



Electroporation for the delivery of immunotherapeutic molecules against cancer

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Malignant tumors are able to grow and spread because of their ability to escape the immune system surveillance. A process called “cancer immunoediting” recognizes the existence of a fine interaction between the immune system and tumors, indicating the dual role the immunity plays in cancer. Studies in the field of oncoimmunology are revealing an attractive set of new, different therapeutic approaches. One promising approach is active immunotherapy, aiming to induce an endogenous tumor-specific immune response into the host.

Immunotherapy can now be considered one of the pillars of cancer treatments that can be carried out by different strategies. Among these, electroporation has become a widely accepted platform technology. Electroporation (EP) is the process of using pulsed electric fields to create temporary pores in the cell membranes of biological tissues. By applying specific electrical pulses, the cell membrane’s permeability is increased, allowing the entry of therapeutic molecules. ElectroChemoTherapy (ECT) and GeneElectroTransfer (GET) are therapeutic options based on administration of electric pulses at different conditions for different purposes. ECT is used for intra-tumoral delivery of drugs such as Bleomycin and Cisplatin. GET is employed for the administration of DNA sequences, coding antigens or immunomodulatory molecules, in vaccination/immunization protocols against infectious and cancer diseases. These medical procedures have been demonstrated to influence the immune system response, due to their capability to recruit different immune cells to the tumor area and, quite often, at distant level.

Nowadays, ECT is used into the clinical practice for the treatment of subcutaneous and deep-seated tumors. More recently, GET, even though still in early clinical developments, has already entered several veterinary and approved clinical trials for the immunomodulation of the host’s response.

When using electroporation as a platform technology for drug and gene delivery, electrical parameters must be adjusted respect to different molecules and different target tissue. We need to develop strategies to combine ECT with GET treatments that will be tailored to specific tumor, tissue, and mode of action of the therapeutic molecules. Successful results will be achieved only thanks to the interdisciplinary exchanges among the whole scientific community involved in pulsed electric field studies.