Effects of oxygen supply, oxygen concentration and collagen coating on the culture and functions of rat fetal liver cells

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Context

Knowing the mechanism of depuration process of a drug is of major interest for the pharmacokinetic researches. With the kidneys, the liver plays an important role in the depuration system. That's why tissue engineering aims to create functional organs using biomaterials and living cells. Nevertheless, the conventional in vitro conditions cannot maintain the liver cells' functions. For now, animal testing is the only trustful alternative. In order to increase the cellular activity, we have to mimic as close as possible the in vivo conditions, creating an optimum culture environment for drug testing.

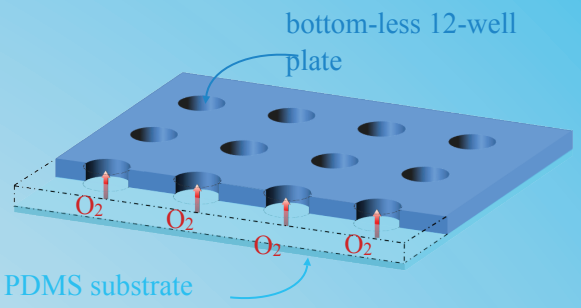

Figure 1 : Bottom-less 12-well plates fixed on PDMS substrate

Objectives

In conventional cell culture, hepatocytes (main cells of the liver) are cultured as a cell monolayer and show after 24 h a decrease of their specific functions (80 to 99% decrease) [1]. In this project, our objective is to avoid in vitro this lost of function.

Methods

In our study, we chose the fetal liver as the cells' source because it contains liver progenitor cells and because of the highly efficient maturation capacity of those cells in hepatocytes. Furthermore, we decided to mimic the in vivo conditions because of the crucial role of the environment [2] for in vitro specific differentiation of embryonic cells.
That's why we decided to i) increase the oxygen supply to the cells, using PDMS membrane (Fig.1), ii) decrease the oxygen concentration of the environment from 21% to 5%, because the gaseous environment of the fetal liver is poor in oxygen, and iii) substitute the basic extracellular matrix component conventionally used (type-1 collagen) with type-4 collagen found in a large amount in healthy liver

References and Publications

[1] D.F. Clayton and J.E. Darnell Jr, Mol. Cell. Biol. 2, p1552, 1983
[2] H.C. Fiegel et al., J. Cell. Mol. Med. 10, p577, 2006