Laser bioprinting using BA-LIFT: from single cell to tissue engineering

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Laser bioprinting techniques are appearing as an ideal tool for cell printing due to their outstanding cell viability (near 100 %) and high spatial resolution (in the micrometer range). In this paper we discuss different applications of a particular adaptation, made at Laser Center UPM, of the Blister-Actuated Laser Induced Forward Transfer (BA-LIFT) technique [1] for cell printing. In our case we use a thick polyimide layer for blister generation to protect the cells from the incomimg laser beam. Due to the transparency of this material in the VIS range we can implement both fluorescence and conventional vision systems coaxially with the laser path in order to identify the cells to be transferred, opening up the possibility of cell sorting [2]. We discuss some current applications of the technique developed at our lab, from single cell isolation to applications in tissue engineering. In addition we present lateral images of the transfer process obtained with a high speed vision camera in order to discus the dynamics of the jet generation and cell deposition mechanisms in the acceptor substrate.

References

[1] M. Brown et al. J. of Appl. Phys. 107 (2010) 083103-083103. doi:10.1063/1.3327432.
[2] A Marquez et al 2020 Biofabrication 12 025019

Figures

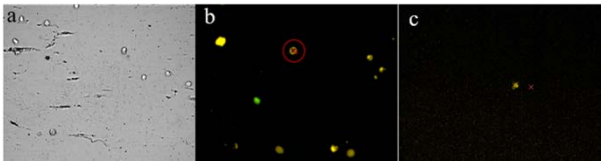

Figure 1: (a) Donor layer bright field image showing mixed cells (b) Donor layer fluorescence image showing mixed cells, Jurkat cells (α-CD45/PE) are shown in yellow and C1R-N1-85 are shown in green. (c) Acceptor layer fluorescence image showing a Jurkat cell (α-CD45/PE) after isolation process

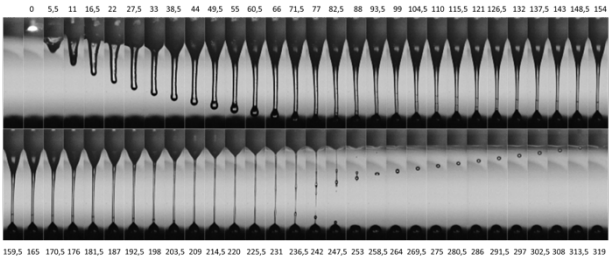

Figure 2: Complete sequence of jet formation an cells transfer. Frames are shown every 5.5 µs.