Plenarvortrag PV VI Mi 9:45 Theater Vorpommern
New Medical Therapies with Ultrashort Pulsed Electric Fields — •Juergen F. Kolb[1], Karl H. Schoenbach[1], Andrei G. Pakhomov[1], Peter F. Blackmore[2], Stephen J. Beebe[1], Barbara Y. Hargrave[3], Ravindra P. Joshi[4], and Richard Nuccitelli[5] — [1]Frank Reidy Research Center for Bioelectrics, Old Dominion University, 830 Southampton Ave., Norfolk, VA 23510, USA — [2]Department of Physiological Sciences, Eastern Virginia Medical School, Lewis Hall, Norfolk 23501, VA, USA — [3]Department of Biological Sciences, Old Dominion University, Mills Godwin Bldg., Norfolk, VA 23529, USA — [4]Department of Electrical and Computer Engineering, Old Dominion University, Kaufman Hall, Norfolk, VA 23529, USA — [5]BioElectroMed Corp., 849 Mitten Road, Burlingame, CA 94010, USA

Nanosecond pulsed electric fields of high field strength have been shown to modify cell function and behavior. With durations on the order of, and often shorter than, the charging time of the cell's plasma membrane, the applied electric field readily interacts with intracellular structures triggering a variety of processes. Electrical and molecular dynamics models suggest that the initial (i.e., primary) response is a fast charging of cellular membranes, which is then followed by the formation of pores. Although a similar "dielectric breakdown" of the plasma membrane is also observed for much longer but lower intensity electroporation pulses, newer experimental data reveal unique properties of nanosecond pulse induced pores. The biological (i.e., secondary) response that is caused by the exposure depends on the duration, the magnitude and the number of the applied pulses. Moderate conditions can lead to a controlled release of calcium from internal stores. In platelet cells, this increase in calcium levels correlates to their aggregation. As a consequence, the application of nanosecond pulsed electric fields can promote and accelerate wound healing. At higher electric fields, the exposure can induce apoptosis (programmed cell death) in cancer cells. Various tumor models have already been successfully treated. For the example of melanoma (skin cancer), treatment modalities for an in vivo mouse model have been defined that lead to the complete remission of the tumor.