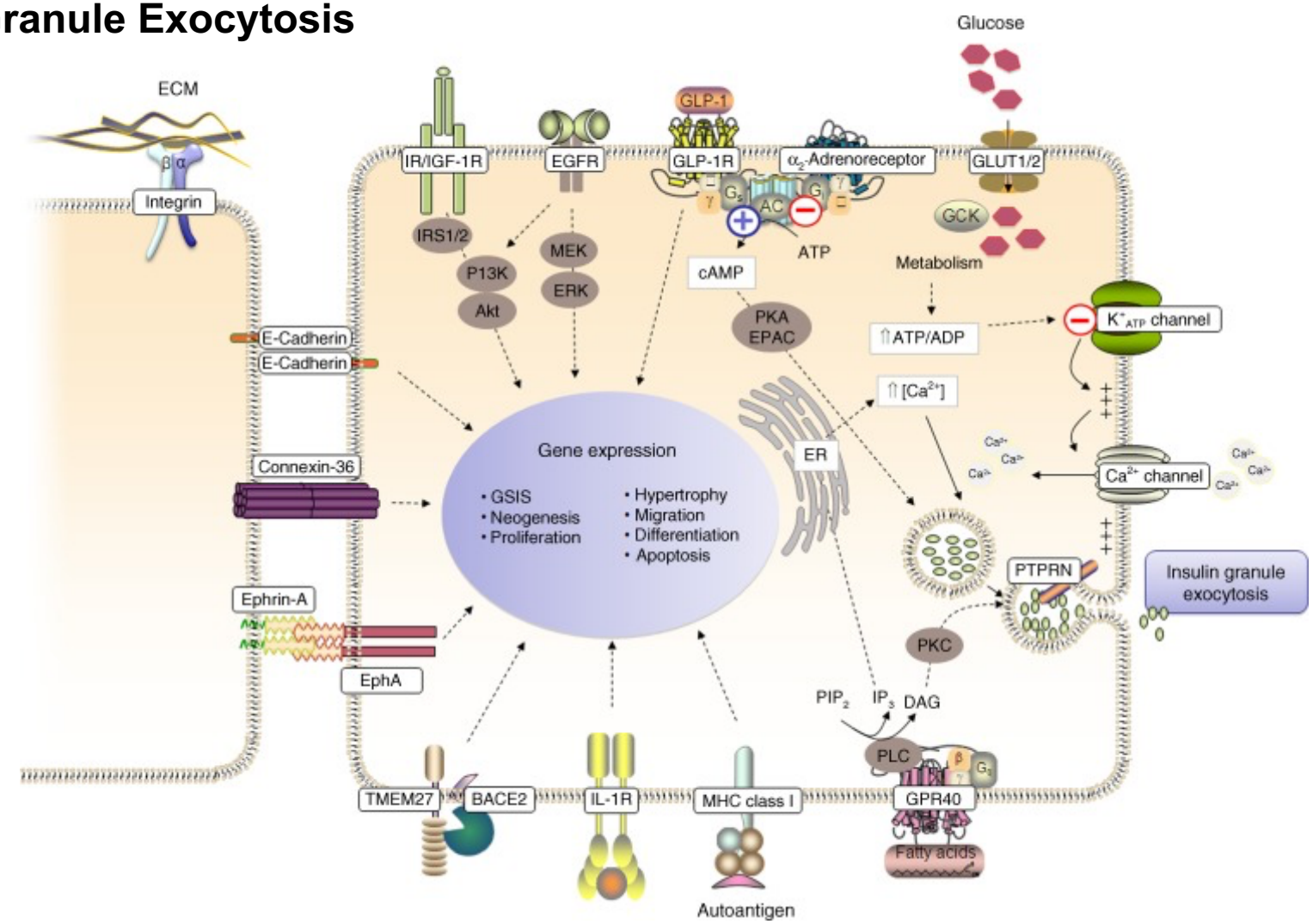
Intracellular Ca^{2+} is involved in Insulin Granule Exocytosis

- ATP-sensitive K^+ channels open and depolarize the cell in response to the availability of glucose
- Voltage-gated Ca^{2+} open and increase in $[Ca^{2+}]$ triggers insulin granule exocytosis
- Gap junctions allow communication of glucose stimuli to neighboring beta cells



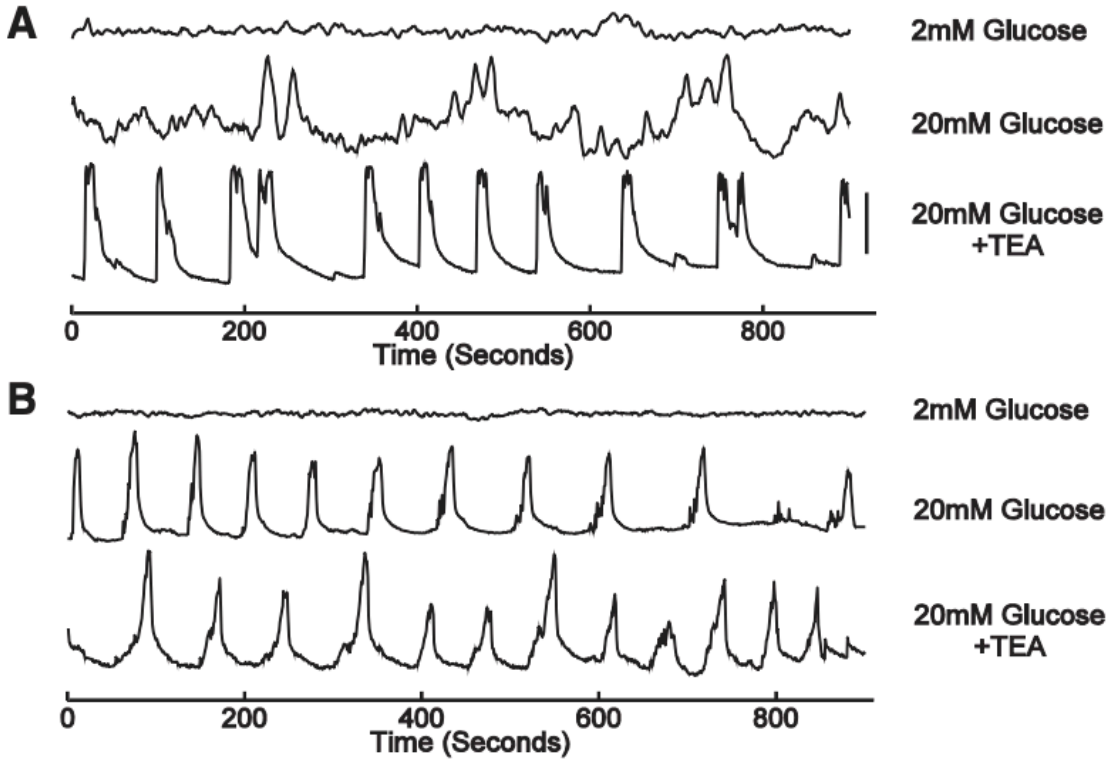
$$C_{\mathrm{m}}\frac{dV_{\mathrm{j}}}{dt} = -(I_{\mathrm{K(Ca)}} + I_{\mathrm{K(ATP)}} + I_{\mathrm{Ca}} + I_{\mathrm{K}} + I_{\mathrm{coupl,j}})$$

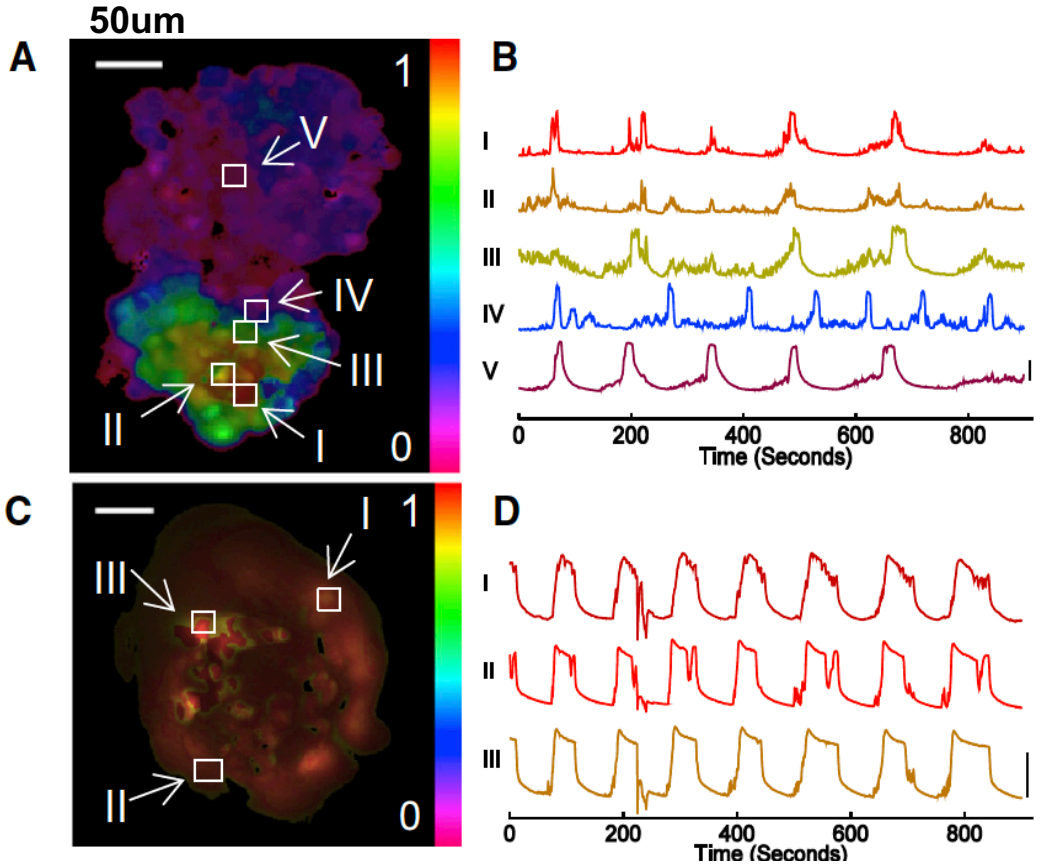
$$I_{\mathrm{coupl,j}} = g_{\mathrm{c}} \sum_{\mathrm{i}}^{\mathrm{neighbor_j}} (V_{\mathrm{j}} - V_{\mathrm{i}}).$$

The pancreatic beta cell surface proteome. **Diebetologia. 2012**

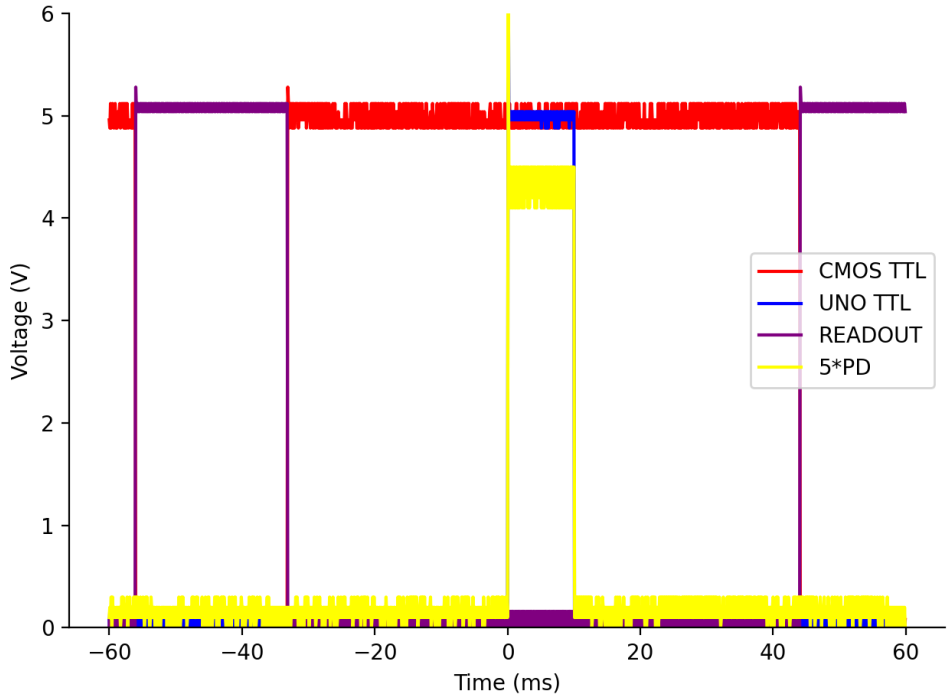
Synchronization of [Ca2+] oscillations is dependent on growth geometry

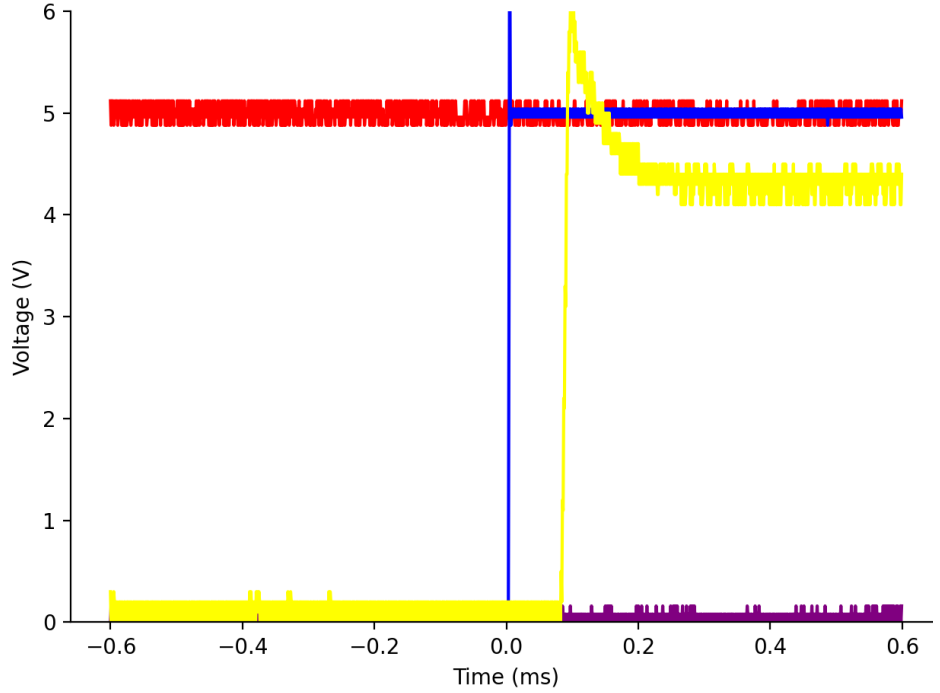
- MIN6 monolayers show reduced synchronization of [Ca2+] oscillations relative to pseudo-islets
- Calcium-dependent fluorescent dyes such as Fluor4 allow us to measure steady-state synchronization of [Ca2+] oscillations

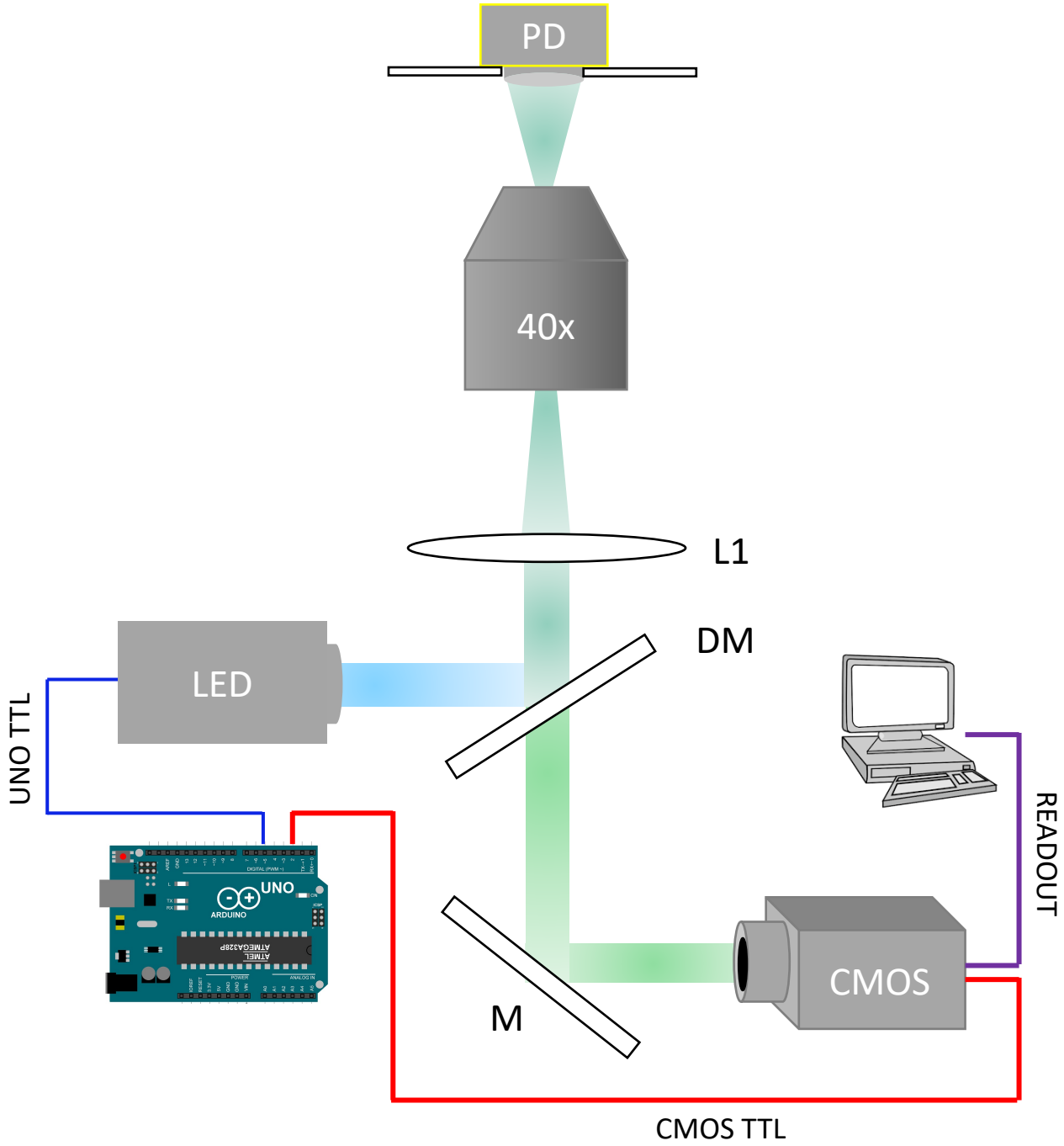




Dimensionality and size scaling of coordinated Ca2+ dynamics in MIN6 beta-cell clusters. **Biophysical Journal. 2014**


Voltage (V)
Time (ms)
CMOS TTL
UNO TTL
READOUT
5*PD


Voltage (V)
Time (ms)


PD
40x
L1
DM
LED
UNO TTL
READOUT
M
CMOS
CMOS TTL

Calcium Experiments

Voltage Experiments