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**Nonlinear electromagnetic responses of active molecular motors in live cells and organelles** DHARMAKIRTHI NAWARATHNA, JEFFREY GARDNER, GUSTAVO CARDENAS, DAVID WARMFLASH, JOHN MILLER, WILLIAM WIDGER, University of Houston, JAMES CLAYCOMB, Houston Baptist University — The response of biological cells to an oscillatory electric field contains both linear and nonlinear (eg. induced harmonic) components. At low frequencies (about 10Hz), harmonic generation by budding yeast cells is observed. These induced harmonics are sensitive to sodium metavanadate, an inhibitor, and glucose, a substrate, respectively, of P-type ATPase membrane pumps. At higher frequencies, two peaks, around 3kHz and 12kHz, are observed in the frequency-dependent harmonic responses. These are sensitive to potassium cyanide, a respiratory inhibitor that blocks cytochrome c oxidase, an enzyme of the mitochondrial respiratory chain. We have also measured the response of uncoupled mitochondria extracted from bovine heart cells, for which a second harmonic sensitive to pericidin A and carboxin is detected at applied frequencies of 3-4kHz. Finally, in coupled mouse mitochondria, an ADP sensitive peak (12-15kHz) is observed, likely due to the F0 domain of ATP synthase, which acts as a molecular turbine.

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