

### Droplet-based Microfluidic System for Spheroid Formation and Cell Sorting Using Magnetic Nanoparticles

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Importance of creating a three-dimensional multicellular spheroid has recently been gaining attention due to the limitation of monolayer cell culture in precisely mimicking in vivo structure and cellular interactions. Due to this emerging interest, researchers have utilized new tools, such as microfluidic devices, that allow high-throughput and precise size control to produce multicellular spheroids. We have developed a droplet-based microfluidic system that integrates magnetic nanoparticles for spheroid separation and patterning. Gelated alginate beads entrapped cells and magnetic nanoparticles, thereby forming magnetic spheroids. These magnetic spheroids were then flown through parallel streamlines of oil and culture media, where the spheroids were directly collected into the media by magnetic separation. This method eliminated the extra step of collecting the spheroids from the oil buffer and transferring them to culture media by hand. Furthermore, by embedding magnetic property within the alginate beads, this property may possibly be used for spheroid sorting and patterning.