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Fertilization Blocks Apoptosis of Starfish Eggs by Inactivation of the MAP Kinase Pathway

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Abstract

Fully grown starfish oocytes are arrested at prophase of meiosis I. The hormonal stimulation of 1-methyladenine (1-MA) induces meiosis reinitiation and germinal vesicle breakdown (GVBD). Optimal development occurs when maturing oocytes are fertilized between GVBD and first polar body emission. In the absence of sperm, oocytes complete both meiotic divisions to yield haploid interphase-arrested eggs. We now report that spontaneous and synchronous activation of caspase-3 in starfish eggs occurs 9–12 h after 1-MA stimulation. Then, caspase-dependent membrane blebbing and egg fragmentation occur, indicating that mature eggs undergo apoptosis if not fertilized. Activation of caspase-3 and induction of apoptosis are blocked both by a MEK inhibitor and by emetine treatment which inhibits MEK kinase (Mos) synthesis. Conversely, when recombinant GST-Mos is injected into the emetine-treated eggs, apoptosis is induced. These results indicate that persistent activation of the Mos/MEK/MAP kinase cascade gives the death-activating signal in starfish eggs. Fertilization inactivates the MAP kinase pathway and suppresses apoptosis, followed by normal development.

Keywords





starfish; egg; apoptosis; caspase; MAP kinase; Mos; fertilization; maturation







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