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

Continuous inertial microparticle and blood cell separation in straight channels with local microstructures

by

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Supplemental Figures

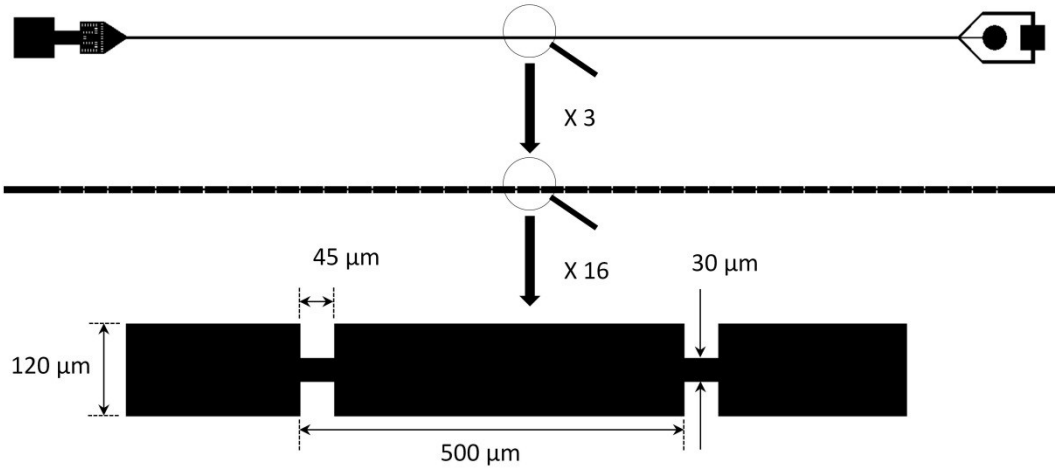

Figure S1. A CAD layout of the inertial particle and cell sorter. The device consists of three sections: (1) A straight rectangular channel (a length of 2.5 cm), (2) A channel with 40 symmetrically positioned square microstructures (a total length of 2 cm), and (3) A straight rectangular channel with a trifurcating outlet (a length of 0.5 cm). The channel height of 21 µm is maintained.

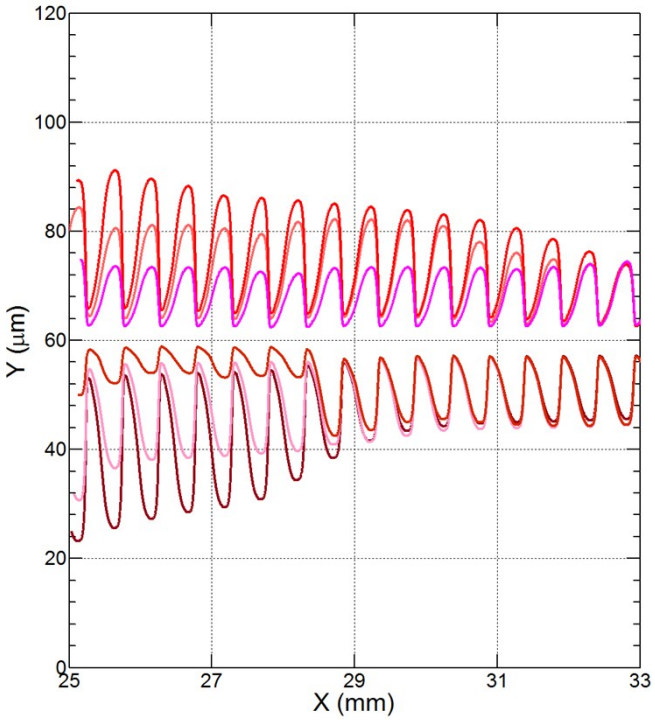

Figure S2. Six 5.5 μm polystyrene particle trajectories. Based on particle initial position and particle-particle interaction, particles initially exhibit different trajectories though later they show similar stable motions by the secondary flows from microstructures.

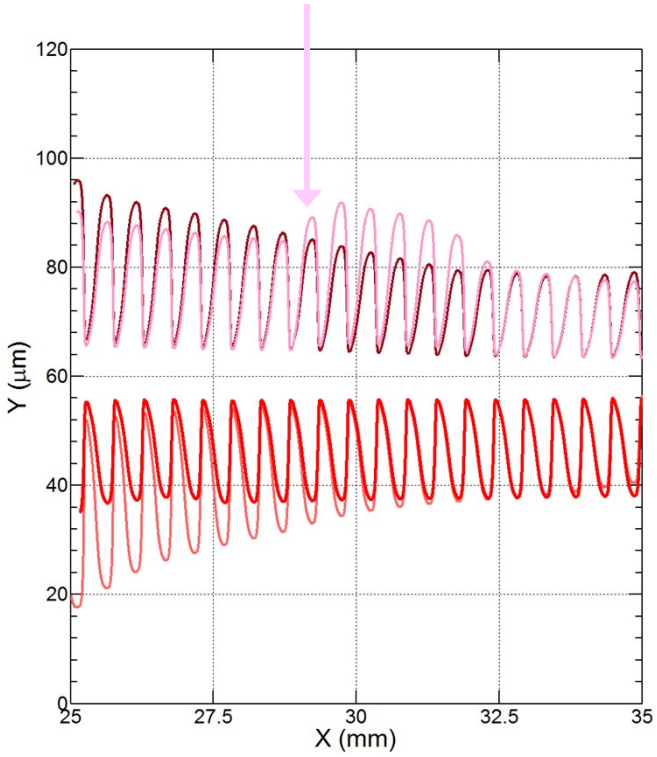

Figure S3. Four 5.5 µm polystyrene particle trajectories. Due to the particle crosstalk near X ≈ 29 mm, a particle trajectory (pink) is modified but later it stabilizes back.

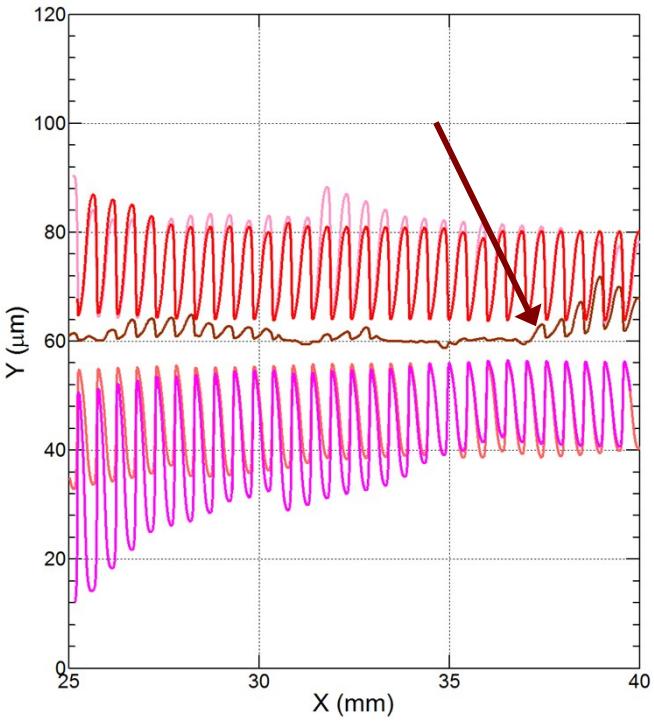

Figure S4. Favourable particle-particle interaction. A particle positioned initially in the channel centre could escape with an assist of the particle-particle interaction (X ≈ 37.5 mm).

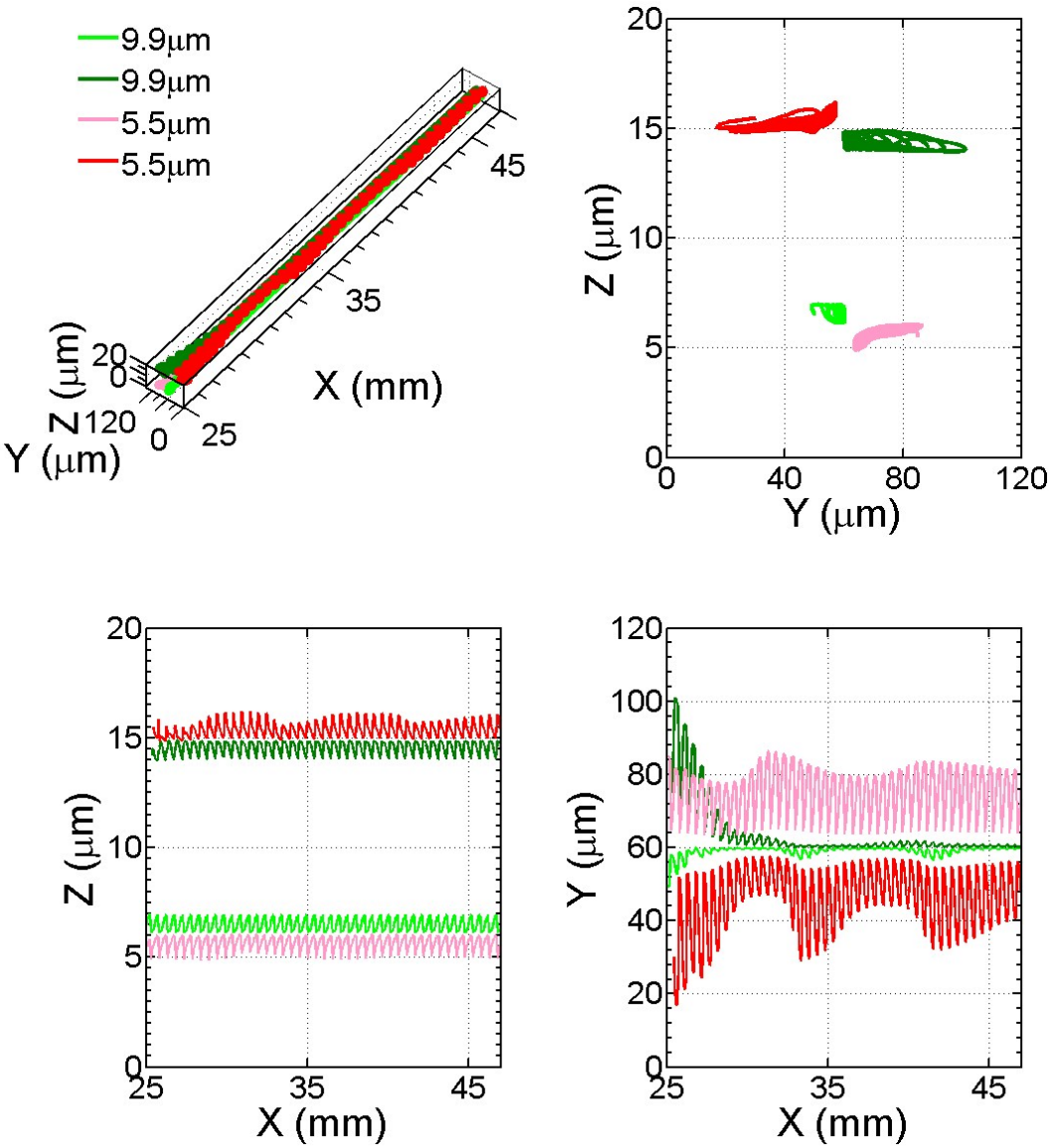

Figure S5. Microparticle migrations of a mixed sample (two 9.9 and two 5.5 μm polystyrene microspheres) for a longer range.

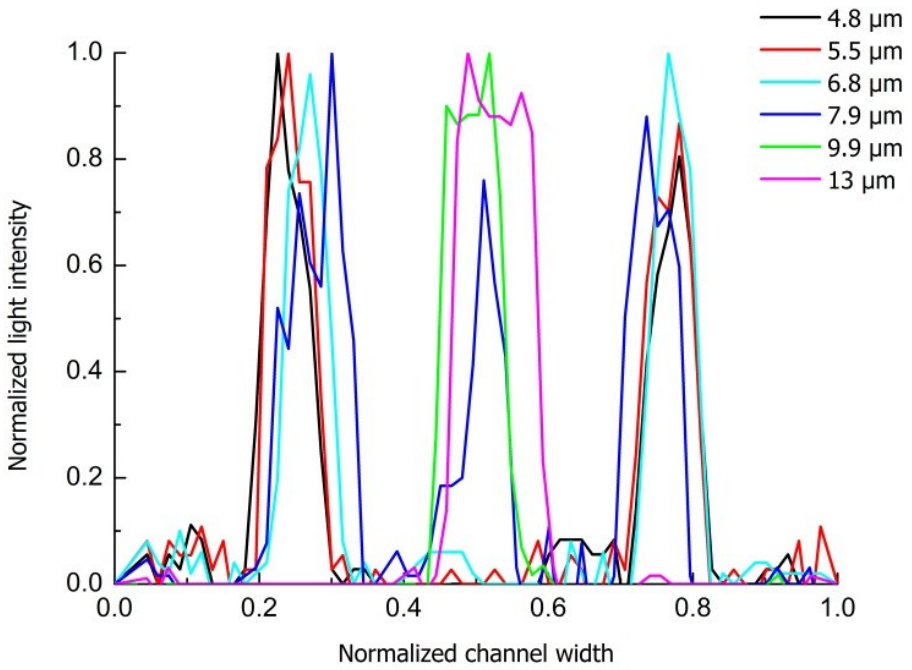

Figure S6. A normalized light intensity plot of particle distribution as a function of different particle sizes with a fixed Reynolds number of 35.5. All lines are generated from 2000 image stacks.

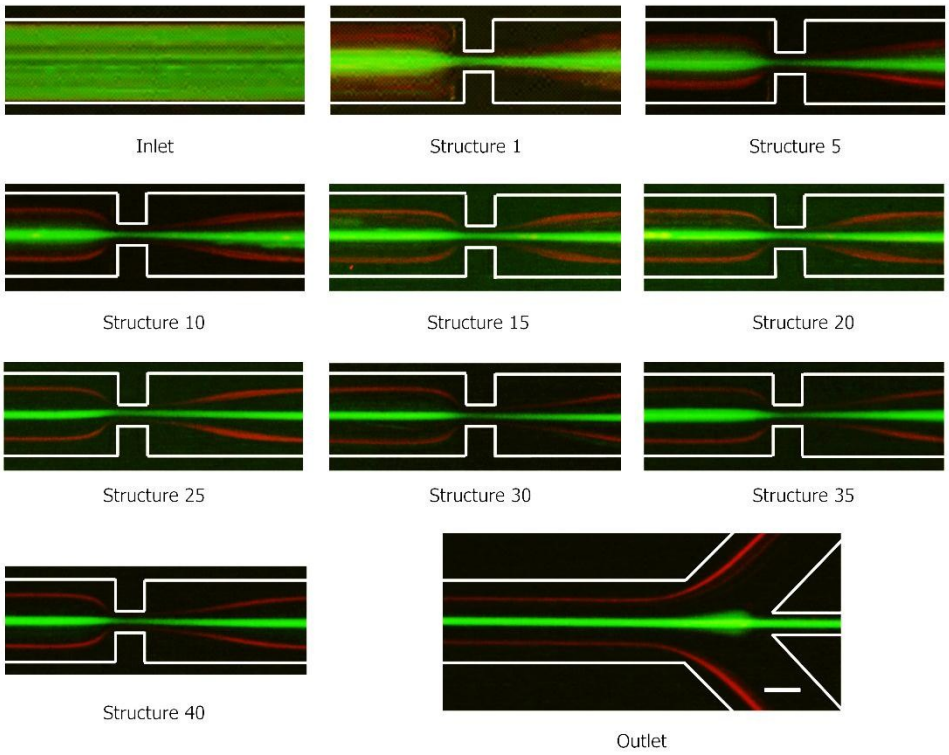

Figure S7. Fluorescent images from top-view as particles flow downstream. A mixture of 5.5 µm (red) and 9.9 µm (green) particles is clearly separated. Scale bar represents 50 µm.

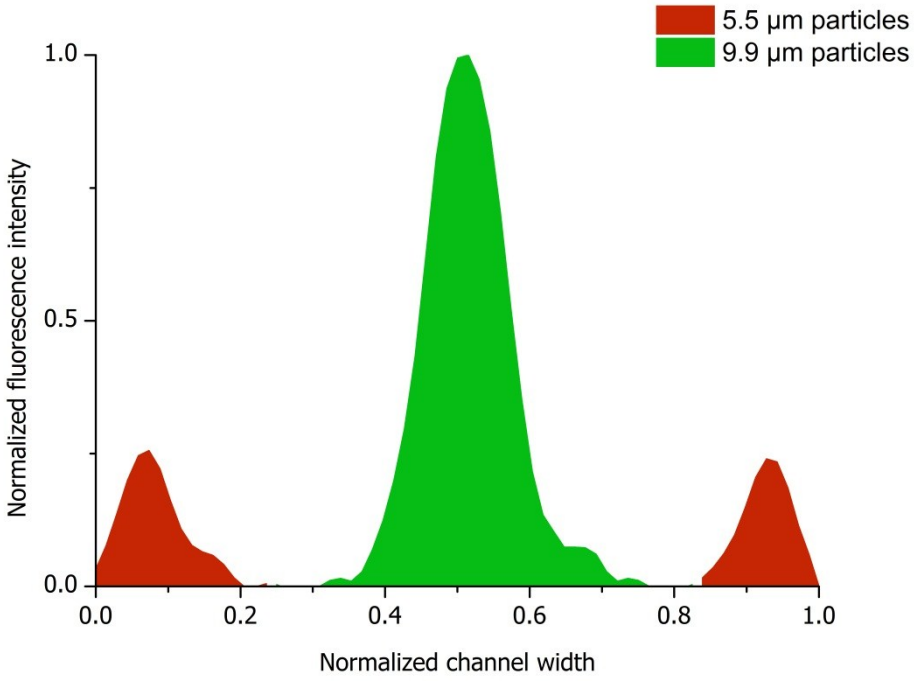

Figure S8. A normalized fluorescence intensity plot of Fig. S7 near the outlet.

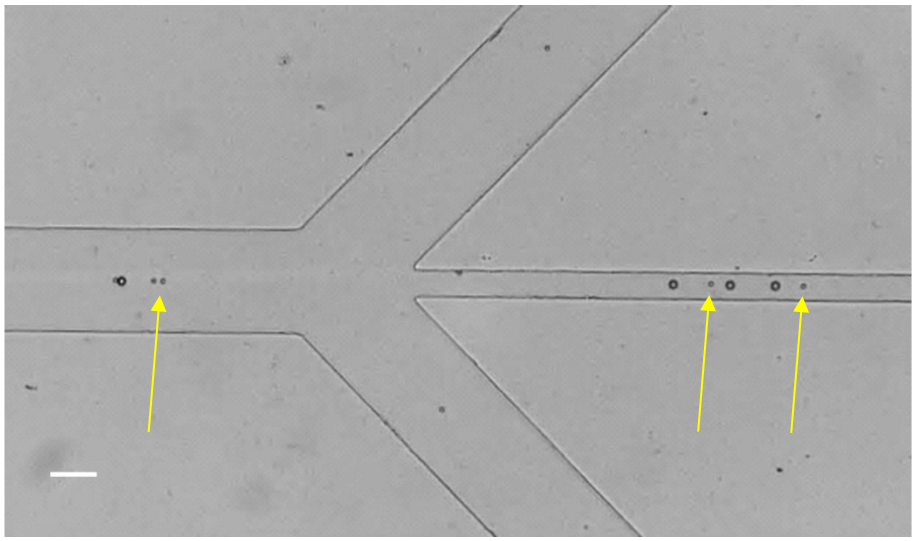

Figure S9. High microsphere concentration test. Due to the undesirable particle-particle interactions at higher particle concentrations, small particles were migrated to the channel centre. Scale bar represents 50 µm.

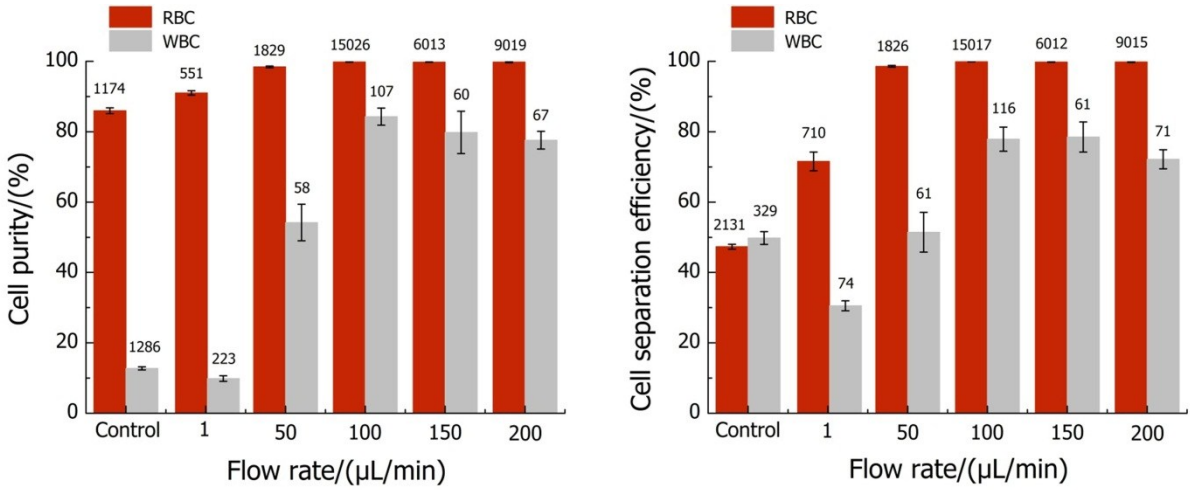

Figure S10. Purity and separation efficiency of RBCs and WBCs of 0.5% diluted human blood at various flow conditions.

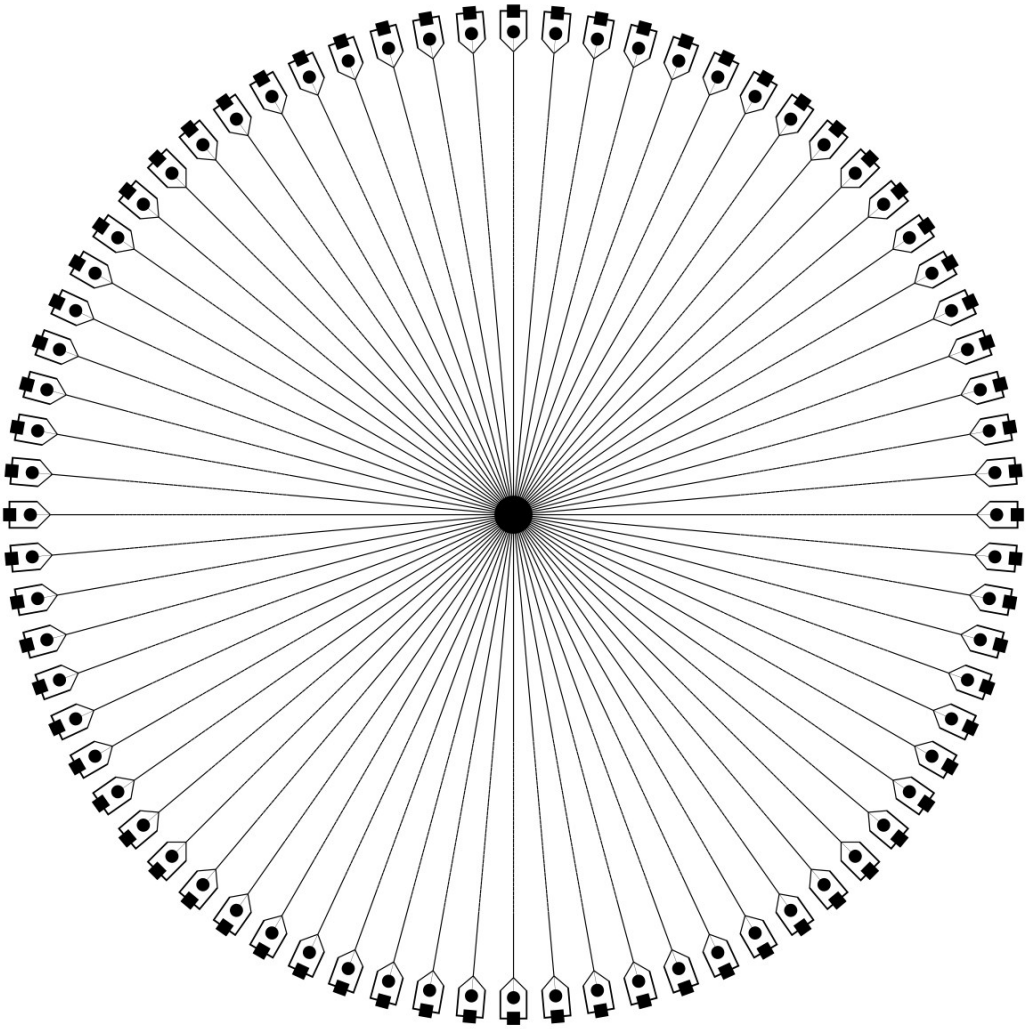

Figure S11. Illustration of a paralleled device with 72 individual channels radially arrayed with a single inlet and two ring outlets. It is expected that we can separate RBCs and WBCs with a throughput of 10.8 mL/min for 0.25% diluted blood.

Supporting Movie Captions

Supplemental Movie S1. **Separation of a microsphere mixture.** A video demonstrating 5.5 µm (0.001% w/w) and 9.9 µm (0.01% w/w) microparticle separation. Test was operated at a flow rate of 150 µL/min.

Supplemental Movie S2. **Single-size particle migrations of four 9.9 µm polystyrene microspheres.** A lattice-Boltzmann method based numerical prediction of large particle behaviours at *Re* = 35.5.

Supplemental Movie S3. **Single-size particle migrations of four 5.5 µm polystyrene microspheres.** A lattice-Boltzmann method based numerical prediction of small particle behaviours at *Re* = 35.5.

Supplemental Movie S4. **Single-size particle migrations of a mixed sample (two 9.9 µm and two 5.5 µm polystyrene microspheres).** A lattice-Boltzmann method based numerical prediction of mixed-sized particle behaviours at *Re* = 35.5.

Supplemental Movie S5. **Separation of RBCs and WBCs from 0.5% diluted human blood.** A video exhibiting RBC and WBC separation. Test was operated at a flow rate of 150 µL/min.