REPRODUCTIVE BIOLOGY

REVIEW

Role of oocyte quality in meiotic maturation and embryonic development

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SUMMARY

The quality of oocytes plays a key role in a proper embryo development. In humans, oocytes of poor quality may be the cause of women infertility and an important obstacle in successful i*n vitro* fertilization (IVF). The competence of oocytes depends on numerous processes taking place during the whole oogenesis, but its final steps such as oocyte maturation, seem to be of key importance. In this paper, we overview factors involved in the development of a fully functional female gamete with *Xenopus laevis* as a major experimental model. Modern approaches, e.g. proteomic analysis, enable the identification of novel proteins involved in oocyte development. EP45, called also Seryp or pNiXa, which belongs to the serpin (serine protease inhibitors) super-family is one of such recently analyzed proteins. This protein seems to be involved in the stimulation of meiotic maturation and embryo development. EP45 is potentially a key factor in correct oocyte development and determining the quality of oocytes. *Reproductive Biology 2009* ***9*** *3: 203-224.*

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INTRODUCTION

High quality gametes produce well-developed embryos. Genomes of both the oocyte and the spermatozoon participate equally in creation of the embryonic genome. However, no transcription occurs at the beginning of embryo development, so the very first steps of embryogenesis are controlled exclusively by maternal information present in the oocyte. Therefore, the embryonic genome has almost no impact on the earliest steps of the developmental program whereas the quality of maternal information plays a major role during this period.

After fertilization, ooplasm becomes the embryo cytoplasm, while the spermatozoon's participation in this process is minimal. For this reason, the quality of oocytes is a key factor in determining the quality of the earliest steps of embryo development. Paradoxically, the simple notion of a "good quality oocyte" is very complex. Factors affecting the first steps of embryo development accumulate throughout the oogenesis period but the nature of them is unknown.

Many case reports present an inability of the human oocyte to undergo successful meiotic maturation and *in vitro* fertilization (e.g. [4, 38, 51, 63]). However, such cases of idiopathic infertility are very difficult to be explained in sporadically identified patients. An understanding of their origin and research on adequate infertility treatments would require better characterization of regulatory mechanisms governing oocyte maturation in animal models [69]. Similarities in regulatory pathways and mechanisms operating in oocyte development in different vertebrate species suggest new avenues for human research [61, 71].

In vertebrates, oocytes are arrested for several weeks, months or years in prophase of the first meiotic division. During this long period, oocytes accumulate molecules of mRNA, proteins, lipids and sugars as well as gradually increase in size. Accumulation of all necessary sources of energy