560a Microbioreactor Array for Controlled Differentiation of Human Embryonic Stem

Nicola Elvassore, Sharon Gerecht-Nir, Christopher Cannizzaro, Robert Langer, Gordana Vunjak-Novakovic, and Elisa Figallo

Human embryonic stem cells (hESCs) possess enormous potential for functional tissue engineering and regenerative medicine. However, their therapeutic use will require a means to accurately differentiate them in vitro, i.e., by controlling the microenvironment surrounding the cells. Due to the complexity of parameters that affect hESC differentiation, high throughput experiments are needed to investigate and optimize the interaction of soluble factors and extracellular matrices for specific tissue development.

In this work, we have developed a platform consisting of an array of independent microbioreactors fabricated using soft lithography. Each microbioreactor was designed to ensure long-term steady-state culture conditions in terms of hydrodynamic and mass transport properties. Factorial experiment design was used for quantitative screening of conditions and to highlight interactions between soluble factors and adhesion molecules. The mesodermal differentiation of hESCs with angiogenic potential was investigated by specific gene (RT-PCR) and protein expression.