

A MICRO-PERFUSION CHAMBER TO FINE-TUNE THE ACTIVITY OF MOTOR PROTEINS

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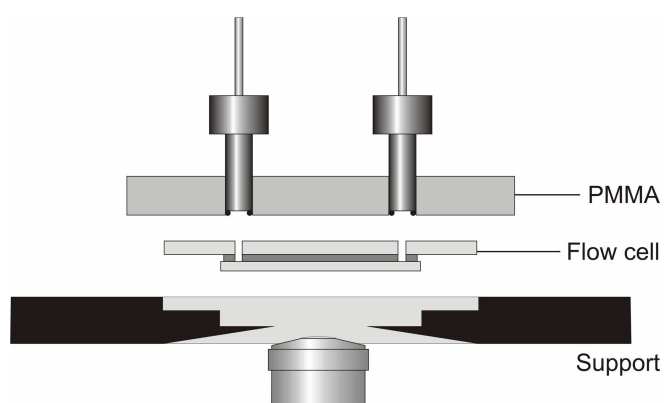
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We report on a versatile computer-controlled microfluidic perfusion system applicable to fluorescence microscopy. Key features of the system are: (i) low chamber and dead volumes, (ii) a removable cover that can be coated by biomolecules or cells, (iii) easy connection to external syringe pumps via standard fittings, and (iv) computer control of all pumps and valves, allowing fully automated operation. The channels are fabricated either as a glass-polymer-glass or PDMS-glass sandwich. Hydrogel microvalves allow the rapid starting and stopping of biochemical reactions in the flowthrough chamber.

The system was used to study the interaction of motor proteins with cytoskeletal filaments. Kinesin molecules were adsorbed onto the coverslip surface and their enzymatic activity was monitored by the migration of fluorescently labeled microtubules on the glass surface. We have enhanced this assay by attaching DNA molecules to the microtubules and used the directed movement of the microtubules (e.g., by applying hydrodynamic force fields or by adding either ATP or non-hydrolyzable ATP analogs) for the generation of DNA nanostructures in order to set up DNA nanoelectrical networks [1].



Its flexible design and expandability (i.e., the already realized integration of fiber optics and electronics) in an easy though accurate way make the perfusion cell an ideal microscopy add-on, especially for cellular assays, biomolecular interaction studies (e.g., to screen drugs or cancer cells via live video imaging), or nanostructuring with only tiny amounts of material.

[1] S. Diez, C. Reuther, C. Dinu, R. Seidel, M. Mertig, W. Pompe, and J. Howard, "Stretching and transporting DNA molecules using motor proteins", *Nano Lett.*, **3**, 1251-1254 (2003).