



Updated Report on the Effects of Weak RF and Low Frequency Magnetic Fields on Biological Systems

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In the four years since I last addressed this meeting, we have substantially added to our experimental database on the effects of weak RF and magnetic fields on the growth rates of fibrosarcoma cells and bacteria. It is to be noted that the fields we are studying are all well below the current safety guidelines and provide additional evidence that long term exposures can have biological effects that our not seen for the short-term exposures currently used in setting most of the current safety guidelines. We have shown that we can both accelerate and inhibit the growth rates of HT-1080 fibrosarcoma cells by as much as 30% by changing the low frequency exposures by less than one cycle per second for magnetic field exposures of 9.8 μT and background static field of 45 μT over a period of 4 days. These results are dependent on the length of the exposure, the magnitude and direction of the background static magnetic field, the temperature, humidity, and carbon dioxide concentrations. We also have related results on the growth rates for bacteria. Additional we have shown that we can both accelerate and inhibit the growth rates of these fibrosarcoma cells by near field exposures to RF fields in the 1MHz to 10MHz frequency range with exposures in the range from 1nT to 1.5 μT over a period of four days with static background field of 45 μT . Modulating the carrier frequency typically decreases the size of the changes in the growth rates. 45 μT is a reasonable estimate of the earth's magnetic field in Boulder Colorado. We believe the forgoing results are associated with the changes in metabolic processes, and reactive oxygen species (ROS) concentrations that can serve as signaling molecules. ROS concentrations outside of the normal ranges can lead to biological damage and are associated with aging, cancer, Alzheimer's and other diseases. The RF results are believed to be associated with the excitation of hyperfine transitions and the low frequency results may be associated with the coupling between nuclear spins.