AN EXPERIMENTAL MODEL FOR DETECTING AND AMPLIFYING SUBTLE RF FIELD-INDUCED CELL INJURIES.

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A combination in vitro/in vivo experimental model utilizing neoplastic target cells, and a special receptive host, is capable of detecting subtle biological effects of non-ionizing, electromagnetic (EM) fields. The experimental findings carry provocative implications concerning the potential biological and pathological influences of radio-frequency (RF) and microwave irradiations, as well as suggesting possible useful applications for EM fields in experimental cancer therapy. Intrinsic, as opposed to hyperthermic, influences of 30 MHz fields upon cancer cells that were exposed in vitro, were detected only when such target cells were reimplanted subcutaneously (sc) in a receptive mouse strain specially selected for its immunocompetent equipoise. The effects of the RF fields on the neoplastic cells were detected by changes in the tumor latent periods, tumor incidence, tumor growth rates, maximum tumor volumes, tumor regressions, and survival times of the hosts. Hyperthermic effects associated with RF field exposure were controlled by: 1) utilization of the Guy cell-exposure apparatus and its sophisticated heat-exchange mechanisms, and 2) by the intentional induction of identical hyperthermias in sham-exposed and RF-exposed neoplastic cells in order to normalize the thermal factor. 3) The possible perturbing effects of thermal gradients were minimized by constantly circulating the cells through the sample chamber so that all cells were exposed to the same average thermal and RF environments. As a result of such controlled exposure of mouse lymphosarcoma cells to 30 MHz fields at 1 to 10 V/cm, a significant number of unexpected tumor regressions was observed. RF-exposed and sham-control neoplastic cells both produced tumors following sc implantation; however, a higher percentage of those tumors derived from cells that had been exposed in vitro to 30 MHz fields subsequently regressed, resulting in host survival. This was in contrast to the sham-exposed and control cells that produced a higher percentage of progressively growing lethal tumors. Mechanisms associated with this model appear to encompass a form of biological amplification that permits the reproducible detection of extremely subtle cell injuries resulting from specific RF field exposures.

These studies have so far been restricted to the single frequency of 30 MHz and electric field strengths of the order of 1, 5, and 10 Volts/cm. These particular field strengths yield average specific absorption rates (SAR) of 31 (±5), 352 (±68), and 1805 (±298) W/kg respectively.