An Initial Approach to *in Silico* Bioelectromagnetics for RF Exposures

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Introduction. Our group has developed an initial capability for creating and solving single cell and multicellular models that involve interactions with nonionizing electromagnetic fields from essentially dc to ∼2 GHz, and estimates of biochemical change. Interactions can range from weak (e.g., animal navigation, environmental exposures at power line frequencies) to strong (e.g., some telecommunication waveforms, conventional and supra-electroporation with potential medical applications). **Methods.** Our approach involves interactions on multiple spatial scales (e.g., molecules and membranes, cellular organelles, single cells, multiple irregular cells in close proximity, tissue level and whole body) and temporal scales of ns to hours [1–5]. The biological system models consist of a large number of interconnected models. The purpose is estimating field-induced biochemical change, using local models for candidate biophysical mechanisms that couple the field to ongoing biochemical processes. *In silico* (computer-based) assessments can provide rapid, approximate information for large numbers of exposures with different magnitudes and waveforms, a capability partly analogous to high throughput screening. **Results.** We have achieved an initial modeling/screeing capability that is applicable at the multicellular, cellular and subcellular levels. Solutions to a biological system model: (1) describe the microscopic field redistribution due to the applied field (microdosimetry), and (2) estimate the biochemical change due to biophysical mechanisms assigned within the system model. Our microdosimetry models can be combined with anatomic whole body models developed by others for macrodosimetry (typically ∼ mm scale) in humans and laboratory animals. This approach can aid the design and interpretation of experiments involving biological effects of nonionizing electromagnetic fields ranging from dc to microwave frequencies. This provides the possibility of preliminary exposure assessment for many different waveforms *in silico*. The estimated biochemical change due to a particular electromagnetic field exposure is based on known biophysical mechanisms (presently heating, voltage-gated channels and electroporation; others can be added). This allows competing in uences to also be considered quantitatively with initial testing of a hypothesis that a particular biophysical mechanism might cause a biological effect [6]. **Support.** NIH grant RO1–GM63857 and a AFOSR/DOD MURI grant on Subcellular Responses to Narrowband and Wideband Radio Frequency Radiation.

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