TRPV3 and Cav3.2 ion Channels Functionally Interacts in Mouse eggs

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Oocyte maturation or the acquisition of meiotic competence requires a controlled expression of proteins that supports this process in preparation for fertilization. Both, oocyte maturation and fertilization are determined by a highly regulated ion homeostasis. Several ion channels, regulating diverse cellular processes, have been reported to be expressed in eggs from different species, including mammals. Fertilization starts with the release of the sperm-specific phospholipase ζ (PLCζ) in the mature oocyte, egg. Ca^{2+} influx is required to accumulate Ca^{2+} in the oocyte in preparation for fertilization, as well as to refill its intracellular stores during fertilization, supporting Ca^{2+} oscillations and egg activation. The egg activation includes the formation of the pronucleus, cortical granule exocytosis, polyspermy blockade, and the completion of meiosis II, between others processes to support the transition to early embryonic development. The voltage-gated activated calcium channel Cav3.2 channel have been reported to be expressed and contributes to the refilling of the calcium store in preparation for fertilization in mouse eggs. In addition, the transient receptor channel from the subfamily vanilloid, TRPV3, a cationic non-selective channel, have been shown to be expressed in mouse eggs, however, its physiological function is currently unknown. Here, we show that TRPV3 and Cav3.2 are functionally interacting in mouse eggs. Using eggs lacking TRPV3 and Cav3.2 proteins, we evaluate their role in cortical granule distribution.
Methods: Using KO animal models, confocal microscopy, bioinformatics and patch-clamp electrophysiology, we tested the expression and function of ion channels in mouse eggs, and evaluated their role in cortical granule dynamics.
Results: Cav3.2 currents at -20 mV are significantly decreased in TRPV3KO eggs (~8 pA/pF WT eggs vs. 3,75 pA/pF in TRPV3KO eggs). TRPV3 currents in response to the agonist 2-APB are decreased in Cav3.2KO eggs (41 pA/pF in WT vs. 30,5 pA/pF in Cav3.2KO eggs). TRPV3KO eggs show a significantly diminished CG density in the plasma membrane measured as fluorescence intensity of labeled *lens culinaris agglutinin* in comparison to WT eggs. Bioinformatics approaches reveal possible sites/residues of physical interaction between Cav3.2 and TRPV3 protein.
Our results suggest a functional and/or physical interaction of Cav3.2 and TRPV3 that might modulate critical cellular processes as cortical granule distribution, underlying egg-to-embryo transition in mammals.
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