Electronic Supplementary Material (ESI) for Analyst.

Biophysical quantification of reorganization dynamics of human pancreatic islets during co-culture with adipose-derived stem cells

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Supplementary Information

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S1. Confidence Ellipses for h-islets with ADSC co-culturing time points.

Confidence ellipses for controls and h-islets co-cultured with ADSC for 24h, 48h and 72h.

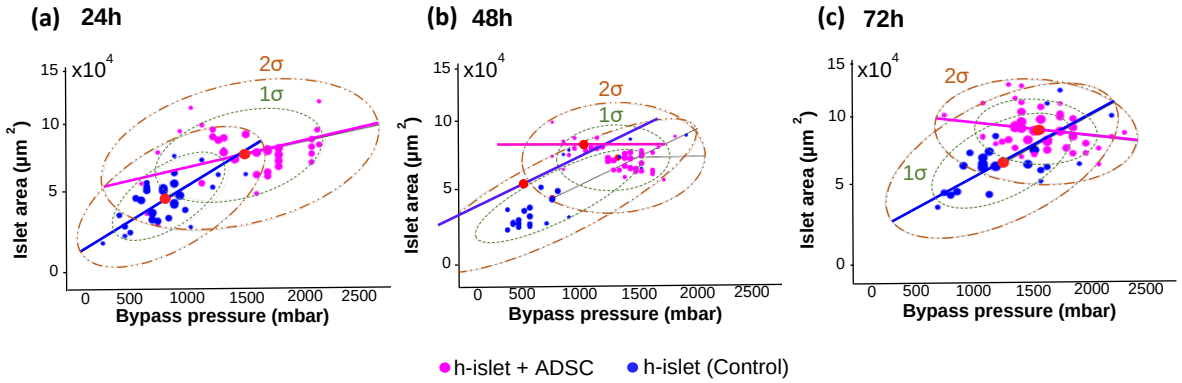

Fig. S1: Bypass pressure of individual co-cultured h-islet + ADSC and h-islet controls. (a) at 24h, (b) at 48h and (c) at 72h of co-culturing time.

A principal component analysis (PCA) was performed to correlate the bypass pressure needed to deform the h-islets through the device constriction, and their changes in area during the co-culturing time with ADSC (Fig. S1). The h-islet aggregates were measured over the course of 3 days of co-culture with ADSCs at 24h, 48h and 72h time points. The confidence ellipses show how the controls maintain a positive slope across the 3 time points (as expected), whereas the h-islet + ADSC slope moves from a positive slope to an almost invariant slope (close to zero) in the 72h measurement. The respective slope at the 48h timepoint shows transition from a wider distribution of bypass pressures to a more compact distribution for the h-islet aggregates co-cultured with ADSCs. We attribute these alterations to the shape reorganization of the aggregates occurring during h-islet co-culture with ADSCs.

S2. Human islets with ADSC brightfield and fluorescent images comparison.

Co-cultured h-islets with ADSC were followed over the course of six days to track their morphology changes. The first row in Figure S2 shows 3 time points of brightfield pictures taken for the co-cultured with ADSC h-islets inside the microfluidic test chip, and the second row shows fluorescence images of the stained co-cultured h-islets with ADSC in their co-culturing well plates.

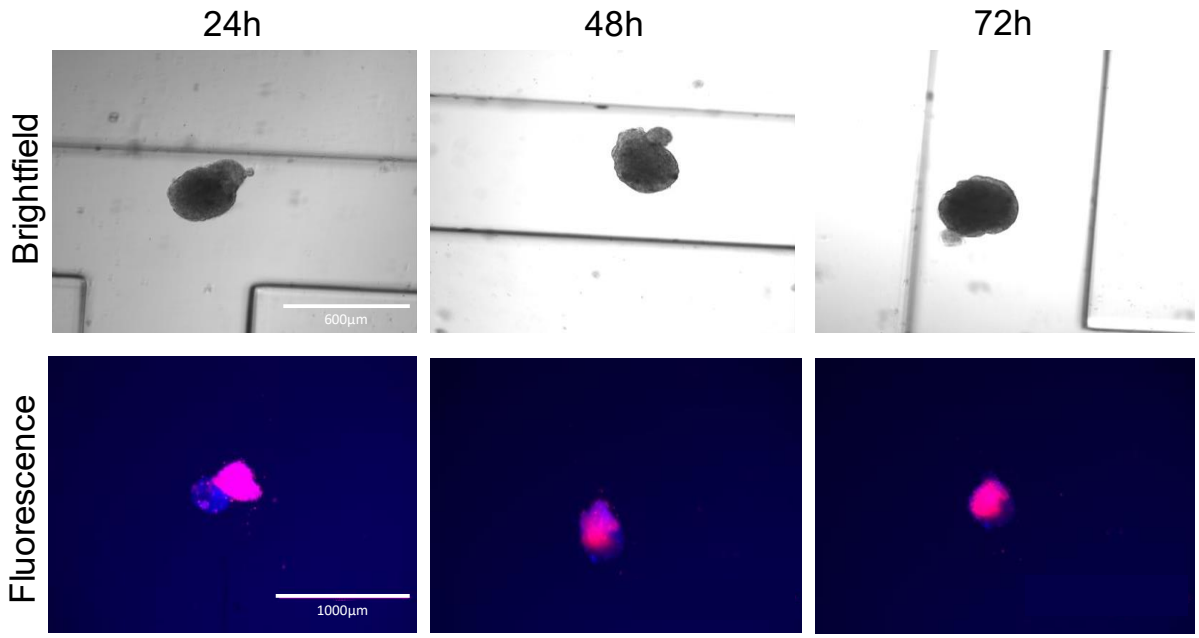

Fig. 2: Brightfield and Fluorescence images from h-islets co-cultured with ADSC at 24h, 48h and 72h. The pink dye corresponds to ADSC and the blue dye to the h-islet tissue.

Brightfield images allow to track the overall morphological changes of h-islet aggregates during ADSC co-culture, but they do not provide further information on the ADSC integration process and on how the ADSC are distributed inside the h-islet tissue. Fluorescence images provide us information about the ADSC integration process and their structural arrangement inside the h-islets during the co-culturing time, but it is a low throughput measurement method. Both, brightfield and fluorescence images are 2D images that provide information about the area of the aggregate from a top view perspective, but they do not offer volumetric information on the h-islet reorganization. Hence, we developed a biomechanical assay that measures, in principle, h-islets in a non-destructive manner and accounts for volumetric changes that the h-islets experience during the co-culturing time with ADSC.