Mitogen-Activated Protein Kinase and Cell Cycle Progression During Mouse Egg Activation Induced by Various Stimuli

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A very sensitive method was established for detecting the activity of mitogen-activated protein (MAP) kinase in mouse eggs, and used to follow temporal changes of this kinase during fertilization and sponatenous or chemically-induced parthenogenic activation. MAP kinase activity increased between 1 and 2.5 h post-insemination, at which time the second polar body was emitted and sperm chromatin was dispersed; its activity decreased sharply at 8 h, when pronuclei were formed. Both calcium ionophore A23187 and ethanol simultaneously induced pronuclear formation and MAP kinase inactivation in aged eggs 8 h after incubation but less effectively in fresh eggs. The protein kinase inhibitor staurosporine induced pronuclear formation and MAP kinase inactivation more quickly than other treatments, with MAP kinase inactivation occurring slightly proceeding pronuclear formation. Okadaic acid, a specific inhibitor of protein phosphatase 1 and 2A, induced increase in MAP kinase activity, and overcame pronuclear formation induced by various stimuli. MAP kinase inactivation preceded pronuclear formation in eggs spontaneously activated by aging *in vitro*, perhaps due to cytoplasmic degeneration and thus delayed response of nuclear envelope precursors to MAP kinase inactivation. These data suggest that MAP kinase is a key protein kinase regulating the events of mouse egg activation. Increased MAP kinase activity is temporally correlated with the second polar body emission and sperm chromatin decondensation. Although different stimuli (including sperm) may initially act through different mechanisms, they finally inactivate MAP kinase, probably by allowing the action of protein phosphatase, and thus induces the transition to interphase.

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