外国語要旨

The regulation of mRNA polyadenylation during meiosis progression in starfish oocytes

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I. Phosphorylation of CPEB and mRNA polyadenylation

In most animals, fully grown oocytes are arrested at prophase of meiosis I. During the growth period, the oocytes synthesize and store large quantities of dormant mRNAs with short poly(A) tails in their cytoplasm. Generally, resumption of meiosis in oocytes can be experimentally induced *in vitro* after isolation of oocytes from female animals. After *in vitro* stimulation of meiosis resumption, translation of maternal mRNAs containing the cytoplasmic polyadenylation element (CPE), such as *cyclin B*, is activated by phosphorylation of CPE-binding protein (CPEB), followed by elongation of their poly(A) tails. However, It remains unknown whether this model can be applied to oocytes maturing *in vivo* in the ovaries.

In this study, we found that active Cdk1 phosphorylated CPEB in ovarian oocytes of starfish arrested at MI in the body cavity, whereas phosphorylation of CPEB was not sufficient for elongation of poly(A) tails of *cyclin B*: mRNA was polyadenylated immediately after spawning. Using a cell-free system made from maturing oocytes at MI, we demonstrated that polyadenylation was suppressed at pH below 7.0. These results suggest that a pH-sensitive process, functioning after CPEB phosphorylation, is suppressed under physiologically lower pH_i (<7.0) in the MI arrested oocytes. After spawning, an increase in pH_i (>7.0) occurs, causing polyadenylation of *cyclin B* mRNA.

Ⅱ. Modification and polyadenylation of mRNA

Generally, mRNAs with long poly(A) tails are stable and translationally activated, and shortening of the poly(A) tail decreases mRNA stability. Recent works revealed that short poly(A) tails on mRNAs are subject to uridylation, which mediates mRNA decay in yeast, plant, and mammalian cells. Although mRNA uridylation has never been reported in animal oocytes, maternal mRNAs with short poly(A) tails are believed to be translationally repressed.

In this study, we found that *cyclin B* mRNAs with short poly(A) tails were uridylated in starfish oocytes. When synthesized RNAs were injected into oocytes, uridylated RNAs were as stable as non-uridylated RNAs. After hormonal stimulation, synthesized RNAs containing oligo(U) tails were trimmed in the 3' to 5' direction, and poly(A) elongation occurred. These results indicate that uridylation of short poly(A) tails in *cyclin B* mRNA of starfish oocytes does not mediate mRNA decay. Instead, hormonal stimulation induces partial degradation of uridylated short poly(A) tails in the 3' to 5' direction, followed by poly(A) elongation. Oligo(U) tails may be involved in translational inactivation of mRNAs.