MICROFLUIDIC SYSTEM FOR SINGLE CELL SORTING BASED ON DEFLECTION BY OPTICAL TWEEZERS

Thomas Bruns¹*, Laszlo Becsi², Ulrich Mescheder², and Herbert Schneckenburger¹

¹Hochschule Aalen, Institut für Angewandte Forschung, Beethovenstr. 1, 73430 Aalen, Germany
²Hochschule Furtwangen, Institut für Angewandte Forschung, Robert-Gerwig-Platz 1, 78120 Furtwangen, Germany

*Corresponding author; e-mail: thomas.bruns@htw-aalen.de

KEY WORDS: microfluidic system, optical tweezers, cell sorting, light dose, cell viability

ABSTRACT

Since the early 1970s laser-based, gradient-force optical traps, also known as optical tweezers, permitted a wide range of applications [1-2]. Use of an appropriate microscope provides the possibility to observe, move and manipulate small objects like spheroids or cells [3]. Presently optical tweezers are combined with a microfluidic system to select single cells from a liquid stream for measurements in molecular biology (e.g. polymerase chain reaction, PCR). The channel structure of the microfluidic system has Y-shape geometry and is embedded into a silicone layer (see Figure 1). For sealing and tubular coupling this layer is attached to a PMMA chip. Vital cells within the flow entering the intersection region from the single channel (1) follow the main flow into the exiting channel (2). Within the intersection region the cells are scanned and examined using adequate sorting criteria (e.g. fluorescence excited via a lateral fibre). Specific cells fulfilling these criteria, are deflected from the main flow by the optical tweezers into the purging channel (3). A single fixed position for the focus of the tweezers is sufficient for this deflection. With this arrangement light dose and irradiation time of the cells can be kept comparably low. Furthermore, the sorted cells will be in their own tubular flow which permits direct continuous measurements.

SELECTED REFERENCES


Figure 1: Setup of the microfluidic chamber consistent of a silicone layer with its channel structure of Y-shape geometry and a PMMA-chip with tubular coupling (left) and the principle of operation at the intersection region in detail (right).