ETTORE MAJORANA FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE

TO PAY A PERMANENT TRIBUTE TO GALILEO GALILEI, FOUNDER OF MODERN SCIENCE AND TO ENRICO FERMI, "THE ITALIAN NAVIGATOR", FATHER OF THE WEAK FORCES

International School of Bioelectromagnetics "Alessandro Chiabrera"

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

Announcement of the VII Course

Biological effects of combined exposures to EMF and other chemical and physical agents

Erice (Sicily, Italy): April 23-29, 2014

Directors of the Course

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Course Presentation

The widespread diffusion of Information & Communication Technology, energy transmission and delivery as well as of therapeutic and diagnostic technologies based on non-ionizing electromagnetic radiation makes the exposure to electromagnetic fields ubiquitous and unavoidable for humans. However, the real-life exposure to electromagnetic fields always occurs in presence of other physical and/or chemical agents and pollutants, giving rise to a more complex exposure scenario. Therefore, studying the effect of combined exposures is a present hot topic in Bielectromagnetics. Moreover, many of the already described biological effects involve cooperation between electromagnetic fields and other chemical or physical

agents. The aim of the VII course of the Erice Bioelectromagnetics school will be to provide participants with insights into the realm of the potential of electromagnetic fields in interacting with biological materials together with other agents. The program will be articulated in the following parts:

A) **a first tutorial section**, in which the student and attendants should learn general concepts relative to the problem of treating a biological object with more than one agent (chemical or physical, including EMF), stressing the general methodology and the related epistemological problems. This section will be articulated in the following items:

1) **a general Introduction to the subject**, the following points will be discussed: a) what does combined exposure means, b) which kind of exposure must be considered, c) which classification of the various effects can we use. Moreover, the importance of combined exposure in real situations, especially in connection with health hazards both in normal environment and in medical or other specific cases, like occupational exposure.

2) **cause-effect relationship between the application of two or more different agents to a complex system, such as a biological one: a system and logico-mathematical perspective**, in which a more systematic treatment of the subject introduced in the first talk; in particular it must be stressed that different classification of the effects can be related to the type of interaction between the agent and biological object (ex. Linear, or Independency, for additive, non-linear in synergistic etc.);

3) **combined effects: a pharmacological perspective**, showing how two or more chemical agents (like drugs) can act in cooperation; the importance of relationship between dose and effects; stochastic and deterministic effects, possible presence of hormesis (ex. Over Compensation Stimulation Hormesis, OCSH or Direct Stimulation Hormesis, which is relevant also in the discussion of adaptation).

B) **an overview of the biological endpoints investigated and future approaches,** including a) a talk about the most common endpoints, including Cell viability, markers of DNA damage (genotoxicity, apoptosis), Oxidative stress, Gene and protein expression etc., b) a talk about Systems Biology, c) a talk about epigenetic approach in EMF research.

C) **exposure to ELF fields combined with chemical agents**, including a general overview and more specific studies.

D) **epidemiology,** in which the few studies explicitly referring to combined exposure will be considered, and discussion of the problem concerning the implicit co-exposure of virtually all the epidemiological studies.

E) **exposure to RF combined with chemical agents,** including a general overview and more specific studies relative to in vitro and in vivo experiments

F) **exposure to static fields and other chemical agents:** a general discussion about the few studies available, in particular with MRI apparatuses.

G) **combination of non-ionizing EMF (NIR) and ionizing radiation;** this session is of particular importance since a lot is known about the effects of IR, and will be divided in ELF, RF and Static like the previous ones. A talk will be dedicated to what can be learned from radiobiology of IR.

H) A special session will be devoted to the recent findings about the so called "**Adaptive response**" with RF both in vivo and in vitro, and its future perspective and possible applications.

I) **Effects of co-exposure to different Electromagnetic fields,** including multiple RF exposure (concomitant or subsequent), and mixture of ELF (or RF) and static like in

certain experiments concerning resonance effects, and combination of static, RF and ELF pulsed, like in the MR apparatuses.

J) **Biophysical Mechanisms,** in which the various fundamental mechanisms (thermal and non thermal) can help explain the effects of combined exposure. Also, the contribution of appropriate combined exposure for clarifying the mechanism of interactions at molecular level will be discussed.

K) **Biomedical Applications,** in which a general overview will be presented on the actual and potential therapeutic applications of combined exposures, and, in particular, the attention will be focalized on the Electro-chemotherapy, and its recent advances.

L) **Concluding section,** including a discussion about the best approach to study the combined exposures and about the research needs and the future priorities.

M) **A final round table,** with representatives of e.g. the European Commission and Institutions.

N) **One half day will be dedicated to a poster session for the students who want to present their work. A symbolic award will be given to the best poster.**

The course will be held in Erice at the:

Ettore Majorana Foundation and Centre for Scientific Culture

(President: prof. Antonino Zichichi)

The Centre for Scientific Culture, located in the fascinating and historical place of Erice (Sicily, Italy) is named after the great Italian scientist Ettore Majorana. Antonino Zichichi, the director 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." The Centre was established in 1962 as a Centre for Nuclear Physics; now it includes many Schools on various scientific topics, from Physics to Biology and Medicine, and it is famous worldwide.

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. (For further details about the Centre see: http://www.ccsem.infn.it/)

Participation to the Course

Participation fee: 1300 € including food and lodging.

Application: Interested candidates should send an e-mail to the Directors of the Course at the following e-mail address:

school@ebea.org, with the following information:

- A short Curriculum Vitae

- Scientific interest of the candidate

- For young Researchers: letter of recommendation of a Senior Scientist by e-mail (attached Word or PDF file)

In case of acceptance the candidate will be informed by e-mail.

The deadline for sending the requests of participation to the School is February 15, 2014.

The participation fee can be paid directly into the Bank Account of the Erice E. Majorana Centre, given to the applicants, following the acceptance, or directly to the School on arrival in Erice.

In a short time a complete program, including speakers and title of the talks will be available on the EBEA website (http://www.ebea.org/).