Supplemental data 1

As demonstrated by Wu et al.[26], the oxygen delivered to the cell culture chamber through the PDMS in the closed configuration can be described with the following formula: $F = D_{PDMS} \times (\Delta c / \Delta z)$ where D is the diffusion coefficient of oxygen in PDMS ($4.1 \times 10^{-5} cm^2 / s$), Δc is the concentration difference over the PDMS barrier and Δz is the barrier thickness. If we assume that all oxygen is consumed Δc equals the atmospheric oxygen concentration, $2 \times 10^{-7} moleO_2 / cm^3$. The PDMS piece covering the chamber is approximately 1 mm thick and a Δz of 1 mm gives an oxygen flow of $8.5 \times 10^{-7} molesO_2 / (chamber \times day)$. The amount of oxygen dissolved in the medium entering the chamber can be described as DO=$(P - p) \times 0.827 / (49 + T)$ where P is the barometric pressure, p is the water vapor pressure and T is the temperature. This will result in an inflow of $3 \times 10^{-7} molesO_2 / (chamber \times day)$. In total this should cover the estimated need for embryonic tissue in the range of 0.1 mg. Further, calculations by Wu et al. also show that the glucose concentrations at the end of a 1.3 mm thick gel construct (2% agarose with a cell density of 4 million cells/ml) is 96.4% of the initial glucose concentration of the medium if continuously replaced. Since the diffusion coefficients in collagen-I and agarose is within the same order of magnitude, this result translates fairly well to our experimental setup.