

### Abstract

COST Actions ([www.cost.eu](http://www.cost.eu)) are a flexible, fast, effective and efficient networking instrument for researchers. COST EMF-MED ([www.COST-EMF-MED.eu](http://www.COST-EMF-MED.eu)) provides a cooperative framework to support the research on beneficial biological effects of non-ionizing EMFs and their use in biomedical applications. Research on biological effects of EMFs has traditionally focused on health risks. This Action focuses on useful biological EMF interactions and associated biomedical applications, aiming for breakthrough results, new discoveries and innovative biomedical technologies. COST EMF-MED aims to contribute to development and optimization of innovative EMF-based medical devices and procedures, which will be safer, more efficient and less invasive. COST EMF-MED is an open network, lasting from 2014 to 2018.

### Introduction

The vast range of possibilities for interactions between EMFs and the human body raises a question whether currently unexplained or even unknown interaction mechanisms may be used for the benefit of human health.

Potentially beneficial interactions are under investigation in various contexts, e.g. EMF-based cancer treatment based on high level and low level EMFs, EMF exposure/stimulation of excitable tissues and cells for neurological, neurodegenerative and psychiatric disorders, as well as EMF exposure/stimulation of non-excitabile tissues in tissue healing, growth, or regeneration applications. Such mechanisms could be harnessed and employed in biomedical applications.

COST EMF-MED aims to provide a better understanding of underlying physical and biological interaction mechanisms, related to both cancer and non-cancer applications, filling the gaps in present state of knowledge.

### Methods

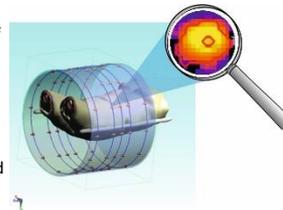
To be able to find, investigate, and make use of certain beneficial effects of EMFs, a whole set of pre-conditions have to be met: the extensive knowledge of life sciences – primarily medicine, biology, and biophysics, aided by modern methodology in molecular biology, chemistry and physics research, and on top of that, engineering apparatus in electrical engineering and bioelectromagnetics, consisting of modern technologies, measurement methods and instruments, computational simulation methods combined with sufficient computational power and accurate physiological models. All these should provide the scientific base for design and development of new healthcare technologies for routine applications, as well as for assessment of such technologies.

#### Working Group 1 (WG1) – Cancer EMF interactions and applications

##### WG1 Leader: Gerard van Rhoon

The main activity is concerting the research on treatment and diagnosis of cancer using EMFs and/or EMF-based technologies, with the following objectives:

- establish the scientific rationale of cancer treatments based on low level and high level EMFs;
- optimize the administration and control of EMF-based cancer treatment;
- develop and/or improve EMF-based cancer diagnostic modalities;
- develop the associated technology for clinical use.



#### Working Group 2 (WG2) – Non-cancer EMF interactions and applications

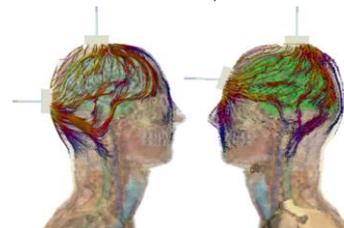
##### WG2 Leader: Lluís Mir

The main activity is concerting the research on non-cancer applications and procedures:

- based on applying EMFs to tissues and cells to produce direct effects of such stimulation;
- essentially and functionally based on EMFs.

The objectives of WG2 are:

- establish the scientific rationale of applications and procedures based on EM stimulation of excitable and non-excitabile tissues and cells;



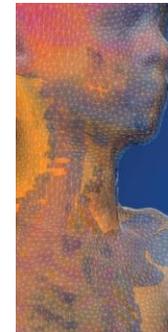
- optimize the administration and control of EM stimulation;
- develop and/or improve biomedical applications and procedures essentially and functionally based on EMFs;
- develop associated technology for clinical use.

#### Working Group 3 (WG3) – EMF dosimetry – in silico tools & measurements

##### WG3 Leader: Niels Kuster

The main activity is concerting the research on EMF computational (in silico) and measurement dosimetry, with the following objectives:

- understand and control the underlying physical, technical, and relevant biological (tissue) parameters during medical procedures and experimental studies;
- develop and/or improve validated multi-physics, multi-scale simulation tools and functionalized anatomical models;
- develop and/or improve dosimetric measurement equipment and exposure equipment;
- provide the technical support to WG1 and WG2.



### Results

#### MC and WG Meetings

- 1st MCM (Kick-off): Brussels (Belgium), April 2014
- 2nd MCM, 1st WGMs: Split (Croatia), October 2014
- 3rd MCM, 2nd WGMs: Madrid (Spain), March 2015
- 3rd WGMs: Zurich (Switzerland), June 2015
- 4th MCM, 4th WGMs: Prague (Czech Republic), November 2015

#### Workshops

- "EMF Interaction with Excitable Tissues", Madrid, 6 March 2015
- "Immune System Modulation by EMF", Rome, 15 May 2015

- "Designing Focused Deep Hyperthermia by EMF", Zurich, 23 June 2015
- "Verification, Validation and Uncertainty Assessment in Medical EMF Applications", Prague, 18 November 2015

#### Training Schools

- "European Training School on Clinical Trials", Galway, May 2015 (co-organization with COST Action TD1301)
- "Summer School on Health Technology Assessment", Warwick, September 2015 (co-organization with several organizations)
- "Diagnostic and Therapeutic Applications of Electromagnetics", Torino, September 2015 (co-organization with European School of Antennas)
- "International School of Bioelectromagnetics: "EMFs and Nervous System - Biological effects, Methodological Aspects and Medical Applications", Erice, April 2016 (co-organization with EBEA)

#### Short Term Scientific Missions (STSMs), Working Modules

- 20 STSMs approved in the first and the second year
- 24 Working Module topics proposed

### Conclusion

In its second year, COST EMF-MED consists of more than 200 researchers from 34 countries.

To the best of our knowledge, it is the very first scientific initiative in the world to systematically approach the topic of beneficial effects of EMFs, especially on this scale.

COST EMF-MED will contribute to development and optimization of innovative EMF-based medical devices and procedures, which will be safer, more efficient and less invasive. Interdisciplinarity of the proposed topic and significance of the expected outcomes require a concerted research network at the worldwide level.

### Join COST EMF-MED:

Web site: [www.COST-EMF-MED.eu](http://www.COST-EMF-MED.eu)

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