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HEMATOLOGICAL EFFECTS OF LOW DOSES OF TELEVISION EMITTED-RADIATION IN MICE: A PARALLEL STUDY WITH A PROTECTIVE EQUIPMENT. L. Bonhomme-Faivre*[1], R. Santini[3], S. Marion*[2], E. Bizi*[1], H. Auclair*[2], L. Bottius*[1], S. Orbach-Arbouys*[1] and N.L. Bui*[1]. [1]Service Pharmacie, Laboratoire de Pharmacologie, [3] Laboratoire d'Hématologie, Hôpital Paul Brousse, 94800 Villejuif, France. [2]Institut National des Sciences Appliquées, Laboratoire de Biochimie-Pharmacologie, 69621 Villeurbanne Cedex, France.

OBJECTIVE: It has been shown both experimentally and clinically that haematologic parameters may be modified when one lives in the middle of an electric field. We have personally observed that EMF generated by transformer station alters biological parameters of chronically exposed mice (1). On the other hand, an electromagnetoprotective device termed Tecno AO* antenna could effectively prevents some adverse biological effect of TV exposure. We studied here if TV exposure could alter hematological parameters in mice and if the Tecno protective device (8-12 Hertz 100-150 ft international patent) could prevent those alterations.

METHODOLOGY: 4 week old Swiss male mice (n=9) were placed at a distance of 20 cm of a TV screen 5 days/week 9 ±2 h a day during 106 days, in transparent (21x14 cm) plastic cages (2 cages of 4 mice). Another group (n=9) was placed in the same conditions with the Tecno AO protective equipment. The control group (n=9) was placed in another room under identical light noise and temperature conditions except for the magnetic field which was below 0.03 μT. The exposure system was a TV set (Waltham 230 V, 50 Hz) 35 cm screen diagonal. Measurement of the magnetic field strength was performed with a Mag check 50* USA. The field was 0.8 μT in front of the cage and 0.23 μT and the back. TV was left on stand by after exposure 0.03 μT. The electric field at 50 Hz was 30 V/m in the center of the cage for the exposed group and 3 V/m for the central group (E FM 130 Electric field measurement Stockbridge MA D 1266 USA. Blood samples were analysed with a Sysmex NE 1500-10A (Medical Electronics Japan). The analysis included erythrocyte hemoglobin neutrophil and monocytes counts.

RESULTS: On day 0 there was no statistical difference in hematological parameters and body weight between the groups. On day 21 erythrocytes and hemoglobin values were significantly higher in the exposed group. On day 56 in the exposed group neutrophils counts were lower than those of the controls and monocytes counts lower than those of the exposed protected group. On day 106 neutrophils counts were lower in the exposed than in the control group and monocytes lower than those of the exposed protected and control group. These results suggest potential protective effect of the Tecno AO antenna against hematological alterations induced during TV exposure.

	ERYTHROCYTES (10^{12}/l)			HEMOGLOBIN (g/dl)		
	Control	**Exposed**	**Exposed Protected**	**Control**	**Exposed**	**Exposed Protected**
Day 0	6.5 ± 0.9	6.1 ± 6.0	6.5 ± 1.1	13.2 ± 1.2	12.7 ± 6.3	13.3 ± 1.4
Day 21	6.54 ± 0.98	8.13 ± 0.46(1,2)	6.5 ± 0.57	11.32 ± 1.83	13.66 ± 0.86(1,2)	10.97 ±0.96
Day 56	8.11 ±0.7	8.09±0.65	8.37±0.93	14.8± 1.3	15.08 ±0.8	13.5 ±.5
Day 106	8.79 ± 0.40	8.46 ± 0.77	8.5 ± 0.77	14.29 ± 0.62	13.41 ±1.29	13.41 ±1.29
	NEUTROPHIL(/mm^3)			**MONOCYTES (mm^3)**		
Day 0	907 ± 329	772 ± 343	888 ± 605	46 ± 28	39 ± 22	55 -± 23
Day 21	863 ± 774	640 ± 272	528 ± 201	37 ± 16	36 ± 29	36 ± 21
Day 56	2247 ± 1314	1095 ± 502(1)	1438 ± 317	103 ± 76	85 ± 37 (2)	141 ± 48
Day 106	1022 ± 537	468 ± 257 (1)	1471 ± 1503	69 ± 41	30 ± 23 (1,2)	72 ± 46

Student's t test* $p<0.05$:1 - Compared to control group. 2 - Compared to exposed-protected group 3- compared to exposed group.

Reference:
1. Bonhomme-Faivre L., Macé A., Bezie Y., Marion S., Frenois N., Szekely A.M., Auclair H., Bizi E., Orbach-Arbouys S., Bindoula G. *Life Sciences* (1998), 62, 14, 1271-1280.

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Has been moved to *in vivo* - RF & ELF.

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INFLUENCE OF EXTREMELY LOW-FREQUENCY ELECTROMAGNETIC FIELDS ON THE SWIMMING BEHAVIOR AND THE SECOND MESSENGER SYSTEM OF *PARAMECIUM BIAURELIA*. M. Wilczek[1], R. Hemmersbach*[1] and W. Stockern*[2]. [1]DLR (German Aerospace Research Establishment), Institute of Aerospace Medicine, 51170 Köln, Germany. [2]Institute of Cell Biology, University of Bonn, Bonn, Germany.

OBJECTIVE: Within the past few years biomedical effects of low frequency electromagnetic fields (ELFs) on signal transduction have gained considerable interest as results obtained from various species point to a possible interaction between ELFs with ion transport mechanisms in the cell membrane. Ciliates can be regarded as swimming sensory cells. Ion channels of different species have been extensively studied and have shown a direct correlation between particular ion currents, the membrane potential, second messenger levels, the control of ciliary activity and the swimming behavior of the cells. Changes in the ion flux and the second messenger concentrations can be identified conclusively with corresponding changes in the swimming velocity and the swimming direction. In the present study, *Paramecium biaurelia* was exposed to ELF fields of 50 Hz and flux density of 2.0 mT with the aim of testing whether such fields have a direct effect on membrane functions and the second messenger system, using changes in the swimming behavior of the ciliates as an indicator and by analyzing cAMP-level changes by biochemical methods.
METHOD: Wild type strain *Paramecium biaurelia* was cultivated in bacterized straw medium (pH 7.2, 22°C). Behavioral studies were performed in the original culture media, biochemical analyses in 10mM MOPS buffer with 1mM K^+ and 1mM Ca^{2+} (pH 7.2). The cylindrical chambers were made of Plexiglas with a glass plate on the lower side Diameter for behavioral and biochemical studies 27 mm, depth for behavioral studies 1.75 mm, for biochemical analyses 7 mm. After transferring the cell suspension into the chamber it was sealed by a second glass plate on the upper side. For adaptation the cells were left undisturbed for 1,5 hr (behavior) or 4 hr (biochemistry) before starting the measurements. The ELFs were generated by a Helmholtz coil. The chamber was placed in the center of the Helmholtz coil. The effective flux density was controlled by means of a custom-made receiver. An air-cooling system kept the temperature in the chamber constant (±0.5°C). Observation of the cells was performed by a stereo-microscope (Wild M5, Switzerland) using dark-field illumination. The microscope image was recorded by a black/white camera (CCD, Philips, Belgium). The swimming behavior of the cells was monitored without applied fields (control) then during exposure and finally after switching off the field, with each sequence lasting for 30 minutes. The video sequences were taped on a VCR and analyzed by computer-controlled image analysis. The linearity and swimming velocity were analyzed with the computer program MedeaLab (Fa. Vogel GbR, *Erlangen,* Germany). The cAMP-level was analyzed after exposing to the field for a few seconds, minutes up to 30 minutes. To determine the cAMP-level a Fluoroimmunoassay (FIA) was used combined with a Lowry-Protein-Assay to standardize the cAMP concentrations. Statistical tests of significant differences of two data sets were performed by the Welch test and the T-test, with $t' > 1.645$ (95%).
RESULTS: A field dependent decrease in the linearity of cell tracks was observed. Field exposure did not change the swimming velocity of the cells. Biochemical analyses showed a significant change in cAMP during magnetic-field exposure: an increase in intracellular cAMP after 50 seconds of field exposure is