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

Supplementary Figure S1:

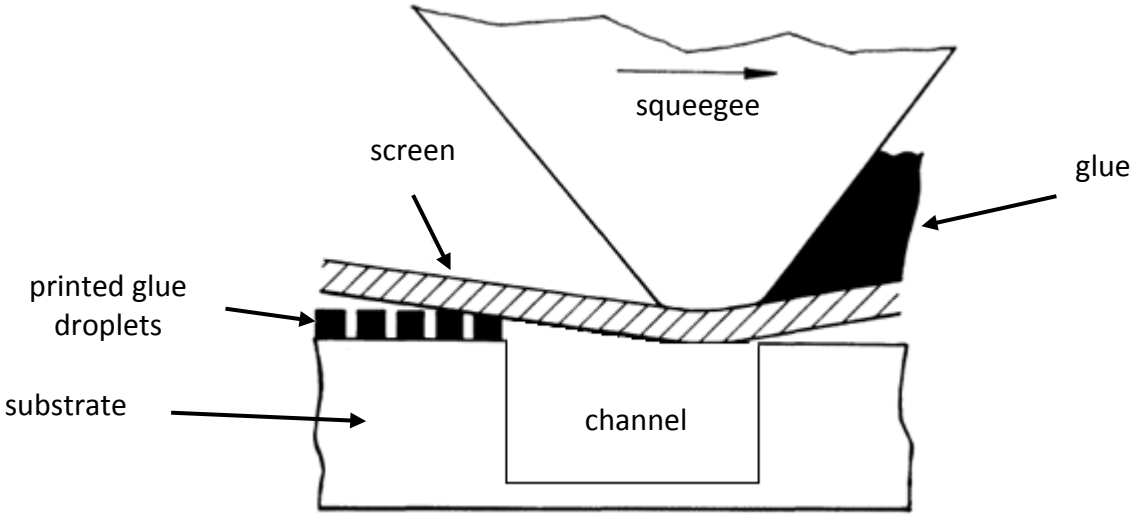


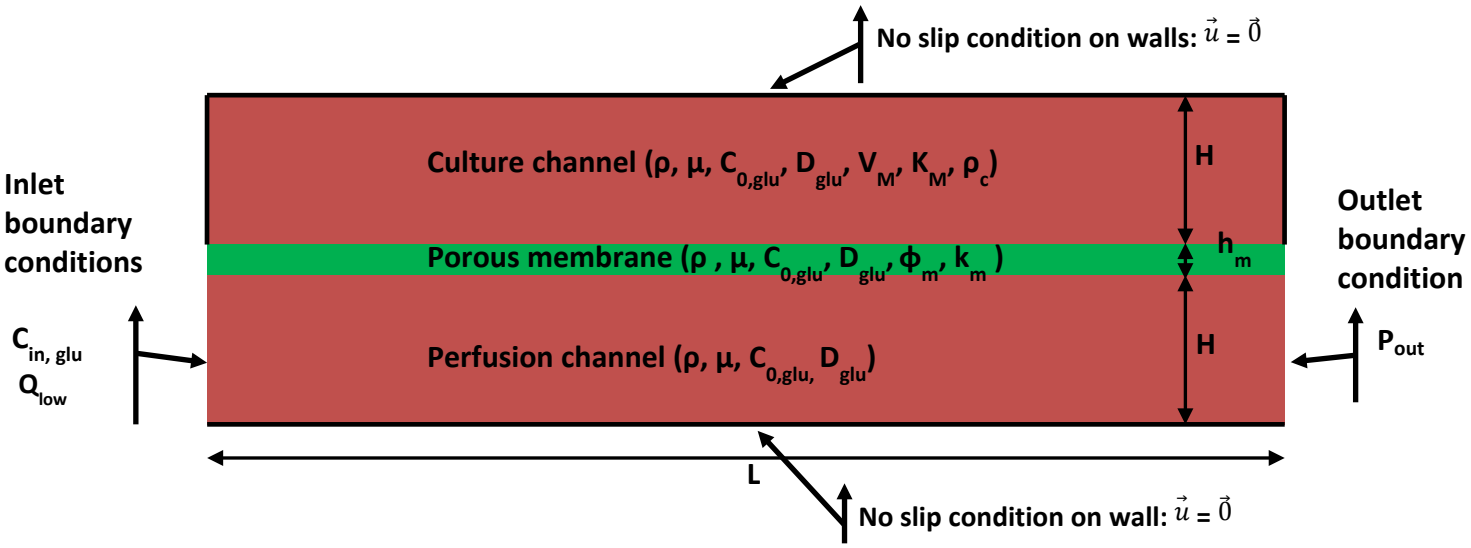
Figure S1. Figure S1. Screen printing concept. Modified from [1].

During screen printing a line of glue is deposited on a stiff screen of fine mesh standing above the substrate to be covered (see the figure below). A squeegee push and move forward this glue line on the screen to force the glue through the mesh openings to wet the underlying substrate. Small volumes of glue are locally deposited along the contact line defined by the squeegee. As the screen peel away from the substrates after the passage of the squeegee, the glue volumes flow laterally due to residual gravitational stress. The glue volumes are usually close enough to merge due to surface tension. Thus, a continuous film of glue is formed behind the squeegee [1]. However, when the squeegee passes over small open structures that form the channels, the size of the squeegee and the mesh stiffness do not permit the deposition of glue droplets on the channel walls. For information, the glue thickness deposited is about 16 µm and the surface of the glue droplets of 34 µm X 34 µm.

Supplementary Table. Parameters used during the simulations to estimate the influence of the perfusion flow rate (Q_{low}) over the cell environment. Perfusion flow rates of 1, 5, 10 and 50 µL/min were tested.

Variable	Value	Description
L	380 mm	Culture channel length
W	1 mm	Channel width
H	500 µm	Channel height
$\mathbf{h_m}$	40 µm	Membrane thickness
$\mathbf{\Phi_m}$	60 %	Membrane porosity
$\mathbf{k_m}$	$3 \cdot 10^{-15}$ m^2	Membrane permeability
$\mathbf{Q_{low}}$	variable	Lower channel flow rate (perfusion)
$\mathbf{P_{out}}$	0 Pa	Outlet pressure
$\mathbf{C_{0,glu}}$	25 mM	Initial concentration of glucose
$\mathbf{C_{in,glu}}$	25 mM	Inflow glucose concentration
$\mathbf{D_{glu}}$	$2.1 \cdot 10^{-9}$ m^2/s	Glucose diffusion coefficient
$\mathbf{\rho_c}$	10^6 cells/mL	Cell density
$\mathbf{V_M}$	10^{-15} mol/cell/s [2]	Saturated consumption rate per cell
$\mathbf{K_M}$	3 mM [3]	Concentration giving a consumption rate equal to half of the saturated rate
ρ	10^3 kg/m^3	Media density
µ	10^{-3} kg/(m.s)	Media viscosity

Supplementary Figure S2:



		Domain		
		Perfusion channel	Culture channel	Porous membrane
Type of the governing equation	Fluid flow	$-\vec{\nabla}p + \mu\nabla^2\vec{u} = 0$		$-\vec{\nabla}p + \frac{\mu}{\Phi_m}\nabla^2\vec{u} - \frac{\mu}{k_m}\vec{u} = 0$
	Concentration	$-D\nabla^2 c + \vec{u}\cdot\vec{\nabla}c = 0$	$-D\nabla^2 c + \vec{u}\cdot\vec{\nabla}c = -\frac{V_M\rho_c c}{K_M + c}$	$-D\Phi_m\nabla^2 c + \vec{u}\cdot\vec{\nabla}c = 0$

Figure S2. Description of the model used for simulations and the governing equations in each domain.

The boundary conditions are specified on the schematic and the simulation parameters are referenced in each domain. The table contains the physical equations used in each domain to describe the fluid flow and the concentration of glucose. u is the fluid velocity vector, c the concentration of the studied specie, $\vec{\nabla}$ is the gradient operator, ∇^2 is the Laplacian; the other parameters are specified in the supplementary table. Because the Reynolds number in the simulations does not exceed 10^{-3}, the inertial term (right hand side) was neglected in the equations describing the fluid flow in each domain.

References:

1. R. J. Horwood, *ElectroComponent Science and Technology*, 1974, **1**, 129-136.
2. C. V. Vaz, M. G. Alves, R. Marques, P. I. Moreira, P. F. Oliveira, C. J. Maia and S. Socorro, *Int J Biochem Cell B*, 2012, **44**, 2077-2084.
3. S. P. Williams, J. E. Flores-Mercado, R. E. Port and T. Bengtsson, *EJNMMI research*, 2012, **2**, 6