An Experimental Determination of Static Magnetic Fields Induced Noise in Living Systems

MEGAN BRADY, CRAIG LARAMEE, Binghamton University — Living systems are constantly exposed to static magnetic fields (SMFs) from both natural and man-made sources. Exposures vary in dose and duration ranging from geomagnetic (\(\approx 50\mu\text{T}\)) to residential and industrial (\(\approx 10\text{s of mT}\)) fields. Efforts to characterize responses to SMFs have yielded conflicting results, showing a dependence on experimental variables used. Here we argue that low to moderate SMF exposure is a sub-threshold perturbation operating below thermal noise, and assays that evaluate statistical characteristics of a single cell may identify responses not consistently found by population averaging approaches. Recent studies of gene expression show that it is a stochastic process capable of producing bursting dynamics. Moreover, theoretical and experimental methods have also been developed to allow quantitative estimates of the associated biophysical parameters. These developments provide a new way to assess responses of living systems to SMFs. In this work, we report on our efforts to use single molecule fluorescence in situ hybridization to assess responses of NIH-3T3 cells to SMF exposure at flux densities ranging from 1 to 440 mT for 48 hours. Results will contribute to determining mechanisms by which SMF exposure influences gene expression.