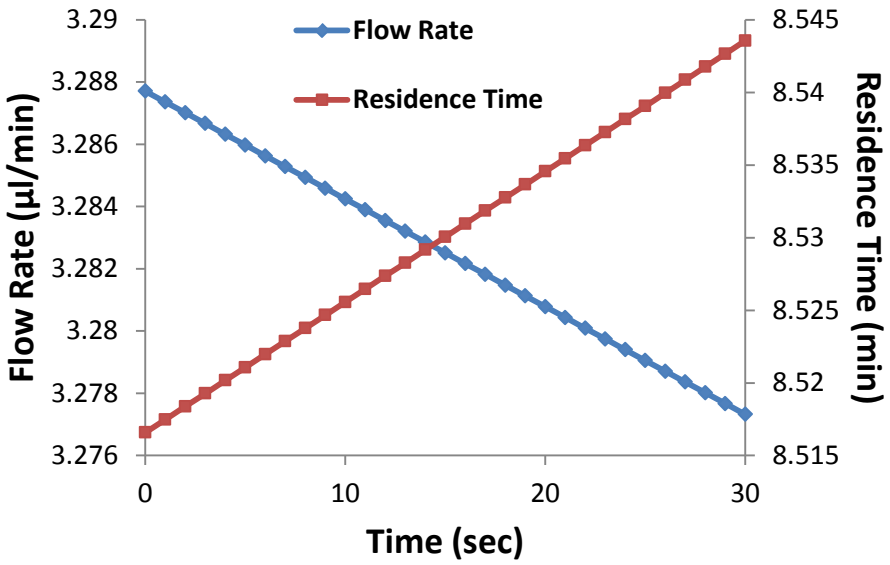
Electronic Supplementary Material (ESI) for Lab on a Chip.

SUPPLEMENTARY INFORMATION



Supplementary Figure 1. Change of flow rate and residence time over time. The change in the flow rate and residence time were analytically estimated for one cycle of rocking platform as described below. Both the flow rate and residence time were stable over 30 seconds of cycling time.

The volumetric flow rate (Q) is defined for a rectangular channel as[1]:

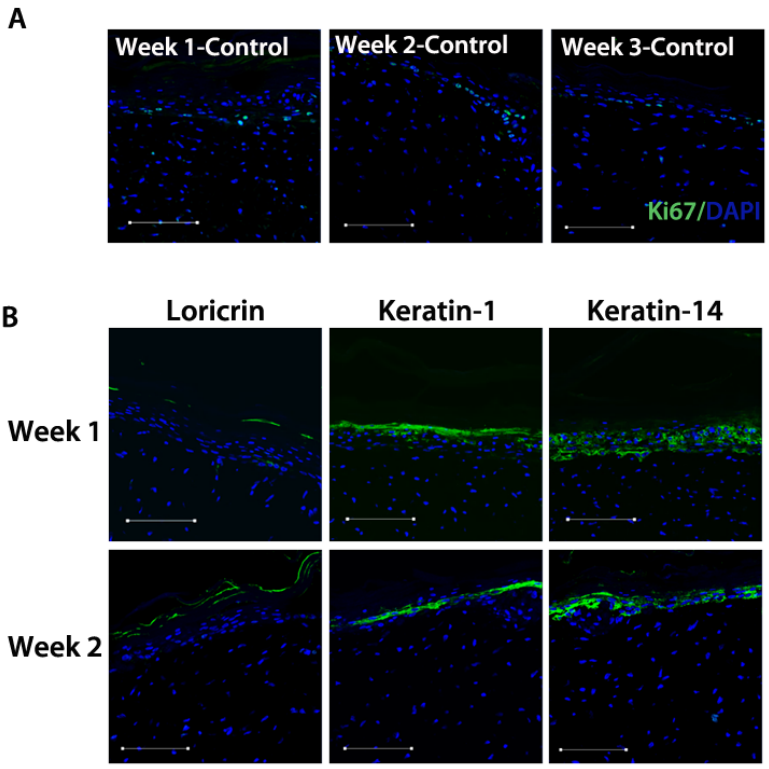
$$Q = \frac{\Delta P w h^3}{\alpha \mu L}$$

where $\alpha = 12\left[1 - \frac{192h}{\pi^2 w} tanh\left(\frac{\pi w}{2h}\right)\right]^{-1}$ and $\Delta P = \rho g \Delta H_T$

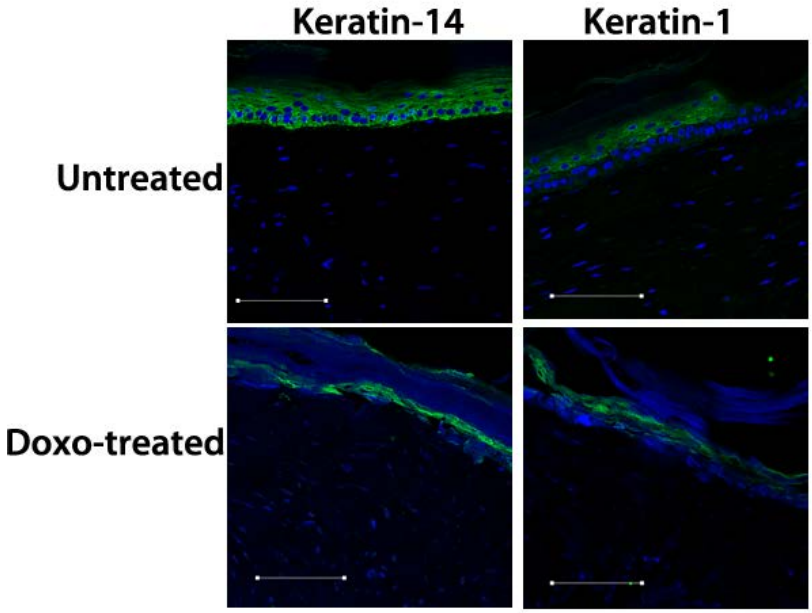
ΔH_T in this equation is the total difference in the media levels on the opposite sides. The total height difference is the summation of the height difference caused by the tilted platform (ΔH_T=*sin(12)*L*) and by the media volume in each reservoir. The ΔH_T can be calculated as a function of time using the equation below:

$$\Delta H_T = \Delta H_P - \Delta H_P e^{-\frac{2\rho g h^3 w \alpha}{\mu L A_c} t}$$

Q, volumetric Flow Rate	*g, gravitational constant*
ΔP, hydrostatic pressure difference	*ΔH_T, total height difference between media levels*
w, channel width	*ΔH_p, height difference caused by tilted platform*
h, channel height	*A_c, Media reservoir surface area*
α, correction factor	*t, time*
μ, medium viscosity	
L, channel length	
ρ, medium density	



Supplementary Figure 2. Maintenance of HSEs throughout three weeks (A) Ki67 staining of control samples for three weeks. **(B)** Immuno-labeled HSE-on-a-chip samples with layer specific markers, Keratin-1, Keratin-14 and Loricrin (green) and DAPI (blue) showing proper formation and structural integrity of epidermal layers after week 1 and 2. Scale bars: 100 µm.



Supplementary Figure 3. Immunostaining of layer-specific markers Keratin-1 and Keratin-14 in untreated and doxorubicin treated HSE-on-a-chip. Scale bars: 100 µm.

References

1. M. J. Fuerstman, A. Lai, M. E. Thurlow, S. S. Shevkoplyas, H. A. Stone and G. M. Whitesides, *Lab on a chip*, 2007, 7, 1479-1489.