Red blood cell phase separation in symmetric and asymmetric microchannel networks: effect of capillary dilation and inflow velocity

Francesco Clavica[1], Alexandra Homsy[2], Laure Jeandupeux[2], Dominik Obrist[1]

[1]ARTORG Center, University of Bern, Bern, Switzerland

[2]Haute Ecole Arc Ingénierie, HES-SO University of Applied Sciences Western Switzerland, La Chaux-de-Fonds, Switzerland

Supplementary information

Table S1: detailed parameters used for the PTVlab algorithm.

PTV settings	Particle detection
PTV algorithm = Cross correlation/ Interrogation window.	Detection algorithm = Gaussian mask
Interrogation area = 20 pixels	Correlation Threshold = 0.5
Minimum correlation = 0.4	Sigma = 10 pixels (particle size)
Similarity neighbours = 25 %	Intensity threshold = 200

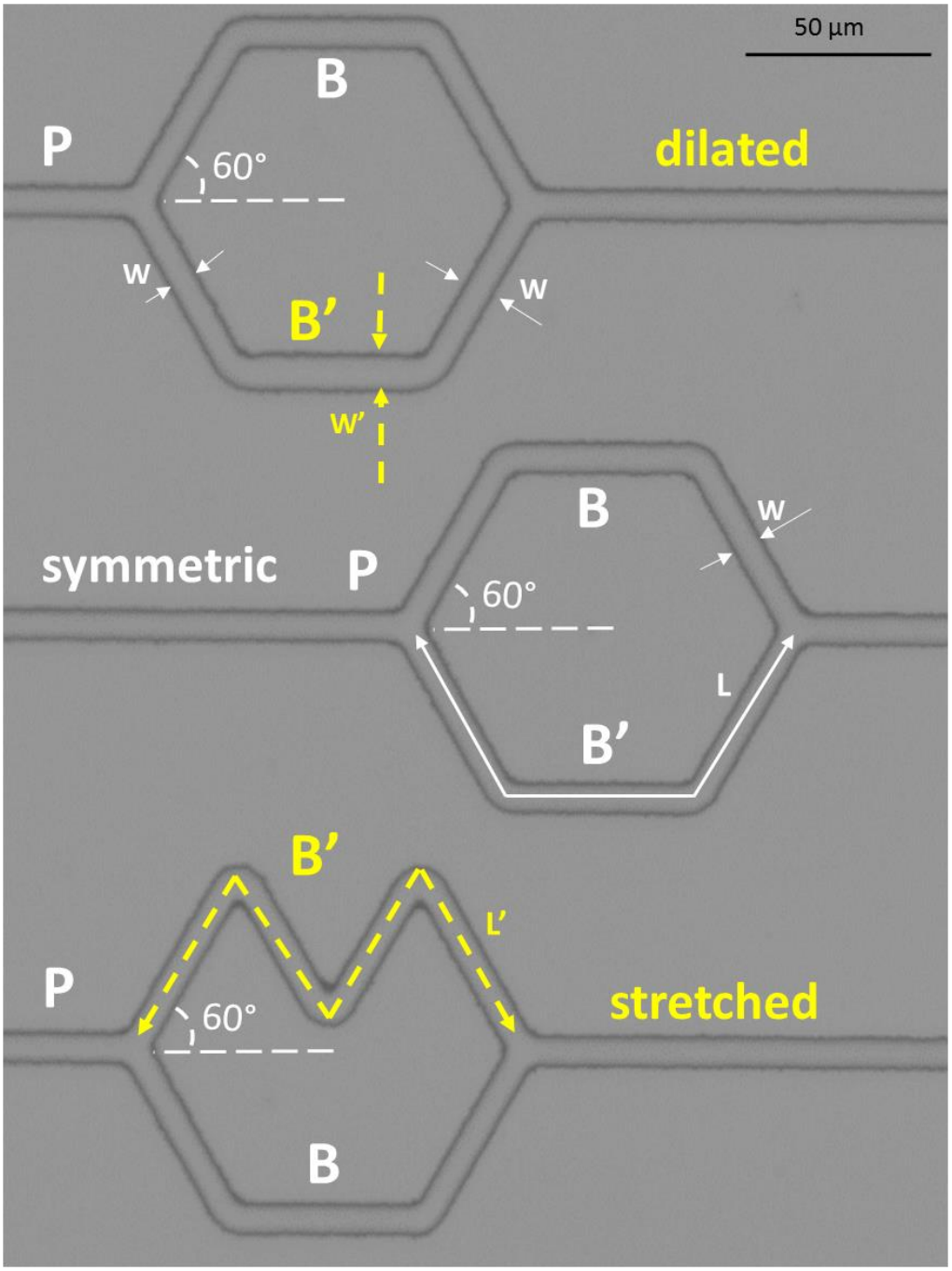
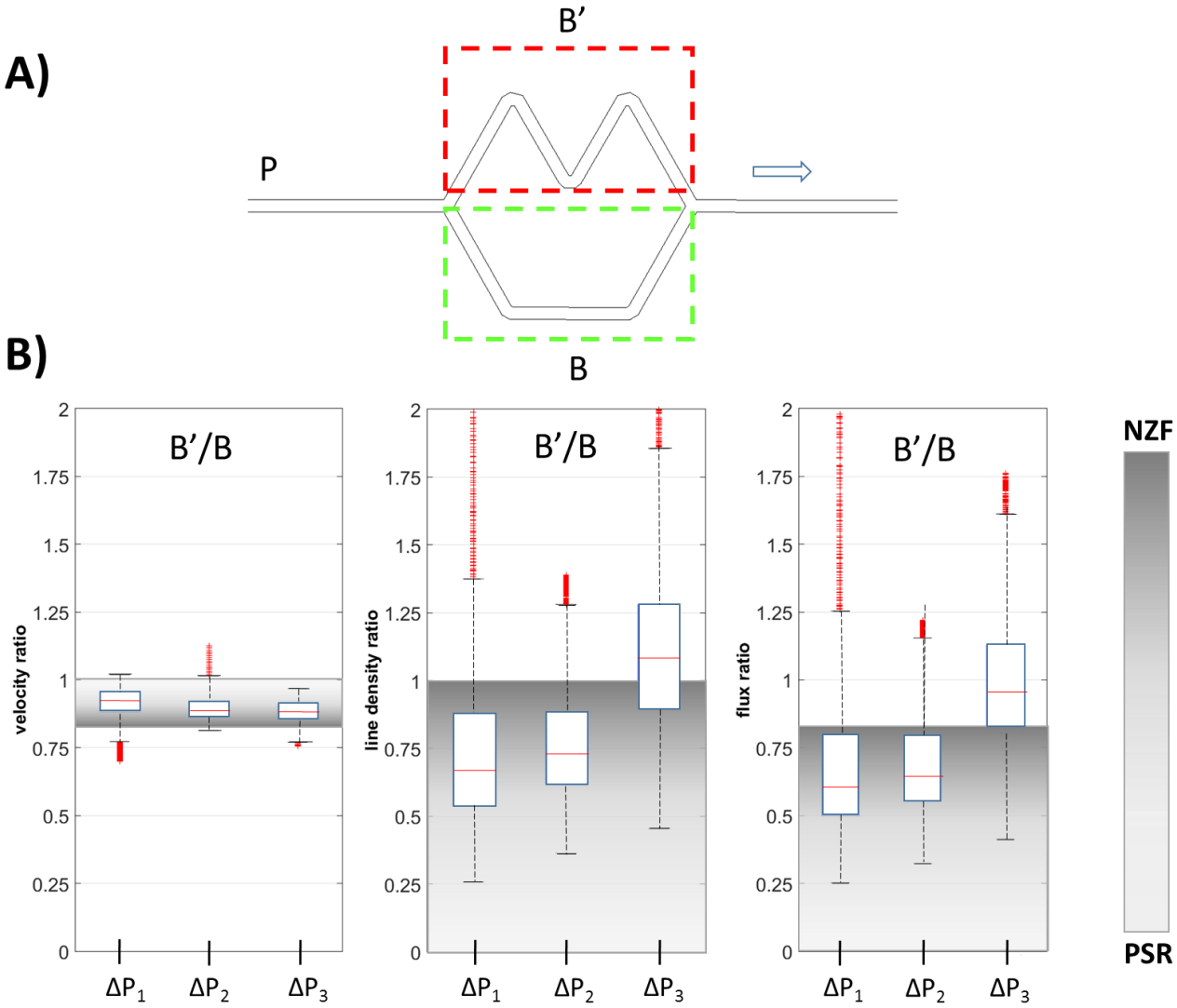


Figure S1. **Experimental setup (hexagonal networks).** Microscope image (10x magnification) of hexagonal networks: three different networks were included in the same microdevice, P denotes the parent vessel, B and B' the daughter branches (the bifurcation angle was 60°). B indicates daughter branches characterized by a total length L= 211.38±0.9µm and width W=10.2±0.3µm (N=5). i) Symmetric model (middle) has identical daughter branches B and B' ii) Dilated model (inset, upper) has one daughter branch B and one modified branch B' which has same length as B but different width W'=12.16±0.1µm >W (in the the horizontal segment) iii) Stretched model (inset, lower) has one daughter branch B and one modified branch B' with the same width as B but with different total length L'=259.32±3.1 µm>L (dashed arrows). All models had a common inlet and separate outlets. The average channel height was H=8.1±0.4 µm in all channels. The parent vessel (P) in all the models had a length of 200µm and same width as B branch.



C)

	U_p (mm/s)	Velocity ratio	Line density ratio	Flux ratio
ΔP_1	0.14	0.92	0.67	0.60
ΔP_2	0.38	0.88	0.73	0.64
ΔP_3	0.76	0.91	1.08	0.95

Fig. S2 Effects of inflow rate on phase separation in stretched model (hexagonal). A) Schematic of the stretched model (hexagonal) with the branch B' longer (ROI: red dashed rectangle) than the B branch (ROI: green dashed rectangle). The arrow indicates the direction of flow. In this experiment three perfusion pressures were used: ΔP_1=2cmH_2O, ΔP_2=5cmH_2O, ΔP_3=10cmH_2O. C) Boxplots of the ratios of RBC velocity, line density and flux of branches B' and B for different perfusion pressures ΔP_i. The shaded areas indicate the range between the no-Zweifach-Fung condition (dark grey, NZF) and perfectly self-regulated situation (light gray, PSR). C) Table of median values of the ratios shown in panel B as function of ΔP. Up indicates the average velocity estimated for the parent vessel.

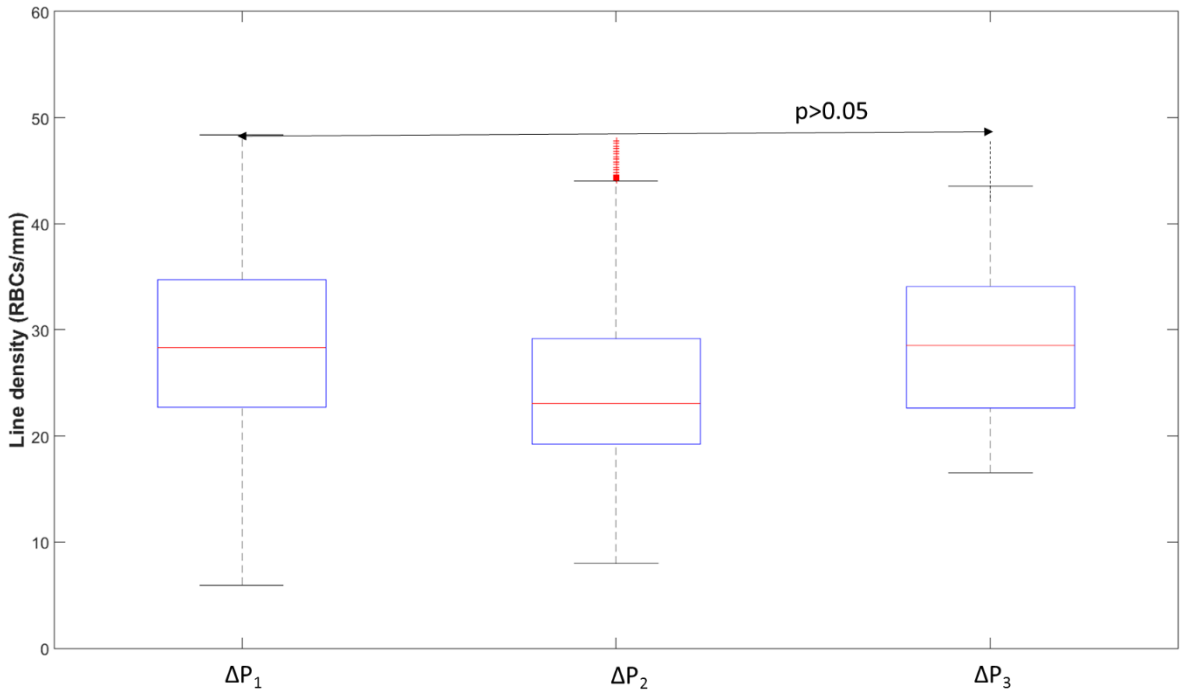


Fig. S3 Line density vs perfusion pressure in the parent vessel of the stretched mode (T-junction)