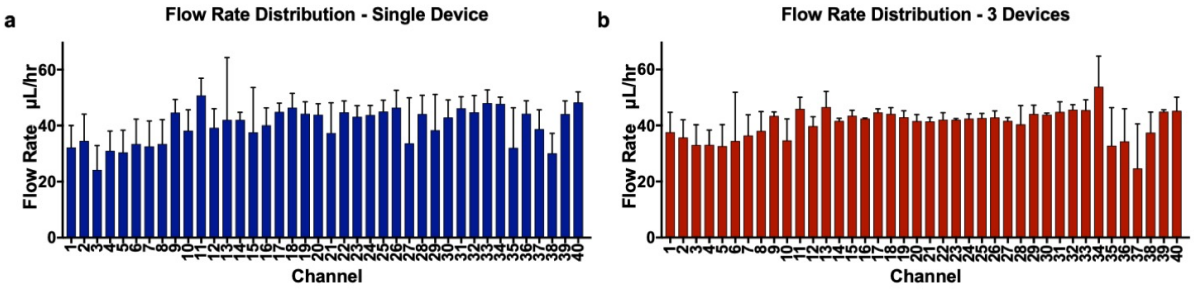
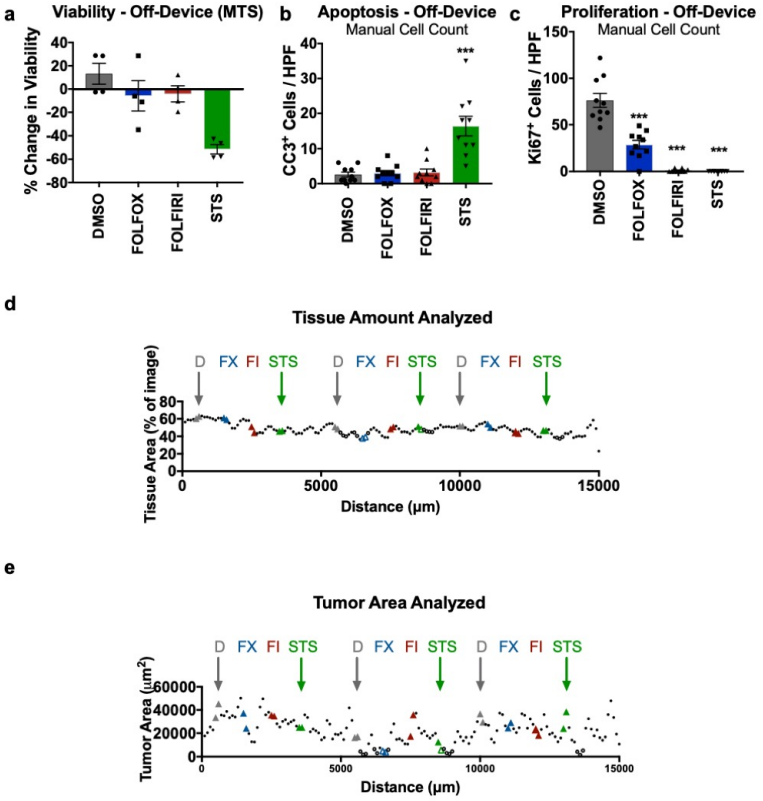
Electronic Supplementary Information

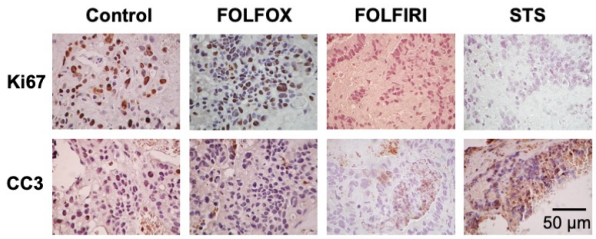


Supplementary Figure 1. a) Flow rate distribution for a single device. A single device was operated four different times at 1.5 mL/hr (37.5 µL/hr/well) for 10 hrs (error bars show SEM, n=4). b) Flow rate distribution for a set of three devices. Each device was operated three different times at 1.5 mL/hr (37.5 µL/hr/well) for 10 hrs (error bars show SEM, n=9).



Supplementary Figure 2. (a-c) Off-device analyses of (a) % change in viability as a function of cell metabolic activity (MTS), (b) apoptosis by manual cell count of cleaved-caspase 3 immunostaining (CC3), and (c) proliferation by manual cell count of Ki67 immunostaining for a colorectal cancer drug slices after three-day drug treatment with 1) (5FU), and Oxaliplatin, 1 µg/mL each (FOLFOX, FX), or 2) 5FU and Irinotecan, 1 µg/mL each (FOLFIRI, FI). We used DMSO as vehicle control and STS as a positive control. 4 slices per drug condition. N=4 consecutive high power fields (HPF) counted per condition. Ave ± SEM. One-way ANOVA-versus DMSO with Dunnett's multiple comparison test. *p<0.05, **p<0.01, ***p<0.001. (d,e) Tissue sampling from the automated immunostaining analysis of Ki67 in Fig. 8, with quantitation of average tissue area per image (d) and

of total tumor area (e) from all 6 images used for each 100 μm-wide region. Open circles represent less than 10,000 μm^2 for (e).



Supplementary Figure 3. Representative 40x micrographs of perpendicular tissue sections showing proliferation (Ki67) and apoptosis (CC3) for each condition performed off-device.

Time (hr)	$D_{Hoechst}$ (m^2/s)	$D_{Doxorubicin}$ (m^2/s)
1	3.52×10^{-14}	5.41×10^{-14}
2	2.09×10^{-14}	5.89×10^{-14}
4	1.57×10^{-14}	2.45×10^{-14}
8	6.93×10^{-15}	1.26×10^{-14}

Supplementary Table 1. Diffusion constant values (D) for Hoechst and doxorubicin estimated (based on Eq. 1) using the experimentally obtained vertical diffusion profiles (Fig. 6) of the molecules in the U87 xenograft tumor slice at 1, 2, 4 and 8 hours.