

Supplementary information

Finite element modelling (FEM) was used to numerically solve the electric field distribution within an individual dot-ring electrode configuration and calculate the electrical properties of culture medium. From symmetry, a 2D axially-symmetric model was used and the solution calculated using the quasi-electrostatic mode in Comsol Multiphysics 3.4 (Comsol Inc. Sweden). The geometry was identical to the actual device. A 200 μ l volume of apical cell culture gave a 6mm high column of liquid in the Transwell®. The conductivity of the cell culture medium is 1.47S/m, and a voltage of 1V is applied across electrodes in the simulation. Supplementary figure 1 shows the global potential and electric field distribution within the device. A local numerical simulation to characterize the effect of the nano-porous polyester membrane was performed as shown in figure 2 in the paper. The boundary conditions of the local simulation were obtained from the numerically solved global potential distribution.

Supplementary Figure 1 Legend:

Finite element model of a single measurement well containing the dot-ring electrodes configuration in 2D axis-symmetry mode in Comsol Multiphysics 3.4 for numerically calculated the electric potential and field distribution. This figure shows the potential distribution and the electric field lines across the apical and basolateral culture medium.