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Mathematical modeling of tumor growth in mice following low-level direct current

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Electrotherapy consists on the application of a low-level direct current to solid tumors, through electrodes inserted in these. The main results of the use of this therapy in experimental tumors (preclinical studies) are exposed. In these experiments, the direct current intensity is one of the fundamental parameters to induce high percentages of tumor destruction. The rest of parameters of the tumor (type, size, proliferation speed and deceleration of the tumor) and therapy (exposure time, times that repeats, and positioning, quantity and polarity of electrodes) remain constants. From these experiences, a modification to the conventional Gompertz equation is proposed in order to describe the different responses of the solid tumors after applied the direct current (disease progression, stable disease, partial remission and complete remission). Direct current intensity is varied in the simulations and the other parameters remain unchangeable. The results evidence that the modified Gompertz equation is feasible to describe different tumor responses mentioned above. A new type of antitumor response is revealed, named stationary partial response. Also, the modified Gompertz equation allows to make a prediction of the possible evolution of a tumor for different parameters of electrodes array and to reveal some interesting findings in the kinetics of unperturbed and direct current perturbed tumors. Finally, the current results and future strategies are exposed on the use of the mathematical modeling in electrotherapy treated tumors.