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Factors regulating stem cell behaviour – P38

New microfluidics-based technologies enable the high throughput screening for optimal cultivation and differentiation conditions: First adaptation to stem cell culture

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Stem cells have the potential to significantly improve future therapies [1]. But new approaches can only be realised safely with reproducible, xeno-free, and efficient culture and differentiation protocols. Until now, these goals have not been completely mastered for clinical purposes. None of the available state-of-the-art methods do allow fast and affordable screenings for optimal conditions, because of high consumption of expensive growth factors and media additives. Therefore, the HYPERLAB consortium aims at improving protocols by adapting microfluidics-based cell cultivation technologies to the specific needs of stem cells [2]. Mainly miniaturisation and parallelisation will enable a rapid, cost efficient, and precise screening by using a *pipette robot*, a *modified hanging droplet approach*, and a medium throughput system based on segmented flow, the *pipe based bioreactors*-system. These techniques enable the analysis of a multitude of test conditions with a parallel reduction of the necessary cell material [3]. After analysing the physicochemical changes in miniaturised compartments, we show that an automated medium exchange using a *pipette robot* has no effects on H1 and MSCs by observing the cells with a live cell imaging system. As cells showed very good viability and proliferation without increased differentiation, this setup can be used for screenings of growth and differentiation factors.

We also demonstrate in this work, that with the *pipe based bioreactors*, cells can be cultivated, transported and observed in small medium volumes, so the screening of many conditions in parallel is possible. For this, culture of various stem cell types on microcarrier was established and cultivation in separated medium compartments was analysed in terms of viability, proliferation, and pluripotency.

The *modified hanging droplet technology*, based on electrowetting or in combination with a *pipette robot*, will enable manipulation of cells, concentrated in droplets of medium. For this innovative approach, we established the hardware and adapted protocols for the use of hanging droplets.

[1] Lerou P.H., Daley G.Q. (2005). Therapeutic potential of embryonic stem cells. *Blood Rev*. **19**(6): 321-331.
[2] www.hyperlab.eu
[3] El-Ali J., Sorger P.K., Jensen K.F. (2006). "Cells on chips." *Nature* 442(7101): 403-11