Figure S-1

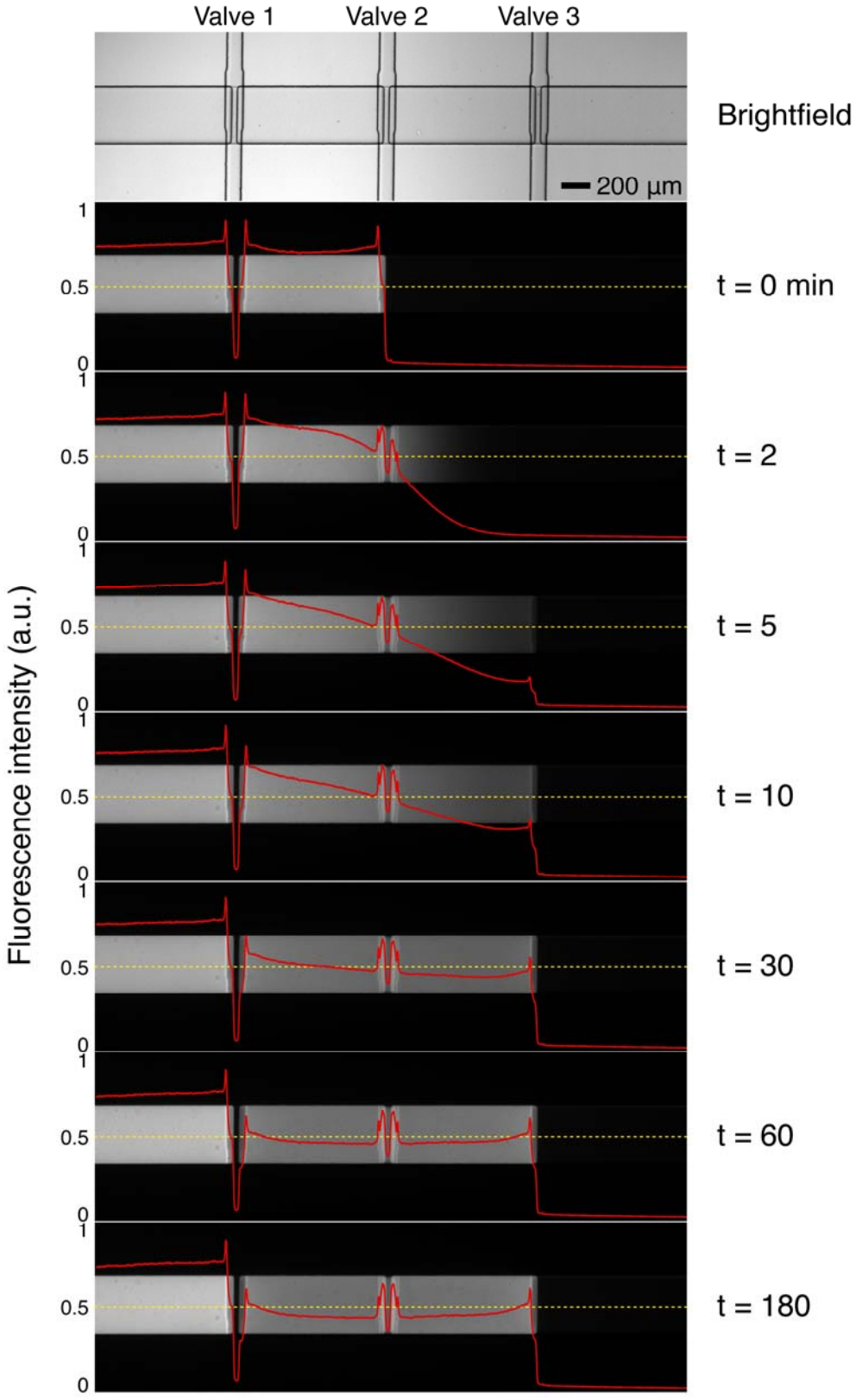

Figure S-1. *Evaluation of microvalve performance by fluorescence microscopy.* An array of three microvalves in series is deployed to test valve performance when wetted. Initially, Valves 1 and 3 are opened to allow fluorescein and diH_2O solutions to converge into the center. Control lines for valves 1 and 3 are filled with deionized water and subsequently pressurized at 15 psi to close while the control line for valve 2 is evacuated by vacuum to open and to allow the solutions to mix by diffusion in the center cavity bound by valves 1 and 3. Fluorescent images are taken every 5 minutes during the first hour and 30 minutes up to 12 hours, with images up to hour 3 shown; line scan (yellow dotted line) measure the fluorescence intensity (red solid line) in the microchannel and can be used to identify channel features and to check for leaks in the device. Fluorescence intensity is normalized to the brightest point (found at the edge of the control channel due to deflection of the thin membrane) and the darkest point (found in the PDMS background outside of fluidic channel).

Potential leakage between compartments on the edges of the microvalve seat can be calculated using Fick's Second Law. Assuming a semi-infinite boundary, $C(x,t\to\infty)=0$ and initial condition, $C(x,0)=0$, a solution to Fick's Second Law is given by $C(x,t)=\frac{S}{\sqrt{\pi Dt}}e^{-\frac{x^2}{4Dt}}$ where S is the total amount of fluorescein per unit area (2.0×10^{-5} mol·m^{-2}). Solving for x = 100 μm (across the valve seat to the right of Valve #3), the concentration of fluorescein after 3 hours should be 4.90 μM, which would be detectable in our setup. Given that the pore radius (r ~ 1 μm) is much larger than the size of a fluorescein molecule (R_H = 0.501 nm), diffusion would not be hindered. Any leakage on the edges of the microvalve seat would quickly (~10 s) contribute to a change in the fluorescent profile.