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Editorial Open Access

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Editorial

The cell cycles during oogenesis, oocyte maturation and early embryogenesis in almost all vertebrate species are greatly different from those of somatic cells. This suggests that cell cycles during these periods, such as prophase I arrest during oogenesis, release from the this arrest, suppression of DNA replication during meiosis I/meiosis II, metaphase II arrest and cleavage of early embryo undergo specific regulation. For this purposes, specific cell cycle regulator(s) should be presence or/and cell cycle regulators(s) should be uniquely regulated during these periods. In fact, we showed that the c-mos proto-oncogene product, Mos, is specifically expressed and implicated in suppression of DNA replication during meiosis I/meiosis II and metaphase II arrestvia the activation of the Mitogen-Activated Protein(MAP) kinase pathway. Moreover, we also showed that the expression of Wee1 protein is uniquely regulated during these periods in Xenopus oocytes: Wee1 protein is progressively decreased and consequently is not detected in stage IV oocytes. After that, Wee1 protein is again appeared in maturing oocytes 1.5 hour after GVBD. The expression of Wee1 seemed to be regulated mainly at the translational level, because the amount of mRNA encoding Wee1 protein did not change during meiosis I and meiosis II. Generally, transcription does not occur during oocyte maturation and an early embryo, translation is thought to be main regulatory step during these periods. As described above, I am interested in specific cell cycle regulator(s) appeared in oocytes and specific mechanism of translational control during these periods.

A maturation/M-phase promoting factor, which consists of cyclin B and Cdc2 kinase, regulates multiple aspects of M-phase, including a nuclear envelopment breakdown, the chromosome condensation and spindle formation. In many species, B-type cyclin has several subtypes; especially cyclin B1 and B2 have only been described in vertebrates. Cyclin B1-null mice die in uterus, and cyclin B1/Cdc2 is able to regulate almost all mitotic events in CHO cells. In contrast, cyclin B2-null mice develop normally and fertile, whereas cyclin B2/Cdc2 only disassemble Golgi apparatus in CHO cells. These data indicate that cyclin B1 is an essential gene, but cyclin B2 is regarded as dispensable. However, in human cells, cyclin B1 and cyclin B2 differ in their subcellular localization, which is due to a Cytoplasmic Retention Signal (CRS). This suggests that the role of each cyclin would be different from other in mitotic phase. In fact, the over expression of the cyclin B2 N-terminus containing the CRS domain, but not cyclin B1, inhibits bipolar spindle formation in Xenopus oocyte and embryos. Another group also reported that the antisense RNA-mediated inhibition of cyclin B2 translation, but not cyclin B1 also induce a bipolar spindle defect in Rana japonica oocytes. I would like to unveil the role of cyclin B2 in bipolar spindle formation and mechanisms of these.

Envisioning a future in which mankind adventures into space, it is important to learn whether it will be possible for plants and animals including man to generate normal and healthy offspring under conditions of gravity and magnetic fields different from that existing on earth. Among many organisms, amphibians have proved to be a suitable model organism for space environment studies. We investigated the effects of hypergravity or Strong Static Magnetic fields (SSM) on oocyte maturation and embryonic development of Xenopuslaevis. We reported that hypergravity mainly disturbed the spindle formation of meiosis II in oocytes and caused a variety of morphological abnormalities in embryos, respectively. Furthermore, we also showed that SSM induced the morphological abnormalities in oocytes and embryos, respectively. The goal of my work is to investigate any deleterious effects that hypergravity and magnetic field might have on general growth and development and specifically endocrine systems, of amphibians, and to study ways to remedy such effects in preparation for man's step into space.