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Automated single cell arrays based on magnetophoretic circuits

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Single-Cell Array (SCA) systems are emerging tools in medical research with applications in cancer therapy, immunology and in studying cellular heterogeneity. However, existing SCAs are neither sufficiently large nor automated to enable the study of rare cell behaviors and cell-cell interactions. In order to achieve these goals, we developed a novel SCA composed of magnetophoretic integrated circuit elements to manipulate and store single living cells, in analogous to Random Access Memories (RAM), which store electrons (data) in computer systems. These integrated circuits are based on overlaid magnetic and metallic patterns fabricated on silicon or glass substrates, coated by non-fouling PEOGMA layer. The driving force for transporting magnetically labeled cells to desired locations on the chip is provided by a rotating magnetic field, which shifts the local minima of the potential energy landscape along controlled directions, dragging the magnetically labeled cells along desired paths. The new platform allows us to build significantly larger cell-based RAMs, capable of organizing>10,000 single-cells with operation times of less than an hour. We have the ability to store single-cells or cell pairs on specific storage sites and perform phenotypic study, over time. Moreover, we can selectively release them for follow-on transcriptomics analyses.

Biography

Roozbeh Abedini-Nassabis is a PhD student at Duke University. His recent works are published in high impact journals such as *Nature Communications, Advanced Materials* and *Advanced Functional Materials.*

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