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The effect of electrical conductivity on pore resistance and electroporation JIANBO LI, HAO LIN, Rutgers University — Electroporation is an elegant means to gain access to the cytoplasm, and to deliver molecules into the cell while simultaneously maintaining viability and functionality. In this technique, an applied electric pulse transiently permeabilizes the cell membrane, through which biologically active agents such as DNA, RNA, and amino acids can enter the cell, and perform tasks such as gene and cancer therapy. Despite wide applications, current electroporation technologies fall short of desired efficiency and reliability, in part due to the lack of fundamental understanding and quantitative modeling tools. This work focuses on the modeling of cell membrane conductance due to the formation of aqueous conducting pores. An analytical expression is developed to determine effective pore resistance as a function of the membrane thickness, pore size, and intracellular and extracellular conductivities. The availability of this expression avoids empirical or *ad hoc* specification of the conductivity of the pore-filling solution which was adopted in previous works. Such pore resistance model is then incorporated into a whole-cell electroporation simulation to investigate the effect of conductivity ratio on membrane permeabilization. The results reveal that the degree of permeabilization strongly depends on the specific values of the extracellular and intracellular conductivities.

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