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[Cell Prolif.](#) 2003 Apr;36(2):101-11.

**The heat shock-induced cell cycle arrest is attenuated by weak electromagnetic fields.**

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Stress-induced effects in human acute leukaemia cells (HL-60) were studied by flow cytometry using the fluorescent dye carboxyfluorescein succinimidyl ester which allows the analysis of several successive cell generations for up to 10 days. Asynchronously cycling cells subjected to heat shock (30 min at 41 degrees C) responded in two distinct ways: while one fraction of the cell population (about 15%) re-entered the cell cycle after a short delay, other cells became arrested at different phases of the cell cycle and remained arrested for up to several days and finally underwent apoptosis. Weak electromagnetic fields (60 micro T, 50 Hz) alleviated the heat-induced block and the fraction of arrested cells was significantly smaller.

PMID: 12680877 [PubMed - indexed for MEDLINE]

[http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=14757377&ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed\\_ResultsPanel.Pubmed\\_RVDocSum](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=14757377&ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum)

[Environ Res.](#) 2004 Feb;94(2):145-51.

## **Weak electromagnetic fields (50 Hz) elicit a stress response in human cells.**

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The aim of this study was to demonstrate the expression of heat shock (HS) genes in human cells in response to extremely low-frequency electromagnetic fields (ELF-EMF) alone and in combination with thermal stress. After exposing human myeloid leukemia (HL-60) cells to the stressor(s) for 30 min we quantified the expression of the HS genes HSP27, HSP60, HSP70 (A, B, and C), HSC70, HSP75, HSP78, and HSP90 (alpha and beta) by RT-PCR. The results clearly show that HS genes, in particular the three HSP70 genes (A, B, and C), are induced by ELF-EMF, a reaction that is enhanced by simultaneous HS (43 degrees C for 30 min). The results show similarities and some significant differences to previous experiments in which transgenic nematodes were used to monitor the induction of the HSP70 gene under similar stress conditions. We also studied the effect of different flux densities on gene expression in the range of 10-140 microT. Even the lowest dose tested (10 microT) resulted in a significant induction of the genes HSP70A, HSP70B, and HSP70C. The reaction to ELF-EMF shows a maximum at a flux density of 60-80 microT. The unusual dose-response relation reveals an interesting difference to other stressors that elicit the HS response.

PMID: 14757377 [PubMed - indexed for MEDLINE]