

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)

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 radiation, 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 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 BM1 309

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

Erice, Sicily (Italy), 11-18 April, 2016

Directors of the Course:

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The nervous system is likely one of the major targets for EMF effects, due to its electrical activity and 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, including epidemiological studies. 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 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.

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

While progress in EMF therapeutics in the nervous system has led to regulatory approval for several devices, and a better understanding of the underlying mechanisms, it must be stressed that, there is also a grey landscape, containing many therapeutic devices which are currently present on the market. These devices are often publicized by paramedical centres and used by medical doctors, mostly in the context of the so-called alternative medicine. The clinical support is still lacking for the use of these devices, and often totally absent, and the related scientific foundation often lies outside of current established knowledge. In this situation, 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.

Session 1: Introduction (basic tutorial)

- Functional organization of the nervous system
- The basic unit of the nervous system: the neuron and its properties
- The neuronal electrical activity: from a single unit to complex neural networks
- Synaptic plasticity
- Mathematical modelling of neural activity - Seminar dedicated to the basic notions for a high quality bioelectromagnetic experimentation

Session 2: Methods in Neurophysiology

- Detection of electrical activity at cellular and system level (intracellular recording; patch-clamp; extracellular single unit, multiunit and field potential recording; electrocorticography; electroencephalography)
- Imaging of neural activity (fMRI, PET, SPECT, MEG, TMS-EEG)
- Non-invasive magnetic and electric stimulation of the human brain (therapy and diagnostic)
- Molecular and morphological techniques
- Dosimetry and microdosimetry

Session 3: Effects of EMF

a) ELF:

in vitro effects:

- influence on electrical activity
- influence on cell and tissue physiology and morphology

in vivo effects:

- in animals
- in humans (in particular behavioural effects)
- indications from human epidemiology (in particular: brain tumours; degenerative diseases)

b) RF:

in vitro effects

in vivo effects

Session 4: Mechanisms

a) Thermal effects in vitro and in vivo

b) Non thermal effects:

- possible molecular and cellular targets for EMF interaction
- modelling the interaction between EMF and nervous cells and tissue

Session 5: Medical applications

- Present state on medical applications
- ELF
- RF

- Perspectives in medical applications from in vitro and in vivo experiments, and a seminars regarding the widespread use of diagnostic and therapeutic applications in alternative Medicine from a critical point of view
- Main Results from COST activity

Session 6: Conclusions

- Research perspectives and research needs

As in the past Courses, a half-day will be dedicated to a touristic excursion, one evening to the social dinner, one special slot of time to the poster session of the Participants, including a symbolic award to young Researchers for the best posters.

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. **In the next few months a detailed program will be available on the EBEA website.**