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| Title of the project: Risk assessment for exposure of nervous system cells to mobile telephone EMF: from in vitro to in vivo studies | | |
| Acronym of the project: RAMP2001 | | |
| Type of contract | Cost-sharing contracts | Total project cost € 1.814.348 |
| Contract number QLK4-CT-2001-00463 | Duration 45 Months | EU contribution € 1.108.500 |
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| PROJECT COORDINATOR | | |
| Name Bruno Bianco | Title Dr. | Address University of Genoa, Interuniversity Center "Interactions between Electromagnetic fields and biosystems", Via All'Operapia, 11A, 16145 Genova, Italia |
| Telephone +39 010 3532753 | Telefax +39 010 3532753 | E-mail address white@dibe.unige.it |
| Key words Electromagnetic fields, GSM, cellular effects, brain | | |
| List of participants | | |
| Contractor (Coordinator) | 1 | Interuniversity Center "Interactions between electromagnetic fields and biosystems", University of Genova |
| Contractor 2 | | Institut National de l'environnement industriel et des risques, Verneuil en Halatte, France |
| Contractor 3 | | School of Informatics, University of Bradford |

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| Contractor 4 | Department of Electromagnetics, Chalmers University of Technology |
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The overall aims of RAMP 2001 are a better understanding and an assessment concerning possible biological effects and hazards due to exposure of brain and nerve cells to high frequency electromagnetic fields emitted by global systems for mobile communication such as GSM 900 MHz and GSM 1800 MHz, as well as to the more recent UMTS system. Since thermal effects are well known and established, this project is particularly concerned with effects arising from non-thermal interaction mechanisms, possibly due to low intensity electromagnetic fields.

- A specific objective of RAMP2001 was to analyse the biological outcomes of experiments performed on brains and nervous cells at electromagnetic power levels below and near the current safety standards. In other words, specific attention was paid to the biological outcomes of low intensity and medium/long - term exposure with the goal of contributing to a new international database, focussed on molecular interaction mechanisms, for the future updating of safety standards;
- Another objective was to address molecular processes as candidates to be the first step of interaction between the EMFs and the nervous system cells and to perform theoretical modelling and computer simulations of the putative interaction mechanisms other than thermal ones;
- The final objective of RAMP2001 was to define well reproducible, predictive in vivo and in vitro tests of the susceptibility and vulnerability of nervous system cells to exposure to mobile phone electromagnetic fields and to assess the related mechanism-based risks, if any. A related by-product would be a more effective procedure for animal testing.

Results and Milestones:

Experiments on the effects on rats of exposure to electromagnetic field similar to those used in cellular telephony seems to indicate that there are no significant phenomena induced by the exposure as regards behaviour and memory, and at specific absorption rates (SAR) levels lower than or close to safety limits.

An effect of mobile phone radiofrequencies was observed on dopamine transporter properties after a single 900 MHz GSM exposure at an high SAR (6 W/kg). This effect seemed to be duration dependant. No effect was observed at lower SAR.

Analysis by immunohistochemistry of phenomena of short duration (some tens of minutes) due to the effects of mobile phone exposure on brain shows that acute exposure can modify cerebral activity. This effect is dependent of the SAR with a window effect, and appears after a minimum duration. It could be due to an interaction of radio frequencies with a biological system such as the neurotransmitter system. This effect did not depend of GSM modulation. Effects observed after a single 1800 MHz GSM exposure were equivalent.

Benefits and Beneficiaries:

The results of the project will contribute to a general progress of knowledge about the interaction between high frequency electromagnetic radiation and biological systems. In

particular, the project will contribute to a better knowledge of possible effects of cellular phones on the human nervous system, which will benefit the general public.

Some of the in vitro and in vivo experimental protocols developed in the RAMP2001 framework could be adopted by national health care services as reference methods for assessing the biological susceptibility to radio frequency exposure and potential health risks.

Future Actions (if applicable):