Microfluidic patterning of proteins and cells using capillary lithography

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The control of surface properties and spatial presentation of functional molecules such as proteins and cells within a microfluidic channel is important for the development of diagnostic assays, microreactors, and for performing fundamental studies of cell biology and fluid mechanics. Here, we present a number of soft lithographic methods to create robust microchannels with precise control over the spatial properties of the substrate. In this approach, the patterned regions were protected from oxygen plasma by controlling the dimensions of the poly(dimethylsiloxane) (PDMS) mold as well as the sequence of fabrication steps. The approach was used to pattern a non-biofouling polyethylene glycol (PEG)-based copolymer or the polysaccharide hyaluronic acid (HA) within microfluidic channels. These non-biofouling patterns were then used to fabricate arrays of fibronectin (FN) and bovine serum albumin (BSA) as well as mammalian cells. In addition, further control over the deposition of multiple proteins onto multiple or individual patterns was achieved using laminar flow. Also, cells that were patterned within channels remained viable and capable of performing intracellular reactions and could be potentially lysed for analysis.