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Microwave radiation induces a heat-shock response and enhances growth in the nematode Caenorhabditis elegans

D. De Pomerai, C. Daniells, H. David, J. Allan, I. Duce, M. Mutwakil, D. Thomas, P. Sewell, J. Tattersall, D. Jones and P. Candido. "Microwave radiation induces a heat-shock response and enhances growth in the nematode Caenorhabditis elegans." 2000 Transactions on Microwave Theory and Techniques 48.11 (Nov. 2000, Part II [T-MTT] (Special Issue on Medical Application and Biological Effects of RF/Microwaves)): 2076-2081.

This paper shows that prolonged (overnight) exposure to continuous microwave fields (750 MHz, 0.5 W) can induce both a heat-shock response and enhanced growth in the nematode worm Caenorhabditis elegans. Exposures were conducted in a TEM cell with matched load, producing an E-field of approximately 45 V m/sup -1/ at the center (where test worms are placed). Biomonitoring of heat-shock responses has been simplified by using two transgenic strains (PC72 and PC161), which both carry stress-inducible reporter constructs, respectively, placing lacZ (/spl beta/-galactosidase) and lacZ plus green fluorescent protein expression under the control of C. elegans hsp16-1 promoters. In situ localization of reporter expression reveals a minority of test worms, which respond strongly to microwave exposure. Enzyme activity measurements average these reporter responses across many thousands of individual worms, giving a reliable indication of the overall stress imposed on a population. The temperature profile of reporter responses induced by microwave exposure parallels that induced in controls by heat alone, but is displaced down the temperature scale by some 3/spl deg/C. Length measurements were conducted at intervals in synchronized C. elegans cultures seeded with L1 larvae. Using pooled data from nine separate runs, growth was stimulated by 8.5% after overnight microwave exposure (relative to controls), and this disparity increased to 11% after 24 h of further growth without irradiation. Both heat-shock responses and increased growth would be consistent with a modest increase in temperature, raising the possibility that microwave exposure might cause limited heating in this system. However, there is no detectable rise in the temperature of either medium or worms during overnight exposure under these conditions, discounting both generalized and localized (worm-specific) heating effects. It is concluded that both growth and heat-shock responses are induced by microwave exposure through one or more nonthermal

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