMF and living organisms. Moreover, we found it very appropriate for the location of the meeting, since South Africa’s national parks consist of over 37’000 km², about 4% of the total country’s area. The second plenary session concerns the latest advances in medical imaging with non-ionizing radiation both in high and low frequencies (microwave imaging and electrical impedance tomography). In our opinion, health applications of EMF is a very topical area attracting a large part of recent research, so we thought of highlighting the aspect of diagnostic techniques this year (last year in Thessaloniki we heard some very interesting developments about therapeutic effects). Finally, a third plenary session was scheduled on mechanistic effects of EMF, since this is a central issue in understanding their interaction with biological matter.

Considering that the d’Arsonval lecture can be counted as a tutorial to young and experienced researchers alike, we have planned for a tutorial on each day of the conference targeting the groups of participants who would like to either receive an introduction to the multidisciplinarity of bioelectromagnetics or update their knowledge.
on a specific subject. As for the technical papers themselves, we have received more than 200 submissions. The requests for a platform presentation have reach almost the double of the number of available time slots, even with the 'hot topic' session having been replaced by a normal platform session, since this year we decided that there was not a single development in the field that could justify a 'hot topic' session. Therefore, to populate platform and poster sessions we heavily relied on the work performed by the members of the TPC and the final ranking of papers, each of which was scored by at least five different reviewers.

All possible effort was taken this year to number posters according to the keywords suggested by the authors, so that their presentation at the venue can be clustered accordingly, thus facilitating participants with specific interests to interact faster with the authors. Of course the flash poster presentations introduced last year will take place again, giving students the chance to compete for one of the best paper awards.

Finally, this year we have received suggestions for themed workshops that will concern ethical and social issues in bioelectromagnetics research, the practical implementation of the EMF directive on occupational exposure, and the latest developments in epidemiological exposure assessment.

We genuinely hope that you will enjoy all the above, which could not have been organized without the help of the TPC members and the hard work of Drs. Jeffrey Carson and Astrid Chamson-Reig from Lawson Health Research Institute in Canada. Thank you all for your invaluable contribution!

Phil Chadwick and Theodoros Samaras
Co-Chairs of the Technical Program Committee
# Schedule at a Glance

## Monday, June 9, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30 - 09:00</td>
<td>OC</td>
<td>Opening Ceremony</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>09:00 - 10:00</td>
<td>DA</td>
<td>The d'Arsonval Lecture. Carl Blackman: A Scientific Career in EMF Research as influenced by Courses, Chiefs, Colleagues, Collaborators, Critics, Circumstances, Conundrums and Cash.</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>10:30 - 12:30</td>
<td>01</td>
<td>Mechanisms 1</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>10:30 - 12:30</td>
<td>02</td>
<td>Children</td>
<td>The Pavilion, Table Bay Hotel</td>
</tr>
<tr>
<td>14:00 - 16:00</td>
<td>03</td>
<td>Neurological effects 1</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>14:00 - 16:00</td>
<td>04</td>
<td>Calculations of Human Exposure</td>
<td>The Pavilion, Table Bay Hotel</td>
</tr>
<tr>
<td>16:30 - 16:50</td>
<td>F</td>
<td>Student Flash Poster Session</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>17:00 - 18:30</td>
<td>PA</td>
<td>Poster Session A</td>
<td>The Pavilion Conference Centre, Clock Tower Square</td>
</tr>
<tr>
<td>18:30 - 20:00</td>
<td>SemI</td>
<td>BEMS seminar: international EMF research (invited presentations) - Refreshments will be provided</td>
<td>The Pavilion, Table Bay Hotel</td>
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## Tuesday, June 10, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Name</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>08:00 - 09:00</td>
<td>TI</td>
<td>Tutorial I: Dr. P. Thomas Vernier, Old Dominion University, USA - An introduction to electroporation and its applications</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>09:00 - 11:00</td>
<td>PI</td>
<td>Plenary Session I: Electromagnetic field effects on fauna</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>11:30 - 13:00</td>
<td>PB</td>
<td>Poster Session B</td>
<td>The Pavilion Conference Centre, Clock Tower Square</td>
</tr>
<tr>
<td>13:00 - 14:00</td>
<td>EBEA</td>
<td>EBEA General Assembly</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
</tbody>
</table>
14:30 - 16:30  05  Genomic instability  The Ballroom, Table Bay Hotel
14:30 - 16:30  06  MRI and medical devices  The Pavilion, Table Bay Hotel
17:00 - 18:00  W1 Discussion Workshop led by Dariusz Leszczynski: Ethical and social issues in bioelectromagnetics research  The Ballroom, Table Bay Hotel
19:00 -  19:00  Dinner  Social event and sponsor recognition  BAIA Seafood Restaurant, V & A Waterfront

**Wednesday, June 11, 2014**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00 - 09:00</td>
<td>T2</td>
<td>Tutorial 2: Prof. Bernard Veyret, Centre National de la Recherche Scientifique, France - Overview of 50 years of laboratory, animal and human studies</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>09:00 - 11:00</td>
<td>P2</td>
<td>Plenary Session 2: Imaging and tomography</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>11:30 - 13:00</td>
<td>W2</td>
<td>Workshop 2: Practical approaches to the implementation of the EMF Directive</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>13:00 -</td>
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<td>Tours/free time</td>
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**Thursday, June 12, 2014**

<table>
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<tr>
<th>Time</th>
<th>Session</th>
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<th>Location</th>
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<tbody>
<tr>
<td>08:00 - 09:00</td>
<td>T3</td>
<td>Tutorial 3: Dr. John Bolte, RIVM, Netherlands - Sources, levels of exposure &amp; standards</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>09:00 - 10:30</td>
<td>P3</td>
<td>Plenary Session 3: Endogenous voltage gradients as mediators of cell-cell communication</td>
<td>The Ballroom, Table Bay Hotel</td>
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<tr>
<td>11:00 - 13:00</td>
<td>07</td>
<td>Mechanisms 2</td>
<td>The Ballroom, Table Bay Hotel</td>
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<tr>
<td>11:00 - 13:00</td>
<td>08</td>
<td>Occupational</td>
<td>The Pavilion, Table Bay Hotel</td>
</tr>
<tr>
<td>13:00 - 14:00</td>
<td>BEMS</td>
<td>BEMS Annual Business Meeting</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>14:30 - 16:30</td>
<td>09</td>
<td>Neurological effects 2</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>14:30 - 16:30</td>
<td>10</td>
<td>Public exposures and RF measurements</td>
<td>The Pavilion, Table Bay Hotel</td>
</tr>
<tr>
<td>17:00 - 19:00</td>
<td>W3</td>
<td>Workshop 3: New avenues in epidemiological exposure assessment</td>
<td>The Ballroom, Table Bay Hotel</td>
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</table>
## Friday, June 13, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Name</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>08:00 - 09:00</td>
<td>T4</td>
<td>Tutorial 4: Prof. Martin Röösli, TPH, Swiss - A tutorial on epidemiology</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>09:00 - 11:00</td>
<td>11</td>
<td>Clinical</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>09:00 - 11:00</td>
<td>12</td>
<td>Standards, policy and compliance</td>
<td>The Pavilion, Table Bay Hotel</td>
</tr>
<tr>
<td>11:30 - 12:00</td>
<td>SA</td>
<td>Student Awards Presentation</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>12:00 - 13:00</td>
<td>CC</td>
<td>Rapporteur’s Reports and Closing Ceremony</td>
<td>The Ballroom, Table Bay Hotel</td>
</tr>
<tr>
<td>14:00 - 17:00</td>
<td>BEMS &amp;</td>
<td>BEMS Board and EBEA Council meetings</td>
<td>The Ballroom, Table Bay Hotel</td>
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<td></td>
<td>EBEA</td>
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</table>
General Information

REGISTRATION AND INFORMATION DESK

You may register and collect your registration material at the venues and dates as specified below:

Specified registration times include

<table>
<thead>
<tr>
<th>Day</th>
<th>Month</th>
<th>Date</th>
<th>Time</th>
<th>Venue Details</th>
</tr>
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<tbody>
<tr>
<td>Sunday</td>
<td>08</td>
<td>June</td>
<td>17H00</td>
<td>Foyer, The Baltic Room, The Pavilion Conference Centre, Clock Tower Centre, V &amp; A Waterfront</td>
</tr>
<tr>
<td>Monday</td>
<td>09</td>
<td>June</td>
<td>07H45</td>
<td>Foyer, The Ballroom, Table Bay Hotel</td>
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<tr>
<td>Tuesday</td>
<td>10</td>
<td>June</td>
<td>07H30</td>
<td>Foyer, The Ballroom, Table Bay Hotel</td>
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<tr>
<td>Wednesday</td>
<td>11</td>
<td>June</td>
<td>07H30</td>
<td>Foyer, The Ballroom, Table Bay Hotel</td>
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<tr>
<td>Thursday</td>
<td>12</td>
<td>June</td>
<td>07H30</td>
<td>Foyer, The Ballroom, Table Bay Hotel</td>
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<tr>
<td>Friday</td>
<td>13</td>
<td>June</td>
<td>07H30</td>
<td>Foyer, The Ballroom, Table Bay Hotel</td>
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</tbody>
</table>

From 9 to 13 June 2014 the Registration and Information desk will be situated in the foyer in front of The Ballroom at the Table Bay Hotel.

WELCOME FUNCTION

<table>
<thead>
<tr>
<th>Day</th>
<th>Month</th>
<th>Date</th>
<th>Time</th>
<th>Venue Details</th>
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</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>08</td>
<td>June</td>
<td>18H00</td>
<td>The Baltic Room, The Pavilion Conference Centre, Clock Tower Centre, V &amp; A Waterfront</td>
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<td>20H00</td>
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</table>

STUDENT ICEBREAKER

<table>
<thead>
<tr>
<th>Day</th>
<th>Month</th>
<th>Date</th>
<th>Time</th>
<th>Venue Details</th>
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<tbody>
<tr>
<td>Sunday</td>
<td>08</td>
<td>June</td>
<td>19H00</td>
<td>Alba Lounge, Hildebrand Hotel, V &amp; A Waterfront</td>
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<td>21H00</td>
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CONFERENCE DINNER:

<table>
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<tr>
<th>Day</th>
<th>Month</th>
<th>Date</th>
<th>Time</th>
<th>Venue Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday</td>
<td>10</td>
<td>June</td>
<td>19H00</td>
<td>BAIA Seafood Restaurant, V &amp; A Waterfront</td>
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<td>24H00</td>
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</table>
THE CONFERENCE VENUE

The Table Bay Hotel (http://www.suninternational.com/table-bay), situated in the V&A Waterfront (http://www.waterfront.co.za). It started off with a small jetty, built by Jan van Riebeeck in 1654 as part of his task to establish a refreshment station at the foot of Africa for the Dutch East India Company. The Cape had become a stopover for Dutch ships sailing to Eastern Africa, India and the Far East on their quest for exotic goods. From these humble beginnings the harbour and city continued to be further developed and in 1988 parts of the historic docklands were redeveloped to establish the V&A Waterfront.

With Table Mountain as its backdrop and extensive views of the ocean, the V&A Waterfront boasts 22 heritage sites across the property. The mixed-used property, at a size of 123-hectares is home to different experiences which range from leisure and shopping to family entertainment.

The V&A Waterfront forms part of the Cape Town Big 6, one destination comprising of 6 memorable experiences. Other partners of the Cape Town Big 6 include Cape Point, Groot Constantia, Kirstenbosch National Botanical Garden, the Table Mountain Cableway and Robben Island where Nelson Mandela spent 18 years in prison.

The V&A Waterfront Information Centre, situated on Dock Road (alongside Ferryman's Pub) and the Waterfront Information Kiosk in Victoria Wharf, are conveniently located to serve and welcome local and international visitors. For more information please visit the following website
http://www.waterfront.co.za/Info

V & A WATERFRONT MAP:
http://www.waterfront.co.za/Documents/VNA%20MAP%20FOR%20WEBSITE%202013%202.pdf

AIRPORT TRANSFERS

Transfers to and from Cape Town International Airport can be organised directly with the travel desk of your hotel.

OR with

Quality Touring Services, Durbanville, Cape Town, South Africa

Robin Troup
Office: 021 979 5936; Fax: 021 979 5934; Cell: 082 657 3443
Email: robin@qualitytouringservices.co.za
Website: http://www.qualitytouringservices.co.za

Additionally, numerous metered taxi services also run from the Cape Town International Airport.
PUBLIC TRANSPORT

MyCiTi, Cape Town’s rapid bus service, operates on the Waterfront feeder route. For routes and timetables please click on the following link http://www.myciti.org.za/en/home/. Note that one transfer will be required to travel from the Cape Town International Airport to the V&A waterfront.

TOURS

For more information on tours visit http://signaturetours.co.za/conference/bioem2014.

VISA REQUIREMENTS

NB! ALL VISITORS (irrespective of whether they need a visa or not) MUST have 2 adjacent blank pages in their passports, which must be valid for 6 months after their departure from South Africa. These pages must be entitled “Visas”. (Note that some passports have an “Endorsement” page, often towards the end, which is not valid for this purpose). This requirement is strictly enforced.

Visitors’ visas are required for international travellers who have permanent residence outside South Africa and who wish to visit the country on a temporary basis for tourism or business purposes for a period of 90 days or less. (To read more about applying for a visa to South Africa visit http://www.home-affairs.gov.za/index.php/applying-for-sa-visa)

Requirements for visitor’s visas differ from country to country (visit http://www.home-affairs.gov.za/index.php/countries-exempt-from-sa-visas” to see which countries are currently exempt) and the requirements are subject to change. As each application is treated as an individual case, you should make enquiries with your nearest South African mission or consulate abroad or any office of the Department of Home Affairs to see whether or not you are required to apply for a visa.

Remember that there is a fee charged for issuing a visa, and you should check the cost with the office as well, as this is updated annually. The fee is payable in different currencies in different countries.

Visas for people attending a conference in South Africa

• Normal procedures must be followed for applying for a visitor’s visa (Form BI-84 - visit the website http://www.bioem2014.org/documents/Visabi84.pdf to download form)
• The application for a visa must be supported by a letter of invitation for the conference
• The conference organizer will notify the Department of Home Affairs that the conference is taking place - giving all the relevant details and a list of delegates, if possible
• The Department of Home Affairs will then notify all South Africa representatives abroad, authorising them to issue visas to the delegates providing that
• nothing detrimental is known about the delegate, and that
• all visitor visa requirements are met

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All delegates from outside Africa are encouraged to take an inter-continental flight directly into Cape Town or Johannesburg on well-known carriers or their alliance partners.

IMPORTANT DOCUMENTS
Make two copies of all your important documents, like passports. Take one with you, in a different bag to the original, and leave one at home with a responsible, easily reachable person. Try to memorise all your important numbers - passport numbers, credit card numbers, etc – or store them securely (some smartphones have “password keeper” applications). If you lose your bag, this could be an enormous help.

INSURANCE
The congress organisers cannot accept liability for personal injuries sustained, or for loss of, or damage to, property belonging to congress participants (or their accompanying persons), either during or as a result of the congress. Please check the validity of your own insurance.

RESTAURANTS
Visit the following websites for a list of restaurants in the V & A Waterfront
http://www.restaurants.co.za/western-cape/victoria-alfred-waterfront

The following restaurants offer a 15% discount off your bill provided delegates produce some sort of identification (conference name tag) that they are part of the conference:

City Grill Steakhouse
www.citygrill.co.za
Greek Fisherman
www.greekfisherman.co.za
Meloncino
www.meloncino.co.za

The following restaurants offer a 10% discount off your bill provided delegates produce some sort of identification (conference name tag) that they are part of the conference:

Belthazar Restaurant and Wine Bar
www.belthazar.co.za
Gibson’s Gourmet Burger and Ribs
www.gibsonsburgers.co.za

MORE USEFUL TRAVEL INFORMATION:
WEATHER IN SA
Please visit the following website for a current weather report http://www.weathersa.co.za/web and choose the city you would like a report on.

Cape Town Climate in June:
Although Cape Town winters have a reputation for rain and wind, they often produce perfect days or even weeks. Some climatic change seems to have reduced winter rainfall, and when its not raining, winter becomes a perfect green season, when temperatures can reach a summery 26C (80F) or higher. Capetonians watching the World Cricket Cup being played in England in June regularly enjoyed temperatures and weather much more suitable for cricket here than they were there. This time is known in Cape Town as the "Secret Season" - because of all the secret pleasures to be experienced!

TAX
14% Value Added Tax is included in all costs. Visitors can claim back this Tax for purchases in excess of R250.00 at central points in major centres and International Airports.

VACCINATIONS
South Africa's yellow fever vaccination requirements policy has been reviewed. As of 1 October 2011, South Africa requires all travellers journeying from yellow fever risk countries to show proof of yellow fever vaccination by means of a valid yellow fever certificate.

Countries for which a yellow fever vaccination certificate is required for entry into South Africa are Angola, Argentina, Benin, Bolivia, Brazil, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Colombia, Guinea-Bissau, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Ecuador, Equatorial Guinea, Ethiopia, French Guyana, Gabon, Gambia, Ghana, Guinea, Guyana, Kenya, Liberia, Mali, Mauritania, Niger, Nigeria, Panama, Paraguay, Peru, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, Sudan, Suriname, Togo, Trinidad and Tobago, Uganda, United Republic of Tanzania, Venezuela, and Zambia.

CREDIT CARDS
All major credit cards are accepted : Visa, MasterCard, Amex and Diners Club.

SERVICE CHARGES
It is customary to add 10% Service Fee to all Food and Beverage charges. The following service providers expect a tip: Luggage porters, taxi drivers, tour guides, coach drivers, restaurant waiters and waitresses, and car guards.

TIME ZONE
GMT + 02:00

CURRENCY
South African Rand (ZAR)

INTERNATIONAL AIRPORTS
Cape Town | Johannesburg | Durban | Nelspruit |

EMERGENCY CONTACTS
If you’re in your hotel room, contact the emergency number provided or the front desk.
If you're out and about, dial 10111 from a landline for the police or 112 from a local mobile phone for emergency assistance.

ELECTRICITY

- The South African electricity supply is 220/230 volts AC 50 HZ.
- Most plugs are 15 amp 3-prong or 5 amp 2-prong, with round pins. Adaptors are available locally.
- US-made appliances may need a transformer.
- Most hotel rooms have 110 volt outlets for electric shavers and appliances.

TELEPHONE CALLS

Telecommunications in South Africa also includes a well-established mobile (cellular) phone network. Four mobile service providers - Vodacom, MTN, Cell C and Telkom Mobile - ensure countrywide coverage and reception is generally good in urban areas. Mobile phones can be hired at all international airports and prepaid airtime can be purchased at most retail outlets.

Useful information on dialing codes:

- For outgoing international calls, dial 00 plus the country and area codes of the destination concerned. Refer to telephone directories for international dialing codes, or obtain 24-hour assistance by calling 10903.
- For incoming international calls, the code is +27 followed by the city code or cellphone code, dropping the first 0.
- Important local city dialing codes: 011 - Johannesburg; 012 - Pretoria; 021 - Cape Town; 031 - Durban; 041 - Port Elizabeth

South Africa's mobile phone operators utilize the GSM system. If your phone is GSM compatible, set up international roaming with your service provider before you leave home.

DRINKING WATER

Drinking water in South Africa is safe to drink when taken from taps in urban areas. The Department of Water Affairs and Forestry maintains that South Africa’s national standard of water quality compares well with World Health Organisation standards.

SECURITY

Safety precautions in South Africa are more common sense than hard and fast measures. Important South African safety advice includes avoiding deserted areas at night; securing valuables such as photographic equipment and wallets on your person; and leaving expensive, flashy jewellery in your hotel safe while out and about.

- Being vigilant of your luggage and other belongings (never leave them unattended).
- Storing valuables in your hotel safe.
- Limit the amount of money you carry on your person. Also, don’t accept offers of assistance at ATMs and keep your pin numbers secure.
- When using a credit card in restaurants, ask the waiter to bring a portable credit card machine to your table. Report stolen or lost cards immediately.
ORAL AND POSTER PRESENTATION GUIDELINES

Please find below some potentially useful material to assist you in preparing a presentation for BioEM2014.

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@bioem2014.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.

Oral Presentations

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

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

Student Poster Presentations with Flash Presentation

Poster sessions are an important part of the BioEM2014 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 9th, and B on Tuesday, June 10th, are planned.
- All student posters will be presented as poster flash presentation. The poster flash session will take place at the beginning of the above mentioned poster session A: on Monday June 9th, in The Ballroom, from 16:30 to 16:50.
• 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 send your presentation tpc@bioem2014.org by June 6th, 2014 either in Powerpoint (.ppt) or PDF format, since all flash poster presentations will be uploaded beforehand on the same computer and in a single presentation. The presenters will not be allowed to use their USB memory sticks or laptops during the session.

The best student poster(s) will be awarded.

*Poster Presentations*

The Poster Sessions will be held in **The Baltic Room, The Pavilion Conference Centre, Clock Tower Square, V & A Waterfront**, walking distance from the main conference venue in the Table Bay hotel. Double-sided boards in portrait format, will be available for each author to attach their posters to and authors are advised to **limit their poster size to 120 cm (height) X 90 cm (width)**. Double-sided tape will be provided by the organizers for mounting posters. The boards will be numbered to correspond with poster numbers in the Program and student posters will be clearly identified. The organizers are not liable for any poster materials.

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

**Mounting:** Posters can be mounted from 12:00 on Monday 9 June 2014. Each board will be marked with the poster number, as indicated in the final program. Double sided tape will be provided to the mount posters

**Removal:** Posters must be removed before 15:00 on Wednesday 11 June 2014.

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

Session: DA
June 9, 2014 • 09:00 - 10:00
The Ballroom, Table Bay Hotel
Chair: Alexandre Legros

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

01-1 [10:30]
Calcium toxicity in cells exposed to nanosecond pulsed electric field (nsPEF)
Olga Pakhomova1, Betsy Gregory1, Iurii Semenov1 & Andrei Pakhomov1
1Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA, 23508
Keywords: Electroporation, Pulsed, Completed (unpublished)

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

01-2 [10:50]
Extremely low frequency pulsed electromagnetic fields improve the maturation of primary human osteoblasts by activation of the ERK1/2 signaling and induction of osteogenic transcription factors
Andreas K Nussler1, Sabrina Ehnert1, Patrysya Lacorte1, Christina Stacke2, Anne-Kristin Fentz2, Karsten Falldorf2 & Jens Sachtleben2

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

02-1 [10:30]
International policy and advisory response regarding children’s exposure to RF-EMF
Mary Redmayne1, 2
1Centre for Population Health Research on Electromagnetic Energy, Monash University, Melbourne, Australia, 3004
2School of Geography, Environment and Earth Sciences, Victoria University of Wellington, Wellington, New Zealand, 6012
Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

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

02-2 [10:50] - STUDENT PAPER
Mobile phone use during night and its impact on health and cognitive functions in adolescents
Anna Schoenl1, 2, Katharina Roser1, 2 & Martin Roosli1, 2
1Swiss Tropical and Public Health Institute, Basel, Switzerland
2University of Basel, Basel, Switzerland
Keywords: Epidemiology, RF/Microwaves, Work in Progress
A therapy improving osteoblast function could accelerate fracture healing for non-unions and/or delayed unions. In this study the influence of electromagnetic fields on primary human osteoblasts' and osteoclast function is investigated. Our data show that EMF treatment significantly improves viability and AP-activity in human osteoblasts early in the differentiation process. Furthermore, electromagnetic stimulation enhanced the formation of mineralized matrix.

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

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

The Effects of Magnetic Fields on Free Radical Pairs
Frank Barnes 1 & Ben Greenebaum 2
1Department of Electrical, Computer, and Energy Engineering, University of Colorado, Boulder, CO, USA, 80309-0425
2Department of Physics, University of Wisconsin-Parkside, Kenosha, WI, USA, 53141-2000
Keywords: Mechanistic/Theoretical, ELF/LF, Completed (unpublished)
Free radical concentrations can be modified by weak magnetic fields by modifying the population distribution of the nuclear and electronic spin states. Coupling between the nuclear and electronic spin states depends on the states and their orientation with respect to the externally applied magnetic field, according to the hyperfine structure Hamiltonian. At frequencies corresponding to the energy separation between the spin orientation energies, magnetic fields at low intensities can lead to transitions that result in

RF and ELF electromagnetic field exposure of children in the French ELFE birth cohort
Bouvier Ghislaine 1, Rene De Seze 2, Gaelle Coureau 1, Blandine Vacquier 3 & Isabelle Baldi 1
1Santé-Travail-Environnement, ISPED, Bordeaux, France, 33076
2ToxiPeritox UMR I01, INERIS, Verneuil en Halatte, France, 60550
3Département Santé Environnement, INVS, Saint-Maurice, France, 94415
Keywords: Epidemiology, RF/Microwaves, Work in Progress
A French birth cohort of about 18000 children called ELFE started in 2011. It is planned to assess RF and ELF exposure in the cohort by questionnaires, and to validate this exposure assessment by actual measurements by 400 children at the age of 3.5. A job-exposure matrix will be
changes in the populations of both electron and the nuclear states, which in turn can change the electrons in radical pairs between S and T and hence their recombination rate and radical concentrations.

01-5 [11:50]
The Increase in Migration Speeds of Amoeba Under 1.6 Hz AC Electric Fields is Consistent with an Electromechanical Transduction Model
Francis Hart¹ & John Palisano²
¹Department of Physics, The University of the South, Sewanee, TN, USA, 37383
²Department of Biology, The University of the South, Sewanee, TN, USA, 37383

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

02-5 [11:50]
Use of mobile phones and cognitive effects in Australian primary school children
Mary Redmayne¹, ², Catherine Smith¹, Geza Benke¹, Rodney Croft¹, ³, Anna Dalecki³, David Darby¹, Christina Dimitriadis¹, Skye Macleod¹, Jordy Kaufman¹, Malcolm Sim¹, Rory Wolfe¹ & Michael Abramson¹
¹Centre for Population Health Research on Electromagnetic Energy, Monash University, Melbourne, Australia, 3004
²School of Geography, Environment and Earth Sciences, Victoria University of Wellington, Melbourne, New Zealand, 6012
³Australian Centre for Electromagnetic Bioeffects Research, University of Wollongong, Wollongong, Australia, 2522

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

01-6 [12:10]
Interdisciplinary research on the causes of childhood leukemia
Gunde Ziegelberger¹, Anne Dehos¹, Bernd Grosche¹ & Sabine Hornhardt¹
¹Federal Office for Radiation Protection (BfS), Neuhemberg/Munich, Germany, 85764

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

02-6 [12:10] - STUDENT PAPER
Children’s Exposure to Extremely Low Frequency Magnetic Fields: A Personal Exposure Measurement Study
Benjamin Struchen¹, Ilaria Liorni², ³, Marta Parazzini², Stephanie Gängler¹, Paolo Ravazzani² & Martin Roosli¹
¹Epidemiology and Public Health, Swiss Tropical and Public Health Institute, Basel, Switzerland, 4051
²Istituto di Elettronica e di Ingegneria dell’Informazione e delle Telecomunicazioni (IEIIT), Consiglio Nazionale delle Ricerche (CNR), Milan, Italy, 20133
³Dipartimento di Elettronica, Informazione e Bioingegneria (DEIB), Politecnico di Milano, Milan, Italy, 20133

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

### Session: 03
**Neurological effects I**

**June 9, 2014 • 14:00 - 16:00**

**The Ballroom, Table Bay Hotel**

**Chairs:** Heidi Danker-Hopfe & Rene De Seze

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**03-1 [14:00]**

**Threshold for magnetophosphenes perception and EEG response in humans exposed to 50 and 60 Hz MF up to 50,000 µT**

Alexandre Legros¹, ², ³, ⁴, Julien Modolo¹, ², ³, Daniel Goulet⁵, Michel Plante⁵, Martine Souques⁶, François Deshamps⁷, Genevieve Ostiguy⁵, Jacques Lambrozo⁶ & Alex Thomas¹, ², ³

¹Human Threshold Research Group, London, ON, Canada, N6A4V2
²Department of Medical Biophysics, London, ON, Canada
³Department of Medical Imaging, London, ON, Canada
⁴School of Kinesiology, London, ON, Canada
⁵Hydro-Québec, Montréal, QC, Canada
⁶Service des études médicales, Paris, France
⁷Service Environnement Réseaux, Paris, France

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

**OBJECTIVE:** Quantify human EEG response and magnetophosphene perception in 50 and 60 Hz MFs up to 50 mT.

**METHODS:** Magnetophosphene perception and EEG collected during 55 MF conditions at 50 and 60 Hz.

**RESULTS:** Magnetophosphene perception threshold between 10 and 30 mT depending on the exposure conditions.

**CONCLUSIONS:** Pilot results provide a preliminary estimate of magnetophosphene perception threshold at 50 and 60 Hz. Associated EEG changes will be presented at the conference.

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**03-2 [14:20]**

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

Julien Modolo¹, ², ³, Daniel Goulet⁵, Michel Plante⁵, Martine Souques⁶, François Deshamps⁷, Genevieve Ostiguy⁵, Raphaël Paquin⁸, Jacques Lambrozo⁶, Alex Thomas¹, ², ³ & Alexandre Legros¹, ², ³, ⁴

¹Human Threshold Research Group, Lawson Health Research Institute, London, ON, Canada, N6A4V2
²Department of Medical Biophysics, Western University, London, ON, Canada
³Department of Medical Imaging, Western University, London, ON, Canada
⁴School of Kinesiology, Western University, London, ON, Canada
⁵Hydro-Québec, Montréal, QC, Canada
⁶Service des Études Médicales, Electricité de France, Paris, France

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### Session: 04
**Calculations of Human Exposure**

**June 9, 2014 • 14:00 - 16:00**

**The Pavilion, Table Bay Hotel**

**Chairs:** Marthinus Van Wyk & Andrew Wood

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**04-1 [14:00]**

**Dosimetry Work in South Africa over the past Two Decades**

Frans Meyer¹, Marthinus Van Wyk¹ & Francois du Plessis¹

¹EMSS Consulting, Stellenbosch, South Africa, 7600

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

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

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**04-2 [14:20] - STUDENT PAPER**

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

Yijian Gong¹, ², Myles Capstick¹, Niels Kuster¹, ², Clemens Dasenbrock³, Maren Fedrowitz⁴, Cesar Cobaleda⁵ & Isidro Sánchez-García⁶

¹IT’IS Foundation, Zurich, Switzerland, 8004
²Information Technology and Electrical Engineering, ETHZ, Zurich, Switzerland, 8092
³ITEM, Fraunhofer Institute, Hannover, Germany, 30625
⁴Department of Pharmacology, Toxicology, and Pharmacy, University of Veterinary Medicine, Hannover, Germany
⁵Centro de Biologia Molecular Severo Ochoa, CSIC/IUAM, Madrid, Spain
⁶Experimental Therapeutics and Translational Oncology Program, CSIC/Universidad de Salamanca, Salamanca, Spain, 37007

**Keywords:** Dosimetry (computational), ELF/LF, Work in Progress
Does TETRA exposure affect brain activity during sleep?
Heidi Danker-Hopf, Cornelia Sauter, Torsten Eggert, Gernot Schmid, Thomas Bolz & Hans Dorn
Competence Center of Sleep Medicine, Charité - University Medicine Berlin, Berlin, Germany, 14050
Seibersdorf Laboratories, Seibersdorf, Austria, 14050
IMST GmbH, Kamp-Lintfort, Germany, 47475

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

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

03-4 [14:40] - STUDENT PAPER
Acute cognitive effects of MRI related magnetic fields: the role of vestibular responsiveness
Lotte Van Nierop, Pauline Slottje, Martine van Zandvoort, Herman Kingma & Hans Kromhout
Institute for Risk Assessment Sciences, Utrecht University, Utrecht, the Netherlands, 3584 CM
Helmholtz Institute, Utrecht University, Utrecht, the Netherlands
Division of Balance Disorders, University Hospital Maastricht, Maastricht, the Netherlands
Keywords: Behavioural, Static, Work in Progress

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

04-3 [14:40] - STUDENT PAPER
Multimodal Imaging-Based Detailed Head Model for EMF-Neuron Interaction Related Applications
Maria Iacono, Esra Neufeld, Esther Akinnagbe, Johanna Wolf, Ioannis Oikonomidis, Deepika Sharma, Bertram Wilm, Michael Wyss, Klaas Pruessmann, Andras Jakab, Ethan Cohen, Niels Kuster, Wolfgang Kainz & Leonardo Angelone
Center for Devices and Radiological Health, U.S. Food and Drug Administration, Silver Spring, MD, USA
Foundation for Research on Information Technologies in Society (IT\'IS), Zurich, Switzerland, 8004
Swiss Federal Institute of Technology (ETH) Zurich, Zurich, Switzerland, 8092
Institute for Biomedical Engineering, University of Zurich and ETH Zurich, Zurich, Switzerland, 8092
Computational Image Analysis and Radiology Lab, Medical University of Vienna, Vienna, Austria, 1090

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

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

04-4 [15:00] - STUDENT PAPER
Study of the influence of the magnetic field orientation using Polynomial Chaos decomposition applied to the pregnant woman exposure at 50 Hz
Ilaria Liorni, Marta Parazzini, Serena Fiocchi, Vanessa Guadagnini & Paolo Ravazzani
Dipartimento di Elettronica, Informazione e Bioingegneria DEIB, Politecnico di Milano, Milano, Italy, 20133
Istituto di Elettronica e di Ingegneria dell’Informazione e delle Telecomunicazioni IEIIT-CNR, Milano, Italy, 20133

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

03-5 [15:20]
Cattle under power lines – extremely low frequency magnetic fields (ELF MF) disturb magnetic alignment

Sabine Begall1, Pavel Nemec2, Erich Malkemper1, Julia Weiße1 & Hynek Burda1, 3
1Dept. General Zoology, University of Duisburg-Essen, Essen, Germany, 45117
2Biodiversity Research Group, Department of Zoology, Charles University in Prague, Prague, Czech Republic, 128 44
3Department of Game Management and Wildlife Biology, Czech University of Life Sciences, Prague, Czech Republic, 165 21

Keywords: Behavioural, ELF/LF, Work in Progress

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

03-6 [15:40]
Effects of Early-Onset Radiofrequency Electromagnetic Field Exposure (GSM 900 MHz) on Behavior and Memory in Rats

Melanie Klose1, Karen Grote1, Oliver Spathmann2, Joachim Streckert2, Volkert Hansen2 & Alexander Lerchl1
1Jacobs University Bremen, Bremen, Germany, 28759
2University of Wuppertal, Wuppertal, Germany, 42119

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

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

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

04-5 [15:20]
The absorption pattern of electromagnetic radiation from wireless devices in the skin at different sites of the body

Ioannis Markakis1, 2, George Tsanidis2 & Theodoros Samaras1
1Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece, 54124
2THESS, Thessaloniki Software Solution S.A., Thessaloniki, Greece, 57001

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

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

04-6 [15:40]
Human Exposure to Magnetic Fields from 765 kV Transmission Lines: Measurements and 3-D Anatomical Body Dosimetry

Roy Hubbard1, Ian Jandrell2 & Steven Dinger3
2Faculty of Engineering and the Built Environment, University of Witwatersrand, Johannesburg, South Africa, 2000
3Biomedical Engineering Research Group in the School of Electrical & Information Engineering, University of Witwatersrand, Johannesburg, South Africa, 2000

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

Limits on human exposure to low frequency magnetic fields are specified for tissues/organs in situ electric fields. These dosimetric limits are referred to as Basic Restrictions for protection against potentially adverse effects from electro-stimulation. Reference Levels are given for compliant purposes and are derived from the Basic Restrictions based on uniform-fields with a provision that the basic restrictions must be observed for non-uniform cases. The human exposure to magnetic fields from Eskom’s 756 kV transmission network operating at 50 Hz, is addressed
through physical measurements, predictions and 3-D human model dosimetry, which is presented in this paper.

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

F-1 [16:30] - STUDENT PAPER
Acute exposure to 1.8 GHz radiofrequency radiation influences cellular oxidation-reduction balance
AnaMarija Marjanovic¹, Ivan Pavicic¹ & Ivancica Trosic¹
¹Radiobiology and Dosimetry Unit, Institute for Medical Research and Occupational Health, Zagreb, Croatia, 10000
Keywords: In vitro, RF/Microwaves, Completed (unpublished)
Rapid technological expansion and increase in the number of mobile phone users has raised concern about possible health effects of radiofrequency radiation exposure. Non-thermal effects and their possible mechanism of action are still being controversial. One of the possible explanations could be connected to reactive oxygen species (ROS) and oxidative stress. The aim of this study was to investigate effect of 1.8 GHz mobile phone radiation on cell oxidative stress development by measuring level of ROS, lipid damage and antioxidant defence mechanism in Chinese hamster lung fibroblasts (V79).

F-2 [16:33] - STUDENT PAPER
Exposure to extremely low frequency magnetic fields in various Swiss and Belgium microenvironments
Milena Foerster¹, Damiano Uribelllo¹, Benjamin Struchen¹ & Martin Roosli¹
¹Swiss Tropical and Public Health Institute, University of Basel, Basel, Switzerland, 4055
Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)
By using portable devices, extremely-low frequency magnetic field (ELF-MF: 40-800 Hz) measurements were conducted during two years in the city of Basel (Switzerland) and during one year in Ghent and Brussels (Belgium) in different microenvironments such as outdoor areas, public transports and indoor settings. We found high spatial variability of EMF within and between cities, but all average exposure values were far below the RF and ELF regulatory limits.

F-3 [16:36] - STUDENT PAPER
Application of the non-intrusive polynomial chaos for the evaluation of the uncertainty in the SAR calculation using a CAD-based mobile phone model
Xi Cheng¹ & Vikass Monebhurrun¹
¹Department of Electromagnetics, SUPELEC, Gif-sur-Yvette Cedex, France, 91192
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)
The TC34/SC2 committee of the International Commission on Electromagnetic Safety is developing standardized procedures for using computational tools to evaluate the specific absorption rate (SAR) in the human body. For meaningful numerical simulation results, it is important to state the uncertainty of the SAR calculation induced by the uncertainties in the input parameters. The Monte Carlo method cannot be applied and the second order unscented transform was previously proposed as a potential alternative to evaluate the uncertainty. Herein the non-intrusive polynomial chaos method is proposed as a more efficient approach to evaluate the uncertainty induced in the SAR calculations using CAD-based mobile phone models.

F-4 [16:39] - STUDENT PAPER
EMF exposure metering: Dealing with pulsed RF signals
Marco Zahner¹ & Jürg Fröhlich¹
¹Institute of Electromagnetic Fields, ETH Zurich, Zurich, Switzerland, 8092
Keywords: Dosimetry (measurements), Pulsed, Work in Progress
In order to achieve a meaningful electromagnetic field (EMF) exposure assessment it is desirable to monitor the contributions of all potential sources at the location of interest. A solely frequency based measurement however lacks sufficient complexity to deal with signal shapes that strongly deviate from those encountered in communication and broadcast systems. The issue of measurement of highly pulsed signals is illustrated by assessing the exposure to radar signals. A hybrid time and frequency domain detection scheme is presented. This approach was successfully tested using an experimental hardware prototype.

F-5 [16:42] - STUDENT PAPER
2 mT Extremely Low Frequency Magnetic Fields have no effect on mouse oocytes meiotic maturation in vitro
Hong Ling1, Kan Zhu1, Hengyu Fan2 & Qunli Zeng1
1Bioelectromagnetics Laboratory, Hangzhou, China, 310058
2Life Science Institute of Zhejiang University, Hangzhou, China, 310058

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

Widely applications of power lines, domestic appliances and electronic products make people exposed to unprecedented levels of extremely low frequency magnetic fields (ELF-MF) and raise concerns about the potential effects on female reproduction. In this study, we investigated the effects of 50 Hz ELF-MF of 2 mT for 24 hours on mouse oocytes cultured in vitro. We focused on several key events in the process of oocytes meiotic maturation, including the following: γH2AX foci formation of oocytes on GV (Germinal vesicle) stage, Germinal vesicle breakdown (GVBD) rate, first polar body (PB1) extrusion rate, spindle and chromosome configurations, and activation of oocytes. No differences were found between sham-exposed and exposed groups.

F-6 [16:45] - STUDENT PAPER
A review of environmental data on where in the industrial and medical work environmental exposure to electromagnetic fields may be hazardous to users of active implantable medical devices (AIMD)
Wiesław Leszko1, Jolanta Karpowicz1, Patryk Zrądziński1 & Krzysztof Gryz1
1Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Czerniakowska 16; wles@ciop.pl; jakar@ciop.pl, Poland, 00-701

Keywords: Occupational, RF/Microwaves, Work in Progress

The study was performed to identify the most common exposure situations in the industrial and medical work environments where AIMD EMF-related dysfunctions may be considered.
Effect of radiofrequency electromagnetic field on human blood cells
Yao-Xiong Huang1

1Department of Biomedical Engineering, Ji Nan University, Guang Zhou, China, 510632
Keywords: In vitro, RF/Microwaves,

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

Sem1-4 [19:00]
Challenges and opportunities for laboratory studies on EMF exposure and health: experiences from
Bioelectromagnetics Laboratory, Zhejiang University School of Medicine
Zhengping Xu1, 2 & Guangdi Chen1, 2
1Bioelectromagnetics Lab, Zhejiang University School of Medicine, Hangzhou, China, 310058
2Institute of Environmental Health, Zhejiang University School of Medicine, Hangzhou, China, 310058
Keywords: In vitro, ELF/LF,

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

Sem1-5 [19:15]
Cellular response to electromagnetic fields exposure: experiences from in vitro studies
Guangdi Chen1, 2 & Zhengping Xu1, 2
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2Institute of Environmental Health, Zhejiang University School of Medicine, Hangzhou, China, 310058
Keywords: In vitro, ELF/LF,

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

Sem1-6 [19:30] -
Current RF-EMF related research activities in Malaysia
Kwan-Hoong Ng1
1Department of Biomedical Imaging & University of Malaya Research Imaging Centre, University of Malaya, Kuala Lumpur, Malaysia, 50603
Keywords: , ,

To be provided

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

P1-1 [09:00]
Making sense of nonsense: The study of magnetic alignment in vertebrates
Hynek Burda1, 2, Sabine Begall1, Vlastimil Hart2, Erich Malkemper1 & Petra Novakova2
1General Zoology, University Duisburg-Essen, Essen, Germany, 45117
2Game Management and Wildlife Biology, Czech University of Life Sciences, Praha, Czech Republic, 16521
Keywords: Behavioural, Static, Completed (published)
Directional body orientation (heading) of resting, moving, or otherwise active animals is usually not random. We may expect that an individual would adopt a position which, under given conditions, saves energy, is more comfortable, or provides certain advantages, e.g. better access to food, oxygen, and information. Scanning for cases of magnetic alignment (MA), i.e. orientation of the body with respect to the geomagnetic field lines, represents a not only a simple method to monitor the existence of magnetoreception in animals, but also a suitable experimental paradigm for magnetobiological research. We review the known cases of MA in vertebrates and demonstrate heuristic potential of the study of this phenomenon.

P1-2 [10:00]
Reception and learning of electric fields in bees
Uwe Greggers1
1Institut für Biologie, AG Neurobiologie, Berlin, Germany
Keywords: Behavioural, Static, Original - work in progress, concept
Honeybees emit constant and modulated electric fields with low- and high-frequency components when flying, landing, walking and during the waggle dance. Both components induce passive antennal movements in stationary bees according to Coulomb’s law. Using laser vibrometry, we show that the electrically charged flagellum is moved by constant and modulated electric fields and more strongly so if sound and electric fields interact. Recordings from axons of the Johnston organ document its sensitivity to electric field stimuli. Our analyses identify electric fields emanating from the surface charge of bees as stimuli for mechanoreceptors, and as biologically relevant stimuli, which may play a role in social communication.

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

Session: EBEA
EBEA General Assembly
June 10, 2014 • 13:00 - 14:00
The Ballroom, Table Bay Hotel
05-1 [14:30] Impact of millimeter waves exposure on cellular response to energetic stress
Denis Habauzit1, Yonis Soubere Mahamoud1, Meziane Aite1, Catherine Martin1, Maxim Zhadobov2, Ronan Sauleau2 & Yves Le Dréan1
1IRSET, University of Rennes 1, Rennes, France, 35042
2IETR, University of Rennes 1, Rennes, France, 35042
Keywords: In vitro, RF/Microwaves, Completed (unpublished)
This study investigated possible additive effects of millimeter-waves (MMW) radiations on cellular response to metabolic stress. 4 groups of primary keratinocytes were included: 1) Sham; 2) MMW exposure at 60 GHz and 20 mW/cm²; 3) chemical treatment with 2 deoxy-glucose (2dG); 4) 2dG and MMW co-treatment. DNA microarray analysis was performed. Our results show that MMW do not induce significant modification in gene expression when cells do not experience stress. Comparison between MMW-2dG co-exposure and 2dG treatment alone, followed by RT-PCR validation identified 5 genes differentially expressed.

05-2 [14:50] - STUDENT PAPER
Differential Impact of Low Level EMF on Longevity, Apoptosis, and Oxidative Profile of Drosophila melanogaster
Areti Manta1, Issidora Papassideri1, Dimitrios Stravopodis1 & Lukas Margaritis1
1Dept. of Cell Biology and Biophysics, Athens University, Athens, Greece, 15784
Keywords: In vivo, RF/Microwaves, Work in Progress
This study has focused on the biological impact of low level EMFs emitted by DECT cordless phone, used by millions of people in their everyday life. In order to examine possible effects Drosophila melanogaster was chosen to be the model system because of its advantages concerning studies for oxidative stress. It was found increase in ROS levels at all ages, deterioration of insects’ wellbeing but no change in their viability, and accumulation of carbonylated proteins although MDA levels were unaffected.

06-1 [14:30] Numerical Investigation of MRI Gradient Coil Switching Induced Nerve Stimulation
Esra Neufeld1, Ioannis Oikonomidis1,2, Deepika Sharma1,2, Maria Iacono3, Leonardo Angelone3, Wolfgang Kainz3 & Niels Kuster1,2
1Foundation for Research on Information Technologies in Society (IT'IS), Zurich, Switzerland, 8004
2Swiss Federal Institute of Technology (ETH) Zurich, Zurich, Switzerland, 8092
3Center for Devices and Radiological Health, U.S. Food and Drug Administration, Silver Spring, MD, USA
Keywords: Mechanistic/Theoretical, ELF/LF, Completed (unpublished)
Nerve stimulation by MRI gradient coil switching is a safety issue typically addressed through thresholds on slew rates, dB/dt, or E/M-field strength. Coupled EM-neuronal dynamics modeling was performed, considering the impact of tissue/field inhomogeneity, coupling mechanisms, neuron models, and local. RF-coil induced heating affecting ion-channel dynamics. It was found that: the inhomogeneous field affects the stimulation threshold, end-node stimulation is not the only dominant mechanism and local field foci are relevant - as opposed to the assumptions underlying the standards –, and temperature impacts significantly neuronal dynamics, but less so stimulation thresholds. The acceptability of field smoothing is discussed.

06-2 [14:50] Miniaturized vivaldi antenna system for pneumothorax diagnosis: proposed air detection scenarios
Maria Christopoulou1 & Stavros Koulouridis1
1Department of Electrical and Computer Engineering, University of Patras, Rio, Greece, 26504
Keywords: Clinical (diagnostics), RF/Microwaves, Work in Progress
A novel sensor model based on a miniaturized Vivaldi antenna is investigated, in order to non-invasively diagnose air volumes into the pleural cavity of lung area (i.e. pneumothorax). Proposed detection scenarios are calculated using simplified a) planar multilayered, b) closed rectangular layered thorax and c) MRI-based anatomical whole body phantoms. The frequency range of operation is set to 1 - 4 GHz. The best detection scenario for 1 cm air thickness consists of two antennas with given relative positioning onto the closed thorax model and results to 38.2 dB difference in S12, at 3 GHz.
05-4 [15:30] Effects of long-term exposure to 60 GHz millimeter-wave on genotoxocities in HCE-T and SRA cells derived from human eye

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

1 Laboratory of Applied Radio Engineering for Humanosphere, Research Institute for Sustainable Humanosphere, Kyoto University, Uji, Japan, 611-0011
2 Department of Electrical & Electronic Engineering, Graduate Schools of Science and Engineering, Tokyo Metropolitan University, Hachioji, Japan, 192-0397

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

Two kinds of cells (HCE-T and SRA) derived from human eye were exposed to a millimeter-wave for 24 hours. The micronucleus (MN) frequency of cells treated with bleomycin for 1 hour was high enough as a positive control. However, there is no statistically significant increase in the MN frequency of cells exposed to 60 GHz millimeter-wave at 1 mW/cm² compared with sham-exposed controls. The comet assay to detect DNA damage in JAR cells between sham and exposure group. Key words: magnetic fields; DNA Damage; Comet Assay; γ-H2AX; human choriocarcinoma cell line

06-4 [15:30] Estimation of in vivo Local RF-Induced Heating of Implanted Medical Devices during MRI: Method and Validation

Earl Zastrow1, 2, Eugenia Cabot1, Myles Capstick1, Andreas Christ1 & Niels Kuster1, 2

1 ITIS Foundation, Zurich, Switzerland, 8004
2 Department of Information Technology and Electrical Engineering, ETH-Zurich, Zurich, Switzerland, 8092

Keywords: Standards, RF/Microwaves, Work in Progress

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

05-5 [15:50] Genomic instability and DNA damage responses after exposure to 50 Hz magnetic fields in human SH-SY5Y neuroblastoma cells

Jukka Luukkonen1, Anne Höytö1, Miiko Sokka2, Anu Liimatainen1, Juhani Syväoja1, Jukka Juutilainen1 & Jonne Naarala1

1 Department of Environmental Science, University of Eastern Finland, Kuopio, Finland
2 Department of Biology, University of Eastern Finland, Joensuu, Finland

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

06-5 [15:50] - STUDENT PAPER

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

Fatemeh Adibzadeh1, Rene Verhaart1, Valerio Franckena2, Martine Franckena1, Gerda Verdijn1, Gerard van Rhoon1 & Maarten Paulides1

1 Hyperthermia Unit, Erasmus MC - Cancer Institute, Rotterdam, the Netherlands, 3074 ME
2 Biomedical Imaging group of Rotterdam, Erasmus MC - Cancer Institute, Rotterdam, the Netherlands, 3074 ME
In this study, human SH-SY5Y neuroblastoma cells were exposed to a 50-Hz, 100 μT extremely low frequency (ELF) magnetic field (MF) for 24 h, followed by menadione treatment for 1 or 3 h. The study evaluated the induction of genomic instability and a battery of endpoints relevant to DNA damage responses. This study showed, for the first time, that MF exposure induces genomic instability, reflected as an increased level of micronuclei at 8 and 15 days post-exposure. The results on the DNA damage response experiments will be presented in the meeting (including the level of several DNA damage response-related proteins, DNA damage level, and data on cell cycle distribution).

**06-6 [16:10]**
**Development of a New Generation of High-Resolution Anatomical Models for Medical Device Evaluation: The Virtual Population 3.0**
Marie-Christine Gosselin1,2, Esra Neufeld1, Heidi Moser1, Eveline Huber1, Silvia Farcito1, Livia Gerber1, Maria Jedensjoe1, Isabel Hilber1, Fabienne DiGennaro1, Bryn Lloyd1, Emilio Cherubini3, Dominik Szczesna1, Wolfgang Kainz4 & Niels Kuster1,2

1Foundation for Research on Information Technologies in Society (ITIS), Zurich, Switzerland, 8004
2Swiss Federal Institute of Technology (ETH) Zurich, Zurich, Switzerland, 8092
3Schmid and Partner Engineering AG (SPEAG), Zurich, Switzerland, 8004
4Center for Devices and Radiological Health, U.S. Food and Drug Administration, Silver Spring, MD, USA

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

This paper describes the R&D performed to upgrade the first generation of the Virtual Population (ViP 1.0) developed at the ITIS Foundation and obtain anatomical models that meet the requirements of medical implant safety assessment applications. The work included implementation of quality control procedures, re-segmentation at higher resolution, more-consistent tissue assignments, enhanced surface processing, anatomical refinements, the development of tools for enhancing model functionality (e.g., posing, morphing), and the compilation of a comprehensive tissue properties database. *In silico* MRI exposure of an adult woman with an orthopedic spinal implant is used to illustrate the improvements achieved.
W1-1 [17:00]
Ethics and Conflict of Interest in Bioelectromagnetics
Dariusz Leszczynski$^{1,2}$

$^1$Chief Editor of ‘Radiation and Health’, Frontiers in Public Health, Lausanne, Switzerland
$^2$Adjunct Professor, Biochemistry and Biotechnology, University of Helsinki, Helsinki, Finland

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

The Institute of Medicine of The US National Academies defines Conflict of Interest (CoI) as “a set of circumstances that creates a risk that professional judgment or actions regarding a primary interest will be unduly influenced by a secondary interest”. Not all CoI are equal. Some are more significant while some are less significant though classification of the significance seems to be a very gray area.
P2-1 [09:00]
Microwave Breast Imaging: The Potential Role of Dielectric Properties Sensing in Breast Health and Disease Management
Susan Hagness

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

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

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

P2-2 [10:00]
Electrical Impedance Tomography: Clinical and Experimental applications and perspectives
Andy Adler

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

Keywords: , , Original - work in progress, concept

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

W2-1 [11:30]
Workshop on Approaches on the implementation of the Directive 2013/35/EC
Georg Neubauer1, Philip Chadwick2, Joe Wiart3, Jolanta Karpowicz4, Hannelore Neuschulz5 & Georg Hilpert6

1Safety and Security Department, Austrian Institute of Technology, Seibersdorf, Austria, 2444
2EMF Fields Ltd., Trellech, UK, NP16 6QZ
3Recherche et Developpement, Orange Labs, Issy les Moulineaux, France, 92794
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6Federal Ministry of Labour and Social Affairs, Bonn, Germany, 53123

Keywords: Occupational, RF/Microwaves, Other

In 2013 the EU-Directive 2013/35/EC on health and safety requirements regarding the exposure of workers to EMFs was issued laying down obligations for employers to assess risk of their employees arising from electromagnetic fields at their workplaces. Member states have to bring into force laws, regulations and administrative provisions necessary to comply with the above mentioned Directive by 1 July 2016. This workshop is dedicated to give an overview on approaches within the member states on the approaches followed for implementation and to identify promising methods facilitating evaluation of workers exposure.
June 12, 2014

Session: T3
Tutorial 3: Dr. John Bolte, RIVM, Netherlands - Sources, levels of exposure & standards
June 12, 2014 • 08:00 - 09:00
The Ballroom, Table Bay Hotel

Session: P3
Plenary Session 3: Endogenous voltage gradients as mediators of cell-cell communication
June 12, 2014 • 09:00 - 10:30
The Ballroom, Table Bay Hotel
Chairs: Philip Chadwick & Micaela Liberti

P3-1 [09:00]
Staying in Shape: Membrane Voltage as a Master Regulator of Tissue Shape During Regeneration
Wendy Beane¹

¹Department of Biological Sciences, Western Michigan University, Kalamazoo, MI, USA, 49008
Keywords: Behavioural, Static, Completed (published)

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

Session: 07
Mechanisms 2
June 12, 2014 • 11:00 - 13:00
The Ballroom, Table Bay Hotel
Chairs: Andrei Pakhomov & Bernard Veyret

07-1 [11:00]
An Improvement Method of Estimation for Cell Cytoplasm Conductivity Using Nanosecond Pulsed Electric Fields: Coupling of a Microdosimetric model with experiments for a single cell
Agnese Denzi¹, Caterina Merla², Cristiano Palego³, ⁴, Yaqing Ning⁵, Caroline Malti², Xinzhong Cheng³, Francesca Apollonio¹, James C. M. Hwang³ & Micaela Liberti¹

¹ICEmB at DIET, Sapienza University of Rome, Rome, Italy, 00184
²ICEmB at ENEA, Rome, Italy, 00123
³Lehigh University, Bethlehem, PA, USA, 18015
⁴Bangor University, Bangor, UK, LL57 1UT
Keywords: Mechanistic/Theoretical, Pulsed, Completed (unpublished)

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

Session: 08
Occupational
June 12, 2014 • 11:00 - 13:00
The Pavilion, Table Bay Hotel
Chairs: Maila Hietanen & Georg Neubauer

08-1 [11:00]
Occupational Electric Shocks and Extremely Low Frequency Magnetic Fields Exposure and Mortality Due to Amyotrophic Lateral Sclerosis
Ximena Vergara¹, Leeka Kheifets² & Gabor Mezei³

¹EMF/RF Health Assessment and Safety, EPRI, Palo Alto, CA, USA, 94304
²Epidemiology, UCLA, Los Angeles, CA, USA, 90024
³Exponent Health Sciences , Menlo Park, CA, USA, 94025
Keywords: Occupational, ELF/LF, Completed (unpublished)

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

07-2 [11:20]
Nanoelectroablation of tumor cells leads to the translocation of calreticulin to the cell surface and the initiation of immunogenic apoptosis
Richard Nuccitelli1, Zachary Mallon1, Casey Berridge1, Mark Kreis1, Brian Athos1 & Pamela Nuccitelli1
1Research and Development, BioElectroMed Corp., Burlington, CA, USA, 94010
Keywords: Clinical (therapy), Pulsed, Work in Progress
We have been developing a non-thermal nanoelectroablation therapy for ablating tumors and unwanted skin lesions. This therapy delivers short (100 ns long) electric pulses 30 kV/cm in amplitude to the target tissue using contact electrodes. When at least 100 pulses are delivered, the treated tissue undergoes immunogenic apoptosis. The key “eat me” signals that initiate an immune response are the translocation of calreticulin to the cell surface and the movement of phosphatidyl serine to the outer leaflet of the plasma membrane. Here we report on our measurements of this ecto-calreticulin expression following nsPEF treatment of two tumor cell lines. We will also summarize our progress documenting this immune response.

07-3 [11:40]
Actin cytoskeleton and cellular effects of the nanosecond pulsed electric field (nsPEF)
Andrei Pakhomov1, Iuri Semenov1, Shu Xiao1,2, Olga Pakhomova1, Marjorie Kuipers2 & Bennett Ikey3
1Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA, 23508
2Dept. of Electrical and Computer Engineering, Old Dominion University, Norfolk, VA, USA, 23508
3Radio Frequency Bioeffects Branch, Bioeffects Division, Human Effectiveness Directorate, 711th Human Performance Wing, Air Force Research Laboratory, Fort Sam Houston, TX, USA, 78234
Keywords: Electroporation, Pulsed, Completed (unpublished)
We studied (1) the effect of 600- ns pulses at 19-20 kV/cm on actin cytoskeleton and (2) the role of the cytoskeleton in determining the cell permeabilization by nsPEF. A train of 4 pulses caused cell membrane poration, cell rounding, swelling, and disappearance of bright actin features. Blocking of swelling by isosmotic addition of sucrose blocked disassembly of actin features. Hence, disintegration of the actin was downstream from nsPEF-disruption of the actin. Blocking of swelling by isoosmotic addition of sucrose blocked disassembly of actin features. Hence, disintegration of the actin was downstream from nsPEF-induced cell swelling. Pharmacological disruption of the cytoskeleton by either Cytochalasin D or Latrunculin A did not affect the nsPEF-induced uptake of Yo-PRO-1, propidium iodide, or externalization of phosphatidylserine.

08-2 [11:20]
Developing a job-exposure matrix with exposure uncertainty from expert elicitation and data modeling
Heidi Fischer1, Ximena Vergara2, Michael Yost3, Michael Silva4, David Lombardi5 & Leeka Kheifets2
1Bioscience, UCLA, Los Angeles, CA, USA
2Epidemiology, UCLA, Los Angeles, CA, USA
3Environmental and Occupational Health Sciences, University of Washington, Seattle, WA, USA
4, ENERTECH, Los Gatos, CA, USA
5Center for Injury Epidemiology, Liberty Mutual Research Institute for Safety, Hopkinton, MA, USA
Keywords: Occupational, Static, Completed (unpublished)
This paper describes a methodology for creating a novel JEM which defines occupational exposures on a continuous scale and utilizes Bayesian methods to quantify exposure uncertainty by assigning exposures probability distributions with parameters determined through expert involvement.

08-3 [11:40] - STUDENT PAPER
Numerical dosimetry of pregnant woman models exposed to ELF-Magnetic Fields: Compliance to the current exposure regulation for the occupational exposure at 50 Hz
Ilaria Liorni1,2, Marta Parazzini2, Serena Fiocchi2, Vanessa Guadagnini2 & Paolo Ravazzani2
1Dipartimento di Elettronica, Informazione e Bioingegneria DEIB Politecnico di Milano, Milano, Italy, 20133
2Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni IEIIT-CNR, Milano, Italy, 20133
Keywords: Occupational, ELF/LF, Completed (unpublished)
At the current time the new Directive 2013/35/EU suggests limits for the occupational exposure to ELF-MF. Pregnant woman exposure to ELF-MF is a concern because the woman and the fetus should be prevented to possible health hazards at workplaces. In this work the compliance of the pregnant woman exposure to the EU Directive 2013 was assessed, by means of advanced high resolution numerical pregnant woman models at 3, 7 and 9 months of gestational ages, exposed to differently polarized uniform MF of 1 and 6 mT at 50 Hz.

08-4 [12:00] - STUDENT PAPER
Acute transient symptoms among health care and research staff exposed to static magnetic stray fields from MRI scanners
Kristel Schaap1, Yvette Christopher - De Vries1, Catherine Mason1, Frank De Vocht2, Lutzen Portengen1 & Hans Kromhout1

1Department of Information Engineering, Electronics and
Molecular Mechanisms of Gene Electrottransfer induced by Nanopulses

Marie Breton¹, ², ³, Fabrizio Salomone⁴, ⁵, Lucie Delemotte⁶, Isabelle Leray¹, ², ³, Francesco Cardarelli¹, Claudia Boccardi¹, Daniel Bonhenn⁴, Mounir Tarek⁴, Lluis M. Mir¹, ², ³ & Fabio Beltram⁴, ⁵

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Keywords: Electroporation, Pulsed, Completed (unpublished)

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

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

Larry Estlack¹, Caleb Roth², Cesario Cerna¹, Gerald Wilmink³ & Bennett Ibe³

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²Centre for Occupational and Environmental Health, The University of Manchester, Manchester, UK
³Keywords: Occupational, Static, Work in Progress (unpublished)

Incidence of acute transient symptoms in relation to static magnetic field exposure was assessed among health care and research staff working with magnetic resonance imaging (MRI) scanners, and compared to workers who were not exposed to static magnetic fields. This study among 361 workers showed an increased incidence of symptoms among MRI staff working with closed-bore MRI scanners of 1.5 to 7 Tesla, and suggests a positive exposure-response association with exposure to static magnetic fields and/or motion-induced time-varying magnetic fields.
Current in-vitro work from our laboratory shows the induction of mitochondrial activity after nanosecond pulsed electric field (nsPEF) exposure. Exposures at 10-ns/50 kV/cm resulted in increased metabolic capacity in oxygen consumption rate (OCR). We hypothesize that nsPEFs activate the induction of the peroxisome proliferator-activated receptor γ coactivator 1 (PGC-1α) gene expression, thereby increasing mitochondrial biogenesis of the exposed cells and controlling reactive oxygen species levels. To show the correlation between the increased mitochondrial biogenesis and the PGC-1α gene expression, RNAi target selection was used to knock-down the expression of the mRNA for PGC-1α.

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

In this study, three nervous system origin cells (SH-SY5Y, A172, cerebral cortex neurons) were exposed to 1800 MHz radiofrequency electromagnetic fields (RF-EMF) at SAR of 4.0 W/kg for 1 h, 6 h or 24 h to investigate the effects of RF-EMF on DNA damage. DNA damage was examined by γ-H2AX foci formation, using indirect immunofluorescence assay. We found that no difference between sham-exposed and exposed groups for any exposure condition. In conclusion, the RF-EMF exposure under current experimental conditions does not induce DNA damage in different cell types from nervous system. Keywords: Radiofrequency electromagnetic fields; DNA damage; γ-H2AX; nervous system.
09-2 [14:50]
**ELF-MFs exposure potentiates the sensitivity to the neurotoxin MPP+ in an in vitro model of Parkinson’s Disease**
Barbara Benassi¹, Claudia Consales¹, Vanni Lopresto¹, Caterina Merla¹, Rosanna Pinto¹, Giuseppe Filomeni²,³ & Carmela Marino¹

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

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

09-3 [15:10]
**Sodium Currents are Required for Vertebrate Appendage Regeneration**
Ai Sun Tseng¹,², Wendy Beane²,³ & Michael Levin³

¹School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, NV, USA, 89123
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Keywords: In vivo, Static, Completed (published)

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

09-4 [15:30]
**Neurogenesis and neuroinflammation after mobile phone exposure**

10-2 [14:50]
**Sensitivity analysis of downlink received and uplink emitted powers in a geographical area to ICT usage parameters**
Huang Yuanyuan¹,², Emmanuelle Conil¹,², Joe Wiart¹,², Christian Person³,⁴ & Nadege Varsier¹,²

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²Whist Lab, Common laboratory between Orange Labs and Institut Mines-Telecom, France
³Institut Mines Telecom, Telecom Bretagne, France

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

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

10-3 [15:10]
**In-situ RF Exposure in Schools, Houses, and Public Places**
Wout Joseph¹, Leen Verloock¹, Francis Goeminne¹, Mart Verlaak², Kim Constandt² & Luc Martens¹

¹Department of Information Technology, Ghent University/iMinds, Ghent, Belgium, 9050
²Department of Environment, Nature and Energy (LNE), Flemish government, Brussels, Belgium, 9050

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

Exposure to radio-frequency (RF) electromagnetic fields (EMF) is assessed in various “sensitive” microenvironments such as schools and homes, where children are present. In-situ assessment is conducted by performing spatial broadband and accurate narrowband measurements. We distinguish external signals (broadcast and telecommunication signals) and internal signals (WiFi and DECT). All measured field levels satisfied the guidelines of ICNIRP. The highest cumulative field value for internal sources was 3.2 V/m and 0.3 W/m² on average, measured in schools and originating from WiFi. FM, GSM, and UMTS dominate the total downlink outdoor exposure.

10-4 [15:30]
**Novel Linearization of Dosimetric Sensors for Accurate Measurement of Complex Modulations**
Marion Jany1, 2, Julie Enderlin1, 2, Florence Pouillet De Gannes1, 2, Emmanuelle Haro2, Annabelle Hurtier2, Gilles Ruffie1, Yann Percherancier2, Bernard Veyret1, 2 & Isabelle Lagroye1, 2
1Bioelectromagnetics laboratory, Ecole pratique des Hautes Etudes, Talence, France, 33405
2Bioelectronics group, IMS laboratory, Talence, France, 33405

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

10-5 [15:50] - STUDENT PAPER
Increase in chromaffin cell membrane conductance evoked by 5-ns electric pulses
Jihwan Yoon1, Normand Leblanc2, Sophia Pierce2, Indira Chatterjee1, P. Thomas Vernier3 & Gale Craviso3
1Department of Electrical and Biomedical Engineering, University of Nevada-Reno, Reno, NV, USA, 89557
2Department of Pharmacology, University of Nevada, Reno, NV, USA, 89557
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Keywords: Electroporation, Pulsed, Work in Progress

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

10-6 [16:10] - STUDENT PAPER
Influence of an Indoor Small Cell on the Human Exposure to Radio Frequency Electromagnetic Fields
Sam Aerts1, David Plets1, Leen Verloock1, Luc Martens1 & Wout Joseph1
1Department of Information Technology, Ghent University / imeinds, Ghent, Belgium, 9050

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

In this study, the impact of the deployment of a small cell in a train and an office on the total exposure (both downlink and uplink) of a mobile-phone user to radio frequency (RF) electromagnetic fields (EMF) was studied for two technologies. To determine the exposure, the total RF-EMF dose absorbed by the user was calculated, using...
revealed a C-to-T variant at nucleotide position -217. The variant was exist stably and not induced by microwave exposure. Then we detected the learning and memory ability, the contents of amino acids in hippocampus and cerebrospinal fluid, NR2B expression of the different genotypes. The results showed that NR2B protein expressions were decreased, the con

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

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

W3-1 [17:00]
The principles of epidemiological exposure assessment concepts
Martin Roosli1,2
1Swiss TPH, Basel, Switzerland, 4002
2University of Basel, Basel, Switzerland, 4001
Keywords: Epidemiology, RF/Microwaves, Concept
The goal of each epidemiological exposure assessment is to find a good proxy or surrogate measure representative of the exposure of interest. The exposure measure should be both biologically relevant and show a range of levels in the study collective. The availability of appropriate exposure assessment methods determines the design and feasibility of an epidemiological study. Nevertheless, errors in exposure assessment are unavoidable. Under certain circumstances small errors may have a major impact on the study results whereas under different circumstances seemingly large errors affect the study results only to a small degree. Thus, for each specific study appropriate evaluation of the effect of exposure errors on the resul

W3-2 [17:15]
ExpoM - A Personal RF Electromagnetic Field Exposure Meter
Marco Zahner1 & Jürg Fröhlich1
1Institute of Electromagnetic Fields, ETH Zurich, Zurich, Switzerland, 8092
Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
A band selective RF-EMF exposure meter module is presented that can be used standalone or can be connected to a smartphone featuring extended monitoring and communication capabilities as well as user interaction, i.e. diaries. The exposure meter module covers a frequency range from 87.5 MHz to 5.875 GHz and performs band selective true-RMS detection on 16 different frequency bands. Furthermore, integrated GPS and Bluetooth functionality allow for a high degree of versatility.

W3-3 [17:25]
Use of apps for collecting information for exposure assessment
Joe Wiart1,2, Thierry Sarrebourse1,2, Nadege Varsier1,2, Abdelhamid Hadjem1,2 & Azeddine Gati1,2
1Orange Labs, Issy les Moulineaux, France
2Whist Lab, Common laboratory between Orange Labs and Institut Mines-Telecom, Paris, France
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
More than 6 billions people are using a mobile phone over the world. Despite the existing protection limits, the tremendous increase in wireless phone use observed during the last decade has induced a public concern about possible health effects of human exposure to radio-frequency (RF) electromagnetic waves (EMF). International epidemiological studies such as Interphone, Cephalo, Cosmos, Mobikids and Geronimo have studied or are investigated possible sanitary effect linked to phone use. For these studies the brain exposure is a key question and the level of exposure is a key question. Several studies have shown that the mobile is an important source of exposure often several thousand time above the exposure induced by the emission of base stations and access points.

W3-4 [17:35]
New Modelling Approaches
Wout Joseph1, Sam Aerts1, David Plets1 & Luc Martens1
1Department of Information Technology, Ghent University/iMinds, Ghent, Belgium, 9050
2Department of Environment, Nature and Energy (LNE), Flemish government, Brussels, Belgium, 9050
Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)
In this presentation we will discuss surrogate modelling as a way to create heat maps and indoor network planning accounting for downlink and uplink exposure.

**W3-5 [17:45]**

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

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

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

²Soil Geography and Landscape, Wageningen University, Wageningen, the Netherlands, 6708 PB

³ARIAS Umwelt forschung beratung, Bern, Switzerland, CH-3011

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

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

**W3-6 [18:00]**

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

Katharina Roser¹, Anna Schoeni¹,² & Martin Roosli¹,²

¹Swiss Tropical and Public Health Institute, Basel, Switzerland

²University of Basel, Basel, Switzerland

Keywords: Epidemiology, RF/Microwaves, Work in Progress

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

**W3-7 [18:15]**

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

Anke Huss¹, Manon van Eijsden², Mònica Guxens¹, Johan Beekhuizen¹, Rob T. van Strien², Marieke Dijkema², Tanja G.M. Vrijkotte³, Hans Kromhout¹ & Roel Vermeulen¹

¹IRAS, University Utrecht, Utrecht, the Netherlands

²GGD Amsterdam, Amsterdam, the Netherlands

³AMC, University Amsterdam, Amsterdam, the Netherlands

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

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

June 13, 2014

Session: T4

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

June 13, 2014 • 08:00 - 09:00

The Ballroom, Table Bay Hotel
11-1 [09:00]
Thermal effects improve the efficiency of nonthermal electrotherapies
Karl Schoenbach¹, Amy Donate¹, Chelsea Edelblute¹, Anna Bulysheva¹, Derrick Jung², Benjamin Wisecarver², Muhammad Malik¹, Shu Xiao¹,² & Richard Heller¹
¹Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA, USA, 23508
²Dept. of Electrical and Computer Engineering, Old Dominion University, Norfolk, VA, USA, 23508
Keywords: Electroporation, Pulsed, Work in Progress
Rapid heating of cells to values above the physiological temperature has been shown to reduce considerably the energy required for electroporation. This effect allows us to reduce stress on patients being treated with electrotherapy-based therapies and has been confirmed for picosecond pulses as well as for millisecond pulses. In in vivo studies designed to measure the efficiency of thermally assisted electro transfer of plasmid DNA to the skin, an IR laser was used that allowed us to rapidly heat the tissue through an optical fiber. Heating the tissue to temperatures of 43 degree C resulted in significantly higher transgene expression.

11-2 [09:20]
In vivo electroporation: therapeutic effects are not just the consequence of a facilitated drug and gene delivery
Lluis M. Mir¹,²,³, Christophe Y. Calvet¹,²,³ & Franck Andre¹,²,³
¹Laboratoire de Vectorologie et Thérapeutiques Anti-Cancéreuses, UMR 8203, CNRS, Villejuif, France, 94805
²Laboratoire de Vectorologie et Thérapeutiques Anti-Cancéreuses, UMR 8203, Univ.Paris-Sud, Villejuif, France, 94805
³Laboratoire de Vectorologie et Thérapeutiques Anti-Cancéreuses, UMR 8203, Gustave Roussy, Villejuif, France, 94805
Keywords: Electroporation, Pulsed, Completed (unpublished)
Cell electroporation allows the introduction into the cells in culture of various types of molecules. In vivo as well, adequate electric pulses facilitate this uptake. However, in vivo, the electric pulses have consequences other than the increase of exogenous molecules uptake by the target cells: on the one hand, the occurrence of a vascular lock that has been extensively described; on the other hand, the exposure at the cell surface and the the release in the extracellular space of intracellular substances that play pivotal roles in raising an effective immune response. Therefore, in vivo, cells electroporation is not merely a way to increase the uptake of drugs or nucleic acids by the cells.

11-3 [09:40]
Intuitive exposure and risk perception of RF EMF
Frederik Freudenstein¹ & Peter Wiedemann¹,²
¹Karlsruhe Institute of Technology (KIT), Berlin, Germany
²University of Wollongong, Wollongong, Australia
Keywords: Standards, RF/Microwaves, Work in Progress
One of the main assumptions of the LEXNET project is that a reduction of the RF EMF exposure will result in more acceptance of wireless communication networks in the public sphere. We assumed that the effects of any reduction of EMF exposure will depend on the subjective link between exposure perception and risk perception. Therefore, our survey focused on the analysis of the associations among various exposure characteristics and risk perception. The results suggest that perception of RF EMF risks is only marginally determined by exposure characteristics. This finding creates new challenges for further research, especially the question, under which circumstances exposure reduction might affect risk perception.

12-2 [09:20]
EMF Exposure Standards Established Adverse Health Effects vs Possible Biological Effects
C. K. Chou¹
¹C-K. Chou Consulting, Fort Lauderdale, FL, USA, 33322
Keywords: Standards, RF/Microwaves, Review, Commentary, Recommendation, Evaluation
Publications on the biological effects of non-ionizing electromagnetic exposure vary from established effects to possible, questionable and obviously flawed responses. To evaluate the reported effects, most expert review groups, health authorities and standard setting committees such as IEEE and ICNIRP use weight of evidence to review the literature. IEEE and ICNIRP set exposure limits to protect against established adverse health effects with large safety margins. In contrast, those promoting precautionary principle selectively discuss possible biological effects and promote limits to avoid any possible effect. The two different approaches that lead to the recommended safety limits differ by orders of magnitude.
Intrinsic Apoptotic Cell Death and a Vaccine Effect with Clearance of an Orthotopic Rat Hepatocellular Carcinoma by Nanosecond Pulsed Electric Fields (nsPEFs)

Stephen J. Beebe1, Ru Chen1, Nova M. Sain1, K. Tyler Harlow1, Peter K. Shires2 & Richard Heller1
1Bioelectrics, Old Dominion University, Norfolk, VA, USA, 23508
2Ethicon, Cincinnati, OH, USA, 45242

Keywords: In vivo, Pulsed, Work in Progress

NsPEFs have shown promise in pre-clinical skin cancers or xenografts in mice and human clinical studies with basal cell carcinoma. In this report, the first orthotopic hepatocellular carcinoma (HCC) model is established in rats. In a single treatment 80-90% of N1-S1 tumors were eliminated. Intrinsic apoptosis was evident and after tumor clearance rats were resistant to challenge injections of the same cancer in all trials. The protective effect, infiltration of immune cells and the presence of granzyme B expressing cells within days of treatment indicate that nsPEFs not only eliminate HCC tumors, but also likely induce an immunoprotective effect that essentially vaccinates animals against recurrences of the same tumors.

11-4 [10:00]
Suppression of angiogenesis by electric stimulation
Yusuke Inoue1, 2, Masaki Sekino1, 2, Tsuyoshi Sekitani1, 2, Itsuro Saito3, Takashi Isoyama4, Yusuke Abe5 & Takao Someya1, 2
1Department of Electrical Engineering and Information Systems, Graduate School of Engineering, The University of Tokyo, Tokyo, Japan, 113-8656
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3Department of Biomedical Engineering, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan, 113-0033
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5Graduate School of Biomedical Science, The University of Tokyo, Tokyo, Japan

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

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

11-5 [10:20]
Search for tumor-specific frequencies of amplitude-modulated 27 MHz electromagnetic fields in mice with hepatocarcinoma xenografted tumors
Yann Percherancier1, Sophie Kohler2, Renaud Charlet De Sauvage1, Sokha Khiev1, Gilles N'Kaoua1, Annabelle Hurtier1, Emmanuelle Haro1, Florence Poulletier De Gannes1, Isabelle Lagroye2, 3, Philippe Leveque2 & Bernard Veyret1, 3
1IMS laboratory, University of Bordeaux, Talence, France, 33405
2IMS laboratory, University of Bordeaux, Talence, France, 33405

The direct measurement of temperature rise in tissue: from single cells to humans. Time to replace SAR?
Andrew Wood1, Robert McIntosh1, Shaun Flynn1, Mitchell Wilhelm1 & Kundai Chakonda1
1BPsc, Swinburne University of Technology, Hawthorn, Australia, Vic 3122

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

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

12-4 [10:00]
A Non-Electric (E) Field Based Method for Safety Assessment of RF and Microwave Emitting Devices
Leeor Alon1, 2, Gene Y. Cho1, 2, Daniel K. Sodickson1, 2 & Cem M. Deniz1, 2
1Department of Radiology, Bernard and Irene Schwartz Center for Biomedical Imaging, New York University, New York, NY, USA, 10016
2Sackler Institute of Graduate Biomedical Sciences, New York University, New York, NY, USA, 10016

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

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

12-5 [10:20]
Are RF exposure limits appropriate for adverse environmental conditions and the wearing of protective clothing?
Stephen M. Moore1, 4, Robert McIntosh2, 3, 4, Steve Iskra2, 3, 4 & Andrew Wood1, 4
1IBM Research Collaboratory for Life Sciences-Melbourne, Victorian Life Sciences Computation Initiative, Parkville, Australia, 3010
2Telstra, Melbourne, Australia, 3000
Some evidence has been provided by the Pasche group that RF fields, amplitude-modulated at discrete frequencies (AM-RF), elicit therapeutic responses in patients with tumors [e.g., Zimmerman et al., Br J Cancer 2012]. We have attempted to implement a complementary approach using a mouse tumor model for searching for frequency specificity in order to facilitate further mechanistic research in animals. So far, we have not found any exposure conditions that produced an alteration of the pulse in mice.

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

Aim of this work is to theoretically investigate a drug-delivery system consisting of a zwitterionic micelle encapsulating a drug molecule and to verify if intense electric fields may be able to enhance the delivery of the drug. With this objective in mind we present a method to quantitatively evaluate the exit diffusion process of the drug molecule from a molecular vector towards the external aqueous medium, by defining a proper boundary interface as obtained by a complete electrostatic map of the system. Preliminary results showed a significant variation of the exit kinetic constant up to 50% when an external electric field of $5 \times 10^8$ V/m is applied to the system.
Session: BEMS & EBEA
BEMS Board and EBEA Council meetings
June 13, 2014 • 14:00 - 17:00
The Ballroom, Table Bay Hotel
PA-1 [17:00]
The Effect of Exposure to Weak Radiofrequency Radiation from GSM 900 MHz Mobile Phone and Base Station on the Growth of Soybean Seedlings
Malka Halgamuge1, See Kye Yak2 & Jacob Eberhardt3
1Department of Electrical & Electronics Engineering, The University of Melbourne, Parkville, Australia
2Electromagnetic Effects Research Laboratory, School of Electrical & Electronic Engineering, Nanyang Technological University (NTU), Singapore
3Department of Medical Radiation Physics, University of Lund, Lund, Sweden
Keywords: Behavioural, RF/Microwaves, Completed (unpublished)
The aim of the study is to study possible harmful effects of environmental radiation pollution on plants. The association between cellular telephone (short duration, higher amplitude) and base station (long duration, very low amplitude) radiation exposure and growth rate of soybean (Glycine max) seedlings was investigated. In this experiment growth of stems and central roots was reduced as seen in the short-term exposure experiments whereas the outgrowth of hair-roots was stimulated.

PA-3 [17:00]
An Analysis of In vitro Studies from Mobile Phone Radiation
Malka Halgamuge1 & Efstratios Skafidas1
1Department of Electrical and Electronic Engineering, The University of Melbourne, Parkville, Australia, 3010
Keywords: In vitro, RF/Microwaves, Completed (unpublished)
In this paper, we perform a meta-analysis of data from 191 scientific journals (1992-2012) with 883 in vitro experimental observations carried out in the literature that discussed using different experimental techniques (cytogenetic, gene and protein expression analysis) and different cell types (cultured rodent, human cells and human blood lymphocytes) due to non-thermal radio-frequency electromagnetic exposure. Our results show that, based on the papers included in our study, that there appears to indicate that there may be a minimal effect, with no conclusive evidence to prove or disprove non-thermal effects of mobile phone radiofrequency radiation for in-vitro model systems.

PA-5 [17:00] - Behavioural
Magnetic nest building orientation in the wood mouse Apodemus sylvaticus
Erich Malkemper1, Stephan Eder2, Michael Winklhofer2, John Phillips3, Sabine Begall1 & Hynek Burda1
1Department of General Zoology, University of Duisburg-Essen, Essen, Germany, 45141
2Department of Earth and Environmental Sciences, Munich University, Munich, Germany, 80333
3Department of Biological Sciences, Virginia Tech, Blacksburg, VA, USA
Keywords: Behavioural, Static, Completed (unpublished)
Knowledge about the distribution and characteristics of a magnetic sense in mammals is still sparse. We tested the wood mouse Apodemus sylvaticus for its ability to sense the Earth’s magnetic field. The mice were allowed to construct a nest in a circular arena in the unchanged Earth’s magnetic field or with north shifted by 90deg. Different low intensity RF-magnetic fields (MHz-range) were added in some of the tests. Under control conditions the wood mice preferred to build their nests in either the north or south sector of the arena and this preference shifted with the magnetic field. RF-fields also influenced nest distributions, suggesting a RF-sensitive magnetic compass in wood mice.

PA-7 [17:00] - Clinical (diagnostics)
New applications of Corona discharges for photonics characterization of inert or living matter
Georges Vieilledent1, Raymond Herren2, Marc Henry3, Vincent Morard4 & Quynh Nhu Xuan Trinh-Kramer5
1Electrophotonique Ingenierie, Gaillac, France, 81600
2CNRS, Paris, France, 75000
3UMR 7140, CNRS/Université de Strasbourg (Uds), Strasbourg, France, 67000
4Centre de Morphologie Mathématique, Ecole des Mines, Paris, France, 75006
5Hamamatsu Photonics, Paris, France, 75000
Keywords: Clinical (diagnostics), Optical, Work in Progress
Water is everywhere in nature, requiring new imaging techniques for visualization of information storage or transfer in liquids or hydrated solids. Corona discharges created by exciting matter in the UV spectrum is a mean to measure in a reproducible way « bio-compatibility » between a living body and any chemical substance. In medicine, a better match between drugs and receiving bodies is expected. Through its coherence domains, we demonstrate that water is highly sensitive to electromagnetic fields and micro-currents in well-defined frequency ranges. Reproducible exchange of information, through a quartz support, between water and informed ceramics materials will also be presented.

**PA-9 [17:00] - Dosimetry (computational)**
The Effects of Body Height and Mass on the Calculated Induced Electric Fields in the MAXWEL Human model at 50 Hz and Comparisons with the EMF Directive
Richard Findlay  
1EMFcomp, www.emfcomp.com, Oxfordshire, OX128HG  
Keywords: Dosimetry (computational), ELF/LF, Other

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

**PA-11 [17:00] - Dosimetry (computational)**
Specific Absorption Rate (SAR) in the Surface-based MAXWEL Human Model from Exposure to TETRA Handsets
Richard Findlay  
1EMFcomp, www.emfcomp.com, Oxfordshire, UK, OX128HG  
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

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

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

**PA-13 [17:00] - Dosimetry (computational)**
SAR assessment in different models and positions from Wireless Local Area Networks (WLAN) system
Serena Fiocchi 1, Marta Parazzini 1, Ilaria Liorni 1, 2, Norbert Zentai 3, Vanessa Guadagnin 1, György Thuroczy 4 & Paolo Ravazzani 1  
1Istituto di Elettronica e di Ingegneria dell’Informazione e delle Telecomunicazioni IEIIT, Consiglio Nazionale delle Ricerche - CNR, Milan, Italy, 20133  
2Dipartimento di Elettronica, Informazione e Bioingegneria- DEIB, Politecnico di Milano, Milan, Italy, 20133  
3Department of Experimental Neurobiology, Pécs, Hungary  
4National Research Institute for Radiobiology and Radiohygiene - NRIRR, Budapest, Hungary, H-1221 Anna 5  
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

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

**PA-15 [17:00] - Dosimetry (computational)**
A dynamic map of EMF exposure due to wireless systems
Peter Gajsek 1 & Blaz Valic 1  
1Institute of Nonionizing Radiation (INIS), Ljubljana, Slovenia, 1000  
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

The main objective of this presentation is to report on development of a dynamic e-MAP registry of wireless systems which are sources of radio frequency electromagnetic fields (EMF) on the territory of Republic of Slovenia. The Signal Spy application serves as a basis for a publicly accessible interactive map of EMF exposure of general public that summarize the field strengths distribution of all radiofrequency (RF) sources in the environment. This project brings also added value for
consumers - the mobile phone users - because it allows monitoring of personal exposure due to mobile phone which encourages people to minimize the EMF exposure and, consecutively, to reduce the potential health risks.

PA-17 [17:00] - Dosimetry (computational)
CALCULATED SPINAL CORD FIELDS AND CURRENT DENSITIES FROM ELECTRICAL STIMULATION
Ben Greenebaum
1Department of Physics, University of Wisconsin-Parkside, Kenosha, WI, USA, 53141-2000

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

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

PA-19 [17:00] - Dosimetry (computational)
Peak-to-average power density ratio in the vicinity of antenna system for small base station
Junji Higashiyama1, Yoshiaki Tarusawa1 & Teruo Onish1
1Research Laboratories, NTT DOCOMO, INC., Yokosuka, Japan, 239-8536

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

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

PA-21 [17:00] - Dosimetry (computational)
Numerical Modeling for SAR Evaluation in Human Implanted with Osteosynthesis Plates of mandibular fractures
Takashi Hikage1, Taisuke Ono1, Toshio Nojima1, Tomoaki Nagaoka2 & Soichi Watanabe2
1Hokkaido University, Sapporo, Japan, 0600814
2National Institute of Information and Communications Technology, Tokyo, Japan, 1848795

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

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

PA-23 [17:00] - Dosimetry (computational)
Human Exposure to Electric Fields from 765 kV Transmission Lines: Measurements and 3-D Anatomical Body Dosimetry
Roy Hubbard1, Ian Jandrell2 & Steven Dinger3
2Faculty of Engineering and the Built Environment, University of Witwatersrand, Johannesburg, South Africa, 2000
3Biomedical Engineering Research Group in the School of Electrical & Information Engineering, University of Witwatersrand, Johannesburg, South Africa, 2000

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

Limits on human exposure to low frequency electric fields are fundamentally specified for in-situ fields in tissues/organs. Basic Restrictions are defined to protect against potentially adverse effects. Secondary limits, Reference Levels, are also given. These are derived from the Basic Restrictions based on uniform-fields with a provision that the basic restrictions must be observed for non-uniform cases. The human exposure of the general public to electric fields from Eskom’s 765 kV transmission network operating at 50 Hz, is addressed through physical measurements, theoretical predictions and 3-D human model dosimetry, which is presented in this paper.

PA-25 [17:00] - Dosimetry (computational)
Calculation of RF Electromagnetic Fields Strength from Radio Base Station’s Antenna
Byung Chan Kim1, Ae-kyoung Lee1 & Hyung-Do Choi1
1Radio Technology Research Department, ETRI, Daejeon, Korea

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

PA-27 [17:00] - Dosimetry (computational)
SAR Comparison between SAM and Anatomical Head Models for Radiation from a Bar-Type Phone Model
Ae-kyoung Lee¹, Seon-eui Hong¹ & Hyung-Do Choi¹
¹Radio Technology Research Department, ETRI, Daejeon, Korea, 305-700
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress
A typical bar-type phone model with an internal antenna at the bottom of the phone body has been implemented at 1850 MHz. It provides very similar SAR pattern and levels with commercial bar phones released in Korea. For the cheek and tilt positions spatial peak 1 g and 10 g-SARs were calculated and compared in the SAM and four anatomical head models at different ages.

PA-29 [17:00] - Dosimetry (computational)
A Comparison of Fetal and Whole-Body SARs in Computational Human Models of Pregnancy for Far-Field Exposure
Tomoaki Nagaoka¹, Tetsu Niwa², Kazuyuki Saito³, Masaharu Takahashi¹, Koichi Ito¹ & Soichi Watanabe¹
¹National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795
²Department of Radiology, Tokai University School of Medicine, Isehara, Japan, 259-1193
³Chiba University, Chiba, Japan, 263-8522
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)
Recently, one important issue of electromagnetic field safety is the specific absorption rate (SAR) dosimetry in pregnant females and their fetuses. We estimated the SARs in mothers and fetuses under exposure to vertically and horizontally polarized electromagnetic waves ranging from 30 MHz to 3GHz by using novel female models with anatomically realistic fetal and gestational tissues in the second and third trimesters of pregnancy. We also compared the SARs with those of traditional pregnant female models.

PA-31 [17:00] - Dosimetry (computational)
Characteristics of resonance-based wireless power transfer technique for biomedical applications
SangWook Park¹
¹EMI/EMC R&D Center, Korea Automotive Technology Institute, Cheonan, Korea, 330-912
Keywords: Dosimetry (computational), IF, Work in Progress
The resonance-based wireless power transfer technique is applied to biomedical devices implanted in the human body. The wireless power transfer system is designed for maximum power transfer into a small receiving coil. The power transfer efficiency from the transmitting resonant coil outside the phantom into the receiving resonant coil inside the phantom is calculated with varying the size of the free space placing the receiver in the phantom. The results represent that securing the free space surrounding the receiver in the phantom is closely related to the power transfer efficiency and absorbed electromagnetic energies in the human body.

PA-33 [17:00] - Dosimetry (computational)
Exposure Optimization in Indoor Wireless Networks: Application to Heterogeneous WiFi-LTE Case
David Plets¹, Wout Joseph¹, Kris Vanhecke¹ & Luc Martens¹
¹Department of Information Technology, Ghent University/iMinds, Ghent, Belgium, 9050
²Department of Environment, Nature and Energy (LNE), Flemish government, Brussels, Belgium, 9050
Keywords: Dosimetry (computational), RF/Microwaves, Completed (published)
An exposure minimization algorithm to optimize and design wireless networks with satisfying coverage and minimal electromagnetic exposure is presented. It is applied to a heterogeneous WiFi-LTE network. Compared to a traditional network deployment, a field strength reduction of a factor 2.4 for the considered case and a higher homogeneity of the field strength distribution on the building floor are obtained. The algorithm is integrated in a heuristic indoor network planner for exposure calculation and optimization of wireless networks.

PA-35 [17:00] - Dosimetry (measurements)
A Study on the Improvement of the Flat Phantom Size for SAR Validation Test at 150 MHz Band
Dong-geun Choi¹, Kihwea Kim¹, Judong Jang¹, Samyoung Chung¹, Yoon-Myoung Gimm² & Jaehoon Choi¹, 4
¹National Radio Research Agency of Ministry of Science, ICT and Future Plann, Seoul, Korea
²Dankook University, Seoul, Korea
³Hanyang university, Seoul, Korea
⁴Hanyang university, Seoul, Korea
In 2013, the physical dimensions of the reference dipole antenna, the flat phantom, and the numerical target SAR values for the validation test at 150 MHz band were suggested. However, the size of flat phantom becomes a problem for SAR measurement because it requires a great amount of human body tissue equivalent liquid. This paper shows how to gain appropriate flat phantom size. The optimized minimum size was suggested by applying a numerical analysis method in this paper. The results of this study are expected to be used to update the SAR measurement related standards domestically and internationally.

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

**Exposure assessment in the French Comop program**

Rene De Seze¹, Patrice Cagnon², György Thuróczi¹, Samuel Mauger³, Paul Mazet³, Jean-Benoit Agnani⁴, François Gaudaire⁵, Julien Caudelville⁶ & Brahim Selmaoui¹

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

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

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

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

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

¹Electromagnetic Compatibility Laboratory, National Institute of Information and Communications Technology (NICT), Tokyo, Japan, 184-8795
²NTT DOCOMO INC., Tokyo, Japan, 239-8536

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

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

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

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

Teruo Onishi¹, Satoshi Ishihara¹ & Akimasa Hirata²

¹RF Technology Research Group, NTT DOCOMO, INC., Yokosuka, Japan, 239-8536
²Nagoya Institute of Technology, Nagoya, Japan, 466-8555

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

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

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

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

Dominique Picard¹

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

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

The SAR of mobile phones is measured following the protocol described by the IEC62209-1 standard, which imposes the power level to be at its maximal value. In real use, the base station imposes the mobile phone radiated power by mean of power control (PWC). The PWC dynamic range is 30dB for GSM technology and 70dB for WCDMA technology.
Consequently, the emitted power of the mobile phone may be very lower than its maximum value and the real mobile phone exposure may be very lower than the standardized value. This paper describes and compares several methods allowing the evaluation of the variations of the emitted power by a mobile phone.

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

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

Dominique Picard¹ & Joël Legrand¹

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

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

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

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

Measurement of magnetic fields originating from electric vehicle charger system

Dai Sakimura¹, Katsuo Isaka² & Chiyoji Ohkubo¹

¹Japan EMF Information Center, Japan Electrical Safety and Environment Technology Laboratories, Tokyo, Japan, 105-0014

²The University of Tokushima, Tokushima, Japan, 770-8502

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

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

**PA-49 [17:00] - Electroporation**

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

John Lekner¹

¹School of Chemical and Physical Sciences, Victoria University of Wellington, Wellington, New Zealand, 6015

Keywords: Electroporation, Pulsed, Work in Progress

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

**PA-51 [17:00] - Epidemiology**

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

Anke Huss¹, Manuel Murbach², Niels Kuster², Rob T. van Strien³, Imke van Moorselaar², Hans Kromhout¹, Roel Vermeulen¹ & Pauline Slottje¹

¹IRAS, Utrecht University, the Netherlands

²ITIS, Zurich, Switzerland

³GGD Amsterdam, the Netherlands

Keywords: Epidemiology, RF/Microwaves, Work in Progress

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

**PA-53 [17:00] - Epidemiology**

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

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

¹Environmental Health Trust, Teton Village, WY, USA, 83025

²University of Toronto, Toronto, ON, Canada, M5T 3M7

³Cancer and Global Health, Bordeaux University, Bordeaux, Afghanistan, CQ61292 33076

Keywords: Epidemiology, RF/Microwaves, Work in Progress

Using the SEER 13 database, for age specific brain tumor incidence, by gender for malignant, glioma and glioblastoma histologies, and for frontal and temporal lobe anatomical regions for years 1992-2010 was collected. Joinpoint calculation
was used to calculate the Average Annual Percent Change (AAPC) for years 1992-2010. Glioma AAPC= 1.3%, CI[1]= 0.6% to 2.1%, and in the 20-29 age group, the AAPC=3.5%, CI= 0.9% to 6.1%, and 3.2%, CI= 0.5% to 2.1% for women and men respectively. For frontal lobe glioma in the 20-29 year group AAPC=5.5%, CI= 2.3% to 8.7%. Male glioblastoma, age 20-29 AAPC=2.7%, CI= 1.0% to 4.4%. However, all malignant brain tumor decreased slightly (AAPC=-0.90, p-trend <0.01).

**PA-55 [17:00] - In vitro**
Effect of combined radiofrequency fields exposure on Amyloid-beta-induced cytotoxicity in HT22 mouse hippocampal neuronal cells
Jong-Sun Lee¹, Jeong-Yub Kim² & Myung-Jin Park³
¹Korea Institute of Radiological and Medical Sciences, Seoul, Korea, 139-706
Keywords: In vitro, RF/Microwaves, Work in Progress
In the present study, we examined the effect of combined radiofrequency fields (RF) radiation on the cytotoxicity of amyloid-beta in HT22 hippocampal neuronal cells. Our results demonstrate that RF exposure did not significantly affect amyloid-beta-induced decrease of cell proliferation, increase of reactive oxygen species production, and induction of Annexin V/PI positive population in these cells.

**PA-57 [17:00] - In vitro - STUDENT PAPER**
2 mT Extremely Low Frequency Magnetic Fields have no effect on mouse oocytes meiotic maturation in vitro
Hong Ling¹, Kan Zhu¹, Hengyu Fan² & Quili Zeng¹
¹Bioelectromagnetics Laboratory, Hangzhou, China, 310058
²Life Science Institute of Zhejiang University, Hangzhou, China, 310058
Keywords: In vitro, ELF/LF, Work in Progress
Widely applications of power lines, domestic appliances and electronic products make people exposed to unprecedented levels of extremely low frequency magnetic fields (ELF-MF) and raise concerns about the potential effects on female reproduction. In this study, we investigated the effects of 50 Hz ELF-MF of 2 mT for 24 hours on mouse oocytes cultured in vitro. We focused on several key events in the process of oocytes meiotic maturation, including the following: γH2AX foci formation of oocytes on GV (Germinal vesicle) stage, Germin al vesicle breakdown (GVBD) rate, first polar body (PB1) extrusion rate, spindle and chromosome configurations, and activation of oocytes. No differences were found between sham-exposed and exposed groups.

**PA-59 [17:00] - In vitro**
Pro-inflammatory responses of astrocytes and microglia are differentially modulated by radiofrequency radiation through differential STAT3 activation
Yong-Hui Lu¹, Chun-Hai Chen¹, Lei Zhang¹, Zheng-Ping Yu¹ & Zhou Zhou¹
¹Department of Occupational Health, Third Military Medical University, Chongqing, China, 400038
Keywords: In vitro, RF/Microwaves, Completed (unpublished)
Microglia and astrocytes were activated by RF exposure which showed differential pro-inflammatory responses, characterized by different expression and release profiles of pro-inflammatory cytokines. The RF exposure activated STAT3 in microglia but not in astrocytes.

**PA-61 [17:00] - In vitro**
Extremely low-frequency electromagnetic fields affect transcript levels of neuronal differentiation-related genes in embryonic neural stem cells
Qin-Long Ma¹, Chun-Hai Chen¹, Zheng-Ping Yu¹, Zhou Zhou¹ & Lei Zhang¹
¹Department of Occupational Health, Third Military Medical University, Chongqing, China, 400038
Keywords: In vitro, ELF/LF, Completed (unpublished)
There was no significant change in NSC proliferation after 50 Hz ELF-EMF exposure. A down-regulation of Sox2 and up-regulation of Math1, Math3, Ngf1 and Tuj1 mRNA levels after 50 Hz ELF-EMF exposure (2 mT for 3 days) was observed without alteration in the percentages of neurons and astrocytes.

**PA-63 [17:00] - In vitro - STUDENT PAPER**
Acute exposure to 1.8 GHz radiofrequency radiation influences cellular oxidation-reduction balance
AnaMarja Marjanovic¹, Ivan Pavicic¹ & Ivancica Trosic¹
¹Radiobiology and Dosimetry Unit, Institute for Medical Research and Occupational Health, Zagreb, Croatia, 10000
Keywords: In vitro, RF/Microwaves, Completed (unpublished)
Rapid technological expansion and increase in the number of mobile phone users has raised concern about possible health effects of radiofrequency radiation exposure. Non-thermal effects and their possible mechanism of action are still being controversial. One of the possible explanations could be connected to reactive oxygen species (ROS) and oxidative stress. The aim of this study was to investigate effect of 1.8 GHz mobile phone radiation on cell oxidative stress development by measuring level of ROS, lipid damage and antioxidant defence mechanism in Chinese hamster lung fibroblasts (V79).
PA-65 [17:00] - In vitro
Decreased electrical activity in neuronal networks exposed to CW and GSM-1800 signals
Daniela Moretti^[1], André Garenne^[2], Florence Poulletier De Gannes^[1], Stéphane Azzopardi^[1], Raphaël Roder^[1], Emmanuelle Haro^[1], Isabelle Lagroye^[1,3], Bernard Veyret^[1,3] & Noëlle Lewis^[1]

^[1]IMS Laboratory, University of Bordeaux, Talence, France, 33405
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^[3]Bioelectromagnetics Laboratory, EPHE, Bordeaux, France, 33000

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

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

PA-67 [17:00] - In vitro
Appearance of polar and non-polar cytoskeleton filaments in neuronal cells after GSM modulated RF exposure
Ivan Pavicic^[1], AnaMarija Marjanovic^[1] & Ivancica Trosic^[1]

^[1]Radiobiology and dosimetry unit, Institute for Medical Research and Occupational Health, Zagreb, Croatia, 100000

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

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

PA-69 [17:00] - In vitro
Mitochondrial Hyperpolarization and Cytochrome-c Release in Microwave Exposed MCF–7 cells
Nesrin Seyhan^[1], Ayse Canseven Kursun^[1], Meric Arda Esmekaya^[1], Handan Kayhan, Mehmed Tuysuz^[2], Bahriye Sirav^[1] & Munci Yagci^[1]

^[1]Department of Biophysics, Gazi University, Ankara, Turkey

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

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

PA-71 [17:00] - In vitro
Effects of Static Magnetic Fields on Biological Behaviors and Electromagnetic Properties of Bone Cells
Peng Shang^[1], Jian Zhang^[1], Chong Ding^[1], Airong Qian^[1], Zhe Wang^[1] & Lifang Hu^[1]

^[1]Key Laboratory for Space Bioscience and Biotechnology, Institute of Special Environmental Biophysics, Northwestern Polytechnical University, Xi’an, China, 710072

Keywords: In vitro, Static, Work in Progress

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

PA-73 [17:00] - In vitro
WITHDRAWN

PA-75 [17:00] - In vitro
Biological Properties of Blue Light Radiated from Different Dental Cured Binding Units

^[1]Radiobiology and Dosimetry Unit, Institute for Medical Research and Occupational Health, Zagreb, Croatia, 10000
^[2]University of Zagreb, Zagreb, Croatia, 10000

Keywords: In vitro, Optical, Completed (unpublished)

The attempt to increase dental resin polymerization quality discharges the commercially available high power light density dental curing units. Widespread worry in both, patients and dentists rises with regard to the adverse effects on the pulp
tissue since the emitted visible blue light belongs to the nonionizing radiation of electromagnetic spectrum. Two devices, halogen curing lights of Elipar® Trilight, ESPE Dental AG (Germany) unit and Bluephase C8® LED light source (Vivadent, Schaan, Lichtenstein) have been evaluated and compared for radiation effects on cell viability, colony-forming ability (CFA) and proliferation of continuous cell culture. Quartz-tungsten-halogen light source emits radiation of the w

PA-77 [17:00] - In vitro
Research on Optimized Multi-scale Sample Entropy Evaluation for Flickering of Human Erythrocytes by the Effects Electromagnetic Field Exposure
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Keywords: In vitro, ELF/LF, Work in Progress
An optimized multi-scale sample entropy (mSampEn) method which inflect damage of the human erythrocytes in terms of the dynamic complexity of the flickering motion of erythrocytes membrane was proposed to analyze the effect of extreme low frequency electromagnetic field exposure and 1950MHz radiofrequency electromagnetic field to the flickering of the stored erythrocytes. Results showed that both ELF-EMF (f=50 Hz, power line signals, B=2.29 mT and duration=2 hours/day) and RF-EMF (f=1950MHz, UMTS, SAR=3W/kg, duration=2 hours/day) exposure enhanced the dynamic complexity of the cytomembranes and thus could be the potential treatment for increasing conservation of stored erythrocytes.

PA-79 [17:00] - In vivo
The effect of radiofrequency-electromagnetic field on microglia in post-natal rat brain
Young Hwan Ahn1, 2, Hae Sun Kim1, You Hee Lee1, 2, Yun-Sil Lee1, Jangwon Park4, Jeong-Ki Pack5, Hyung Do Choo6 & Nam Kim7
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Keywords: In vivo, RF/Microwaves, Work in Progress
The study investigated whether activation and proliferation of microglial cell could be induced by a short exposure to RF-EMF in the post-natal developing rat brain. After RF-EMF exposure for 15 min at whole-body SAR of 6 W/kg to the post-natal day-7 littermate Sprague-Dawely rats did not cause any change in the number of ionized calcium binding adaptor molecule 1 (Iba-1) positive microglia, however, induced activation of Iba-1 positive microglia in the developing rat brain.

PA-81 [17:00] - In vivo
Microwave exposure induces Jaks phosphorylation in rat hippocampus
Junqin Hao1, Lei Zhang2, Guangbin Zhang2, Zhou Zhou2 & Zheng-Ping Yu2
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Keywords: In vivo, RF/Microwaves, Work in Progress
JAK/STAT pathway plays important role in brain development and brain injury. It participates the progress of neuronal degenerative diseases. JAK/STAT signaling pathway was activated after microwave exposure, which indicated that JAK/STAT signaling pathway may participate microwave induced central nervous system injury.

PA-83 [17:00] - In vivo
Characterisation of the effects of 50 Hz magnetic fields on cognitive functions and cerebral markers of ageing and Alzheimer’s disease in aged mice
Isabelle Lagroye1, 2, Olivier Nico3, Nathalie Macrez3, Nathalie Biendon3, Emmanuelle Haro2, Florence Pouletier De Gannes1, 2, Annabelle Hurtier2, Bernard Veyret1, 2 & Bruno Bontempi3
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3CNRS UMR 5293 and University of Bordeaux, Institute of Neurodegenerative Diseases, Talence, France, 33400
Keywords: In vivo, ELF/LF, Work in Progress
Recent epidemiological studies (Huss et al, 2009; Frei et al. 2013) have suggested a possible association between residential exposure to extremely-low frequency (ELF) magnetic fields (MF) of elderly people and Alzheimer disease (AD). We are currently investigating whether repeated exposures of mice to a 50 Hz magnetic field during the course of normal ageing may
translate into exacerbated learning and memory deficits associated with the abnormal expression of specific molecular brain markers related to AD pathogenesis.

PA-85 [17:00] - In vivo
Thermal effects of high-power radio frequency-electromagnetic field (RF-EMF) exposure in vivo
Shin Ohtani¹, Akira Ushiyama², Machiko Maeda³, Kenji Hattori¹, Naoki Kunugita², Jianqing Wang³ & Kazuyuki Ishii¹
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Key words: In vivo, RF/Microwaves, Work in Progress

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

PA-87 [17:00] - In vivo
What is the effect of chronic RF-EMF exposure on thermal preference in juvenile rats?
Amandine Pelletier¹, Rene De Seze¹,², Stéphane Delanaud¹, Jean-Pierre Libert¹ & Véronique Bach¹
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Key words: In vivo, RF/Microwaves, Completed (unpublished)

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

PA-89 [17:00] - In vivo
Effects of WiMAX exposure on mice immune system
Florence Poulletier De Gannes¹,², Emmanuelle Haro², Annabelle Hurtier², Marion Jany¹,², Gilles Ruffie³, Yann Percherancier³, Bernard Veyret¹,² & Isabelle Lagroye¹,²
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Key words: In vivo, RF/Microwaves, Work in Progress

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

PA-91 [17:00] - In vivo
Dosimetry Assessment for 6-GHz Whole-Body Non-Constraint Exposure of Rats in Reverberation Chamber
Jingjing Shi¹, Jerdvisanop Chakarotthi¹, Jianqing Wang¹, Kanako Wake², Soichi Watanabe² & Osamu Fujiwara¹
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Key words: In vivo, RF/Microwaves, Work in Progress

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

PA-93 [17:00] - In vivo
75GHz millimeter wave exposure to eye: role of environment factors in effects
Millimeter waves are increasingly employed in airport security, automobile safety and mobile communication systems resulting in more exposure to humans. It is known that millimeter waves are absorbed by surface tissue, such as skin or cornea. In the present study, it was revealed that millimeter waves damage the eye by heat induction and convection. We hypothesized that convection of aqueous humor is involved in heat transfer from the cornea to the lens. We showed the roles of environment factors, airflow and humidity, in this process. Airflow at 0.5 m/s and low humidity during exposure decreases heat accumulation and transfer.

**PA-95 [17:00] - Human**

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

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Keywords: Human, ELF/LF, Work in Progress

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

**PA-97 [17:00] - Human**

**Risk perceptions of mobile communication in Japan**

Ayumi Masuchi¹

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

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

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

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

Gerard Dubost¹, James Bare² & Frederic Bellossi³

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²DC Albuquerque, NM, USA
³ESE Engineer, Bordeaux, France

Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

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

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

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

PA-103 [17:00] - Mechanistic/Theoretical
The compound Chinese medicine "Kang Fu Ling" protects against microwave-induced myocardial injury
Rui-yun Peng¹, Xueyan Zhang¹, Guo-shan Yang² & Hui Ning³
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This study aimed to investigate myocardial protection by the compound Chinese medicine “Kang Fu Ling” (KFL) against microwave-induced myocardial injury and the role of the mitochondrial permeability transition pore in such protection in vivo and in vitro. The results showed that 30 mW/cm² microwave radiation can cause histological and electrophysiological changes in the heart, and 0.75~3.0 g/kg/day KFL may protect against such injury; KFL at 1.5 g/kg/day had the greatest protective effects; Myocardial protection by KFL is related to inhibition of mitochondrial permeability transition pore opening.

PA-105 [17:00] - Occupational
The system of occupational safety and health legislation implemented in Poland in the context of the process of transposing the provisions of European Directive 2013/35/EU
Jolanta Karpowicz¹
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Occupational EMF legislation binding in Poland has been discussed in the context of the principles of Directive 2013/35/EU and their transposition into national legislation.

PA-107 [17:00] - Occupational
Possible health symptoms associated with electromagnetic field exposure in the welding industry
France Raphela¹
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A questionnaire survey was conducted among employees in a welding company located in the Mangaung Metropolitan Municipality, Free State Province, South Africa in November 2011. The objective of the survey was to describe and calculate the prevalence of health symptoms among subjects exposed to extremely low frequency electromagnetic fields. Subjects completed consent forms and self-administered questionnaires. The majority of exposed group (65%) and unexposed group (56%) experienced headaches most of the time. The exposed group also suffered from sleep disorders (27%), fatigue (36%) and distress (27%). Implementation of safety measures is necessary to prevent these symptoms.

PA-109 [17:00] - Occupational
Advanced Electric Shock Job Exposure Matrix Quantifies Uncertainty
Ximena Vergara¹, Heidi Fischer², Michael Yost³, Michael Silva⁴, David Lombardi⁵ & Leeka Kheifets⁶
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We present an update to a previously published electric shocks job exposure (JEM) matrix, geared to disentangle exposures within the electric occupation environment and examine their relationship to neurodegenerative diseases, such as...
amyotrophic lateral sclerosis (ALS). We describe overall results and highlight examples demonstrating the impacts cutpoint selection has on exposure assignment. Using uncertainty intervals, we show where more information on exposure to electric shocks might be needed.

**PA-111 [17:00] - Public Health Policy**

**Health Effects From Overhead Power Lines: A South African Perspective**

Linda De Jager

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

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

**PA-113 [17:00] - Public Health Policy**

**A new approach for the conflict resolution of power facilities including EMF in Korea**

Taeho Lee, Kim Yong Won & Tae-yong Kim

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

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

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

**PA-115 [17:00] - Public Health Policy**

**US Federal Communications Commission Review of Radiofrequency Exposure Policies**

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

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

**PA-117 [17:00] - Public Health Policy**

**Electric and Magnetic Fields from an Upgraded 132 kV Double Circuit Power Line – A Probabilistic Approach in Field Calculation and Exposure Assessment**

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2Eskom Holdings SOC Ltd, Johannesburg, South Africa

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

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

**PA-119 [17:00] - Public Health Policy**

**Study of Increased EMF levels generated by Collocated Base Station Sites**

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Keywords: Public Health Policy, RF/Microwaves, Concept

Last few years have witnessed a lot of emphasis being put on the collocation of Base Stations of different operators and different technologies majorly due to unavailability of space especially in Dense Urban areas. This approach has not just resulted in faster rollout but was also cost effective. However, with this has increased overall EMR generated from the same location. This has resulted in increased risk on the general public who are living in the close proximity of these Base stations.
This paper is an attempt to study the impact in terms of increase in the overall power density for the collocated base stations with respect to the EMF limit thresholds defined by ICNIRP (International Commission for Non Ionization Radi
Biomagnetic Pair Effect on Neuromuscular Excitability
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Keywords: Behavioural, Static, Completed (published)
A significant statistical difference of neuromuscular excitability during magnetic pair application occurs by significantly altering the curves as measured with Rheotome.

PB-4 [11:30] - Behavioural
Short-term and Long-term Exposure to Radiofrequency Electromagnetic Field Exposure (GSM 900 MHz) has no Effect on Blood-Brain Permeability in Rats
Melanie Klose1, Karen Grote1 & Alexander Lerchl1
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Keywords: Behavioural, RF/Microwaves, Completed (unpublished)
Female and male Wistar rats were exposed in the head region to a GSM-modulated 900 MHz radiofrequency electromagnetic field (RF-EMF). The average specific absorption rates (SAR) in the brain were 0 (sham), 0.7, 2.5 and 10 W/kg. Female rats (n = 24 / group) were long-term exposed beginning at an age of 14 days to 19 months, for two hours per day, five days per week. Male rats (n = 48 / group) were distributed into 3 groups and short-term exposed to RF-EMF on day 14 and 15, 16 and 17, or 18 and 19, respectively. A histopathological analysis revealed no higher tumor incidence in the central nervous system (CNS) due to long-term or short-term exposure, or a difference in the blood-brain-barrier (BBB) permeability, respectively.

PB-6 [11:30] - Clinical (diagnostics)
Study and Analysis of Medical Data using structural and functional Magnetic Resonance Imaging procedures (MRI/DTI/fMRI): Assessment of changes induced by Brain Radiotherapy
Irene Karanasiou1, Melina Giamalaki1, Konstantinos Bromis1, George Matsopoulos1, Eric Ventoura2, Vasileios Kouloulias3 & Nikolaos Uzunoglu1
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32nd Department of Radiology, University of Athens, Athens, Greece, 12462
Keywords: Clinical (diagnostics), RF/Microwaves, Work in Progress
While the use of prophylactic brain irradiation (PCI) in certain types of cancer has considerably increased life expectancy, it is questionable whether it could result in serious side-effects on the patient’s cognitive functions. The aim of the present research is the multilevel combined study of data from conventional and advanced techniques of Magnetic Resonance Imaging (MRI), such as diffusion tensor imaging (DTI) and functional MRI (fMRI) of healthy volunteers and cancer patients before and after being administered brain radiotherapy. The scope is to investigate neurocognitive underlying mechanisms of cancer progression and treatment using functional and structural neuroimaging.

PB-8 [11:30] - Clinical (therapy)
Biophysical stimulation of cartilage repair by pulsed electromagnetic fields
Ruggero Cadossi1 & Stefania Setti1
1Clinical Biophysics, IGEA, Carpi, Italy, 41012
Keywords: Clinical (therapy), ELF/LF, Review, Commentary, Recommendation, Evaluation
It is known that physical stimuli modulate cartilage metabolism. In particular, low frequency pulsed electromagnetic fields (PEMF) allow to treat homogenously the whole cartilage surface and thickness and the underlying subchondral bone. PEMF represents an innovative therapeutic approach in tissue engineering for cartilage repair and an effective treatment to promote cartilage anabolic activity thus optimizing clinical results and preventing cartilage degeneration over time.

PB-10 [11:30] - Clinical (therapy)
Intracavitary microwave heating for treatment of bile duct carcinoma - Numerical calculations in consideration of practical treatments
Microwave thermal therapy is one of the modalities for cancer treatment. There are several schemes of microwave heating. The authors have been studying thin coaxial antenna for intracavitary microwave heating aiming at the treatment of bile duct carcinoma. Up to now, the heating characteristics of the antenna are investigated by numerical simulation and experiment for finding a possibility of the treatment. In this study, in order to consider practical situations of the treatment, heating characteristics of the antenna are calculated by use of some different models. As the results of calculations, possibilities of microwave heating could be confirmed under the practical situations.

PB-12 [11:30] - Clinical (therapy)
Development on microwave forceps for coagulation of biological tissue
Kenta Suzuki¹, Yuta Endo¹, Yoshito Tezuka¹, Kazuyuki Saito¹, Masaharu Takahashi¹ & Koichi Ito¹
¹Chiba University, Chiba, Japan
Keywords: Clinical (therapy), RF/Microwaves, Work in Progress

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

PB-14 [11:30] - Clinical (therapy)
Numerical Modeling of Radiofrequency Ablation of Tumors Embedded in Realistic Anatomy
George Zorbas¹ & Theodoros Samaras¹
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Keywords: Clinical (therapy), RF/Microwaves, Work in Progress

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

PB-16 [11:30] - Dosimetry (computational)
Correlation between electromagnetic power absorption and induced temperature elevation in the human body for plane wave exposure
Marta Cavagnaro¹, Stefano Pisa¹, Emanuele Piuzzi¹ & James Lin²
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Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

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

PB-18 [11:30] - Dosimetry (computational) - STUDENT PAPER
Application of the non-intrusive polynomial chaos for the evaluation of the uncertainty in the SAR calculation using a CAD-based mobile phone model
Xi Cheng¹ & Vikass Monebhurrun¹
¹Department of Electromagnetics, SUPELEC, Gif-sur-Yvette Cedex, France, 91192
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

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

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

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

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

When simulating CAD models of wireless devices, scaling factors are determined to adjust the feedpoint power of the simulation to experimental reference data. Investigations of different configurations show that these factors depend on the loading conditions of the simulated device. This work discusses the impact of changing the loading conditions on the scaling factor with respect to dielectric losses of the materials of the phone, normalization and matching for different realistic device models.
The purpose of this study was to develop young child anatomical models. Two models were developed, one of a 12-months-old male whole body anatomical model and one of a 17-months-old male head model for evaluation of electromagnetic field exposure. These two models were built from magnetic resonance (MR) images. Using image segmentation algorithms, 28 and 30 tissues were identified for the whole body model and the head model respectively. We compared differences between these two models and existing human models.

Dosimetric assessment of an in vitro setup at 50 Hz
Caterina Merla1, Vanni Lopresto1, Carmela Marino1 & Rosanna Pinto1
1UTBIORAD, ENEA, Rome, Italy, 00123
Keywords: Dosimetry (computational), ELF/LF, Work in Progress
A first dosimetric assessment of the induced electric (E) field making numerical simulations on different samples (dimensions, culture medium volume) exposed to an homogeneous 50 Hz magnetic field is proposed. From such an analysis, the induced E field resulted to be strongly depended on the geometry of the sample (i.e. Petri dish dimension) and the volume of the simulated culture medium. This study can be useful to guide the biologist to expose their samples in the best configuration and with a known dose level according to the specific biological endpoint and hypothesized interaction mechanisms.

Conservativeness of the SAM phantom for the SAR evaluation of mobile phones with bottom-mounted antennas
Vikass Monebhurrun1
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Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)
The conservativeness of the SAM phantom for the compliance test of mobile phones with bottom-mounted antennas is investigated. Numerical simulations using half-wave dipole antennas positioned against either the visible human head or the SAM phantom are performed at 900 MHz, 1750 MHz, 1950 MHz and 2450 MHz. The homogeneous counterpart of the visible human is found to be always conservative with respect to the inhomogeneous model. The SAM phantom provides less conservative values above 1750 MHz for the peak 1g SAR. This is probably observed because of the difference in the morphologies around the cheek region and the difficulty of positioning the dipole antennas in a comparable way as already reported elsewhere.

Numerical Modelling of Transcutaneous Spinal Direct Current Stimulation (tsDCS)
Marta Parazzini1, Serena Fiocchi1, Ilaria Liorni1, 2, Vanessa Guadagnin1, Alberto Priori3, 4 & Paolo Ravazzani1
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Keywords: Dosimetry (computational), Static, Completed (published)
This work estimates the distribution of the current density on the spinal cord due to transcutaneous spinal direct current stimulation. We used computation method applied to realistic human model of different age and sex and we compared three different electrode montages. Data showed that the current density tends to be primarily directed longitudinally along the spinal cord with the region of higher amplitude influenced by the reference electrode position, while on transversal sections the J amplitude distributions were quite uniform.

Analysis of the Impact on Humans caused by pulsed electromagnetic Radiation from a Remote Piloted Aerial System
Alexander Preinerstorfer1, Stefan Cecil2, Franco Fresolone1, Daniel Prost3 & Georg Neubauer1
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3Electromagnetism and Radar Department, ONERA-The French Aerospace Lab, Toulouse, France, 31055
The project Aeroceptor has the aim to develop tools to remotely and safely control, slow and stop “non-cooperative” vehicles, such as cars used for illegal trafficking or for conducting terrorist attacks, in a safe way. Various techniques are tested and applied such as payloads emitting pulsed electromagnetic radiation to disturb or damage electronic components of the vehicles. To ensure that human health is not threatened by the emissions of the payload an exposure evaluation is performed by numerical simulations using the Finite-Difference Time-Domain (FDTD) algorithm.

Induced electric field strengths and current densities caused by exposure against Electronic Article Surveillance (EAS) systems
Gernot Schmid1, Rene Hirtl1, Stefan Cecil1, Richard Überbacher1, Ana Escorihuela-Navarro1, David Sainitzer1, Pia Schneeweiss1 & Tobias Jhala1
1EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, A-2444
Keywords: Dosimetry (computational), ELF/LF, Completed (unpublished)

SAR Calculations in the Human Fetus Radiated from a Typical Tablet Computer Placed Variant Positions
Akihiro Tateno1, Tomoaki Nagaoka2, Kazuyuki Saito1, Soichi Watanabe2, Masaharu Takahashi1 & Koichi Ito1
1Chiba University, Chiba, Japan, 263-8522
2National Institute of Information and Communications Technology, Tokyo, Japan, 184-8795
Keywords: Dosimetry (computational), RF/Microwaves, Completed (unpublished)

ACTE: a new project analyzing the exposure of very young children to LTE wireless communication systems
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5Public Health England, London, UK
6China Academy of Telecommunication Research of Ministry of Industry and Inf, Beijing, China
Keywords: Dosimetry (computational), RF/Microwaves, Work in Progress

PB-44 [11:30] - Dosimetry (measurements)
Measurement and Analysis of Driver Exposure to Electric Fields on Public Transport Bus Services in Seoul, Korea
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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress

There has been an unprecedented increase of various RF devices on the public transport bus service. For the representative RF devices are the bus information system (BIS) that is a kind of automatic vehicle location system by using CDMA wireless
communication, the Wi-Fi system, etc. In this paper, electric field levels sitting in the driver’s seat on the public buses are measured and compared with exposure limit values. As a result of measurement by using the personal EMF meters, the electric field value is only 0.08 V/m which is extremely lower than the human EMF exposure limit of 40.53 V/m in the field of CDMA wireless communication.

Characterization of a personal exposure dosimeter
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Keywords: Dosimetry (measurements), RF/Microwaves, Completed (unpublished)
To be able to perform occupational exposure assessment in an airport area with personal dosimeters, two models of personal dosimeters were indeep characterized. Frequency response, linearity, cross-over, reproducibility, isotropy were measured, and results are presented in view of practical considerations for daily use.

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

PB-50 [11:30] - Dosimetry (measurements) - STUDENT PAPER
Exposure to extremely low frequency magnetic fields in various Swiss and Belgium microenvironments
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Keywords: Dosimetry (measurements), ELF/LF, Completed (unpublished)
By using portable devices, extremely-low frequency magnetic field (ELF-MF: 40-800 Hz) measurements were conducted during two years in the city of Basel (Switzerland) and during one year in Ghent and Brussels (Belgium) in different microenvironments such as outdoor areas, public transports and indoor settings. We found high spatial variability of EMF within and between cities, but all average exposure values were far below the RF and ELF regulatory limits.

Simplified LTE Portable Handsets For RF Exposure Analysis
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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
Three simplified wireless handheld devices for LTE applications are described and studied in this paper. The study focuses mainly on the design and the radiation characteristic of the LTE antennas. From the FDTD simulations, antenna performances are computed in free space as well as in the presence of a flat phantom. The paper highlights the challenges of LTE antennas for miniaturized and simplified multi-band system that are suitable for the latest wireless systems.

PB-54 [11:30] - Dosimetry (measurements)
Exposure to Magnetic Fields in Residential Situations
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²EMR Australia PL, Sydney, Australia

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

PB-56 [11:30] - Dosimetry (measurements)
A Preliminary Analysis of Magnetic Fields Emitted from Non-hybrid and Hybrid Cars
Ronen Hareuveny¹, Madhuri Sudan², Malka Halgamuge³, Yoav Yaffe¹, Yuval Tzabari⁴, Daniel Namir⁴ & Leeka Kheifets⁵
¹Soreq NRC, Yavne, Israel
²Department of Epidemiology, UCLA School of Public Health, University of California (UCLA), Los Angeles, CA, USA
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Keywords: Dosimetry (measurements), ELF/LF, Work in Progress
The investigation of the exposure of the general public to Extremely Low-Frequency magnetic fields caused by the transportation system is of interest. In this study, measurements of magnetic fields emitted from both hybrid and non-hybrid cars at different speeds (0-80 km/h) and in different locations within a vehicle were investigated. Details of measurements in different locations of the vehicles and under different driving scenarios would be presented. Levels of magnetic fields in hybrid cars would be compared to non-hybrid cars.

EMF Field Measurement Around the Vulnerables (Kindergarten) About EMF in Korea
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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
This paper analyses the results of electromagnetic field strength measurement around the kindergarten environments. The data is considered very important with its high reliability to use in epidemiological researches and prediction model for EMF exposure including researches on EMF health effects.

PB-60 [11:30] - Dosimetry (measurements)
Electric field uniformity in a GTEM cell for in-vitro exposure studies: simulations and measurements
Nektarios Moraitis¹, Maria Christopoulou², Vasileios Papavasileiou² & Konstantina Nikita³
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²Biomedical Simulations and Imaging Laboratory, National Technical University of Athens, Athens, Greece, 15773
³Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
In this paper we present field uniformity measurements inside a GTEM cell at mobile communication frequencies for different modulation types and stress levels. In addition, a numerical GTEM model is developed and simulations of the electric field are carried out. Measured and simulated field values are in satisfactory agreement with a maximum difference lower than 3 dB.

Frequency Selective Simultaneous LF and RF EMF Monitoring
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¹Section 414, Federal Network Agency, Mainz, Germany, 55122
Keywords: Dosimetry (measurements), RF/Microwaves, Completed (published)
The requirements for a combined isotropic and automated measurement of LF and RF in the frequency range 5 Hz to 3 GHz are: Overlap in frequency range requires evaluation according both criteria from 100 kHz to 10 MHz, Using the accepted and established test and communication platforms also for LF and RF ensures public trust.

PB-64 [11:30] - Dosimetry (measurements)
Evaluation of the exposure to radiofrequency portable transmitters
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Keywords: Dosimetry (measurements), RF/Microwaves, Work in Progress
Several activities, in particular serviceman, require the use of a portable transmitter. These portable transmitters can emit several Watts in the VHF frequency band. These devices are worn near the body and there are questioning on the level of the exposure to the electromagnetic field which they get. This study consists of the numeric and experimental dosimetry of the whole body exposed to a radiofrequency portable transmitter at the frequency 90MHz.
Pulsed EM field characteristics and dosimetric relevance
Katerina Skouroliakou1, Giannis Giannarakis3, Aikaterina Stefi4, Adamantia Fragopoulou2, Areti Manta2 & Lukas Margaritis2
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2Department of Biology, University of Athens, Athens, Greece

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

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

PB-68 [11:30] - Dosimetry (measurements) - STUDENT PAPER
EMF exposure metering: Dealing with pulsed RF signals
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Keywords: Dosimetry (measurements), Pulsed, Work in Progress

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

PB-70 [11:30] - Electroporation
Activation of Autophagy in Response to Nanosecond Pulsed Electric Field Exposure
Jody Ullery1, Larry Estlack1, Melissa Tarango1 & Bennett Ibe2
1General Dynamics Information Technology, JB, Fort Sam Houston, TX, USA, 78234-2644
2Air Force Research Laboratory, 711th Human Performance Wing, Human Effectiveness Directorate, Bioeffects Division, Radio Frequency Bioeffects Branch, JB, Fort Sam Houston, TX, USA, 78234-2644

Keywords: Electroporation, Pulsed, Work in Progress

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

PB-72 [11:30] - Epidemiology
Car-mounted mobile measurements used for radio-frequency spectrum monitoring may have a wider application for population exposure studies: A test survey in Cambridge, UK and Amersfoort, The Netherlands
John Bolte1, Loek Colussi2, Jos Kamer3, Terry Mee4, Darren Addison3 & Myron Maslanyj3
1Centre for Sustainability, Environment and Health, National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands, 3720BA
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Keywords: Epidemiology, RF/Microwaves, Completed (unpublished)

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

PB-74 [11:30] - Epidemiology
Childhood leukemia with and without Down syndrome
Down syndrome (DS) is a common congenital anomaly, and children with DS have a substantially higher risk of leukemia. We provide background on DS epidemiology and review the similarities and differences in biological and epidemiologic features of leukemia in children with and without DS. We propose that both acute lymphoblastic (ALL) and acute myeloblastic leukemia (AML) among DS children can serve as an informative model for development of childhood leukemia.

PB-76 [11:30] - In vitro
Effects of mobile phone radiation on the hematopoietic system?
Henning Hintzsche1, Katharina Taichrib1, Martina Rohland2, Thomas Kleine-Ostmann2, Thorsten Schrader2 & Helga Stopper1
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Keywords: In vitro, RF/Microwaves, Completed (unpublished)

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

PB-78 [11:30] - In vitro
In vitro and in vivo studies to elucidate mechanisms of RF and IF radiation in GERoNiMO-project
Anne Höytö1, Mikko Herrala1, Kajal Kumari1, Jukka Luukkonen1, Heikki Tanila1, Matti Viluksela1, Jonne Naarala1 & Jukka Juutilainen1
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2Department of Neurobiology, University of Eastern Finland, Kuopio, Finland, 70211
Keywords: In vitro, IF, Work in Progress

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

PB-80 [11:30] - In vitro
Investigation of the effects of oscillating temperature and pulsed magnetic fields on HT1080 cell proliferation
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2ETH Zürich, Zürich, Switzerland, CH-8004
Keywords: In vitro, Pulsed, Work in Progress

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

Can we find experimental evidence in favour of an association between extreme low frequency magnetic field exposures and an increased risk for Alzheimer’s disease?
Annemarie Maes1, Roel Anthonissen1 & Luc Verschee1
1Scientific Institute of Public health (WIV-ISP), Brussels, Belgium
Keywords: In vitro, ELF/LF, Completed (unpublished)

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

PB-84 [11:30] - In vitro

70
Low-frequency pulsed electromagnetic fields significantly improve time of closure and proliferation of human tendon fibroblasts
Claudine Seeliger1, Karsten Falldorf2, Jens Sachtleben1 & Martijn van Griensven1
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Keywords: In vitro, ELF/LF, Completed (unpublished)
The promotion of the healing process following musculoskeletal injuries comprises growth factor signalling, migration, proliferation and apoptosis of cells. If these processes could be modulated, the healing of tendon tissue may be markedly enhanced. Here we report the use of the Somagen® device generating low-frequency pulsed electromagnetic fields (PEMF) that trigger effects that need to be determined more precisely, yet. However, the instrument is certified for medical use according to European laws.

PB-86 [11:30] - In vitro
Effects of Pulsed Radiofrequency Fields on Viability of Cell Cultures
Rachel Whiting1, Alex Wright1, Chris Lindsay1, Iain Scott1, Masood Ur Rehman2,3, Yasir Al-fadhl2, Xiaodong Chen & John Tattersall1
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Keywords: In vitro, Pulsed, Work in Progress
Although ICNIRP and IEEE guidelines specify limits on peak field intensity for pulses, these limits are not based on any established biological effect. To investigate the possible relationship between biological effects and peak field intensity, we have developed a novel system that can achieve high peak field intensities for the exposure of cell cultures. We have now begun to characterise the thermal characteristics of exposures in this system and their effects on cell viability, in preparation for future studies to search for effects related to peak field intensity alone.

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

Oxidative stress effects of 1880-1900 MHz electromagnetic radiation emitted from cordless phone on mouse brain.
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2Department of Pharmaceutical Technology, Faculty of Pharmacy, University of Athens, Athens, Greece, 15784
Keywords: In vivo, RF/Microwaves, Work in Progress
Whole body exposure of C57BL/6j mice to DECT base EMR (1880-1900 MHz frequency band) at an average electrical field intensity of 2.7 V/m for 14 h/day(constantly or intermittently (1h45΄ 8 ON, 1h15΄8 OFF)) x 2 months not capable to induce any increase or decrease of the lipid peroxidation content in the mouse brain as revealed by the measurement of the malondialdehyde (MDA) levels. The MDA content, as well as other oxidative stress markers are under further investigation in individual brain regions (hippocampus, cerebellum, frontal lobe), as well as in more time points of exposure duration.

Long Term Effect of WCDMA Radiofrequency Electromagnetic Fields on Memory Impairment in Alzheimer's Disease Mice
Ye Ji Jeong¹, Hyung-Do Choi², Jeong-Ki Pack³, Nam Kim⁴, Yun-Sil Lee⁵ & Hae-June Lee¹
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²Radio and Broadcasting Technology Laboratory, ETRI, Daejon, Korea
³Department of Radio Sciences and Engineering, Chungnam National University, Daejon, Korea
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Keywords: In vivo, RF/Microwaves, Completed (unpublished)
To investigate whether electromagnetic fields emitted by mobile phone effects on brain function, we evaluated memory function by behavioral test in Alzheimer’s disease mice. Transgenic mice enhanced passive avoidance performance and alteration behavior (spatial working memory) by long term RF exposure (1.95 GHz, SAR 5W/kg, 2 hr/day for 8 months). Reduction of Amyloid-b (Ab) deposits in histopathological analysis correlated with behavior test. We concluded that RF exposure may have preventive effect against memory impairment in Alzheimer’s disease mice.

Millimeter wave exposure induces cornea and lens epithelium damage
Masami Kojima¹, Cheng-Yu Tsai¹, Yukihisa Suzuki¹, Kensuke Sasaki¹, Kanako Wake¹, Soichi Watanabe¹, Yoshitsugu Kamimura¹, Akimasa Hirata¹, Masao Taki¹, Kazuyuki Sasaki¹ & Hiroshi Sasaki¹
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Keywords: In vivo, RF/Microwaves, Work in Progress
International guideline for millimeter waves (MMW) pertain to the surface of biological tissues or organs. MMW effects on ocular tissues, especially inside the eye, remain unclear. Lens damage by 75 GHz MMW exposure was investigated in rabbit eye. Exposure to 75 GHz MMW induced not only corneal damage but also lens epithelial cell damage in rabbit eye. MMW absorbed by cornea caused heat transport to the crystalline lens.

Reactivity of different brain structures in response to magnetic and electromagnetic field of low intensity
Svetlana Lukyanova¹, Oleg Grigoriev¹, Viktorya A. Alekseeva¹ & Anastasia Prokofieva¹
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Keywords: In vivo, RF/Microwaves, Work in Progress
Rabbits was exposed by a magnetic field and electromagnetic field of low intensity with different parameters and conditions of exposure. Was made analysis of total and pulsed bioelectric activity of different brain regions of the rabbits. Result of analysis showed that brains regions has different influence for general reactions of the central nervous system.

Differential Effects of CW, FM and Pulsed EMF Signals in Model Biological Systems; the Role of Dosimetry
Lukas Margaritis¹, Areti Manta¹, Aikaterina Stefi¹,², Rallou Selimou¹,³, Michael Fasseas⁴, Popi Syntichaki⁴, Anastasios Argyriou⁴, Giannis Giannarakis⁴ & Kostas Kefalas²
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Keywords: In vivo, RF/Microwaves, Completed (unpublished)
We attempted to answer questions on the effects of EMFs created by wireless devices: a) what is the role of the selected biological system, b) which is the threshold in terms of dose, modulation, duration to initiate bioeffects, c) is the kind of pulse characteristics crucial to induce biomolecular changes compared to pure CW signals?, d) is the two-source or three-source exposure creating additive results? To answer these questions we used 1) ex vivo human sperm, 2) diptera flies of the genus Drosophila, 3) nematodes C. elegans, 4) microcrystallization process of CaCO₃ saturated solution. EMF sources included cell phone, DECT base and handset, signal generator, Wi-Fi router and cell phone jammer.
Mobile Phone Exposure and Sleep in Children and Adolescents
Sarah Loughran1, 2, 3, Ray McKenzie1 & Rodney Croft1, 2, 3
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3Centre for Population Health Research on Electromagnetic Energy, Monash University, Melbourne, Australia
Keywords: Human, RF/Microwaves, Work in Progress

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

Effects of Pulsed Magnetic Fields on neurons: a study on how the Cnp signal silences neuron model
Francesca Camera1, Alex Thomas2, Alessandra Paffi1, Guglielmo d’Inzeo1, Francesca Apollonio1, Frank Prato2 & Micaela Liberti1
1ICEmB@DIET, “Sapienza” University of Rome, Rome, Italy, 00184
2Bioelectromagnetics Group, Imaging Program, Lawson Health Research Institute, London, ON, Canada
Keywords: Mechanistic/Theoretical, Pulsed, Work in Progress

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

The influence of different types of barrier creams on skin barrier function
Sonette du Plessis1 & Anja Franken
1Physiology, North West University, Potchefstroom, South Africa
Keywords: Occupational, Static, Other

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

A review of environmental data on where in the industrial and medical work environmental exposure to electromagnetic fields may be hazardous to users of active implantable medical devices (AIMD)
Wiesław Leszko1, Jolanta Karpowicz1, Patryk Zradziński1 & Krzysztof Gryż2
1Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Res. Inst. (CIOP-PIB), Warszawa, Czerniakowska 16; wiles@ciop.pl; jokar@ciop.pl, Poland, 00-701
Keywords: Occupational, RF/Microwaves, Work in Progress

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

Influence of electromagnetic fields of mobile radio systems TETRA, GSM and UMTS on the behaviour of humans in different demand situations
Hannelore Neuschulz1, Klaus Hentschel1 & Norbert Kersten1
1Federal Institute for Occupational Safety and Health, Berlin, Germany, 10317
Keywords: Occupational, RF/Microwaves, Completed (published)

In five studies health risk and effects of radiofrequency fields on cognitive function and psychological basic activity during use of handsets of TETRA (range 400 MHz), GSM (range 900 MHz) and UMTS (range 2000 MHz) were assessed. Using generic antennas or/and modified handsets the members of carefully selected homogeneous samples of 20 to 30 years old male volunteers were exposed to the RF-field or a sham exposure (no field) according a crossover design. In double blind tests the subjects fulfilled computer-based visual demands as well as a test known as “autokinetic illusion” in a Faraday room. The investigations revealed no statistically significant differences (p < 0.05) between field exposures and sham conditions.
The use of anthropometric data of human body and virtual body models to personalise assessment of SAR caused by exposure to radiofrequency fields
Patryk Zradziński1, Jolanta Karpowicz1, Krzysztof Gryz1 & Wiesław Leszko1
1Laboratory of Electromagnetic Hazards, Central Institute for Labour Protection - National Research Institute (CIOP, Warszawa, Poland, 00-701)

Keywords: Occupational, RF/Microwaves, Work in Progress
Statistical relations between SAR in human body and its anthropometric dimensions were used to personalise RF EMF exposure assessments, especially desired for workers.

Australian Centre for Electromagnetic Bioeffects Research (ACEBR)
Rodney Croft1,2, John Finnie1,3, Andrew Wood4, Irene Yarovsky1,5, Peter Blumbergs1,3, Boris Martinac1,6, Elena P. Ivanova1,7, Robert Vink1,8, Nigel Taylor1,9, Mark Elwood1,10 & Sarah Loughran1,2
1Australian Centre for Electromagnetic Bioeffects Research, Australia
2School of Psychology, Illawarra Health and Medical Research Institute, University of Wollongong, Australia
3SA Pathology, Hanson Institute Centre for Neurological Diseases, University of Adelaide, Australia
4Department of Biomedical and Health Sciences, Swinburne University of Technology, Melbourne, Australia
5Health Innovations Research Institute, RMIT University, Melbourne, Australia
6Molecular Cardiology and Biophysics Division, Victor Chang Cardiac Research Institute, Sydney, Australia
7Department of Chemistry and Biotechnology, Swinburne University of Technology, Melbourne, Australia
8School of Medical Sciences, University of Adelaide, Australia
9Centre for Human and Applied Physiology, School of Medicine, University of Wollongong, Australia
10School of Population Health, University of Wollongong, Australia

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

PB-114 [11:30] - Public Health Policy
New open-access journal ‘Frontiers in Radiation and Health’
Dariusz Leszczyński1,2
1Chief Editor of ‘Radiation and Health’, Frontiers in Public Health, Lausanne, Switzerland
2Adjunct Professor, Biochemistry and Biotechnology, University of Helsinki, Helsinki, Finland

Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation
New open-access journal ‘Frontiers in Radiation and Health’, part of the Frontiers in Public Health, is published by the Swiss Frontiers and by the British Nature publishers.

Crowdtasking – A Solution to Evaluate Workers Combined Exposure due to Multiple Sources
Hamid Molla-Djafari1, Doris Leopold2, Alexander Preinerstorfer2, Maria Egly2, Gernot Schmid3 & Georg Neubauer2
1Austrian Workers Compensation Board (AUVA), Vienna, Austria, 1200
2Safety & Security Department, Austrian Institute of Technology, Seibersdorf, Austria, 2444
3EMC & Optics, Seibersdorf Laboratories, Seibersdorf, Austria, 2444

Keywords: Public Health Policy, RF/Microwaves, Completed (unpublished)
In summer 2013 the EU-Directive 2013/35/EC on the exposure of workers to EMFs was released obligating employers to evaluate workplaces of their employees. The platform EMES makes such an evaluation for several environments like the crafting industry, medical or office workplaces possible. EMES is based on an exposure data repository and offers an interface allowing qualified experts to provide relevant data in order to extend the database. A crowd of experts would make it possible to share and combine all relevant exposure data all over Europe in order to ensure workers safety.

Electric Field Coupling from an Overhead Power Line to a Large Refrigerated Truck – A Case Study And Safety Assessment
Pieter H Pretorius
1TERRATECH, Johannesburg, South Africa

Keywords: Public Health Policy, ELF/LF, Completed (unpublished)
Electric field coupling from a 400 kV overhead power line to a large delivery vehicle was evaluated to ensure the safety of persons coming in contact with the vehicle. A safety assessment based on a numerical model of a large vehicle underneath a power line was done and comparison with experimental results obtained from earlier measurements. The numerical model was extended to include the shape of the actual refrigerated vehicle and power line. The 5 mA “safe-let-go” current noted by the NESC and EPRI was used as reference. The induced voltage on the vehicle and current, that may flow through a person when touching the vehicle when parked parallel or perpendicular to the line, was also addressed.

PB-120 [11:30] - Public Health Policy
Recent Findings of Gazi Biophysics GNRK on RF
Nesrin Seyhan

Biophysics, Gazi University, Ankara, Turkey, 06500
Keywords: Public Health Policy, RF/Microwaves, Review, Commentary, Recommendation, Evaluation

Gazi Biophysics is located in Ankara at the Medical Faculty of Gazi University and has been carrying out in vivo, in vitro and clinical research studies on the biological impacts of Static, Extremely Low Frequency (ELF) and Microwave (MW) electromagnetic fields (EMF) since 1989. Our laboratory includes: physicists, biologists, electrical engineers, all of whom are studying how living systems respond to EMF. Our research team includes physicists, biologists, electrical engineers, physicians, biochemists, pathologists and veterinarians.

Estimation of Safe Height of Structures Surrounding Base Stations with respect to EMF Exposure Compliance Standards
Ashish Kumar Shrivastava

Network Engineering, Ericsson India Global Services (P) Ltd., Kolkata, India
Keywords: Public Health Policy, RF/Microwaves, Concept

An attempt has been made to estimate the compliance height for the structures surrounding a Base Station (BTS) under the worst case conditions of EMR Exposure to General Public. Equivalent Isotropically Radiated Power Threshold is used as a basis for the estimation. The methodology and calculations are based on the ITU-T recommendation K.52 and K.61. For this, a hypothetical site located in an urban area is considered, which is radiating with maximum EIRP as per the limits defined by ICNIRP.
The Mobile Manufacturers Forum is an international association of mobile and wireless communications equipment manufacturers that was established to facilitate research and cooperation on standards, regulatory issues and communications concerning the safety of wireless technology. For more information, please visit the MMF website at www.mmfai.org.

The Electric Power Research Institute (EPRI), with major locations in Palo Alto, California; Charlotte, North Carolina; Knoxville, Tennessee, and Washington, DC was established in 1973 as an independent, nonprofit center for public interest energy and environmental research. EPRI brings together members, participants, the Institute’s scientists and engineers, and other leading experts to work collaboratively on solutions to the challenges of electric power. These solutions span nearly every area of electricity generation, delivery, and use, including health, safety, and environment. EPRI’s members represent over 90% of the electricity generated in the United States, and international participation represents a more than 15% of EPRI’s total research portfolio. Robert Kavet, ScD, MS, MEE is a Senior Technical Executive at EPRI responsible for managing the research program in Electric and Magnetic Fields and Radio-Frequency Health Assessment. For more information, please visit the EPRI website at www.epri.com
The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world’s mobile operators, as well as more than 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organisations. The GSMA also produces industry-leading events such as the Mobile World Congress and Mobile Asia Expo. For information on GSMA activities related to electromagnetic fields please visit www.gsma.com/health.

The U.S. Office of Naval Research Global (ONR Global) provides worldwide science & technology (S&T) -based solutions for current and future naval challenges. Leveraging the expertise of more than 50 scientists, technologists and engineers, ONR Global maintains a physical presence on five continents. The command reaches out to the broad global technical community and the operational fleet/force commands to foster cooperation in areas of mutual interest and to bring the full range of possibilities to the Navy and Marine Corps.
It is ZonMw’s goal to ensure that healthy people stay that way for as long as possible, that ill people recover as quickly and completely as possible and that people who require care and nursing receive the highest standard of services. To achieve this, we need to focus on prevention: on stopping people from becoming ill. And we need good health care for people who nevertheless fall ill. The question ZonMw faces is how to improve disease prevention and health care. One thing is clear: you need a lot of knowledge, and therefore a lot of research. And it is important that people actually use that knowledge. With this in mind, ZonMw funds and promotes research, development and implementation.

FEKO is a state-of-the-art 3D electromagnetic simulation platform, offering a broad range of different solvers, including finite difference time domain (FDTD) and finite element methods (FEM). FEKO is ideal for the simulation of Bio-electromagnetic applications, including body arena networks (BAN), MRI and telemetry of implanted devices. FEKO has a well-established global distribution and technical support network. Visit the website for more information www.feko.info
SAECA (South African Electronic Communications Association) is the independent non-profit association representing the communications industry within the Republic of South Africa. SAECA aims to provide a source of credible information, guidance, co-operation and communication for the local and global communications industry, the public, regulators and Government on matters relating to radio frequency emissions. Current membership consists of MTN, Vodacom, Telkom, Cell C, Nokia and Samsung.

Since 1980, the year the company was founded, IGEA has been working to provide innovative and effective therapies to patients. IGEA’s constant commitment and knowledge, built on solid scientific foundations, led to the birth of Clinical Biophysics, a branch of medicine based on the use of non-ionising physical energy. Over the years, scientific research and intellectual curiosity have always distinguished the work of IGEA enabling the company to develop new and efficacious orthopaedic medical devices to promote reparative osteogenesis and joint protection. In 2000, with the aim of offering the patient an effective and safe therapy that is easy to use, with minimal side effects, IGEA decided to take on a new challenge: the development of oncological biophysics for the treatment of solid tumours. The significant progress made in science, technology and continuous identification of innovative and efficacious treatment solutions for the improvement of patients’ quality of life, have made IGEA the leading company in the field of Clinical Biophysics. IGEA’s work, focused on the search for efficacious therapies, is built on a knowledge-based approach and awareness of patient issues. Individuals, their ideas and the quality of the products are the foundation on which IGEA decided to build its future and on which its destiny depends on.
EMSS Consulting specialises in the field of electromagnetic simulation software, services and products. The comprehensive 3D RF Safety compliance software system Ixus (http://www.emssixus.com) and fieldSENSE personal monitor (http://www.fieldsense.com) are some of the products developed by EMSS. Further details available at (http://www.emss.co.za/consulting.php)
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