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Motivation

Recent advances of automated cell culturing are combining microelectronics, micromechanics, micro-optics, communication technologies, microfluidics and assembly technology, which has lead to a number of miniaturized devices [1-3]. Many scientific publications can be found in which integrated complicated systems are studied, while in hospitals or in fertility clinics the procedures are still predominantly based on Petri dishes.

Description

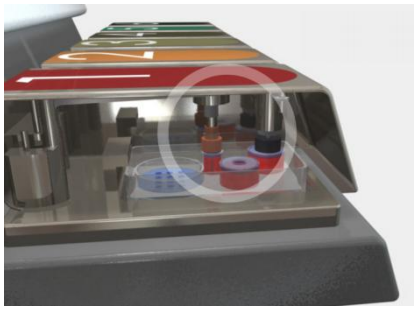

Figure 1. Side view of the IVFLAB6

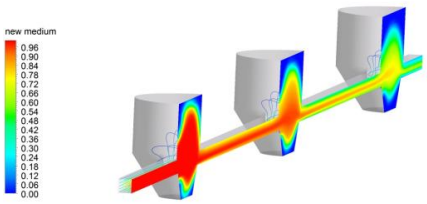

Figure 3. CFD simulation analysis of new media distribution in the IVFChip cell compartments after 10 s.

- ❖Fully automated culturing of six single chips
- ❖Flow rate up to 20µl per hour
- ❖Can handle 2 media
- ❖T and pH control and logging
- ❖Undisturbed bio-mimetic environment
- ❖Low shear stress
- ❖Cont. metabolic waste removal
- ❖Minute amounts of samples (14µl) for pH
- ❖Evaporation control by surface covering mineral oil
- ❖Environmental control of 5 or 6 % CO_2

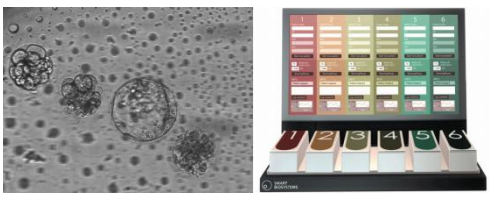

Figure 4. A photo of cultured embryo cells (left) and the integrated IVFLAB6 for microfluidic culture system (right).

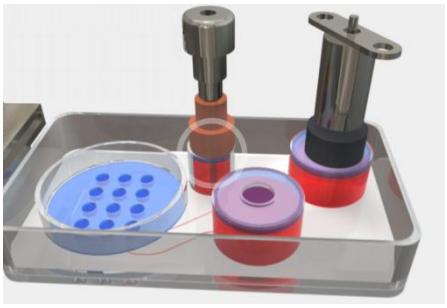

Figure 2. Valve for fluidic control and sampling compartment for pH measurements

One of the key features is the novel way of controlling the microfluidic distribution of media by using a combination of hydrostatic pressure and opening and closing valves on the top of the medium reservoirs (Figure 2). In this way a very gentle flow (Figure 3) is generated and the medium is not in contact with any other surfaces apart from the material from which the IVFChip is fabricated. **This is highly important, especially with respect to regulatory restrictions.**

Results

The temperature and pH values can be found in a cultivation at physiological levels.

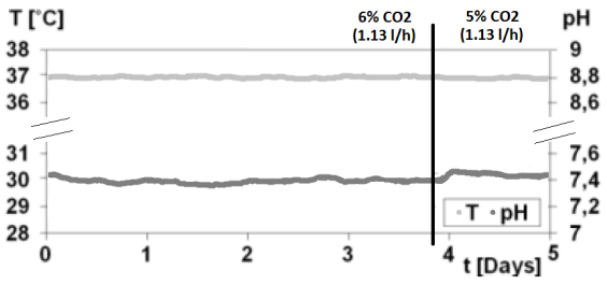

Figure 5. pH and temperature measurements for a period of 5 days with change the percentage of the gas.

An externally performed cytotoxicity test has been successfully demonstrating that the IVFChip is reaching comparable performance with assay control experiments (shown in Figure 6).

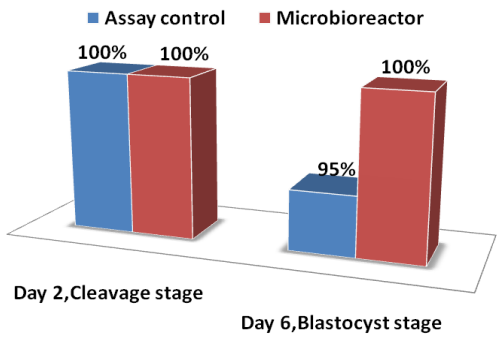

Figure 6. Cytotoxicity tests

Conclusions

The described system is an efficient compromise between the demands and requests from a very conservative clinical working and research require-ments and the advances of microfluidic technology available at high technology research environments.

Acknowledgments

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