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Learning from the Jersey Turnpike: Cell Lysis, Labeling and Washing with Microfluidic Metamaterials

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Directing objects across functional streamlines at low Reynolds number is difficult but important since this motion can be used to label, lyse, and analyze complex biological objects on-chip without cross-contamination. Here we use an asymmeteric post array to move cells across coflowing reagents and show on-chip, immunofluorescent labeling of platelets with washing and *E.Coli* cell lysis with simultaneous separation of bacterial chromosome from the cell contents. Furthermore, we develop the concept of a microfluidic metamaterial by using the basic asymmetric post array as a building block for complex particle handling modes. These modular array elements could be of great use for developing robust techniques for on-chip, continuous flow manipulation and analysis of cells, large bio-particles, and functional beads.