



GAZİ BIOPHYSICS DEPARTMENT
GAZİ NON-IONIZING RADIATION PROTECTION CENTER – GNRK
TURKEY’S NATIONAL REPORT 2009

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ACTIVITIES ON EMF

✚ Education Activities on EMF

Initiated in 1989 by Prof. Dr. Nesrin Seyhan, Biophysics Dept. at Gazi University has a long history of important research achievements. Members of Biophysics Department, including experts of Physics and Electrical and Electronics Engineering, participate in the training of students in the Biophysics Program. Gazi Biophysics Education Program on EMF and health effects has been giving to Medical Faculty students since 2001. Graduate programs on EMF -Master of Science and Doctorate- have been done since 1990. The primary objective of the programs is to educate and train individuals with this background to apply the concepts and methods of the physical sciences to the solution of biological problems especially on the health effects of EMF. Owing to the interdepartmental nature of the programs, a student's research options are increased greatly. In 2009, one M.Sc. and four Ph.D. students are attending to these programs.

✚ Gazi Non-Ionizing Radiation Protection Center (GNRK) EMF Activities

Established by Dr. Seyhan in 2005, GNRK has been performing EMF measurements and counseling activities on Non-Ionizing Radiation (NIR). Measurement reports related to occupational exposure from industrial applications of NIR, residential exposure from base stations and High Power Lines are being given to individuals and companies upon request. Totally 76 EM field measurements were realized due to personnel and/or institutional requests, 18 of them as expertise and related reports aimed at health and biological effects were prepared.

✚ EMF Organizations by GNRK

GNRK had organized the first occupational health and safety (OHS) seminar in Ankara whose goal is to start the framework study on the legislations about occupational health and safety. It was “**Risk Evaluation in Occupational Health & Safety Seminar and Training**” and held on May 12, 2007 with supports from Ministry of Labour and Social Security, Gazi University, Atılım University, Chamber of Mechanical Engineers, Chamber of Chemical Engineers, Chambers of Physicians in Ankara. GNRK aims to “Contribute to developing and forming national standards for occupational exposure to electromagnetic radiation”. Workplace physicians, occupational safety experts, legal entities, people from industry came together in this seminar.

GNRK and Gazi Biophysics had organized lecture series on EMF with collaboration to NATO Research and Technology Agency (RTA). Many experts visited GNRK and GAZİ Biophysics within this program. **Prof. Dr. Kenneth Foster, Prof.**

Dr. James C. Lin, Prof. Dr. Lawrie Challis, and Dr. Andreas Bitz presented seminars on “EMF Exposure Systems for in vivo, in vitro & Volunteer Studies, SAR Stimulation & Calculations, biological and health effects of electromagnetic fields, interaction mechanisms of EMF with organisms ”. Prof. Dr. Henry Lai will be visiting GNRK and Gazi Biophysics to give lectures on biological effects of EMF on living organisms, especially on the DNA with NATO RTO collaboration on 12-16 October 2009.

Assessing the EM POLLUTION MAP Project

GNRK EM Pollution Map Project is aiming to provide high quality EMF investigations and measurements, especially for the public concerned about the EMF levels at their property. Electromagnetic field measurements will be presented around the vicinity of overhead power lines and base stations located in residential areas of Ankara. First stage of the study has been done in Çayyolu, west part of the city. It is planned to extent it all over Ankara to constitute the EM Pollution map. In that respect, the study will be helpful in establishing more precise boundaries to regions around base stations and transformers.

General Research Activities Related to EMF Health Issues

In Turkey, researches about health and biological effects, dosimetry and exposure assessment to EMF is performed in universities and research centers. Some of them are Istanbul University (Istanbul), Cumhuriyet University (Sivas), Dicle University (Diyarbakır), 19 Mayıs University (Samsun), Çukurova University (Adana), Fatih University (Ankara). Corresponding results by several groups are published in scientific journals, magazines and presented in conferences.

The research topics are categorized as Epidemiological studies, Studies on biological systems, Engineering studies, Field measurements and monitoring of electromagnetic radiation

Gazi Biophysics and GNRK is one of the collaborator of “International study of childhood leukemia and residences near electrical transformer rooms” called TransExpo Project. The purpose of the study is to evaluate the association between residential MF exposure and childhood leukemia incidence in an epidemiologic study of highly exposed population where the potential for selection bias is minimized or eliminated.

A new study on “EM field effects in neonatal intensive care units” has been started with Department of Pediatrics, Medical Faculty of Gazi University.

Studies of Gazi Biophysics are summarized below:

- ❖ Cooperated studies with Telecommunication Authority, Turkish Standards Institution (TSE), Ministry of Health, Ministry of Energy, Ministry of Labor & Social Security and Ministry of Environment and Forestry.
- ❖ Animal studies for analyzing several biochemical parameters such as oxidative stress, antioxidants, natural killer cell activity, tissue levels of hydroxyproline etc. continue (4,6-11,13-22).
- ❖ Study on the effects of RFR on permeability of Blood Brain Barrier (BBB) has been finished (12).
- ❖ SAR and current density is being evaluated in human models with different size and electrical properties of tissues for ELF and RF radiation. The study is being funded by Gazi University.
- ❖ Simulation of RF exposure from mobile phones with Semcad X RF simulation software, MRI based two phantoms and SAM phantom is being studied.
- ❖ Research studies on investigating collagen synthesis; radical synthesis and antioxidant enzyme levels of male guineapigs exposed to 1800 MHz RFR and the influence of the antioxidants, NAC and EGCG on the oxidative effects are completed.

- ❖ The research on 1800 MHz RFR exposure of pregnant animals and their infants had been started at 2006. Free radicals, antioxidants, Apoptosis, DNA base modifications were analyzed beside immunohistochemical parameters. Some of the results are in the queue of some journals to be published. Results of transient evoked and distortion product otoacoustic emissions of nonpregnant, pregnant and their offsprings were published (1-3,5). Results might be used in adopting special approach to the protection of pregnant. Further laboratory studies related with other parameters and tissues are on the way.
- ❖ In-vivo study on 900 MHz pulse modulated RFR on thyroid gland is completed. In the study, activities of caspase-3 and caspase-9 along with oxidative damage were observed.
- ❖ The main issues of EMF - public concern appear to be the health effects from base stations, mobile phones, high power lines and transformers, especially ones on the bottom floor of the buildings.

✚ *Studies About Policies and Legislations Regarding EMF Exposure*

- ❖ Still no standard for 0 – 10 kHz and 60 GHz – 300 GHz frequency ranges.
- ❖ No occupational exposure standard for ELF and RF. GNRK is preparing a regulation and going to discuss it with Ministry of Labor and Social Security.

✚ *Public Information Activities*

Turkish people can get information on the various aspects of the EMF from several sources. Some of these are:

- Web sites : GNRK web site informing people about the electromagnetic fields, measurement and counseling activities: www.GNRK.gazi.edu.tr and EM Pollution web site www.emk.gazi.edu.tr. Gazi Biophysics Department web site announcing Departments' general activities and education programs: www.biyofizik.gazi.edu.tr
- GNRK brochures on measurement and counseling about NIR
- Publications in newspapers and wide circulation magazines
- Discussion programs organized in radio and TV
- Talks, seminars and conferences addressed to special audiences, mainly school students and teachers.

✚ *Some of the recent Gazi Biophysics Publications on EMF and biological effects*

1. **Budak GG, Muluk NB, Budak B, Oztürk GG, Apan A, Seyhan N.** Effects of GSM-like Radiofrequency on distortion product otoacoustic emissions of rabbits: Comparison of infants versus adults. *Int J Pediatr Otorhinolaryngol.* 2009 May 26. [Epub ahead of print]
2. **Budak GG, Muluk NB, Budak B, Apan A, Öztürk GG, Seyhan N.** Effects of Intrauterine and Extrauterine GSM-like Radiofrequency on Distortion Product Otoacoustic Emissions in Infant Female Rabbits. *The Journal of International Advanced Otolaryngology* Vol. 5(2) June 2009. (In press)
3. **Budak GG, Muluk NB, Oztürk GG, Budak B, Apan A, Seyhan N, Sanli C.** Effects of GSM-like radiofrequency on distortion product otoacoustic emissions in pregnant adult rabbits. *Clin Invest Med.* 2009 Apr 1;32(2):E112-6.
4. **Budak GG, Budak B, Oztürk GG, Muluk NB, Apan A, Seyhan N .** Effects of extremely low frequency electromagnetic fields on transient evoked otoacoustic emissions in rabbits. *Int J Pediatr Otorhinolaryngol.* 2009 Mar;73(3):429-36.
5. **Budak GG, Muluk NB, Budak B, Oztürk GG, Apan A, Seyhan N.** Effects of intrauterine and extrauterine exposure to GSM-like radiofrequency on distortion product otoacoustic emissions in infant male rabbits. *Int J Pediatr Otorhinolaryngol.* 2009 Mar;73(3):391-9.
6. **Budak B, Budak GG, Oztürk GG, Muluk NB, Apan A, Seyhan N.** Effects of extremely low frequency electromagnetic fields on distortion product otoacoustic emissions in rabbits. *Auris Nasus Larynx* 2009 Jun;36(3):255-62
7. **Guler G, Turkozer Z, Ozgur E, Tomruk A, Seyhan N, Karasu C.** Protein oxidation under the stress of extremely low frequency electric field: Effects of treatment with N-Acetylcysteine. *General Physiology and Biophysics,* 2009, 28(1):47-55.

8. **Guler G, Turkozer Z, Ozgur E, Seyhan N.** Antioxidants alleviate electric field-induced effects on lung tissue based on assays of heme oxygenase-1, protein carbonyl content, malondialdehyde, nitric oxide, and hydroxyproline. *Science of the Total Environment*, 2009, 407, 1326 – 1332.
9. **Coşkun S, Balabanlı B, Canseven A, Seyhan N.** Effects of Continuous and Intermittent Magnetic Fields on Oxidative Parameters In vivo. *Neurochemical Research* 2009 Feb;34(2):238-43.
10. **Kismali G, Ozgur E, Sayiner S, Alpaslan B, Guler G, Seyhan N, Sel T.** The Evaluation of Epigallocatechin Gallate and N-Acetylcysteine on Serum Testosterone Levels in Male Guinea Pigs Expose to Cell Phone Microwave. *Journal of Animal and Veterinary Advances*, 2009, 8(6), 1149-1151.
11. **Kismali G, Ozgur E, Sayiner S, Alpaslan B, Guler G, Seyhan N, Sel T.** The Effects of Epigallocatechin Gallate and N-Acetylcysteine on Mobile Phone-Induced Oxidative Stress in Guinea Pigs. *Journal of Animal and Veterinary Advances*, 2009, 8(5), 959-961.
12. **Sırav B, Seyhan N.** Blood-brain barrier disruption by continuous wave radio frequency radiation. *Electromagnetic Biology and Medicine* 2009, [in press]
13. **Canseven AG, Coskun S, Seyhan N.** Effects of various extremely low frequency magnetic fields on the free radical processes, natural antioxidant system and respiratory burst system activities in the heart and liver tissues. *Indian Journal of Biochemistry & Biophysics* 2008, Oct; 45(5): 326-331
14. **Guler G, Turkozer Z, Tomruk A, Seyhan N.** The protective effects of N-acetyl-L-cysteine and epigallocatechin-3-gallate on electric field-induced hepatic oxidative stress. *International Journal of Radiation Biology* 2008 Aug;84(8):669-80.
15. **Türközer Z, Güler G, Seyhan N** . Effects of exposure to 50 Hz electric field at different strengths on oxidative stress and antioxidant enzyme activities in the brain tissue of guinea pigs. *International Journal of Radiation Biology* 2008 Jul;84(7):581-90.
16. **Hardalaç F., Güler G.** Examination of static and 50 Hz electric field effects on tissues by using hybrid genetic algorithm and neural network, *Expert Systems*, 2008, 25(4): 349-366.
17. **Güler G, Türközer Z, Seyhan N** . Electric field effects on Guinea Pig serum: The role of free radicals. *Electromagnetic Biology and Medicine* 2007, 26: 207-223.
18. **Tohumoglu G, Canseven AG, Cevik A, Seyhan N.;** Formulation of ELF magnetic fields' effects on malondialdehyde level and myeloperoxidase activity in kidney using genetic programming. *Comput Methods Programs Biomed* . 2007 Apr;86(1):1-9.
19. **Canseven, A.G., Z. Aktuna Keskil, S. Keskil ve N. Seyhan,** “Pentylene-tetrazol-induced seizures are not altered BY pre- or post-drug exposure to a 50 Hz magnetic field,” *International Journal of Radiation Biology*, 83 (4), 231-235 (2007).
20. **Seyhan N, Canseven AG.;** In vivo effects of ELF MFs on collagen synthesis, free radical processes, natural antioxidant system, respiratory burst system, immune system activities, and electrolytes in the skin, plasma, spleen, lung, kidney, and brain tissues. *Electromagn Biol Med.* 2006;25(4):291-305.
21. **Canseven AG, Seyhan N, Mirshahidi S, Imir T.;** Suppression of natural killer cell activity on *Candida stellatoidea* by a 50 Hz magnetic field. *Electromagn Biol Med.* 2006;25(2):79-85.
22. **Seyhan N, Guler G.;** Review of in vivo static and ELF electric fields studies performed at Gazi Biophysics Department. *Electromagn Biol Med.* 2006;25(4):307-23.

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