Bio-optofluidics and biophotonics at the cellular level

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We present ongoing research and development activities for constructing a compact next generation BioPhotonics Workstation and a Bio-optofluidic Cell Sorter (cell-BOCS) for all-optical micro-manipulation platforms utilizing low numerical aperture beam geometries. Unlike conventional high NA optical tweezers, the BioPhotonics workstation is e.g. capable of long range 3D manipulation. This enables a variety of biological studies such as manipulation of intricate microfabricated assemblies or for automated and parallel optofluidic cell sorting. To further reduce its overhead, we propose ways of making the BioPhotonics Workstation platform more photon efficient by studying the 3D distribution of the counter propagating beams and utilizing the Generalized Phase Contrast (GPC) method for illuminating the applied spatial light modulators. Moving ahead, we envision optimal designs for the manipulated microstructures through the use of advanced topology optimization.

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