Wrocław, dnia 15.06.2021

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SUMMARY

„MEMS-type deformational cytometer to research on the deformability of animal oocytes"

The aim of this study was to develop an original and proprietary design and technology of MEMtype microcytometer and research methodology for studying the mechanical properties of deformed oocytes. The micromechanical, micro-optical and microfluidic elements constituting the microcytometer were developed and characterized. Then, the integration of microstructures into a deformational microcytometer was performed in three different configurations allowing for conducting studies in reflection or fluorescence microscopy. Systems and algorithms for pneumatic and fluidic control for the microcytometer were developed, as a result of which a control and measurement system was created. In the developed microcytometers, it was possible to carry out research on biological material thanks to taking into account the issue of biocompatibility and sterility of the instrument. The use of microengineering techniques and microscopic observation allowed for the examination and parameterization of pig oocytes with a diameter of 110-150 µm. The oocytes were compressed evenly throughout their volume, in a controlled manner, and the compression range covered up to 80% of the cell diameter value. Potential cell damage was observed during the measurement of oocytes, and changes in the geometric parameters of the cells were examined before and after compression. The researchers searched for differences in the deformability of fixed and live oocytes, cells assigned to different quality classes, and the relationship between the studied parameters of deformed oocytes. The results of the oocyte studies conducted are a valuable insight into the deformability of oocytes and are a precursor to in-depth research on the instruments allowing for the qualitative classification of oocytes using the mechanical properties of the tested cells.

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