Development of a Low-invasive mRNA Electroporation Method into Immature Mouse Oocytes and Visualization of Oocyte Chromosomes during Early Embryogenesis

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Deterioration of oocyte quality along with aging of mother is a major cause of infertility. Nowadays, abnormalities of oocyte chromosome segregation is known to occur mainly during meiosis I. However, there has been a technical limitation in the introduction of mRNA into premature oocytes. Here, we established a low-invasive electroporation method to introduce mRNA into premature mouse germinal vesicle (GV) oocytes without affecting embryonic developmental ability. The electroporation procedure with an optimized impedance value resulted in the efficient expression of enhanced green fluorescent protein (EGFP) from its mRNA at a oocyte survival rate of 95.0%. Moreover, the introduction of histone H2B-EGFP mRNA into the GV oocytes enabled us to visualize oocyte chromosomal dynamics and integrity during oocyte maturation and embryonic development. The establishment of this low-invasive EP method can offer assessing quality of pre-implantation embryos and assist improvement of embryonic quality.