Machine-vision based optofluidic cell sorting.

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Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

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Abstract
In contemporary life science there is an increasing emphasis on sorting rare disease-indicating cells within small dilute quantities such as in the confines of optofluidic lab-on-chip devices. Our approach to this is based on the use of optical forces to isolate red blood cells detected by advanced machine vision[1]. This approach is gentler, less invasive and more economical compared to conventional FACS-systems. As cells are less responsive to plastic or glass objects commonly used in the optical manipulation literature[2], and since laser safety would be an issue in clinical use, we develop efficient approaches in utilizing lasers and light modulation devices. The Generalized Phase Contrast (GPC) method[3-9] that can be used for efficiently illuminating spatial light modulators[10] or creating well-defined contiguous optical traps[11] is supplemented by diffractive techniques capable of integrating the available light and creating 2D or 3D beam distributions aimed at the positions of the detected cells. Furthermore, the beam shaping freedom provided by GPC can allow optimizations in the beam's propagation and its interaction with the laser catapulted and sorted cells.

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