1. Summary

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"Microfluidic chip for cells' electrofusion"

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Cells' electrofusion research started about 25 years ago. Nowadays, this field is being studied at the single cell level on microfluidic chips. The present project is one of the first pieces of this new field research within the LMIS4.

The final goal of cell electrofusion is to create hybridoma for the production of monoclonal antibodies for immunological related diseases and vaccines in cancer immunotherapy.

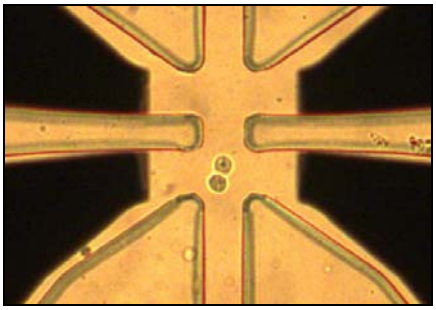

Fig. A : n-DEP trap of EG7 cells.

Electrofusion of cells is achieved in two main steps. The first one is to stop the cells in the flow and bring them into close contact with dielectrophoresis, a non uniform electrical field with high frequency and low voltage. Fig. A shows two cells experimenting n-DEP. The second step is to initiate fusion based on electroporation by applying short and high electric fields.

During this project, the fusion feasibility of chips produced for other applications have been tested and some critical fusion parameters have been defined. Then, with the help of FEM simulations, a new chip design has been proposed to overcome the problems faced during the experiences and to optimize the fusion feasibility. The fusion feasibility optimization involved the creation of bypasses channels to avoid accumulation of cells in the trapping chamber, it involved also geometric changes in the trapping chamber.

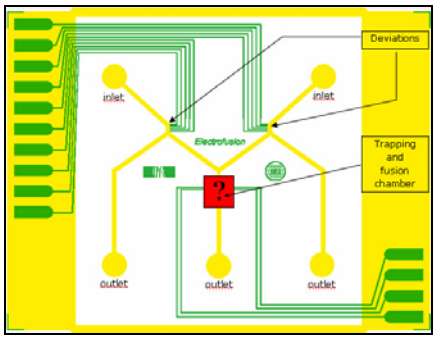

Fig. B : Deviation in the new layout.

The new chips shown in fig. B have been produced in clean room and partially tested. The preliminary results are promising, the deviation of cells by n-DEP is successful for all the cells tested and trapping can be achieved with similar electrical features for two different types of cells. Fig. C show the p-DEP trapping of one of them, MCF7.

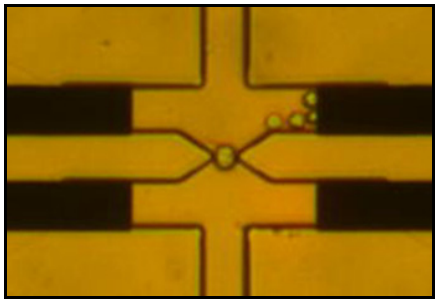

Fig. C : p-DEP trap of MCF7 cells in the new chip

The next steps should find a way to decrease the voltage applied and go for controlled electroporation.