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

Figure S1. Platform overview
Microtissues consisting of co-cultured hepatocytes or iPSC derived hepatocytes were restrained in a microfluidic device with an array of C-shaped traps. After loading the C-trap devices with microtissues, the inlet of the device was connected to a media reservoir and the outlet was connected to a peristaltic pump to pull the media through the device into a collection tube.

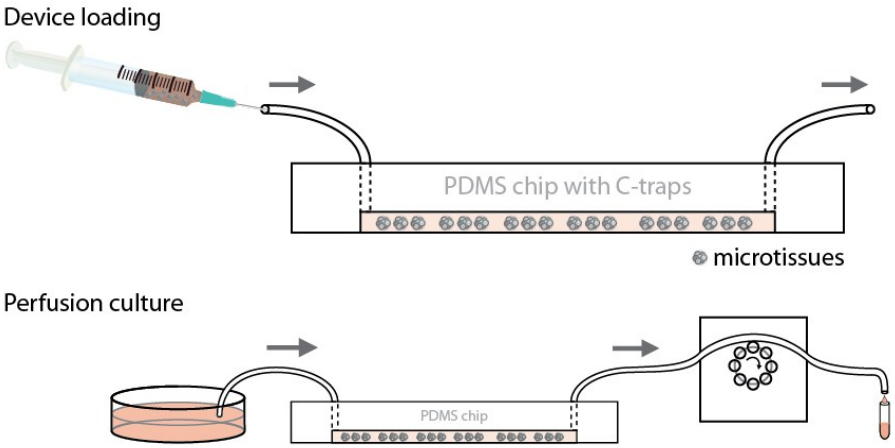

Figure S2. Uncontrolled growth of un-encapsulated aggregates on-chip
A) Aggregates of primary human hepatocytes and 3T3-J2 fibroblasts were loaded on chip and perfused for 28 days. Aggregates clumped together into large structures that exceed the theoretical nutrient diffusion limit with structures as large as 1 mm observed. In addition, fibroblast grew on the inside of the devices despite pretreatment with anti-fouling pluronic (PEG triblock) to reduce cell adhesion. B) iPS cells were dissociated and aggregated at day 8 of their differentiation and loaded on chip at d16. Within four weeks of perfusion, cells had reorganized in the device, increasing the resistance to perfusion. Scale bars represent 500µm.

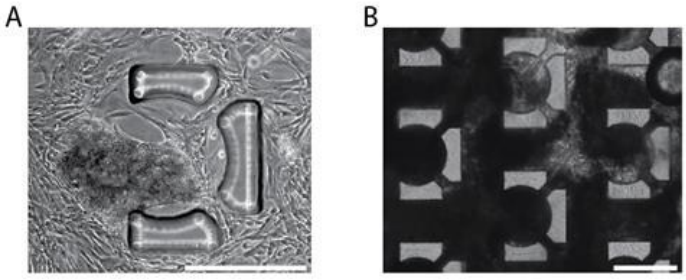

Figure S3. Viability of hepatic aggregates after UV exposure
Hepatic aggregates in aggrewells were exposed to different doses of light at ~365 nm. The UV exposure required to polymerize microtissues (~500 mJ cm^{-2}) did not affect their viability, shown by the percentage of viable cells per aggregate. Three wells with aggregates were exposed per condition, and analyzed 24 and 48 hours after exposure. Viability was analyzed by Calcein AM (live) and Propidium Iodide (dead). The number of Calcein positive cells is represented as a percentage of total number of cells. Error bars represent standard deviation.

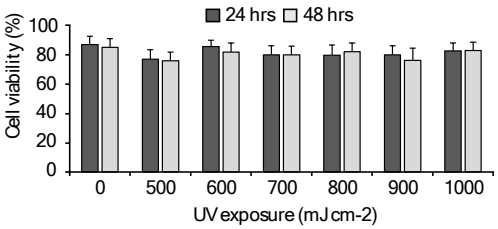

Figure S4. Viability of hepatic microtissues under perfusion

Cell viability was evaluated during perfusion culture by AlamarBlue assay (ThermoFischer). Microfluidic devices, perfused at 24µl/h, were disconnected from the pump, injected with 50 µl of 1x AlamarBlue reagent in ITS media, and incubated for 1 hour without perfusion. After incubation, samples were collected at the outlet by injecting 50 µl of ITS media to the inlet, and devices were reconnected to the pump. Samples were transferred to a 96 well plate and fluorescence was measured in a microplate reader (Tecan). Fluorescent spectra were normalized to day 4 values. Bars represent the average measurement from three different devices. Error bars represent standard deviation.

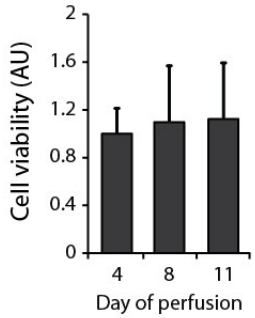

Figure S5. Shear stress modeling

Shear stress was modeled for a flow rate of 540µl/h along five different streamlines in the device using Comsol Multiphysics.