B-9

Morphological and functional changes of dissociated single pancreatic acinar cells: testing the single cell as a model for exocytosis and calcium signaling

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Isolated single pancreatic acinar cells have long been used as a good model for studying many kinds of signaling processes due to their good structural and functional polarities without a significant validation. In this study, we have examined morphological and functional changes of the dissociated single pancreatic acinar cells by imaging cytosolic Ca^{2+} concentration, exocytosis of granules, and by observing their shapes with confocal microscopy.

The acutely isolated single pancreatic acinar cells showed a collapsed membrane potential and much reduced secretion of zymogen granules in response to acetylcholine stimulation whereas the single cells positioned within isolated pancreatic clusters showed a much negative membrane potential and potent secretion of zymogen granules through the whole luminal areas. In isolated single cells, their shapes became vertically flattened due to the loss of supporting connections with nearby cells and the granule-attached luminal areas were severely reduced by contrast with the cells within acini. However, the polarized Ca^{2+} signals and mitochondrial localization were relatively well-preserved in the isolated single cells, in that the Ca^{2+} release by acetylcholine was started from one of the granular area close to the lumen. In the cells within pancreatic acini the Ca^{2+} release site was closest to the lumen where more than three cells met or to the tip of conical shapes of the luminal membrane. From these results, we conclude that the dissociated single pancreatic acinar cells relatively preserve intact Ca^{2+} signaling machineries but have altered in shapes with impaired exocytotic functions and resting membrane potentials.

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