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Simulation study of affinity-based cell sorting on switchable microstructured surfaces

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Affinity-based cell sorting on microstructured substrates offers a label-free route for separating heterogeneous cell populations based on differences in cell-surface interactions. In such systems, the efficiency of separation is controlled by the spatial distribution of adhesive regions together with the possibility of externally induced switching between adsorbing and desorbing surface states. This makes it possible to design multistage sorting protocols in which cell attachment and detachment are regulated in time. In this talk, I will present a computer simulation study of cell sorting on dynamic microstructured adhesive surfaces represented by a disordered array of circular adhesive domains. The interdomain regions are associated with a thermoresponsive polymer layer that induces a repulsive interaction facilitating cell detachment. Special attention is paid to the role of adhesive domain size at fixed surface coverage and to its influence on separation during successive adsorption-desorption steps. Different regimes of surface switching are considered in order to examine how dynamic control of surface properties can improve sorting performance. The results help to clarify how the combination of surface microstructure and switching protocol affects the efficiency of label-free cell separation.

Reference:
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Dynamic Microstructured Thermoresponsive Interfaces for Label-Free Cell Sorting Based on Nonspecific Interactions, ACS Applied Materials & Interfaces, 17 (2025): 49193-49209.

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