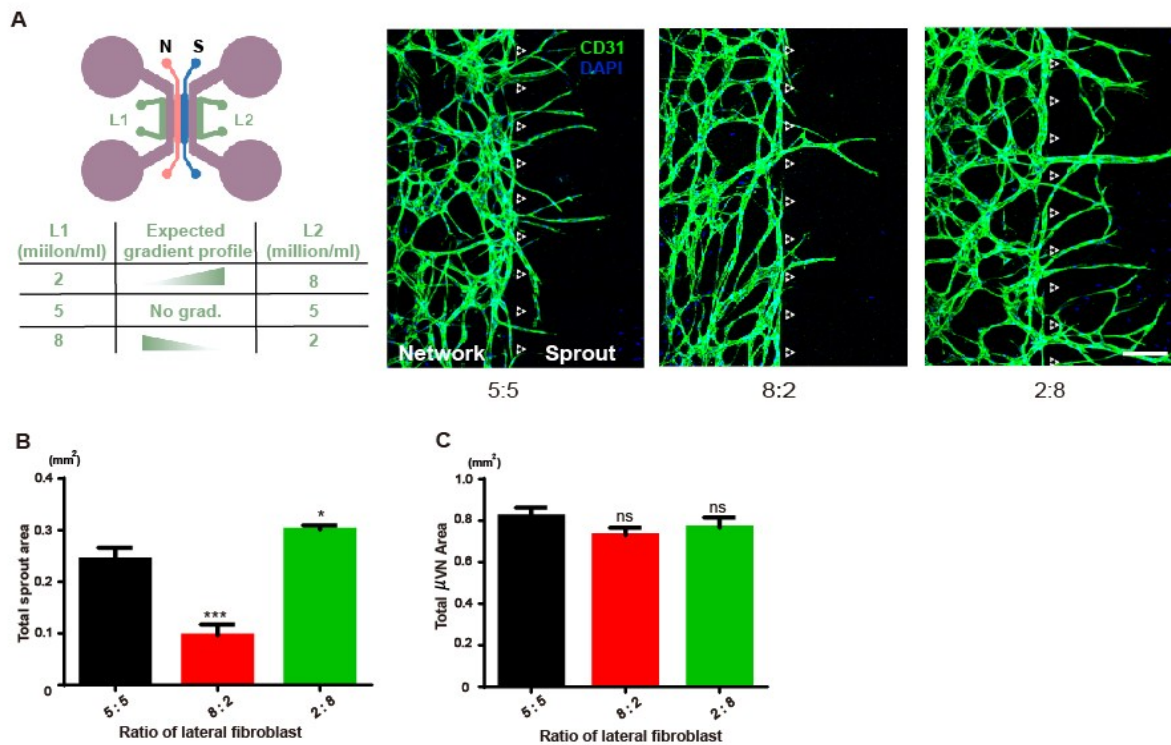
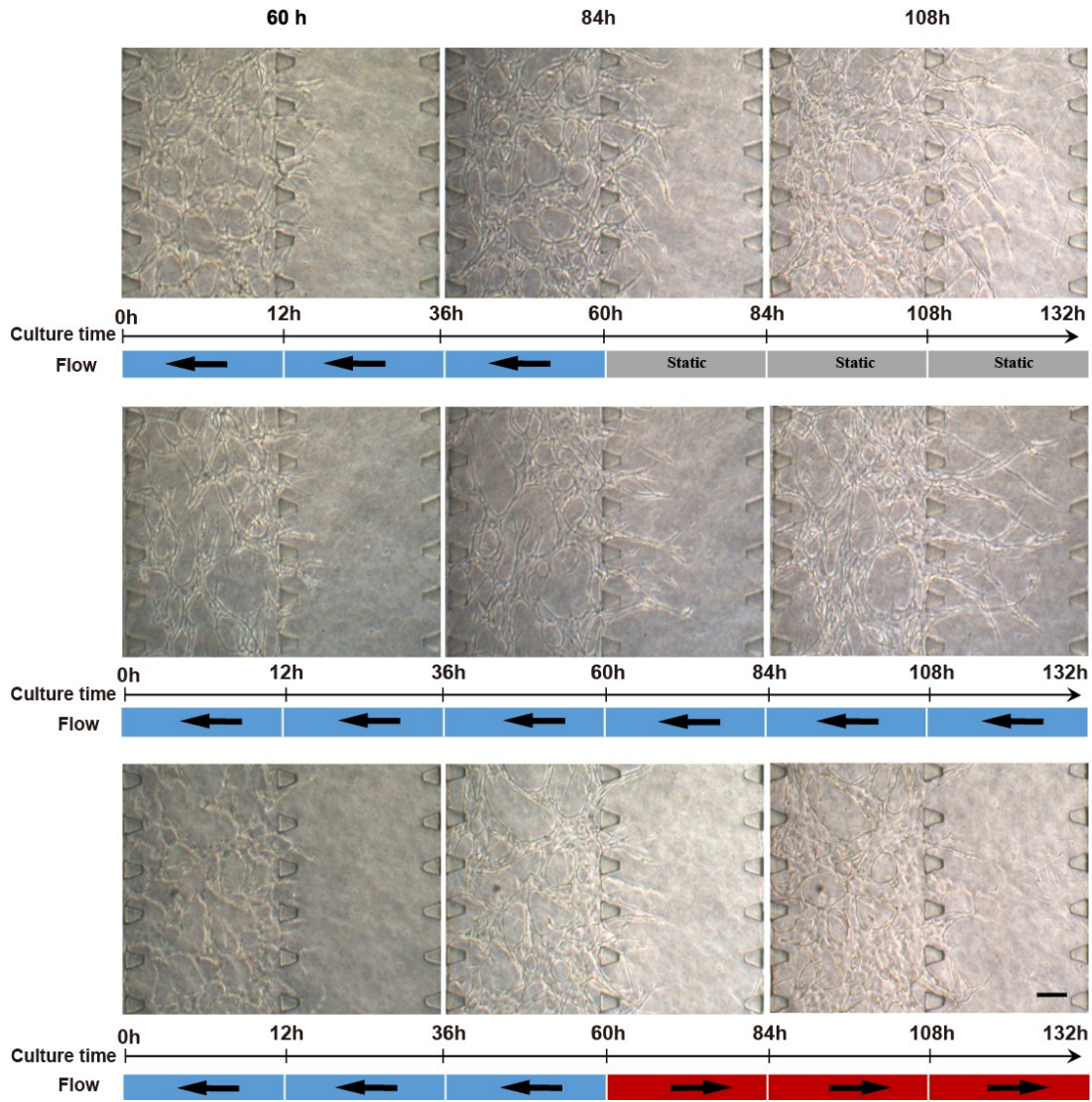


Supplementary figure 1. Measuring the speed of interstitial flow in fibrin matrix by fluorescent recovery after photobleaching (FRAP) technique. (A) Time lapse image of photo bleached region of FITC-dextran moving along interstitial flow. Scale bar; 20 μm . (B) Speed of interstitial flow across the device filled with acellular fibrin gel was measured at 2 hours after the flow introduced, under given media volume difference between the lateral sides of the hydrogel channel. $n=12$ for each point. (C) IF speed measured over time under experimental setting, 10 μL volume difference in fully vascularized device. Flow speed decreased gradually during 12 hours before it was reset. $n=10$ for 3 and 6 hours and $n=7, 9$ for 1 and 12 hours, respectively. Error bars represent SEM.



Supplementary figure 2. Asymmetric patterning of fibroblast on the lateral channel demonstrates directional gradient effect of secreted growth factors on angiogenic sprouting but not on VN. (A) Representative image that demonstrate gradient of angiogenic factor generated by asymmetrically loaded fibroblast in the lateral channels is guiding sprouting angiogenesis. Scale bar; 200 μ m. (B) Quantitative image analysis exhibited significantly reduced or increased sprout area in response to the direction of growth factor gradient, (C) while the area of VNs are not affected.



Supplementary figure 3. Time lapse tracking of angiogenic sprouting in response to reverse of interstitial flow direction. Images were taken 60, 84 and 108 hours after the assay started, and flow was maintained as indicated under each image. Sprouts were progressively regressed when the flow is reversed, showing clear contrast to the static or flow-maintained condition. Scale bar; 100 μm .