Lab on a chip automates in vitro cell culturing

Perozziello, Gerardo; Møllenbach, Jacob; Laursen, Steen; Fabrizio, Enzo di; Gernaey, Krist; Krühne, Ulrich

Publication date:
2011

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
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

- 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 % CO2

Results

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

![Figure 1. Side view of the IVFLAB6](image)

![Figure 2. Valve for fluidic control and sampling compartment for pH measurements](image)

![Figure 3. CFD simulation analysis of new media distribution in the IVFChip cell compartments after 10 s.](image)

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

![Figure 5. pH and temperature measurements for a period of 5 days with change the percentage of the gas.](image)

![Figure 6. Cytotoxicity tests Day 2, Cleavage stage](image)

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

Conclusions

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

Acknowledgments

This work was partially supported by the European Project “SMD”, proposal no. CP-FP 229375-2 of the call FP7-NMP-2800-SMALL-2 and the project FIRB “Rete Nazionale di Ricerca sulle Nanoscienze ItaliNanoNet” (cod. RBPR05JH2P_010, CUP B41J09000110005)

References