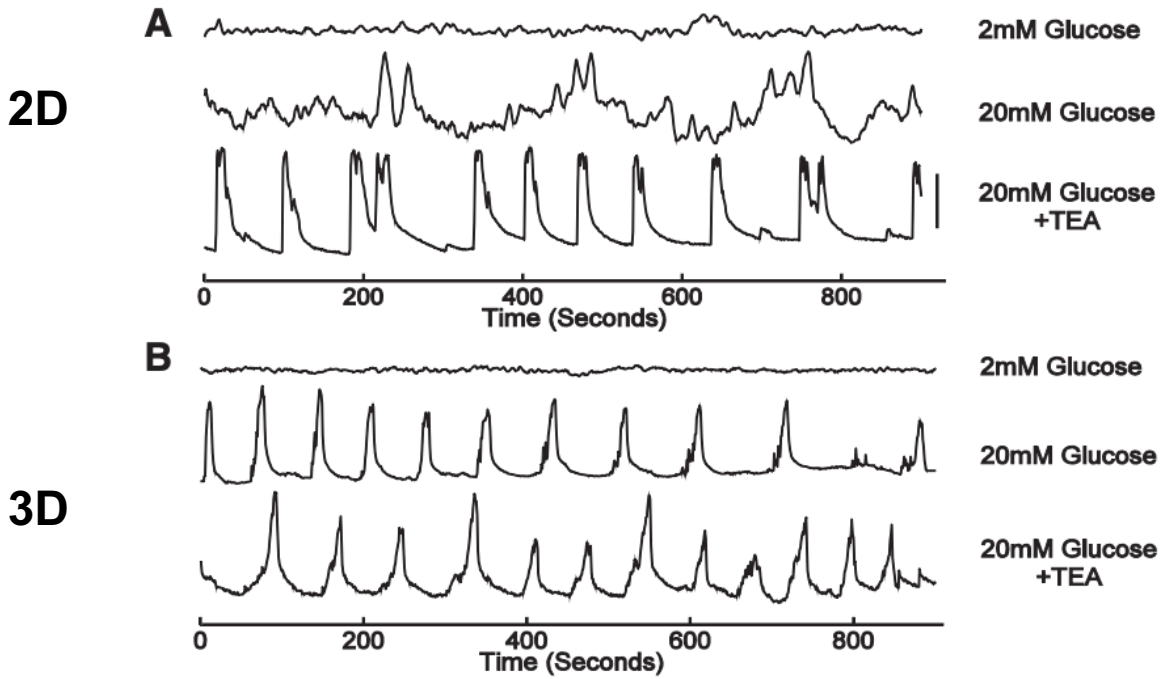
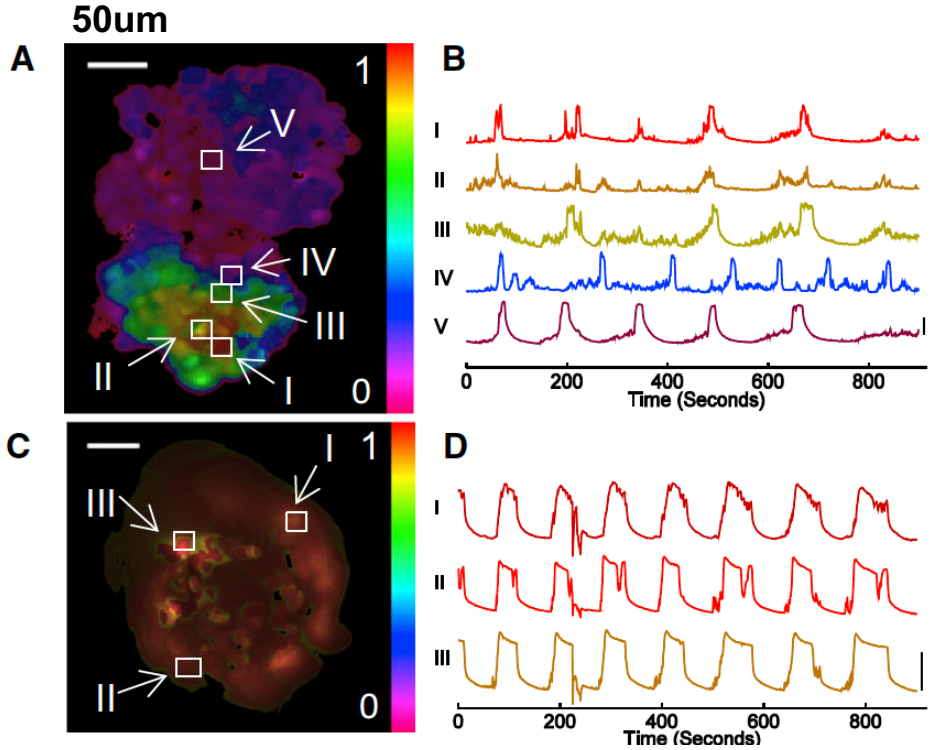
Dimension and size dependence of [Ca2+] synchronization

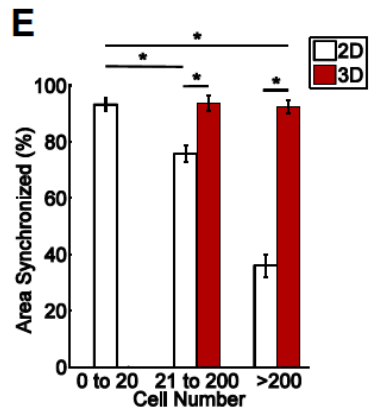
2D: ~4000 cells/mm^2 (MIN6)
3D: ~520,000 cells/cm^2 in hydrogel microwell arrays

[Ca2+] readout using Fluor4





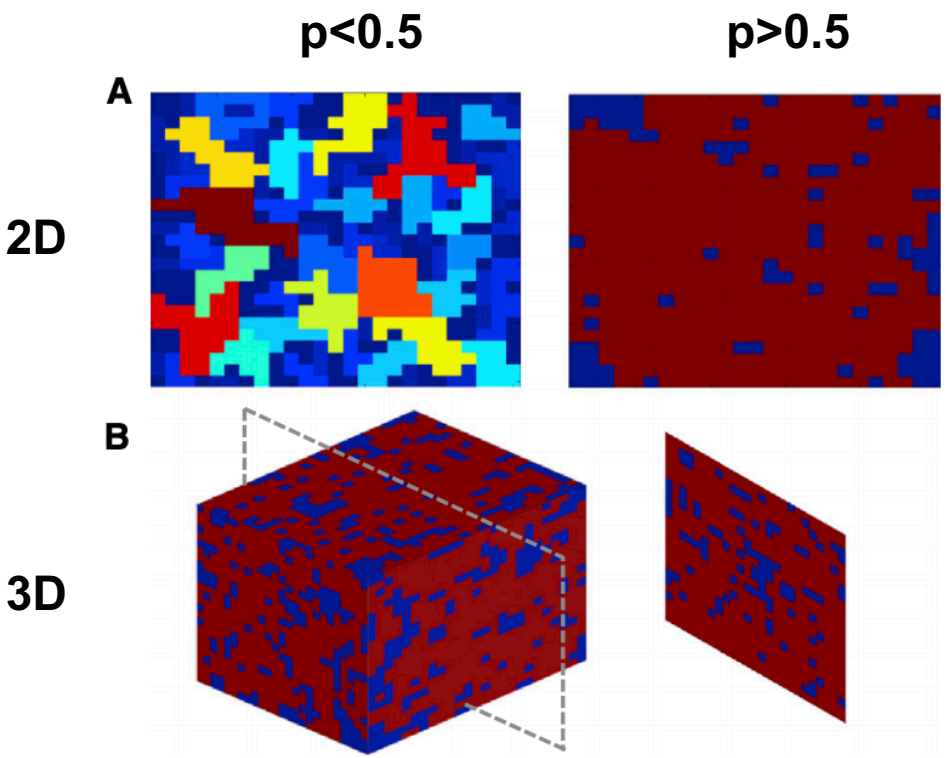
- High-glucose + TEA
- ~5 cell synchronization radius in 2D
- Synchronization is scale-dependent in 2D but not in 3D

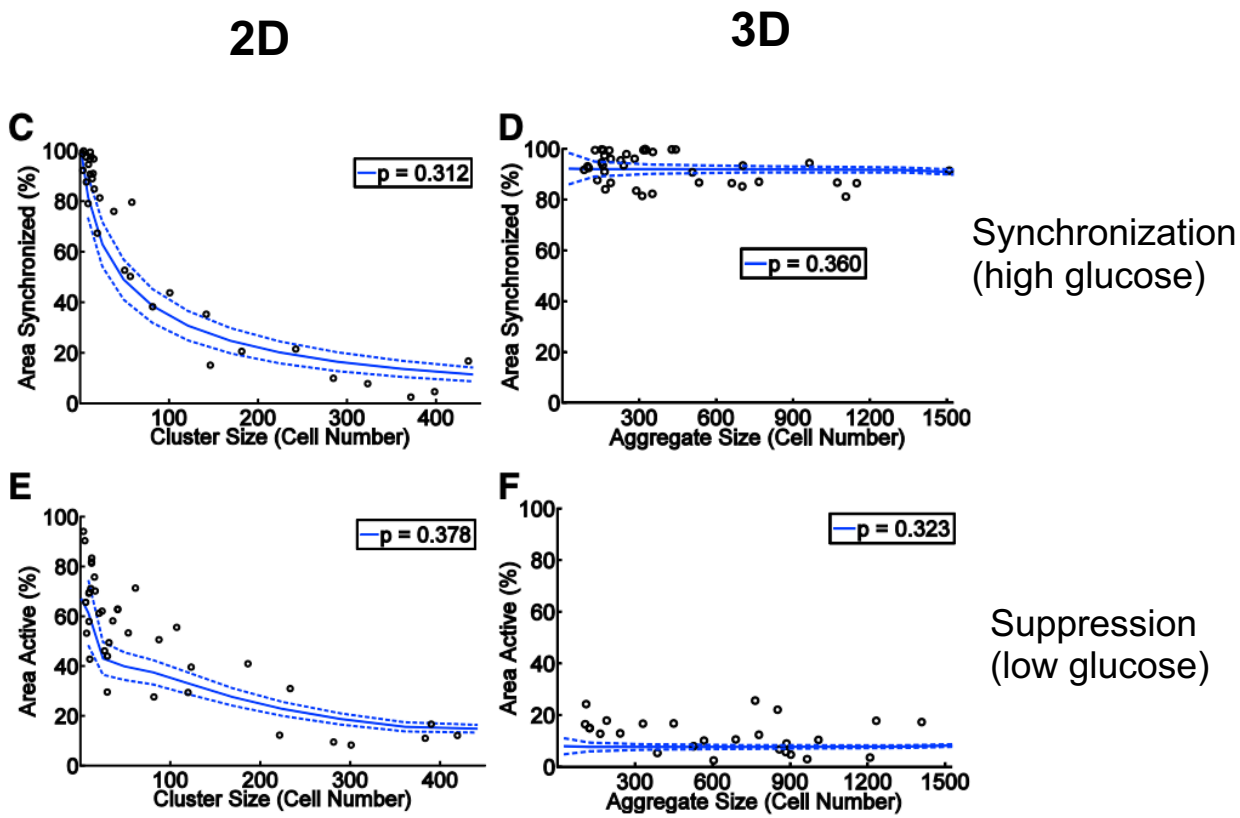


Dimensionality and size scaling of coordinated Ca2+ dynamics in MIN6 beta-cell clusters. **Biophysical Journal. 2014**

Coupled-resistor network model

p represents the probability for two neighboring cells to be functionally coupled to synchronize their oscillations or suppress spontaneous calcium





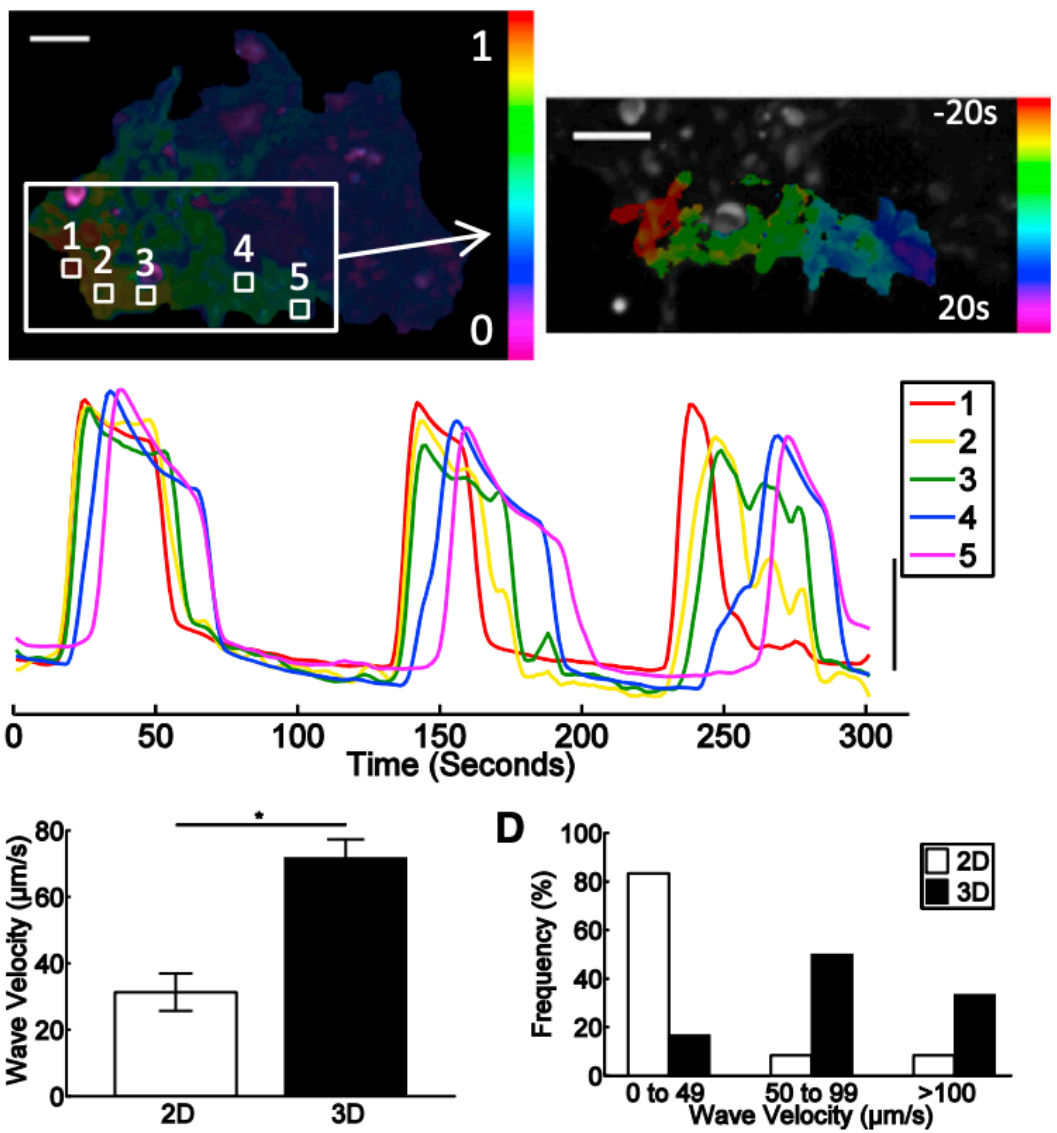
Synchronization (high glucose)

Suppression (low glucose)

Dimensionality and size scaling of coordinated Ca2+ dynamics in MIN6 beta-cell clusters. **Biophysical Journal. 2014**

Wave velocity under 2D/3D coupling

2D



P<0.001

Dimensionality and size scaling of coordinated Ca2+ dynamics in MIN6 beta-cell clusters. **Biophysical Journal. 2014**