Mini-Symposium on the Molecular-based Approach to Embryogenesis

Preface

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After fertilization, mammalian eggs enter embryonic cell cycles, which simply divide the egg into smaller cells without any growth between cell divisions and are dependent on time elapsed from fertilization. During this early embryo development before implantation, the first event is zygotic gene activation or embryonic gene activation. The activation of the zygotic genome indicates the transition from maternal to embryonic control during the embryo development. Stimulation of fertilization induces zygotic gene activation in the egg and sequentially fertilized eggs develop under the control of the zygotic genome.

Although the events of early embryo development, including fertilization, pre-implantation development, and implantation are understood physiologically, the molecular mechanisms that regulate these events in embryogenesis are not well understood. The recent completion of a high-quality comprehensive sequencing of the whole genome of the human, mouse, and rat has made it apparent that mammalian genomes also present fundamental information for developmental biology and reproductive physiology. Especially, strategies for coupling genome sequence information with manipulation of gene function (transgenesis, gene-targeting, and knockdown technologies) can determine how the genome-encoded components function in an integrated manner to perform cellular functions in embryogenesis. In other words, molecular-based approaches are advantageous in unraveling the complexities of early embryo development.

This mini-symposium will focus on the molecular-based approach to embryogenesis. The first section of the mini-symposium will focus on the molecular mechanisms underlying fertilization, genetic control during transition of oocytes to embryos, and establishment of pregnancy after implantation. Dr. Takahashi will discuss the molecular events that are involved in sperm-oocyte interaction at the site of fertilization. Dr. Amano will focus on the involvement of the translation of maternal mRNAs that are stored in oocytes during oocytogenesis, in the development of early pre-implantation embryos. Dr. Kimura will review the current knowledge about the molecular mechanisms, which underlie the establishment of pregnancy in the mouse, human, sheep, cattle, and pig. In the second section, both basic molecular developmental study and therapeutic research learned from transgenesis by gene transfer via sperm cells and RNA interference (RNAi) will be discussed. Dr. Sato will summarize what has been achieved in the field of transgenesis via sperm cells. Dr. Mitani will outline the knockdown method using RNAi and the scientific value of this approach.

I hope this mini-symposium will help readers to integrate the molecular information about normal development and physiology of embryogenesis in different species and to develop an understanding of them. I truly appreciate all authors for their fine contributions to the Journal of Mammalian Ova Research.