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Analysis of mitochondrial dynamics in porcine oocytes during meiotic maturation

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Mitochondria are essential organelles that play critical roles in the survival of aerobic organisms. Although intracellular distribution and functions of mitochondria in somatic cells differ dramatically reflecting metabolic demands of cells and tissues, their dynamics and functional changes during oocyte maturation remain unknown. To understand critical functions of mitochondria in the maturation and meiosis of mammalian oocytes, we analyzed mitochondrial dynamics in porcine oocytes during meiotic maturation. Immature oocytes were collected form freshly obtained prepubertal porcine ovaries. After fluorescence labeling with Mitotracker Orange-containing culture medium, oocytes were centrifuged at 10.000 x g and 37 °C for 15 min. Mitochondria-enriched cytosolic specimens were obtained from the centrifuged oocytes by micropuncture and injected into ooplasm of the recipient oocytes. The dynamics of fluorescence-labeled mitochondria in the maturing oocytes was analyzed using time-lapse cinematography. Kinetic analysis revealed that the injected mitochondria rapidly moved within the cytoplasm and dispersed in recipient oocytes along the cortical regions of plasma membranes where microfilaments were highly enriched. The present work permits visualization of mitochondrial dynamics in live oocytes *in vitro*. The mechanism and pathophysiological significance of mitochondrial dynamics in maturing oocytes will be discussed in relation to meiosis and remodeling of the cytoskeleton.