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A novel tool for *in vitro* correlation of cell adhesion behavior and local shear flow

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Studying cell adhesion behavior is crucial not only for scientific interests, but also for development of implant materials in medical engineering. Therefore, we examine adhesion phenomena of different cell-substrate combinations to thoroughly determine specific properties like adhesion strength, regarding both kinetics and magnitude. Here, we present a miniaturized ($\sim$ 100 μl) lab-on-a-chip system which allows to quantify cell de-adhesion under dynamic flow conditions of physiological relevance (1). Using an improved technique of shear flow measurements, so called scanning Particle Image Velocimetry (sPIV) in combination with acoustic streaming experiments on adherent cells, we are able to time resolved correlate cell de-adhesion and local shear rates, ranging from 0–8000 s^{-1}, within one ensemble of identically cultured and treated cells. We combine the functionality of the software PIVDAC (Particle Image Velocimetry De-Adhesion Correlation) with a thermodynamic rate model to describe the process of adhesion and de-adhesion. In turn, ongoing studies combine these results with numerical simulations to extract cell-substrate-specific properties like a dynamic adhesion strength.
References: (1) Hartmann, A., M. Stamp, R. Kmeth, S. Buchegger, B. Stritzker, et al. 2014. A novel tool for dynamic cell adhesion studies–the De-Adhesion Number Investigator DANI. Lab Chip. 14: 542–6.