

Ettore Majorana Foundation and Centre for Scientific Culture

(President: prof. Antonino Zichichi)



International School of Bioelectromagnetics “Alessandro Chiabrera”

Director of the School: prof. Ferdinando Bersani (University of Bologna, Italy)

Sponsored by: European Bioelectromagnetic Association (EBEA); Italian Inter-University Centre for the study of the Interaction between Electromagnetic Fields and Biosystems (ICEmB); IGEA Clinical Biophysics (Carpi, Italy); World Health Organization (WHO).

The Centre for Scientific Culture in Erice (Sicily, Italy) is named after the great Italian scientist Ettore Majorana. Antonino Zichichi, the President of the Centre, has said: “At Erice, those who come in order to follow a certain School are called ‘students’, but actually they are young people who have successfully completed their University studies and who come to Erice in order to learn what the new problems are. However, what is distinctive for Erice is the spirit animating all participants: students no less than teachers. The prime objective is to learn. The student listens to the lectures and after that comes the most amusing part: the discussion session.” Topics in Bioelectromagnetics have come to Erice many times in the past, especially in the 1980s, with international courses and workshops on non-ionising radiations, and today many participants of those courses contribute greatly to the development of this research field.

Following the request of the European Bioelectromagnetics Association (EBEA) and the Italian Inter-University Centre for the study of the Interaction between Electromagnetic Fields and Biosystems (ICEmB), in 2003 the Ettore Majorana Centre has established a Permanent School of Bioelectromagnetics, named after Alessandro Chiabrera, who is considered as a Master by the young scientists of the two organizations.



VIII COURSE, organized with COST Action BM1309:

European network for innovative uses of EMFs in biomedical applications ([COST EMF-MED](#))

Electromagnetic Fields and the Nervous System: Biological Effects, Biophysical Mechanisms, Methods, and Medical Applications

Directors of the Course:

Vincenzo Di Lazzaro

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The nervous system is likely one of the major targets for EMF effects, due to its electrical activity and its role in the body response to external stimuli. In the last decades, several investigations have been focused on the effects of ELF or RF fields at cellular, tissue or whole-body levels, both in animals and humans. The research emphasis on the nervous system greatly increased following the introduction of mobile telephones, due to the vicinity of the electromagnetic source to the brain during conversation. In addition to the open question about the health risk related to field exposure, a number of medical applications have been proposed or developed, including nerve regeneration, cancer therapy, analgesia, treatments for depression, traumatic brain injury, multiple sclerosis, Alzheimer's and other neurodegenerative diseases, etc. Despite all these studies and the interesting future perspectives concerning medical applications, the mechanisms underlying the effects of EMF on the nervous system, with the exception of thermal effects, are still unclear, and much work remains to be done. Recent progress in EMF therapeutics in the nervous system has led to regulatory approval for several devices. However, it must be stressed that there is also a grey landscape, consisting of many therapeutic devices currently present on the market, although lacking scientific support and adequate clinical evidence. These devices are often publicized by paramedical centres and used by medical doctors, mostly in the context of the so-called alternative medicine. In this context, it is particularly important to distinguish the wheat from the chaff, in order to clarify the situation and to identify the gaps in our present knowledge, future perspectives and research needs.

The Course is intended to give a general overview of this topic, including biological effects, biophysical mechanisms, present medical applications and future perspectives. Particular attention will be paid to the methodology in this specific field of research.

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COST is supported by the EU Framework Programme Horizon 2020

PROGRAMME

Monday, April 11

14.00-14.30: Introduction to the Course by the Directors

INTRODUCTION TO THE NERVOUS SYSTEM

14.30-15.30: Functional organization of the nervous system: sensory, motor, autonomic and superior functions

- *Flavio KELLER (Rome, Italy)*

15.30-16.30: The neuron: structure and basic functions

- *Flavio KELLER (Rome, Italy)*

16.30-17.00: coffee break

17.00-18.30: Neurophysiology and computational modelling of neural networks

- *Nicolas ROUGIER (Bordeaux, France)*

Tuesday, April 12

METHODS IN NEUROPHYSIOLOGY

Electrophysiology

8.30-9.30: Electrophysiology in humans

- *Sarah LOUGHRAN (Wollongong, Australia)*

9.30-11.00: Electrophysiology in animals, tissues and cells

- *Giorgio AICARDI and Isabella ZIRONI (Bologna, Italy)*

11.00-11.30: coffee break

Neuroimaging

11.30-13.00: fMRI, PET, SPECT, MEG

- *Hartwig SIEBNER (Copenhagen, Denmark)*

13.00-15.00: lunch

15.00-16.00: Optogenetics: a new tool to interrogate and modulate neuronal circuits

- *José Fernando MAYA-VETENCOURT (Genoa, Italy)*

Behavioural studies

16.00-17.00: Behavioural studies in humans

- *Sarah LOUGHRAN (Wollongong, Australia)*

17.00-17.30: coffee break

17.30-18.30: Behavioural studies in animals

- *Laura CALZÀ (Bologna, Italy)*

Wednesday, April 13

METHODS IN NEUROPHYSIOLOGY (cont.)

Molecular techniques

8.30-9.30: From brain to cell cultures: an overview of molecular techniques

- *Florence POULLETIER DE GANNES (Bordeaux, France)*

9.30-10.30: Quantitative data from molecular neuroanatomy

- *Laura CALZÀ (Bologna, Italy)*

10.30-11.00: coffee break

Other diagnostic and therapeutic techniques

11.00-12.00: Transcranial direct current stimulation (tDCS), transcranial alternating current stimulation (tACS)

- *Walter PAULUS (Göttingen, Germany)*

12.00-13.00: Transcranial magnetic stimulation (TMS) and deep brain stimulation (DBS)

- *Vincenzo DI LAZZARO (Rome, Italy)*

13.00-15.00: lunch

METHODS IN BIOELECTROMAGNETICS

15.00-16.00: General criteria for a good experimental practice in Bioelectromagnetics

- *Ferdinando BERSANI and Maria Rosaria SCARFÌ (Bologna and Naples, Italy)*

16.00-17.00: Exposure systems and dosimetry

- *Delia ARNAUD-CORMOS (Limoges, France)*

- 17.00-17.30: coffee break
17.30-18.30: From macrodosimetry to microdosimetry
- *Micaela LIBERTI (Rome, Italy)*
18.30-19.30: How to combine EMF exposure with neurophysiological techniques
- *Delia ARNAUD-CORMOS (Limoges, France)*

Thursday, April 14

BIOLOGICAL EFFECTS OF EMF

Extremely low frequency (ELF) *in vitro*:

- 8.30-9.30: ELF effect on the molecular biology of the neuron
- *Barbara BENASSI, Claudia CONSALES, Carmela MARINO (Rome, Italy)*
9.30-10.00: Influence of ELF on electrical activity and nerve regeneration
- *Giorgio AICARDI (Bologna, Italy)*
10.00-10.30: coffee break and **poster session**

Extremely low frequency (ELF) *in vivo*:

- 10.30-11.30: Review on animal navigation
- *Daniel KATTNIG (Oxford, UK)*
11.30-12.30: Humans
- *Alexandre LEGROS (London, Canada)*
12.30-14.30: lunch

Intermediate frequency (IF) and Radiofrequency (RF)

- 14.30-15.30: Review *in vitro* and *in vivo*
- *Bernard VEYRET (Bordeaux, France)*
15.30-16.30: Sleep and EEG in humans
- *Sarah LOUGHRAN (Wollongong, Australia)*
16.30-17.00: coffee break

MECHANISMS OF INTERACTION

- 17.00-18.00: Mechanisms of interaction of ELF fields
- *Ferdinando BERSANI and Guglielmo D'INZEO (Bologna and Rome, Italy)*
18.00-19.00: Effects of RF on neural networks
- Seminar of *Noëlle LEWIS (Bordeaux, France)*

Friday, April 15

MECHANISMS OF INTERACTION (cont.)

- 8.30-9.30: The radical pair mechanism and its possible implications beyond animal navigation
- *Daniel KATTNIG (Oxford, UK)*
9.30-10.30: Mechanisms of interaction of RF fields
- *Guglielmo D'INZEO and Alessandra PAFFI (Rome, Italy)*
10.30-11.00: coffee break

MEDICAL APPLICATIONS

- 11.00-12.00: Introduction to medical application of EMF
- *Lluis MIR (Villejuif, France)*
12.00-13.00: Review on modelling and technical aspects in non-invasive brain stimulation tools
- *Marta PARAZZINI (Milan, Italy)*
13.00-15.00: lunch
15.00-16.00: Part I- Electrical sensation and electrostimulation waveform effects
- *J. Patrick REILLY (Silver Spring, USA)*
16.00-16.30: coffee break
16.30-17.30: Part II- Electrostimulation models in perspective
- *J. Patrick REILLY (Silver Spring, USA)*
16.30-17.30: Vagus nerve stimulation
- *Fioravante CAPONE (Rome, Italy)*
17.30-18.30: Intraoperative electrical stimulation for prevention of surgically-induced neurological lesions
- *Vedran DELETIS (New York, USA / Split, Croatia)*
18.30-19.30: Deep brain stimulation (DBS) in clinical practice
- *Darko CHUDY (Zagreb, Croatia)*
20.30: **Social dinner and award to the best poster**

Saturday, April 16

MEDICAL APPLICATIONS (cont.)

8.30-9.30: Critical review of medical applications of EMF lacking scientific support

- *Ferdinando BERSANI (Bologna, Italy)*

9.30-10.30: Seminar - Development of a new medical application, from basic research to clinical study - effect of ELF on stroke

- *Katia VARANI (Ferrara, Italy), Giorgio AICARDI (Bologna, Italy), Fioravante Capone (Rome, Italy), Ruggero CADOSSO (Carpi, Italy)*

10.30-11.00: coffee break

11.00-12:00: Research and innovation initiatives and perspectives

- *Antonio SAROLIC (Split, Croatia)*

12.00: Round Table: Research needs and final conclusions

In the afternoon, for those staying in Erice until Sunday, a touristic tour will be organized.

Participation fee: 1300 € including food and lodging.

Application: interested Candidates should send an E-mail to the Directors of the Course at the following address: school@ebea.org with the following information:

- a short Curriculum Vitae;

- scientific interests of the Candidate;

- for young Researchers: a letter of recommendation of a Senior Scientist (attached Word or PDF file).

In case of acceptance, the Candidate will be informed by E-mail, and will receive detailed information about the Course.

Deadline for application: March 31, 2016