

## Electronic Supplementary Information

### Supplementary Figure Captions

Fig. S1 Schematic of gas exchange testing setup. Syringe pump delivers blood through vascular network of device while oxygen flows through alveolar chamber. Blood gas analysis is done on blood sampled before device ( $S_1$ ) and after device ( $S_2$ ) to determine gas transfer performance. Debubbling chamber and pump are used to eliminate all bubbles in device prior to testing.

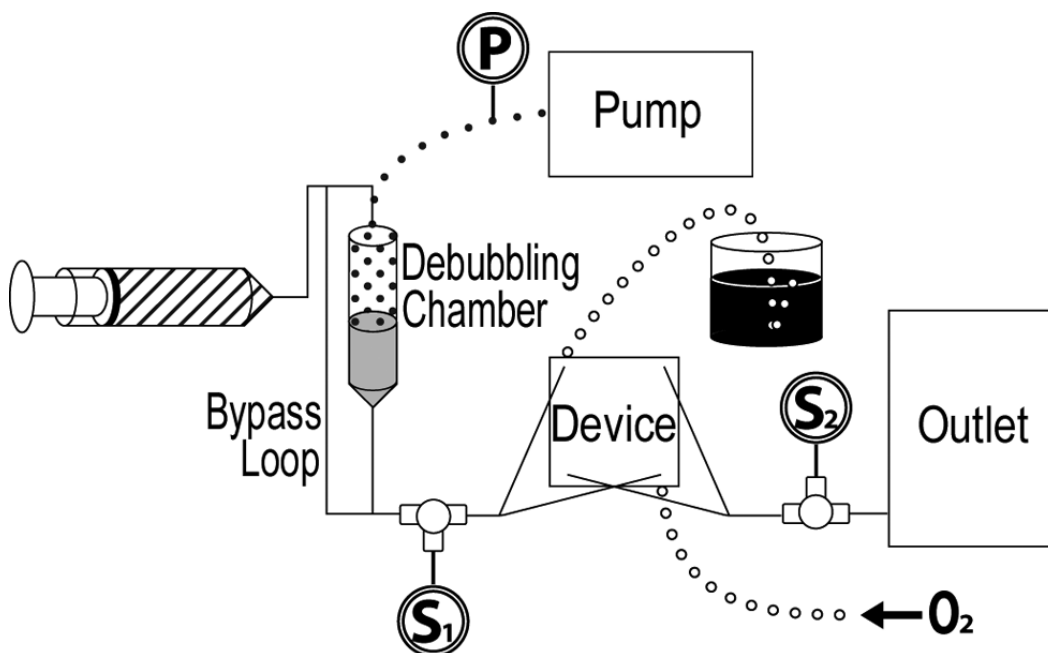


Fig. S2 Flow streamlines in the vascular network correlate the CFD to actual blood flow within the device. (a) Streamlines predicted by CFD are shown and compared to (b) streamlines created by flowing carmine fluorescent microspheres in whole blood through the network under the same conditions as the CFD analysis. Scale bare = 500  $\mu\text{m}$ .

