relative cyclin D1 protein by Western blot, the ECL chemiluminescence detection system (commercially available), and NIH ImagePC software.

RESULTS: In four separate experiments, we have found that tamoxifen treatment in a 2mG field reduces levels of the cyclin D1 protein, which is critical to the cell cycle G1 phase progression in breast cancer cells to 75 ±12% of untreated MCF-7 cell levels. However, in a 12mG field, tamoxifen-treated cyclin D1 levels are essentially identical to the untreated controls (96 ±8%; $p<0.05$ relative to 2mG). These results correspond well with our cell proliferation studies measuring the cytostatic action of tamoxifen.

CONCLUSIONS: These results identify a specific biochemical event that independently corroborates our previously reported 12mG inhibition of tamoxifen's action in MCF-7 cell proliferation studies. Since all mitogenic signaling cascades converge at the cyclin D-controlled G1 checkpoint of the cell cycle (3), the 12mG field could affect any one of at least three receptor signaling pathways. In the future, we plan to track the site of initial interaction of the 12mG field with the cell by using inhibitors which block specific transduction pathways.

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TWO DIMENSIONAL ELECTROPHORETIC PROTEIN PROFILE ASSOCIATED WITH EMF INHIBITION OF CYTOSTATIC EFFECT OF TAMOXIFEN ON MCF-7 CELL GROWTH.

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Epidemiological studies suggest an increased risk of breast cancer is associated with exposure to electromagnetic fields (EMFs). Previous investigations have shown that a 12 mG, 60 Hz magnetic field significantly inhibits the cytostatic action of pharmacological doses of tamoxifen (10^{-7} M) on the growth of MCF-7 human breast cancer cells. Here we use high resolution two dimensional polyacrylamide gel electrophoresis (2D PAGE) to investigate phenotypic biochemical alterations which may represent protein biomarkers of effect of exposure of drug-treated human breast cancer cells to an environmental-level magnetic field. Solubilized MCF-7 cell fractions (20 µG) from each treatment group (control - 2 mG field; control - 12 mG field; tamoxifen - 2 mG field; tamoxifen - 12 mG field) are subjected to 2D PAGE using the Anderson ISODALT method. Computer analysis and comparison of gel patterns across treatment groups were performed using PDQUEST software (BioRad Labs, CA). The protein alterations associated with the observed 12 mG blocking effect of tamoxifen inhibition are characterized with respect to Mr and pI. These studies may provide an understanding at the biochemical level of the EMF-induced reversal of tamoxifen's cell growth inhibition of human breast cancer cells and offer some insight into the putative role of EMF in human breast cancer risk.

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