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Multiplexing nano-electroporation for simultaneous transfection of multiple cells M. HOWDYSHELL, G. VIEIRA, D. GALLEGO-PEREZ, X. ZHAO, L. J. LEE, R. SOORYAKUMAR, The Ohio State University — Transfection of biomolecules into cells via electrophoresis across nanochannels, or nano-electroporation, is a recently developed technique shown to deliver precisely controlled dosages with low cell mortality rates. Such advantages are due to the nanochannels used for transfection, which distinguish this technique from bulk and micro-electroporation. Recent demonstrations of nano-electroporation rely on optical tweezers for cell localization, which restrict throughput to sequential electroporation of one cell at a time. In the current work, we overcome this drawback by advancing a multiplexed approach that integrates the nano-channel device with an array of magnetic traps remotely controlled by external magnetic fields. This setup enables multiple magnetically labeled cells to be manipulated in parallel, allowing for simultaneous electroporation of many cells with precisely controlled dosages. After transfection, the cells can be moved downstream for further analysis. Such a magnetically-actuated, remotely-controlled approach for loading of cells and subsequent removal of transfected cells has the potential to transform the current device into an automated platform for simultaneous dosage-controlled biomolecule delivery to large numbers of individual cells.

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