

MICROFLUIDIC TOOLS AND HIGH-CONTENT IMAGING FOR CELL THERAPY BIOPROCESSING

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Culture parameters including type of matrix, feeding regimes and media formulations have to be fine-tuned in order to obtain the desired cell quality attributes that will be the basis of large scale bioprocess development. Costly and time consuming screenings, usually performed in multi-well plates, are undertaken to obtain preliminary results. In contrast, microfluidics offers the possibility to perform studies of different parameters in an integrated manner, with high-throughput analysis, lower consumption of reagents and reduction in time. This approach has the possibility to unveil valuable information in early stages of process development that can reduce the risks associated with scale-up.

In one working example, a range of process parameters were screened for the development of a microcarrier-based cell culture of a commercial cell line. Two different media flow rates and four different microcarrier substrates were assessed for their capacity to sustain cell growth and known markers of different stages of cell differentiation. It was possible to define combinations of parameters that yield very distinct outcomes in terms of cell number and identity.

In a second working example, modular production of bone-like tissue using mesenchymal stem cells, different implantable biomaterial scaffolds and different culture media feeds was assessed. In situ analysis identified optimal combinations of parameters that maintained multipotency in Mesenchymal Stem Cells (MSCs) and also combinations that promote MSCs maturation. Scaling up to 125 mL cultures enabled the production of large clusters of bone-like material.