MEASUREMENT OF THE AZIMUTHAL MEMBRANE VOLTAGE DISTRIBUTION AT BY-2 PROTOPLASTS EXPOSED TO NS PULSED ELECTRIC FIELDS

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Theoretical calculations of the azimuthal membrane voltage distribution of spherical cells in suspension exposed to an external electric field, based on isolating shell models, predict a sinusoidal angular dependency along an undisturbed membrane. These typical waveforms can be measured by pulsed laser fluorescence microscopy, while exposing the cells, stained with a voltage sensitive dye (ANNINE-6), to a rectangular electric field pulse, 500 ns after pulse onset and at low external electric field amplitude.

At earlier times and higher electric field amplitudes, a non-typical fluorescence response at the hyperpolarized cell hemisphere can be observed. Starting at the anodic pole region of the cell, a strong depolarization fluorescence response can be obtained. The fluorescence intensity decreases instead of increasing as theoretically expected. This fluorescence reversal appears more distinct and earlier at higher electric field amplitudes. Several 10 ns after the beginning of the electric field pulse, the fluorescence intensity increases again to theoretically expected values, indicating hyperpolarization of the membrane.

After shortly introducing the experimental setup, the measurement results will be discussed against the background of current concepts of membrane-nsPEF-interaction.

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