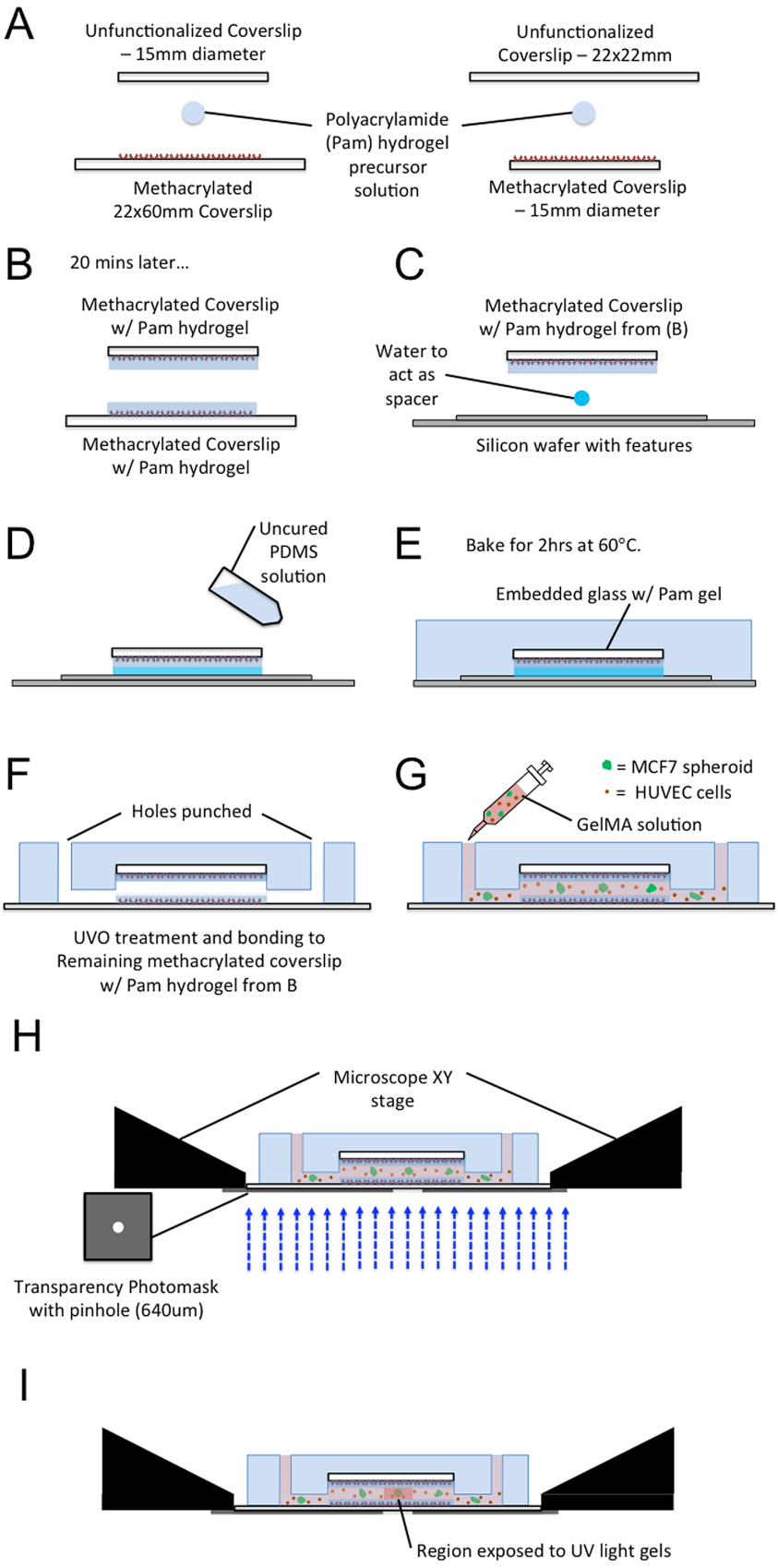
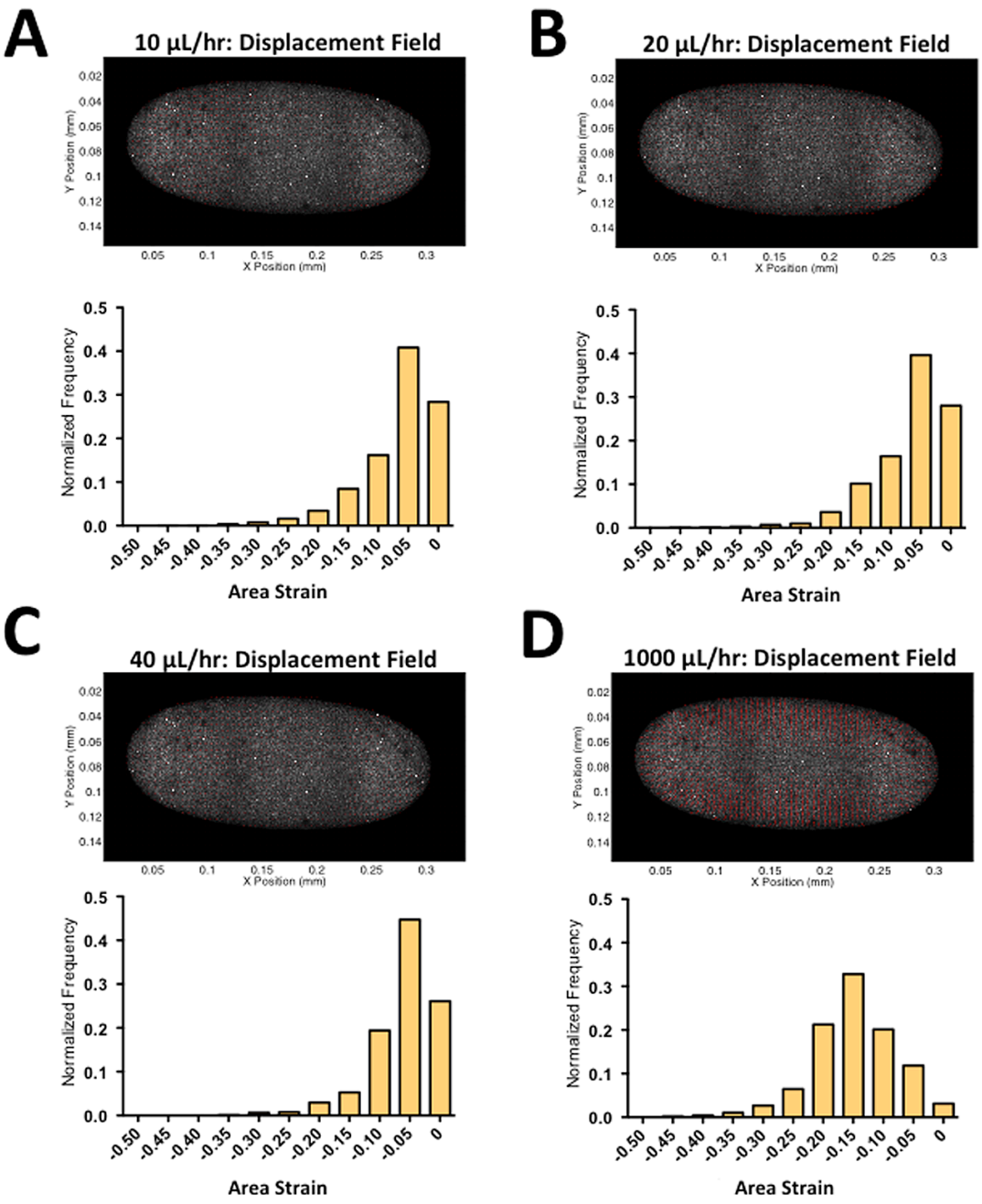
Electronic Supplementary Material (ESI) for Lab on a Chip.

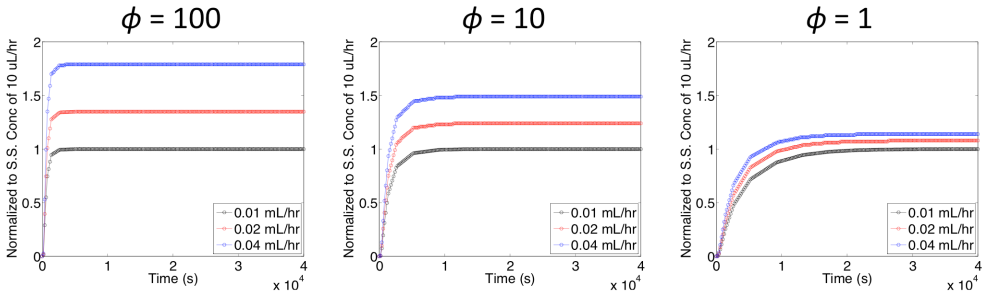


Supplementary Figure 1: Schematic of fabrication of tumor-on-a-chip devices. (A-B) Synthesis of thin PAm hydrogels tethered to the methacrylated coverslips is done by sandwiching 3 μL of polymer precursor solution between a methacrylated coverslip and a non-treated coverslip. (C-E) 5 μL of deionized water is sandwiched between the Si wafer mold and PAm hydrogel tethered to the methacrylated coverslip to act as a spacer as the uncured PDMS solution is poured on top of the wafer slowly and casted in the oven for 2 hours at 60°C. (F) Holes were punched on the cured PDMS after detachment from the Si wafer prior UVO treatment and bonding. (G) MCF7 spheroids and HUVECs were suspended gently in GelMA solution, drawn into a syringe before injecting into the microfluidic chip. (H-I) The chip is then mounted onto the movable microscope stage mount, on a transparency photomask. This allows us to see the MCF7 spheroids through the photomask on the microscope. After centering a spheroid in the middle of the transparency hole, collimated UV light is reflected via the DAPI filter cube through the transparency, gelling only the selected region of within the microfluidic chamber.

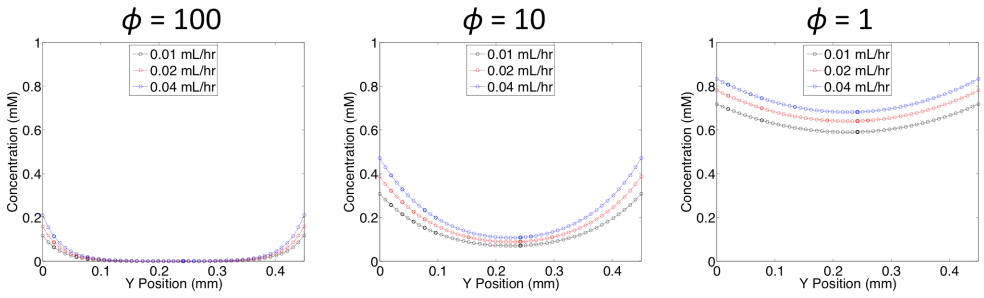


Supplementary Figure 2: Flow induced compression of GelMA hydrogels. (A-D) The deformation of the GelMA hydrogel at different flow rates of 10, 20, 40, and 1000 µL/hr. The deformation of the hydrogel is depicted by (i) 2D displacement vectors

overlaid onto the fluorescent images and (ii) distribution of area strain, shown as a histogram, to assess the extent of mechanical compression.

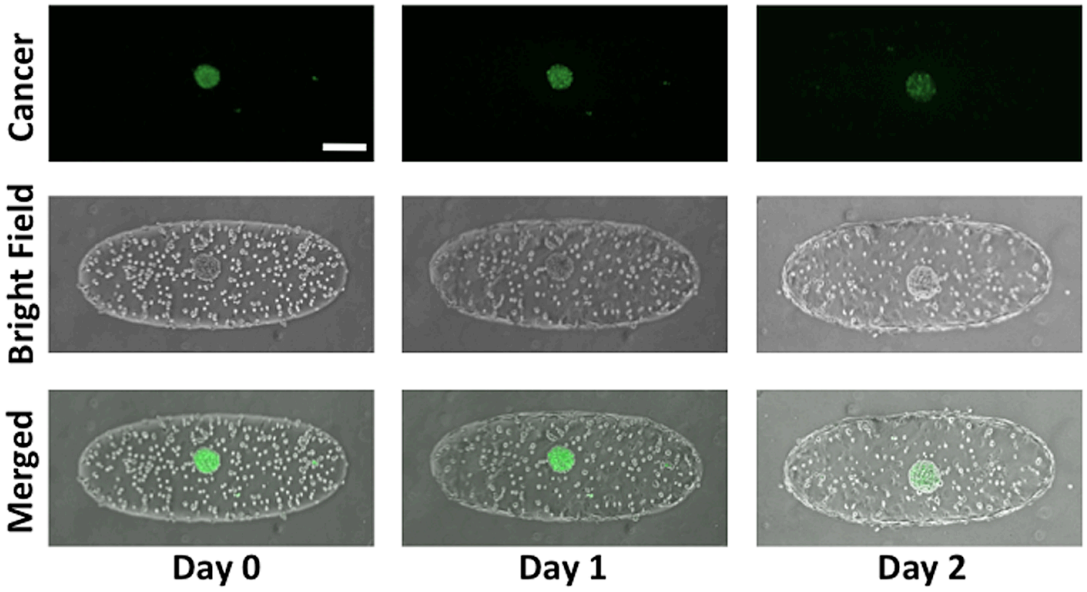


Supplementary Figure 3: Transient concentration changes within the GelMA hydrogel. The normalized concentration, defined as the ratio of the concentration within the hydrogel to the bulk concentration, at the center of the ellipse as function of time for different flow rates and ϕ values. Here, ϕ is a non-dimensionalized parameter that compares the diffusion to the consumption of a solute.

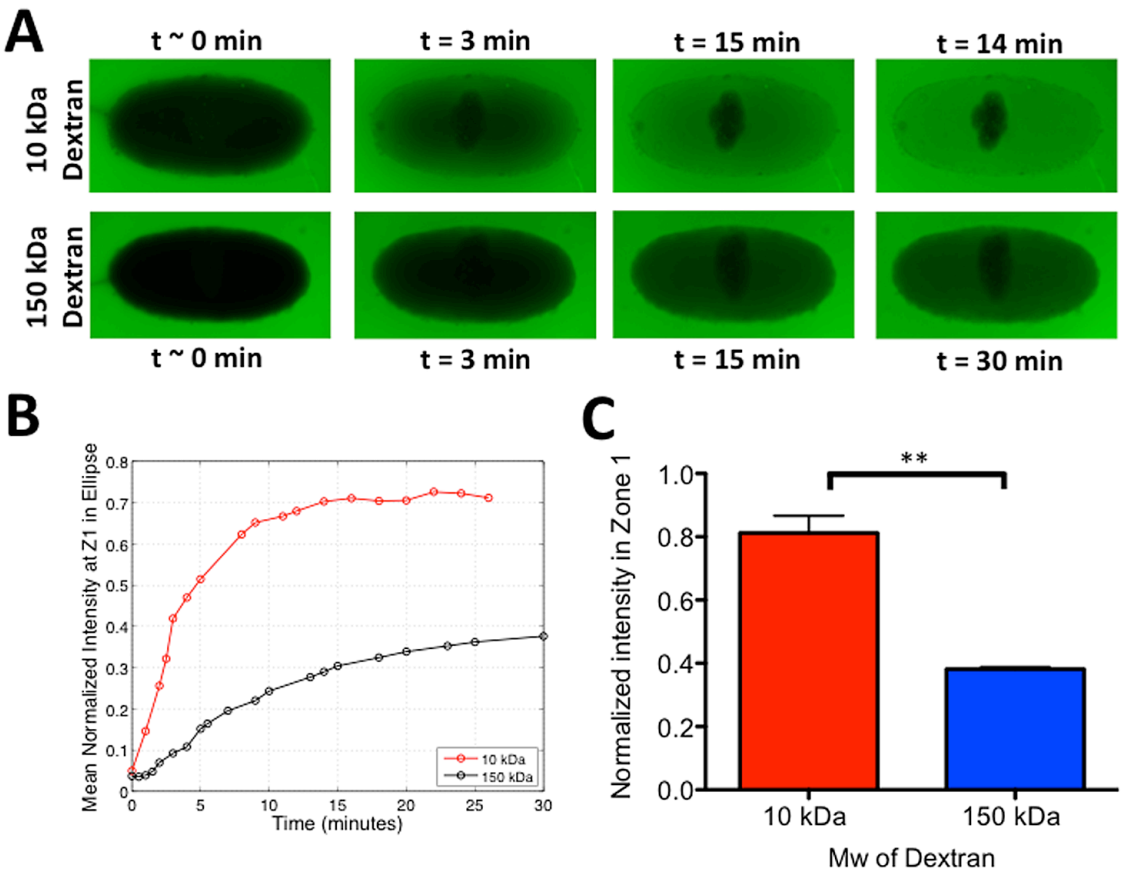


Supplementary Figure 4: Steady state profile within the GelMA hydrogel. The normalized concentration (the ratio of the concentration within the hydrogel to the bulk

concentration) profile along the minor axis of the ellipse structure for different flow rates and ϕ values.



Supplementary Figure 5: Cancer spheroids remain clustered within the GelMA hydrogel with culture time. Brightfield and fluorescent images of HUVECs and cancer spheroid (labeled with green dye) within GelMA structures at immediately after encapsulation and after 1, 2, and 3 days in culture. Scale bar: 200 μm.



Supplementary Figure 6: Diffusion of FITC-dextran into cell-laden GelMA hydrogels. (A) Time-dependent fluorescent images of 10 μg/mL 10 kDa and 100 μg/mL 150 kDa FITC-conjugated dextran (top and bottom row, respectively) diffusing into the ellipse-shaped GelMA hydrogels. The mean normalized intensity with zone 1 or Z1 ellipse for 10 and 150 kDa FITC-dextran as a function of time (B) and at steady state (C). Zone 1 or Z1 ellipse is the small ellipse shown in Figure 3B. ** indicates a statistically significant difference of $p < 0.01$ as obtained from t-test.

Supplementary Movie 1: Perfused GelMA hydrogel within fluidics device. Time-lapse video of the flow profile of the surrounding fluid, visualized by green particles, around a 3-D photopatterned GelMA hydrogel embedded with red fluorescent particles.