

Electric Field Induced Fusion of Biological Cells

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Fusion of biological cells is observed when attached cells are subjected to an external electric field pulse of short duration and of high amplitude (20 to 50 μ s, \geq 750 V/cm). The attachment of the cells was achieved by an inhomogeneous alternating electric field of low intensity. As calculated by the integrated Laplace equation the field strength of the single field pulse is high enough to induce reversible electrical breakdown in the membranes of the adhered cells [1-3]. Field pulses of undercritical strength initiate no cell fusion, that means that electric breakdown of the membrane is a prerequisite in field induced cell fusion. The electric field induced fusion is independent on the presence of chemical agents and is observed even in the absence of Ca^{2+} -ions.

The time to complete fusion between two cells, i.e. the time to form a new spherical aggregate, depends on the biological species. Whereas mesophyll cell protoplasts both of Avena sativa and Petunia inflata are completely fused within 3 to 6 min, those of Vicia faba need 30 to 60 min to fuse. On the other hand, isolated vacuoles from different sources fuse within seconds after stimulation with an external electric field pulse.

As well as plant protoplasts erythrocytes can be adhered by an inhomogeneous alternating electric field of low intensity and furtheron can be fused by subjecting an external electric field of high strength.

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