(1-5')

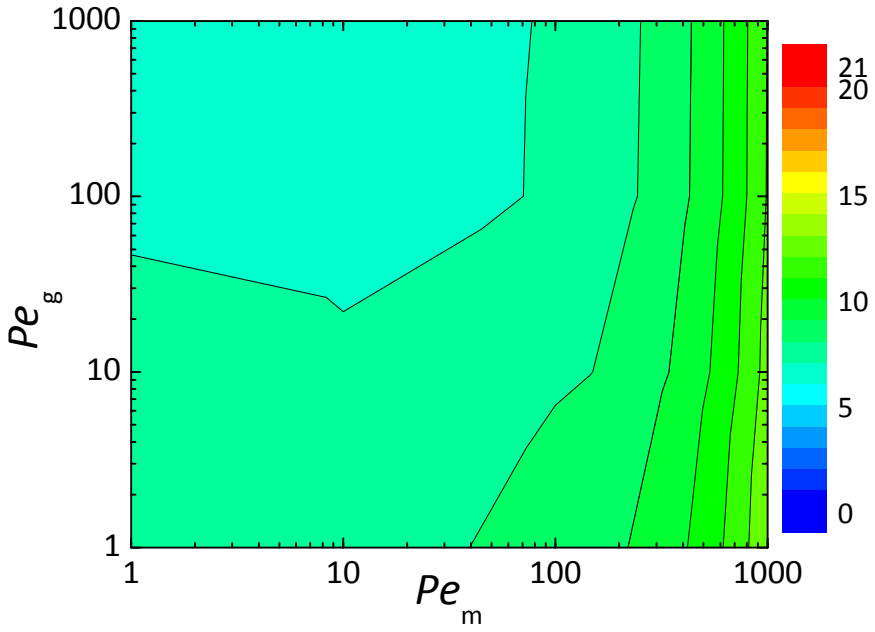


Figure S1. Contour map of oxygen tension at the center of the gel region on a glass cover slip, (x, y, z) = (0 m, 1.975×10^{-3} m, 1×10^{-6} m), in the microfluidic device without a film with a combination of Péclet numbers for media and gas flow, supplying 0% oxygen gas to both gas channels.

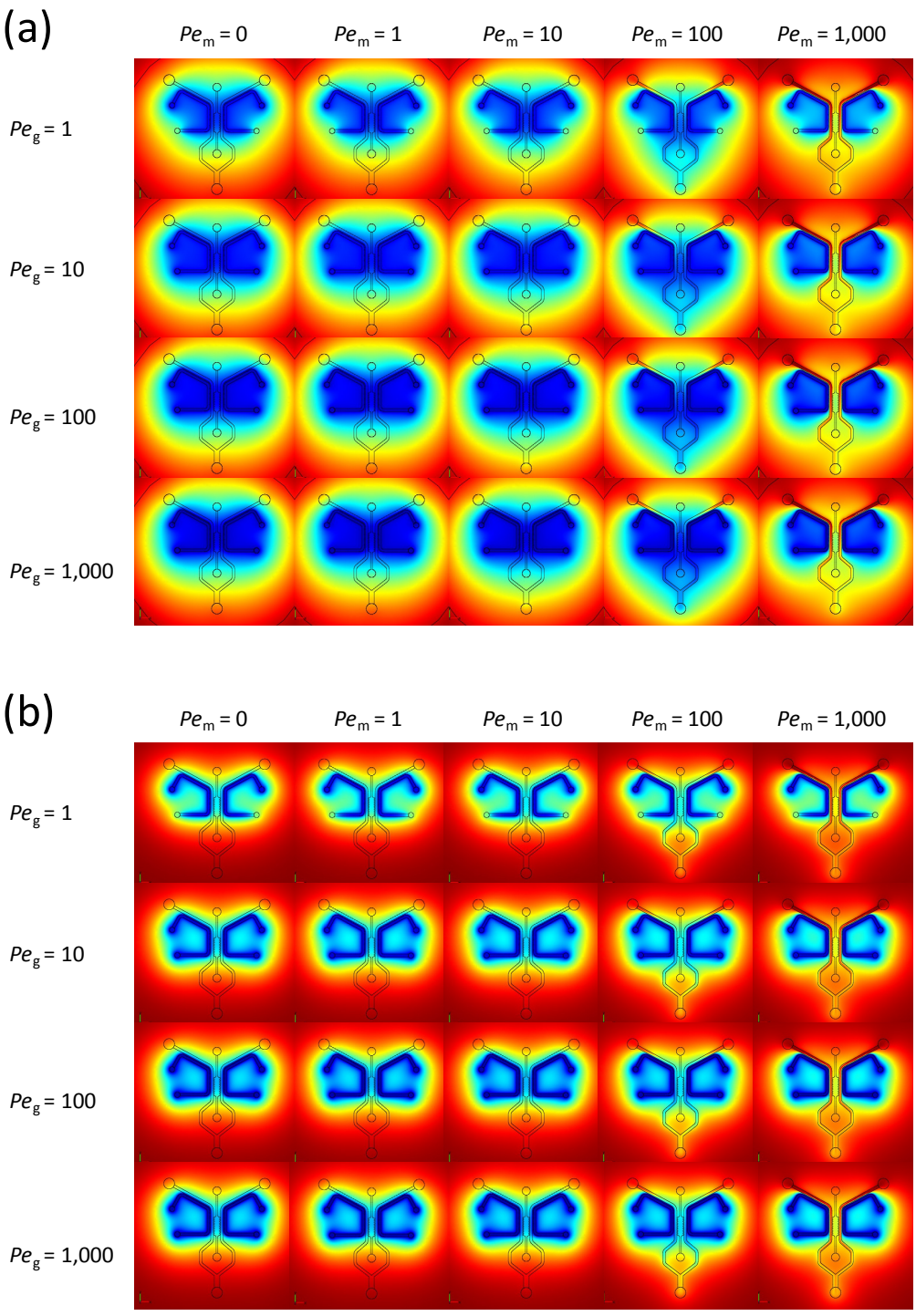


Figure S2. Variations of steady oxygen tension on a crosssection (z = 1.0×10^{-6} m) of the microfluidic devices (a) with and (b) without a film of low diffusion coefficient of oxygen (D_{film} = 2.0×10^{-12} m^2/s) with a combination of Péclet numbers for media and gas flow, supplying 0% oxygen gas to both gas channels.

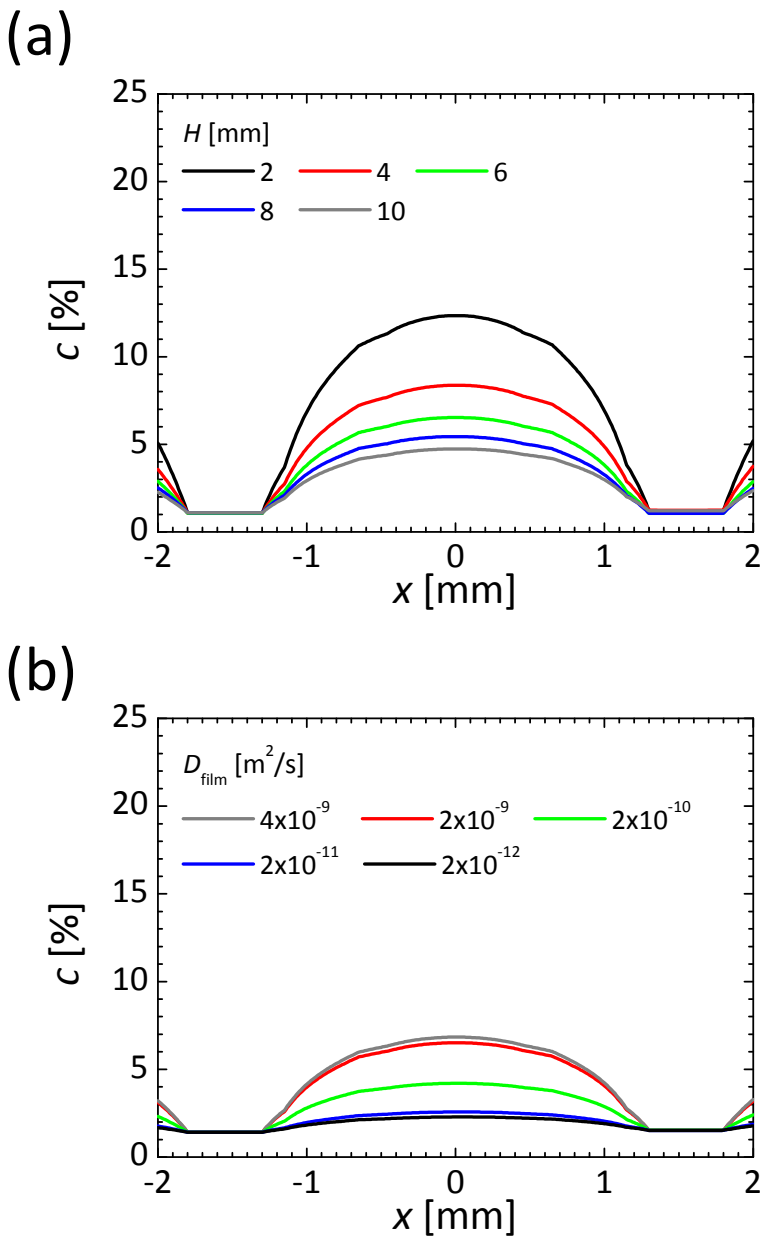


Figure S3. Variations of oxygen tension profile across the middle of the gel region, (y, z) = (1.975×10^{-3} m, 1×10^{-6} m), in the microfluidic device at media and gas flow rates of (Pe_m, Pe_g) = (10, 100) with parameters: (a) the device of different thickness without a film, and (b) the device with a film of different diffusion coefficient of oxygen (H = 6 mm).

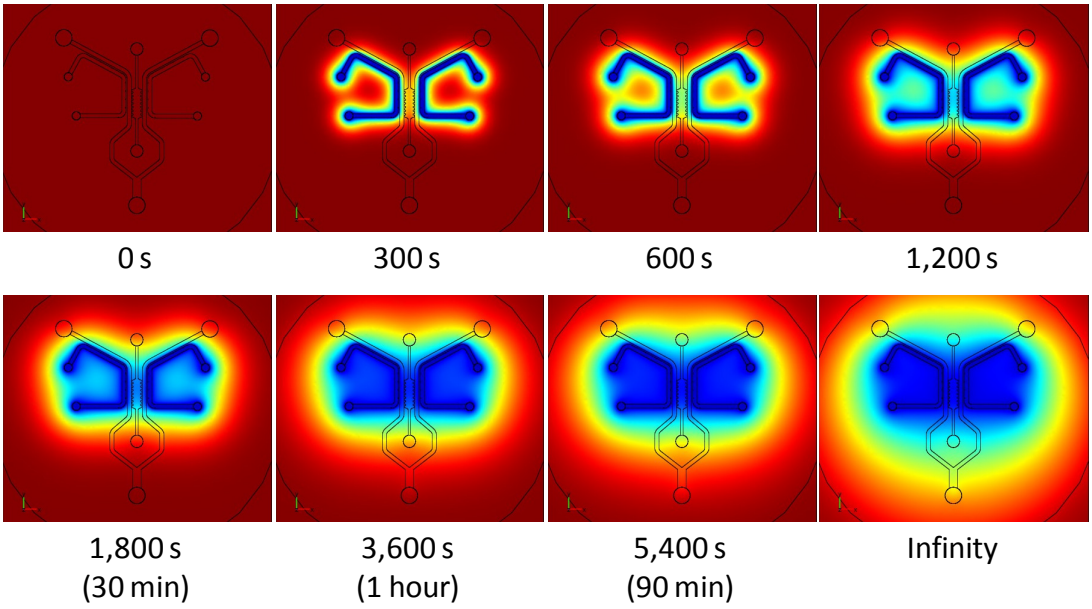


Figure S4. Transient change of oxygen tension on a crosssection ($z = 1.0\times10^{-6}$ m) of the microfluidic device with a film of low diffusion coefficient ($D_{film} = 2.0\times10^{-12}$ m^2/s), supplying 0% oxygen gas to both gas channels.

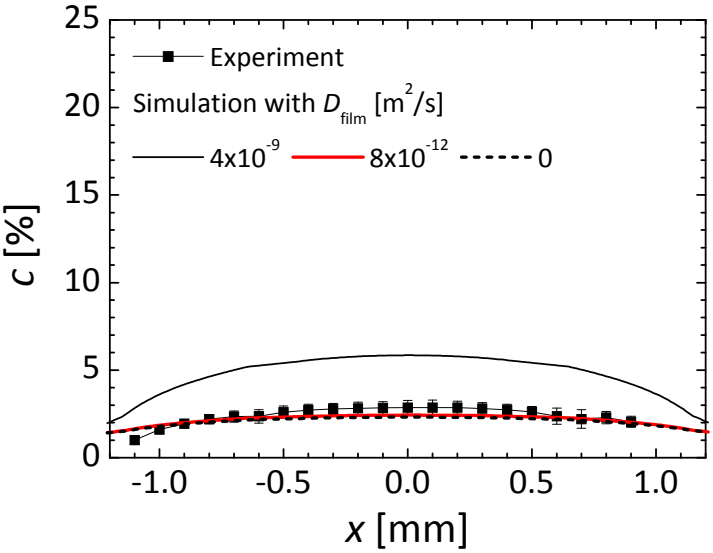


Figure S5. Comparison of steady oxygen tension profiles across the gel region between the experiment and the corresponding numerical simulations with three different diffusion coefficients of oxygen in a film, supplying 0% oxygen gas to both gas channels. The three different values of D_{film} = 4.0×10^{-9} m^2/s, 8.0×10^{-12} m^2/s, and 0 m^2/s correspond to the microfluidic device with no film, with a PC film having the literature value of the diffusivity, or with a film having no diffusivity of oxygen, respectively.

(2-2')

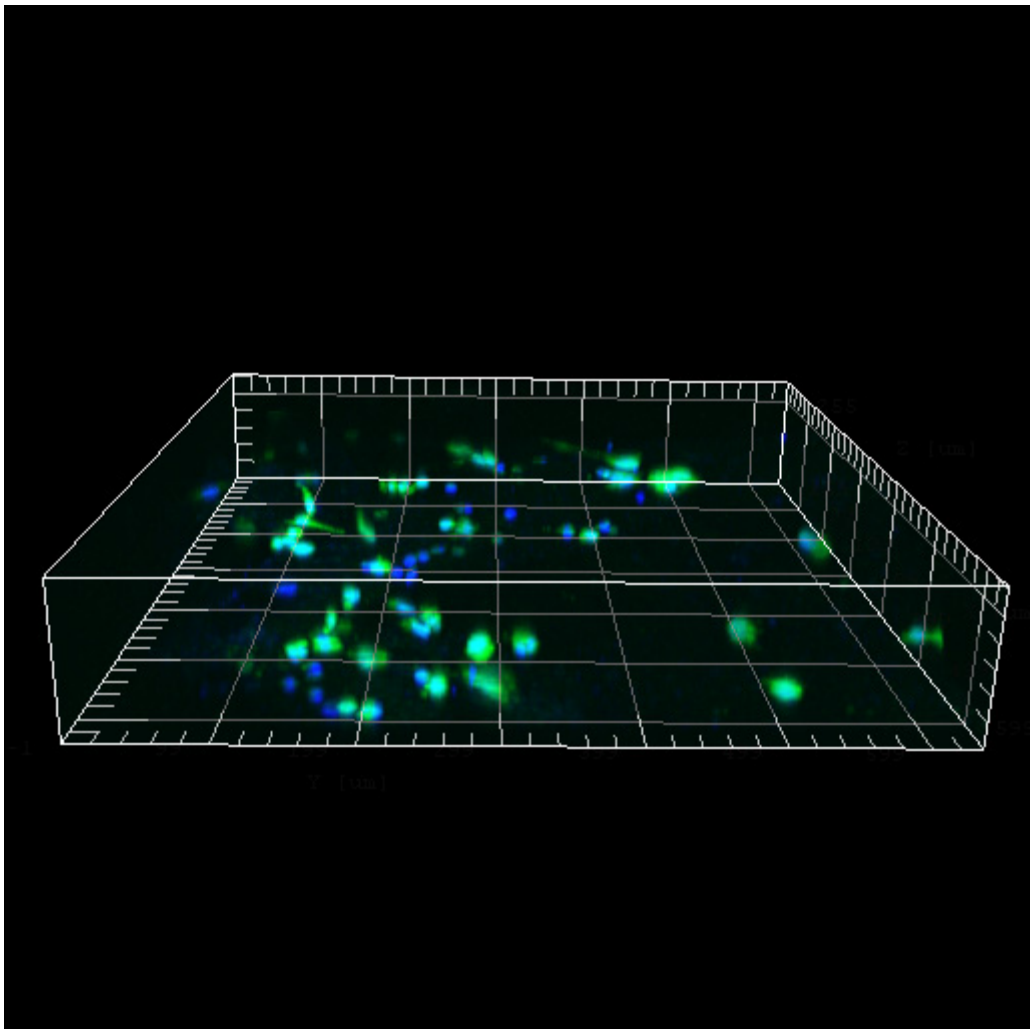


Figure S6. 3D confocal rendering of tumor cell distribution in the device. Tumor cells express GFP (green) and are stained for nucleus (blue: DAPI).

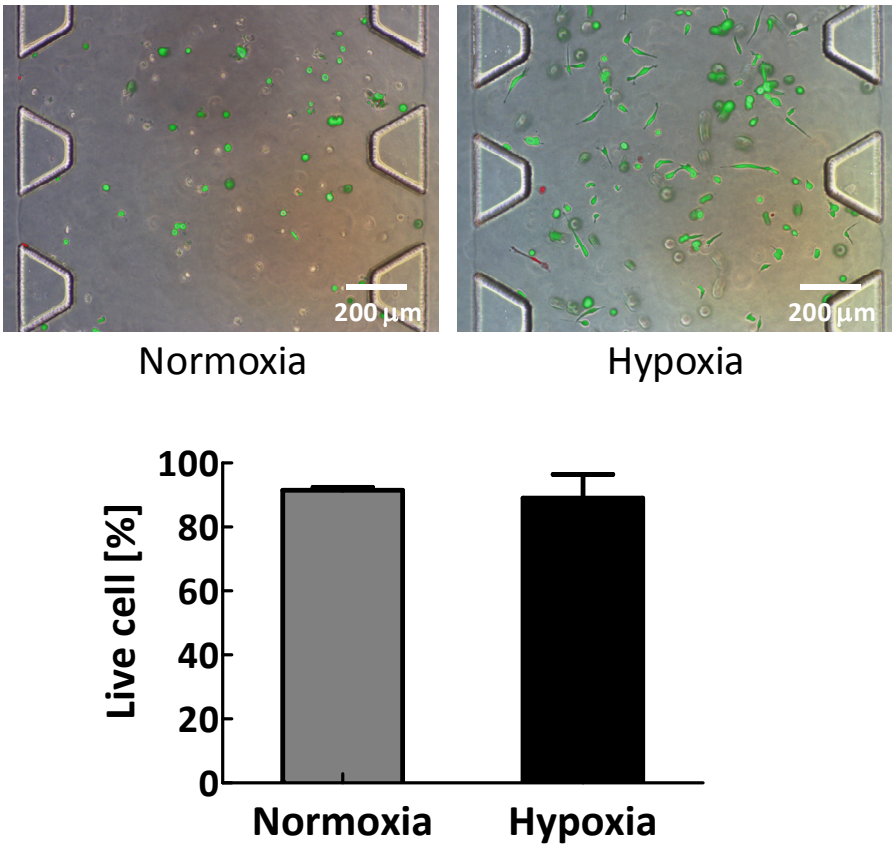


Figure S7. Live/dead assay of the cancer cells in the microfluidic device after 24-hr normoxia/hypoxia. Average values of four devices in each condition, and error-bars represent SEM.

(2-4')

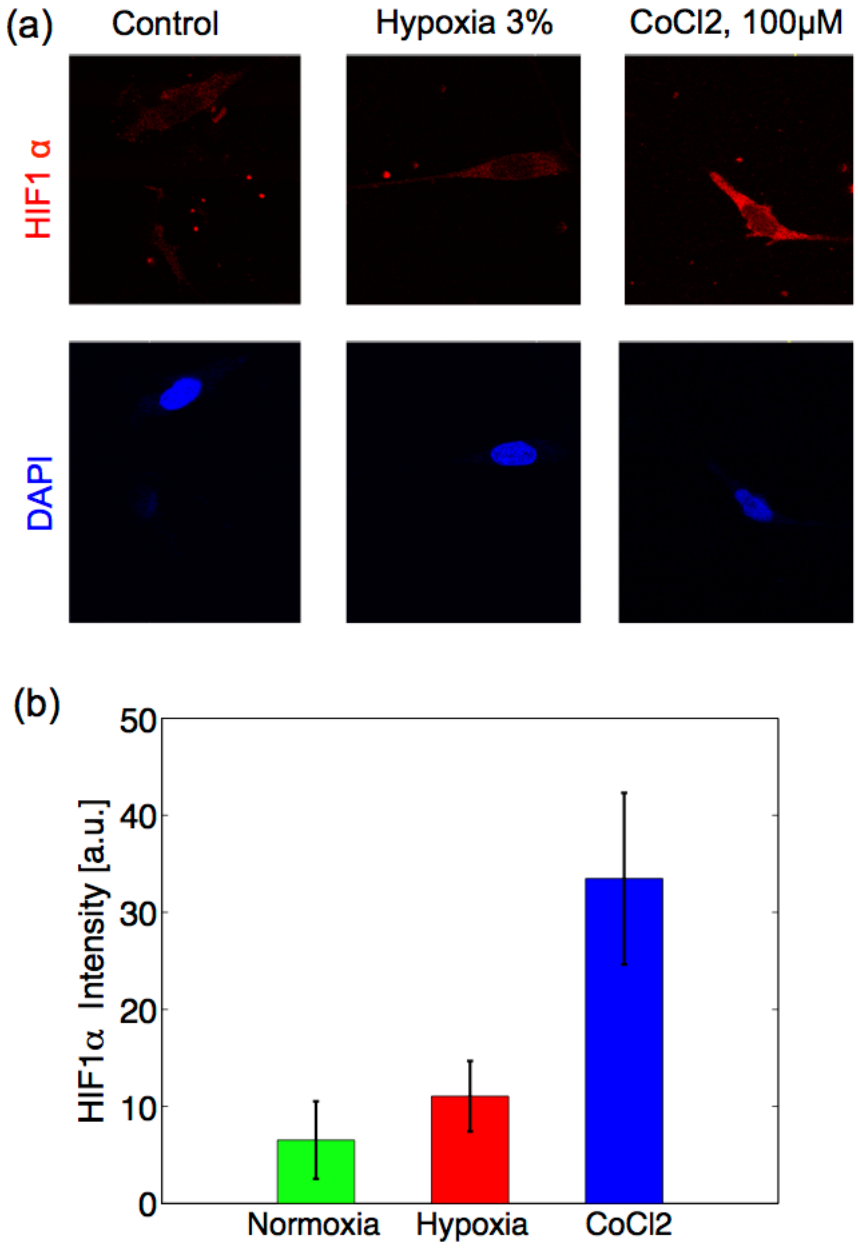
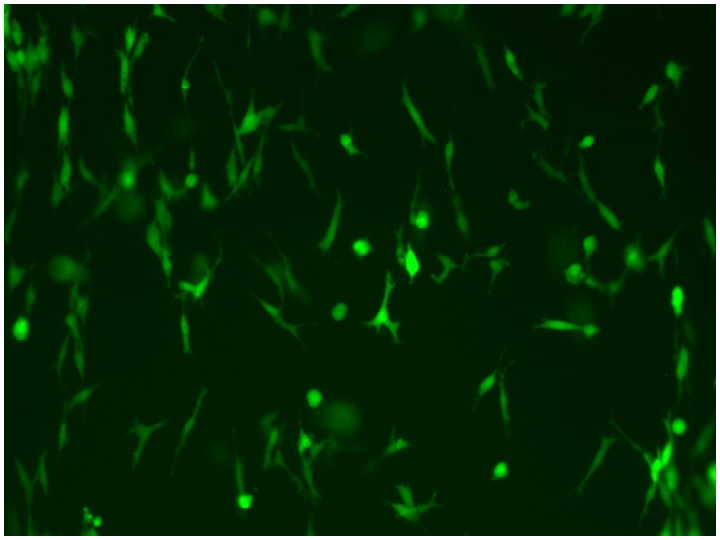
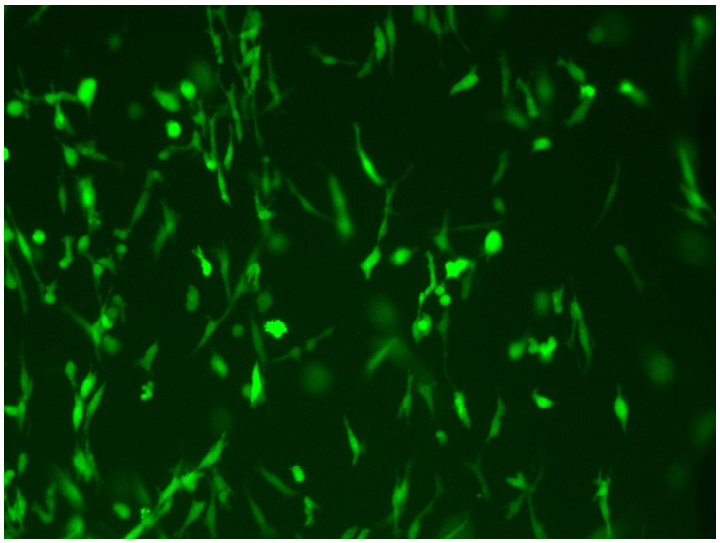


Figure S8. Characterization of HIF-1α in the microfluidic device: (a) Top row: Staining against HIF-1α under control (normoxia), hypoxia and stimulation with CoCl2; Bottom row: DAPI staining to indicate nucleus localization. (b) Quantification of images in (a), error-bars represent standard deviation.

(a)



(b)



Movie S1. The time-lapse images of migration of the MDA-MB-231 breast cancer cells for six hrs under (a) normoxia and (b) hypoxia.