Electronic Supplementary Information for

MICROFLUIDIC ASSAY FOR THE ON-CHIP ELECTROCHEMICAL MEASUREMENT OF CELL MONOLAYER PERMEABILITY

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SUPPLEMENTARY FIGURES

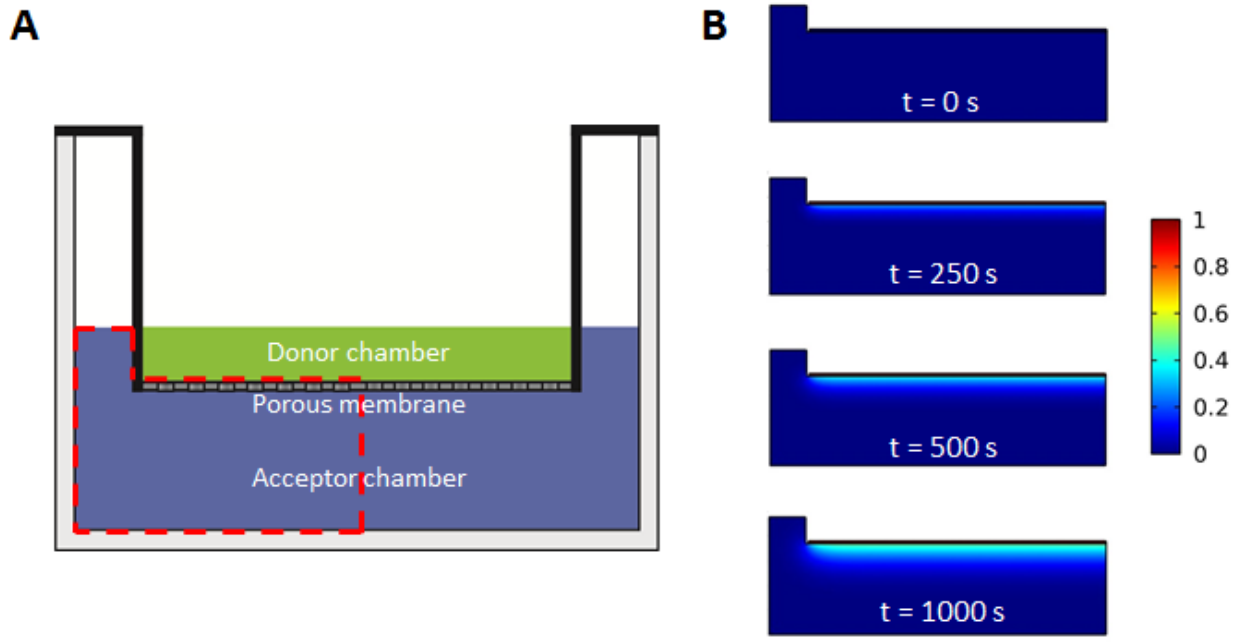

Fig.S1 Computational model of fluorescein transport in a 6-well Transwell system. A) Schematic of the 6-well Transwell geometry and the numerically simulated portion (dashed red outline). B) Normalized concentration profiles at selected time points in the Transwell system. Mass transport was assumed to be invariant around the central vertical axis. Physical dimensions of the model were based on manufacturer specifications and the volume of solution used in the permeability experiments. The concentration of fluorescein in the donor chamber was assumed to be much greater than the concentration in the acceptor chamber and thus remained constant. Diffusive permeability was calculated by integrating the fluorescein concentration in the acceptor chamber at a given time point to obtain the fluorescein flux across the porous membrane support.

Parameter	Value	Reference
Falcon 1.0 µm pore PET cell culture insert (Cat. No. 353102)		
Pore density (pore cm^{-2})	$1.6\pm0.6\times10^{6}$	(Corning, 2016)
Porosity	0.0126	
Darcy permeability (m^2)	3.93×10^{-16}	
Thickness (µm)	10	(Corning, 2016)
MB concentration (µM)	40	
MB diffusion coefficient ($m^2\ s^{-1}$)	4.6×10^{-10}	(Miložič et al., 2014)
RuHex concentration (µM)	200	
RuHex diffusion coefficient ($m^2\ s^{-1}$)	8.42×10^{-10}	(Wang et al., 2011)
Fluorescein concentration (µM)	0.1	
Fluorescein diffusion coefficient ($m^2\ s^{-1}$)	4.2×10^{-10}	(Casalini et al., 2011)

Table S1 Computational model parameters for electroactive or fluorescent tracer transport simulations.

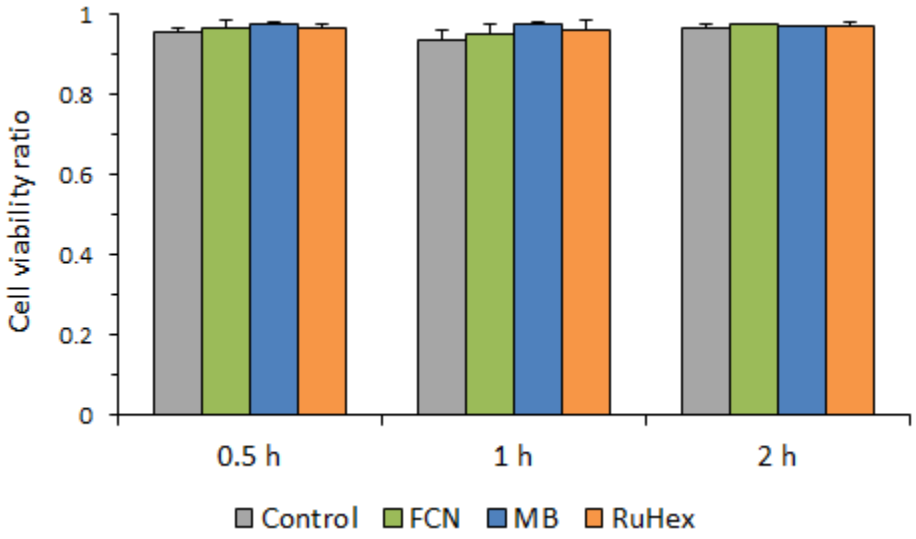

Fig.S2 Fraction of viable cells relative to the total number of cells (viable + dead) after treatment with different electroactive tracers. The cell viability ratio was > 0.94 across all conditions. $n \geq 3$ for all treatments and timepoints except for FCN at 2 h where $n = 1$.

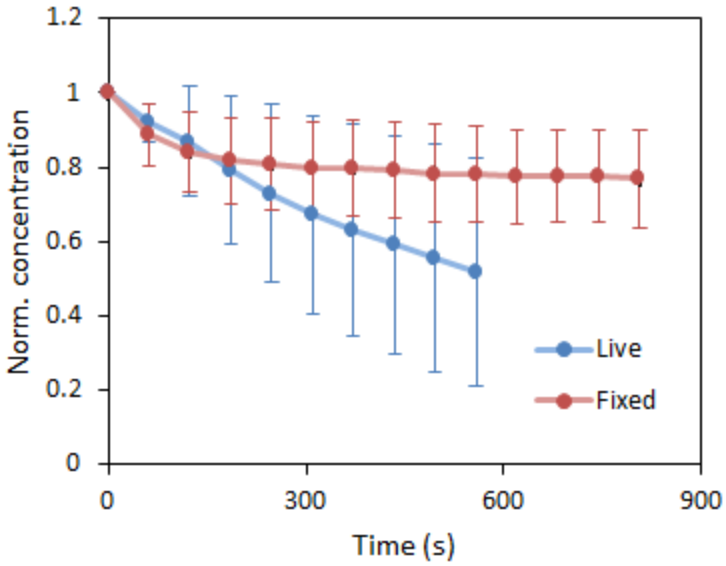

Fig.S3 MB electrochemical signal over time in the presence of a live PAEC monolayer and fixed (dead) PAEC monolayer. The electrochemical signal decreases continually and rapidly in the presence of live cells whereas the signal stabilizes in magnitude when these same cells are no longer active, a strong indication that MB is reduced by living endothelial cells.

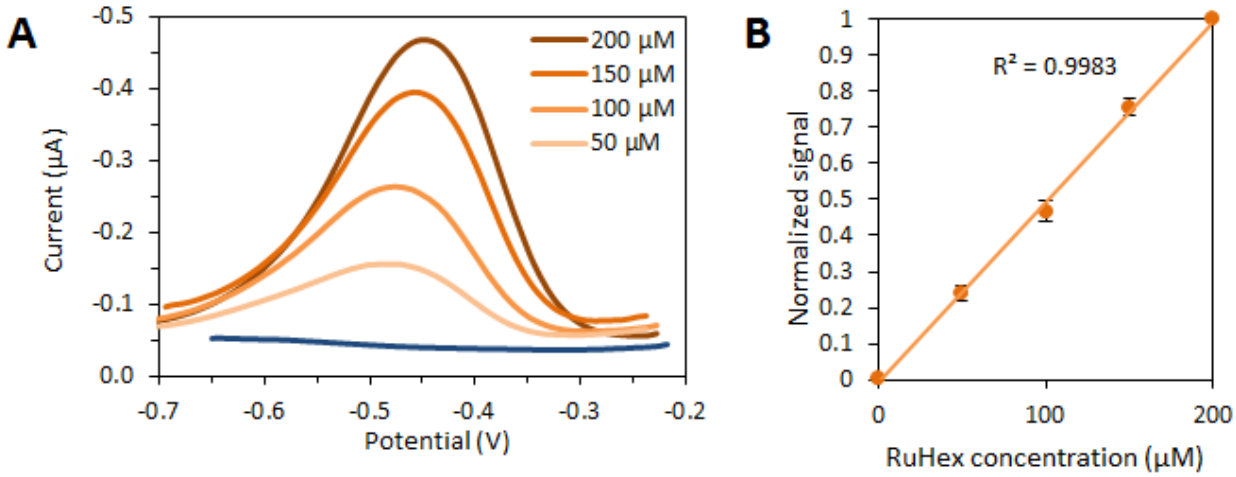

Fig.S4 A) Sample SWV scans at different concentrations of RuHex measured using the integrated electrodes in the bilayer microfluidic device. The peak current increases as the concentration of RuHex increases. The blue curve represents a blank scan. B) Standard curve. A strong linear correlation was found between the normalized peak current and RuHex concentration.

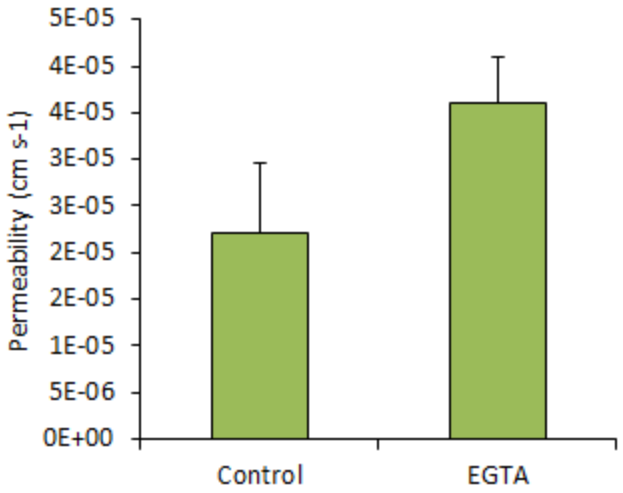

Fig.S5 PAEC monolayer permeability to fluorescein as measured by a Transwell assay.

REFERENCES

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