ANNUAL REPORT on EMF ACTVITIES in ITALY (2012)

General research activities related to EMF health

The scientific activities in Italy are presented here on the basis of results published in 2012 in peer-reviewed scientific journals, authored or co-authored by researchers affiliated to Italian Universities, research Agencies and research organizations.

Biological studies investigated the effects of the exposure to radiofrequency (RF) and extremely low frequencies (ELF) fields, with some of them being focused on early life exposures or having the nervous system as targeted tissue. In some studies the effects of pulsed EMF were explored. Both in vitro and in vivo models were used. There was also a conspicuous number of studies on the therapeutic use of thermal ablation.

Effects of early life exposures were investigated in animal models and human beings. Immune system development, with focus on T cell differentiation, was assessed in mice exposed during embryo life to WiFi signals [1]. The effects of MF were investigated in newborns (birth defects) from mothers exposed to ELF [2] and in newborns that required to stay in incubators (melatonin production) [3]. The effects of GSM signals on brain BOLD (blood-oxygen-level dependent) response, as well as its time course while performing a Go-NoGo task, were investigated in human patients with functional MRI [4]. The effects of GSM were also investigated on the inter-hemispheric synchronization of temporal and frontal resting electroencephalography (EEG), evaluating cortical neural efficiency and simple cognitive-motor processes in humans [5, 6]. In neuron-like cell models, in vitro studies investigated the effects of UMTS and GSM signals assessing DNA damage/cell viability [7] and heat shock proteins expression [8], respectively. The effects of nanosecond pulsed electric fields on neuronal activity were studied in mathematical neuronal models [9]. The effects of pulsed EMF on osteocytes [10, 11] and chondrocytes differentiation [12] and in inflammatory processes involved in osteoarthritis [13] were investigated. Effects of “musically-modulated” (variable in frequencies, intensities and waveforms) EMF were studied in chondrocytes in vitro for therapeutic purposes in osteoarthritis [14]. Several studies reported the therapeutic use of microwave/radiofrequency thermal ablation in several cancer settings, including hepatocellular carcinoma [15-17] and liver metastasis from colorectal cancer [18-20], primary bone tumors [21, 22] and long bone metastasis [23], lung tumors [24, 25], breast cancer [26] and metastatic lesions from breast cancer [27], pancreatic cancer [28], renal cell carcinoma [29, 30], thyroid nodules [31]. Thermal ablation was used also in other medical applications [32-34]. In vitro models were also used to study the effects microwaves/radiofrequencies on gene transcription and cell differentiation in fibroblasts [35, 36], gene expression in T lymphoblastoid leukemia cells [37], adaptive response of blood lymphocytes [38]; the effects of static fields on gene expression in endothelial cells [39]; the effects of ELF on oxidative metabolites generation [40]. There was also a certain number of studies that investigated scattered topics including effects of microwaves on antigen properties of peach allergens [41], of magnetic fields on protein folding and the protective role of disaccharides-containing media [42], of static and ELF magnetic fields on the hyphal growth of T. borchii, a (not valuable) variety of truffles [43], and of ELF on E. coli and P. aeruginosa growth and resistance to antibiotics [44].

Studies on EMF exposure assessment, dosimetry and interaction mechanisms have also been considered. One paper studied the electric field induction by movements nearby a MRI devices for occupational exposure to static and gradient magnetic fields [45]. Studies on ELF and Low Frequency fields were mainly focused on exposure to unknown magnetic sources [47, 49-50]. One paper was focused on exposure from power lines [48] and another one was about the low frequency fields generated by laptop computers [46]. Two papers addressed the Intermediate Frequency range: one study was focused on the design and development of an exposure system at Intermediate Frequencies [51], and the second one was about the modeling of an induction cooking system [52]. The research on RF and microwaves (MW) was mainly based on boundary element solution of EMF and Bioheat equation for estimation of SAR and temperature increase [53], on safety aspects of people exposed to UWB radar [54], on modeling the exposure to UHF RFID devices of pregnant women and fetuses [55], on the modeling of the design and development of MW exposure systems for in-vitro and in-vivo experiments [56, 58], and on a comparative analysis between customized and commercial systems for complex permittivity measurements at MW [56]. The studies related to biomedical applications were strongly differentiated. They were focused on RFID devices applied to health and biomedical applications, such as on RFID devices for health care monitoring systems [59], on the design of UHF RFID tags for drug tracing [60], and on the study of the regulatory framework on RFID electromagnetic compatibility in medical environment [66]. Moreover, they were focused on non-invasive brain stimulation, particularly on transcranial Direct Current Stimulation (tDCS) of the cerebellum [63], modeling of the current density induced, during tDCS stimulation, in the heart [69] and in the brainstem at different electrode positions [70], on modeling electric fields and current densities in the brain during tDCS stimulation for tinnitus treatment [71] and on the estimation of the electric field and current density distribution in the brain and of modeling of the nerve fibers,

inserted in a review of the effect of low intensity low frequency magnetic field on the central nervous system [62]. They also addressed the study of the role on MRI induced heating of the lead structure of pacemaker/defibrillator leads [67], the change in dielectric properties of ex-vivo bovine liver during MW thermal ablation [64] and the research on dielectric simulators for dosimetric studies on MW antennas for interstitial ablation [65]. EMF and biomedical applications were also addressed by studies on microdosimetry of nanosecond pulsed electric fields [68], on modeling of the monitoring of breath-activity by UWB impulse radar systems [72], on antennas for UWB medical radars [74] and on the study of the dielectric properties of sodium chloride solutions at different glucose concentration, for possible development of noninvasive monitoring system for glycaemia [73]. The research on EMF interaction mechanisms was mainly focused on the feasibility of MW energy to affects biological systems via non-thermal mechanisms [75], on micro-dosimetry of nanosecond pulsed electric field for cell circuit model with nucleus [76] and on the effect of high exogenous electric pulses on protein confirmation [77].

New policies and legislations regarding EMF exposure

In the frame of a legislative decree aimed at promoting the economical growth, published in October 2012, relevant modifications to the procedure for compliance verification of RF emissions from telecommunication plants were introduced. In particular, the time period over which to average the measured field to be compared with the attention value and the quality goal established by the law (6 V/m) as mandatory inside residential environments since 1998, was changed from "*any 6 minutes period* to "*24 hours*". The averaging time for assessing compliance with the limit of exposure (20 V/m) to be applied everywhere remained unchanged at 6 minutes. The National Institute for Environmental Research and Protection (ISPRA) has prepared new guidelines in order to update monitoring procedures, and, according to a preliminary impact assessment, the new rule will bring an increase of current exposure levels from base stations during the hours of the day with higher telephone traffic, in particular in dense populated areas. The new provision produced some controversies, and the Ministry of Health has proposed to adopt an averaging time of 4 hours. No other significant event has occurred, also on the occupational side waiting for the new upcoming EU Directive.

Areas of public concern and national responses

The major concern of the public remains focused on base stations for mobile phones and installation of new Wi-Fi network. In October 2012 a definitive sentence of the Court of Cassation had a wide echo, and the overall message to the public from the media was that it was finally documented that mobile phones can produce cancer. Actually, the Court of Cassation is concerned with evaluation of formal legal adequacy of previous levels of judgment, and in this particular case the Court decided that the Court of Appeal of Brescia (in Lombardia region), in a sentence of 2009, had not violated the law in adopting the opinion of its consultants, who had affirmed a casual link between intense occupational use of mobile phone and development of neuroma of trigeminal nerve, in a subject who had been denied for compensation by the National Workers' Compensation Authority (INAIL), even though the prevailing international scientific opinion is much more prudent in establishing causal link between use of mobile phones and tumours. In a media release, the legal service of INAIL, definitively condemned to compensate the worker for 80% of disability, declared that the Cassation sentence refers to a single case and does not change the scientific evidence, so that INAIL will continue not to recognise occupational origin of tumours in relation with exposure to RF fields. Nevertheless, the Cassation sentence poses a demand for adoption in Italy of standard criteria for selection of Courts consultants, which today is completely open to the discernment of the Judge, and more generally for a better ability of communication between science and justice.

Public information activities

Despite the wide interest of the media on the Court of Cassation sentence, public concern on potential risks from mobile phones remains very low compared to base stations or fixed plants, and restricted to cancer patients or associations. The Ministry of Health, according to the recommendation issued in November 2011 by the Highest Council of Health on possible RF long term risk, published in October 2012 a web focus to inform about that state of art of scientific evidence and promote a responsible use of mobile phones: *www.salute.gov.it/portale/news/p3_2_3_1_1.jsp?lingua=italiano&menu=dossier&p=dadossier&id=2*. In the focus it is clearly stated that no risk is established but it cannot be completely ruled out, suggesting practical measures for reduction of exposure and special advice for children to consider the mobile phone as a tool for communication to be used when necessary, and not as a toy. The website *www.iss.it/elet*, promoted by the Ministry of Health and carried out by the National Institute of Health (ISS), is continuing to be regularly updated as well the web site *www.portaleagentifisici.it* devoted to the occupational safety from all physical agents.

ANNEX: Quoted references

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