http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=7698291&ordinalpos=7&itool=EntrezSystem2.

Experientia. 1995 Mar 15;51(3):284-8.

Biological responses in Caenorhabditis elegans to high magnetic fields.

Bessho K, **Yamada S**, **Kunitani T**, **Nakamura T**, **Hashiguchi T**, **Tanimoto Y**, **Harada S**, **Yamamoto H**, **Hosono R**.

Laboratory of Magnetic Field Control and Applications, Kanazawa University.

Here we describe a device for testing possible influences of high magnetic fields on biological processes, by which alternating-current magnetic stimuli as high as 1.7 T can be administered. Experiments with a simple multicellular organism, the nematode Caenorhabditis elegans, revealed that intermittent exposure to the magnetic fields modestly inhibited the animal's reproduction as well as its post-embryonic development, and caused a marked but transient derangement in its locomotory behavior. Available evidence indicates that alternating high magnetic fields can elicit both chronic and acute biological effects, but that the effects may be well tolerated or compensated for by the living organism.

PMID: 7698291 [PubMed - indexed for MEDLINE]

http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=9635489&ordinalpos=6&itool=EntrezSystem2.

Mutat Res. 1998 Mar 13;399(1):55-64.

Transgenic nematodes as biomonitors of microwave-induced stress.

Daniells C, **Duce I**, **Thomas D**, **Sewell P**, **Tattersall J**, **de Pomerai D**.

Department of Life Science, University of Nottingham, University Park, UK.

Transgenic nematodes (Caenorhabditis elegans strain PC72), carrying a stress-inducible reporter gene (Escherichia coli beta-galactosidase) under the control of a C. elegans hsp16 heat-shock promoter, have been used to monitor toxicant responses both in water and soil. Because these transgenic nematodes respond both to heat and toxic chemicals by synthesising an easily detectable reporter product, they afford a useful preliminary screen for stress responses (whether thermal or non-thermal) induced by microwave radiation or other electromagnetic fields. We have used a transverse electromagnetic (TEM) cell fed from one end by a source and terminated at the other end by a matched load. Most studies were conducted using a frequency of 750 MHz, at a nominal power setting of 27 dBm. The TEM cell was held in an incubator at 25 degrees C inside a shielded room; corresponding controls were shielded and placed in the same 25 degrees C incubator; additional baseline controls were held at 15 degrees C (worm growth temperature). Stress responses were measured in terms of beta-galactosidase (reporter) induction above control levels. The time-course of response to continuous microwave radiation showed significant differences from 25 degrees C controls both at 2 and 16 h, but not at 4 or 8 h. Using a 5 x 5 multiwell plate array exposed for 2 h, the 25 microwaved samples showed highly significant responses compared with a similar control array. The wells most strongly affected were those in the rows closest to the source, whereas the most distant row did not rise above control levels, suggesting a shadow effect. These differential responses are difficult to reconcile with general heating effects, although localised power absorption affords a possible explanation. Experiments in which the frequency and/or power settings were varied suggested a greater response at 21 than at 27 dBm, both at 750 and 300 MHz, although extremely variable responses were observed at 24 dBm and 750 MHz. Thus, lower power levels tended, if anything, to induce larger responses (with the above-mentioned exception), which is opposite to the trend anticipated for any simple heating effect. These results are reproducible and data acquisition is both rapid and simple. The evidence accrued to date suggests that microwave radiation causes measurable stress to transgenic nematodes, presumably reflecting increased levels of protein damage within cells (the common signal thought to trigger hsp gene induction). The response levels observed are comparable to those observed with moderate concentrations (ppm) of metal ions such as Zn2+ and Cu2+. We conclude that this approach deserves further and more detailed investigation, but that it has already demonstrated clear biological effects of microwave radiation in terms of the activation of cellular stress responses (hsp gene induction).

PMID: 9635489 [PubMed - indexed for MEDLINE]

http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=11424156&ordinalpos=4&itool=EntrezSystem2.

Bioelectromagnetics. 2001 Jul;22(5):333-9.

Exposure of Caenorhabditis elegans to extremely low frequency high magnetic fields induces stress responses.

Miyakawa T, **Yamada S**, **Harada S**, **Ishimori T**, **Yamamoto H**, **Hosono R**.

Laboratory of Magnetic Fields Control and Applications, Faculty of Engineering, Kanazawa University, Ishikawa, Japan.

Responses of the small heat shock protein gene, hsp-16, were examined in transgenic Caenorhabditis elegans exposed to electromagnetic fields. Expression of the hsp-16-lacZ gene was enhanced when transgenic animals were exposed to magnetic fields up to 0.5 T at 60 Hz. The hsp-16 promoter was more efficiently expressed at the embryonic than at the post-embryonic stage irrespective of exposure. Promoter activity was more sensitive to the stimulus in the intestine at the post-embryonic stage. Evidence is presented that the induction occurs at the transcriptional step of hsp-16.

PMID: 11424156 [PubMed - indexed for MEDLINE]

Bioelectromagnetics. 2000 Feb;21(2):100-6.

Electromagnetic fields enhance the stress response at elevated temperatures in the nematode Caenorhabditis elegans.

Junkersdorf B, **Bauer H**, **Gutzeit HO**.

Institut für Zoologie, Technische Universität Dresden, Dresden, Germany.

We have studied the effect of extremely low frequency electromagnetic fields (ELF-EMF) in the presence of a second stressor (mild heat shock) on the expression of a lacZ reporter gene under the control of hsp16 or hsp70 promoters in two transgenic strains of C. elegans. The expression of the reporter gene was studied by scoring animals with induced beta-galactosidase activity after staining in toto or by biochemical quantitation of the enzyme activity, respectively. In our experimental setup we were able to expose the animals to 50 Hz magnetic flux density of 0-150 microT and at the same time control temperature with high precision (+/-0.1 degrees C). Experimental conditions were defined for which EMF strongly enhances the expression of the reporter gene.

PMID: 10653620 [PubMed - indexed for MEDLINE]