Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information:

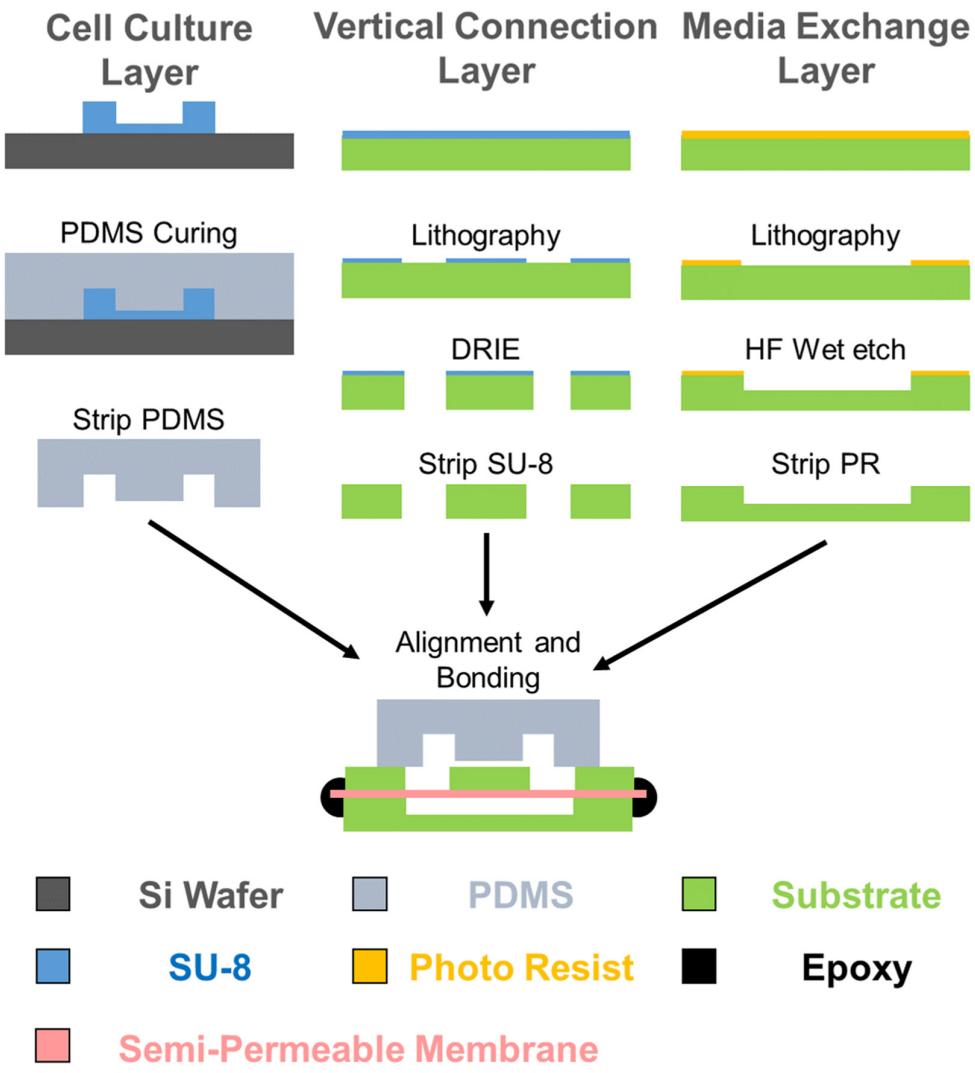

Fig. S1. Fabrication process. Three layers, cell culture layer, substrate layer with vertical connections, and the media exchange layer, were fabricated respectively, and all three layers were aligned and bonded. For the cell culture layer, three masks were used to fabricate a SU8 master mold. The PDMS layer was fabricated by the standard soft lithography processes. For vertical connections in the fused silica substrate, a thick SU-8 layer of 50μm in thickness was spin-coated and patterned as a mask for DRIE. The fused silica was etched through by DRIE, and the residual SU-8 was removed by PG Remover. The media exchange channel was formed by HF etching of a glass substrate. The media exchange layer has many pillars to support the semi-permeable membrane on top. The PDMS channel layer and the vertical connection layer were treated by oxygen plasma, aligned, and bonded together. Finally, the bonded PDMS-fused silica, the semi-permeable membrane and the media exchange layer were all assembled and sealed by UV cured Epoxy.

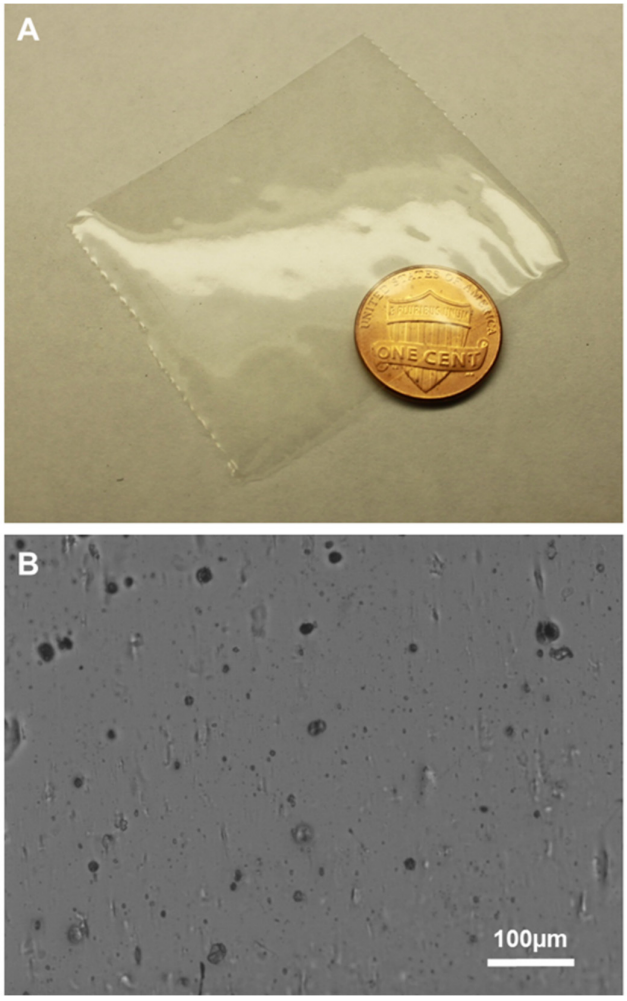

Fig. S2. The semi-permeable membrane used for nutrition exchange: (A) photo and (B) microphotograph.

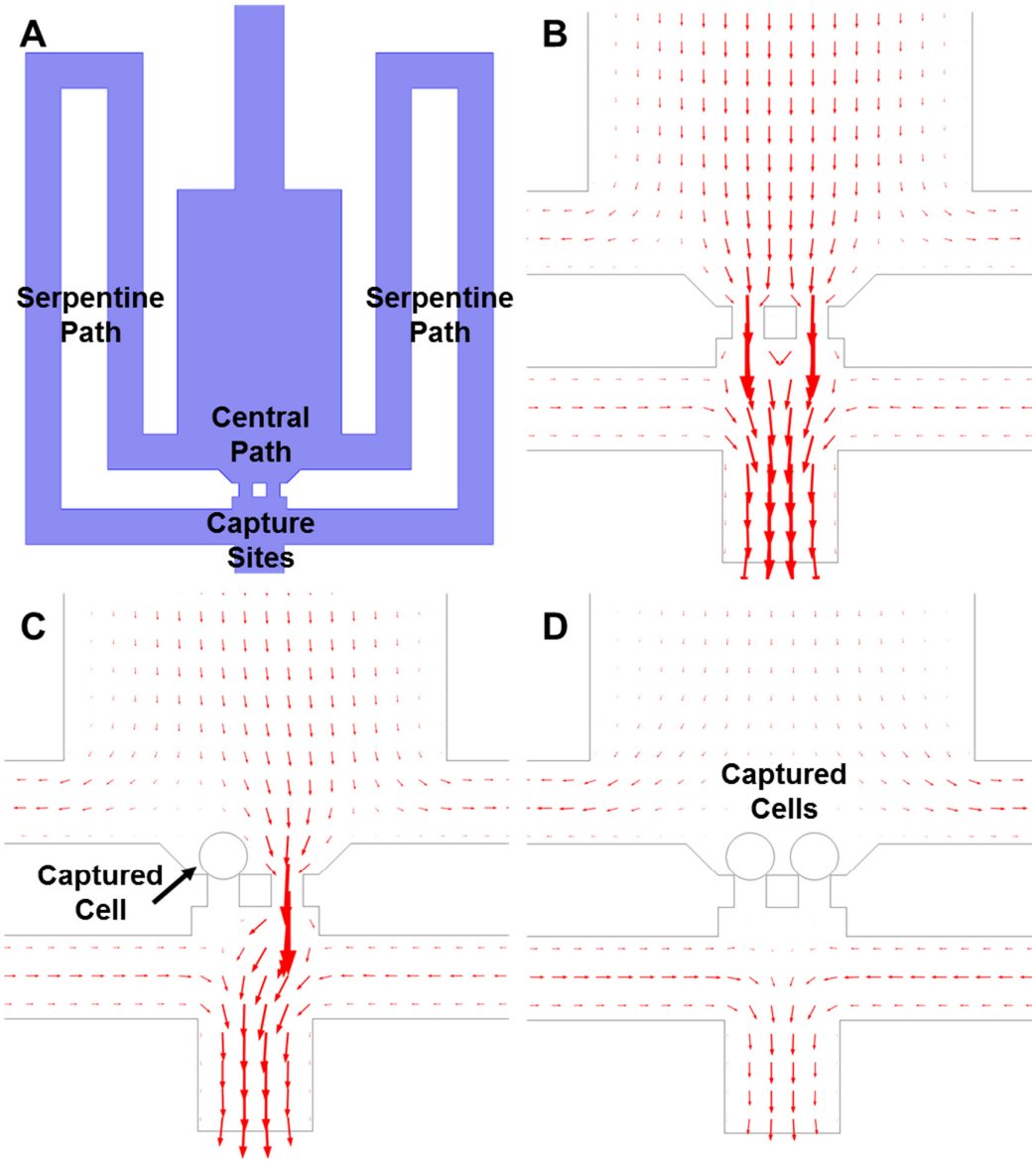

Fig. S3. Simulations of flow velocity and pressure during cell capture in a chamber by COMSOL 4.3: (A) schematics of cell capture scheme showing two capture sites, a central path, and two serpentine paths, (B) The simulated flow pattern before cell capture. The red arrows indicating flow direction and velocity suggest that the cells are likely to be guided to the capture sites and get captured by either of capture sites. (C) After one capture site is taken, the next cell is guided and captured in the other capture site. (D) Once both capture sites are taken, the flow resistance through the central path becomes higher than that of serpentine paths, so the next coming cells will flow through the serpentine paths to the downstream.

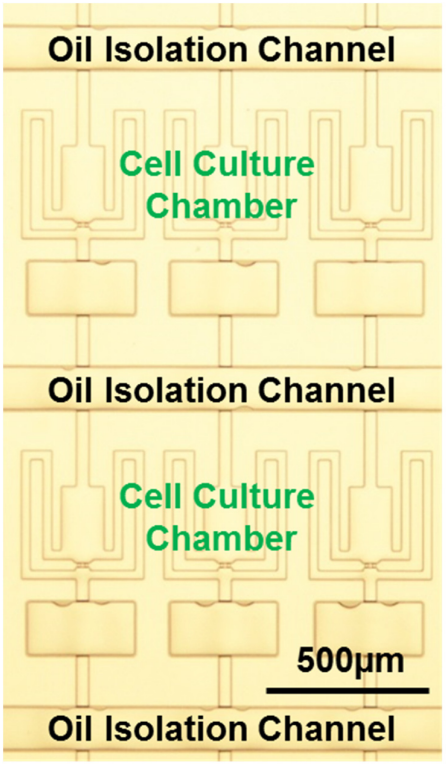

Fig. S4. Fabricated device. The cell culture chambers are separated and isolated by oil channels for cell-cell interaction.