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STUDY OF ELECTRICAL CONDUCTIVITY OF SOME ANIMAL'S OOCYTES

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Relevance. The most interesting biological objects in the latest research in the field of cell engineering are oocytes (eggs) of the mammalian class animals. These cells are mainly used in reproductive technologies, including biomedical technologies for the reproduction of human embryos, including, in particular, methods and technical means of cryobiology [1-3]. The use of various cell engineering technologies requires a certain degree of electroporation of living cell membranes, which is ensured by a given electric field strength. It has been established that the electrical conductivity of the entire cell in a pulsed electric field of rising strength (PEFRS) can serve as an indicator and at the same time an integral characteristic of the degree of electroporation from reversible to irreversible electrical breakdown of the membrane [4-6]. Therefore, the research of electrical conductivity is an adequate process for obtaining data characterizing membrane electroporation.

Purpose. This work was carried out with the aim of obtaining comparative characteristics of the electrical conductivity of some mammal's oocytes for further use in various cell engineering technologies that use the electroporation phenomenon of the cell membrane.

Results. To study the conductivity dynamics, the method and device for pulsed conductometry of single animal cells in PEFRS were used [4, 5]. Electrical conductivity studies were performed on oocytes of mammalian animals of the following species: mouse, rabbit, pig and cow. The results were processed using the algorithm proposed earlier [4, 6]. The instrumental error of the primary measurements did not exceed 4%.

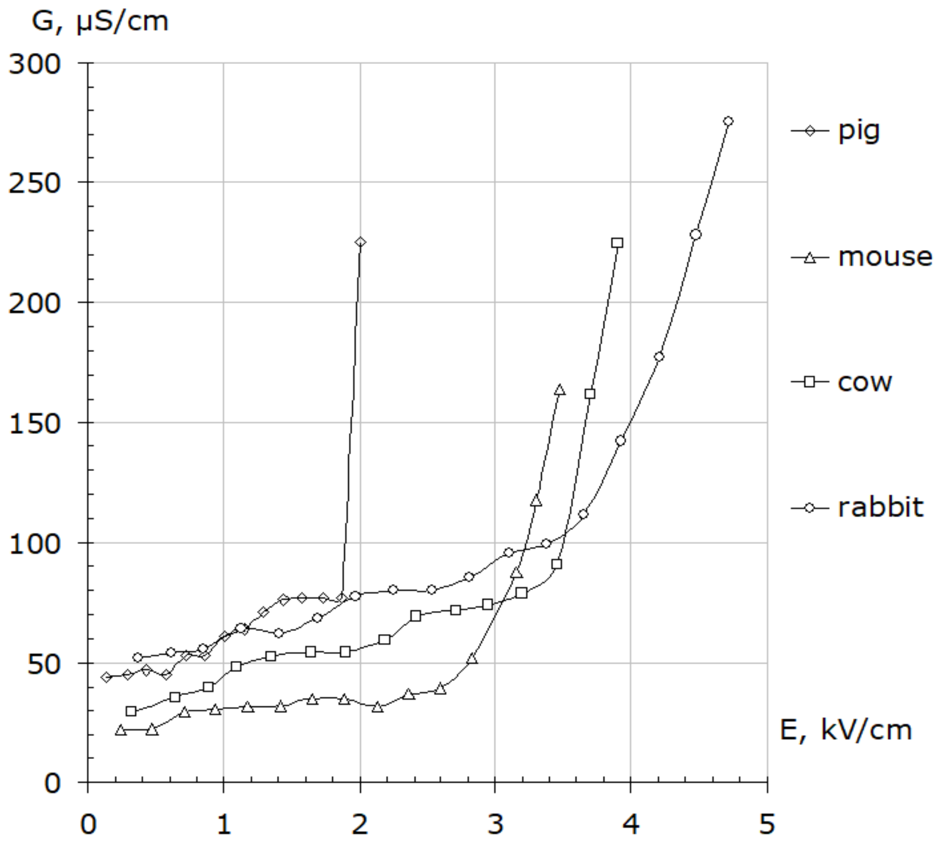

Figure 1 - Dependences the conductivity of pig, mouse, cow and rabbit oocytes on field strength.

Fig. 1 shows the dependences of electrical conductivity in the PEFRS of mouse, cow, pig and rabbit oocytes in comparison.

From Fig. 1 shows that the electrical conductivity of the oocytes of these animals has significant species-specific characteristics and differences. Thus, based on the nature of the dependence of the studied cells electrical conductivity on the field strength, it was established that pig oocytes were the least resistant to electrical breakdown. The electrical breakdown field strength of their membrane is on average E_{br} = 1.8 kV/cm. Then, mouse oocytes E_{br} = 2.7 kV/cm were more resistant to electrical breakdown, followed by cow oocytes E_{br} = 3.2 kV/cm and rabbit oocytes E_{br} = 3.5 kV/cm.

The initial electrical conductivity of rabbit oocytes turned out to be higher than other cells, which can apparently be explained by their poorer lipid composition (lipid - dielectric). All oocytes, except rabbit oocytes, were prone to a sharper electrical breakdown, while rabbit oocytes showed the most extended electrical breakdown process (the conductivity slope in the breakdown region is the smallest). This is also indicated by the higher rate of increase in conductivity. This can be associated both with the characteristics of the lipid composition of their membrane and with its physical and mechanical properties, i.e. The method of pulsed conductometry at the PEFRS is a convenient tool for the objective study of not only these, but also, in the prospective, the biochemical properties of animal reproductive cells.

Thus, a graphical representation of changes in cell electrical conductivity in PEFRS makes it possible to detect and study all stages of membrane electroporation and purposefully select the required mode of action of PEFRS on the cells of various animals in accordance with the task during one of the processes of cell engineering.

Conclusions.

As a result of the study, experimental dependences of the electrical conductivity of pig, mouse, cow and rabbit oocytes in a pulsed electric field of increasing strength were obtained. Significant species-specific differences in the electrical conductivity of oocytes have been established, which can be explained by differences in the structure and composition of membranes and cells in general.

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