Calcium and Modulation of Meiotic Cell Cycle in Mammalian Oocytes

Shilpa Prasad[*1], Meenakshi Tiwari[1], Ashutosh N. Pandey[1] Anima Tripathi [1], Amritanjali Pandey[1], B. Koch[2], T. G. Shrivastava[3] and Shail K. Chaube[1]*

[1]Cell Physiology Laboratory, Biochemistry Unit, Department of Zoology, Banaras Hindu University, Varanasi-221005, U.P., India
[2]Genotoxicology and Cancer Biology Laboratory, Department of Zoology, Banaras Hindu University, Varanasi-221005, U.P., India
[3]Department of Reproductive Biomedicine, National Institute of Health and Family Welfare, Baba Gang Nath Marg, Munirka, New Delhi 110067, India
E-mail: [*]shailchaubey@gmail.com

Abstract—*Calcium (Ca^{2+}) is one of the major signal molecules that regulate various aspects of somatic cell functions but its role in the modulation of meiotic cell cycle of mammalian oocytes is ill understood. Recent studies suggest that the supplementation of Ca^{2+} in extracellular medium modulate meiotic cell cycle of mammalian oocytes. Drugs that induce Ca^{2+} release from internal stores and elevate cytosolic free Ca^{2+} level can also modulate meiotic cell cycle depending upon it's intraoocyte concentration. A transient increase of cytosolic free Ca^{2+} is required for spontaneous exit from diplotene- as well as M-II arrest, while high sustained level results in the maintenance of diplotene, M-II as well as M-III like arrest. The depletion of internal stores and increase of cytosolic free Ca^{2+} level leads to generation of reactive oxygen species (ROS). A moderate level of ROS modulates phosphorylation status of Cdk1 and cyclin B1 degradation that leads to MPF destabilization. The destabilized MPF in oocytes results spontaneous exit from diplotene as well as M-II arrest. On the other hand, further increase of cytosolic free Ca^{2+} generates higher than the physiological level of ROS sufficient to induce MPF destabilization. The destabilized MPF mediates spontaneous meiotic resumption in mammalian oocytes. Indeed, Ca^{2+} plays a major role in the modulation of meiotic cell cycle probably by inducing generation of ROS in mammalian oocytes.*

Keywords*: Calcium, Meiotic cell cycle, Oocyte, ROS, MPF.*