- of intracytoplasmic sperm injection. Hum. Reprod. V. 12. P. 1267.
- Sun F., Cun J., Huang R., Chen Y., Verwoerd G., Yu Y. 2022. Different occurrence rates of centrally located cytoplasmic granulation in one cohort oocytes show distinctive embryo competence and clinical outcomes. Reprod. Biol. V. 22. P. 100649.
- Takahashi Y., Hashimoto S., Yamochi T., Goto H., Yamanaka M., Amo A., Matsumoto H., Inoue M., Ito K., Nakaoka Y., Suzuki N., Morimoto Y. 2016. Dynamic changes in mitochondrial distribution in human oocytes during meiotic maturation. J. Assist. Reprod. Genet. V. 33. P. 929.
- Van Blerkom J., Runner M. N. 1984. Mitochondrial reorganization during resumption of arrested meiosis in the mouse oocyte. Am. J. Anat. V. 171. P. 335.
- Wang Y., Chen D., Cai B., Huang D., Xu Y., Ding C. 2023. Effects of different oocyte cytoplasmic granulation patterns on embryo development and euploidy: a sibling

- oocyte control study. Arch. Gynecol. Obstet. V. 308. P. 1593.
- Wilding M., Dale B., Marino M., di Matteo L., Alviggi C., Pisaturo M. L., Lombardi L., de Placido G. 2001. Mitochondrial aggregation patterns and activity in human oocytes and preimplantation embryos. Hum. Reprod. V. 16. P. 909.
- *Yi X. F., Xi H. L., Zhang S. L., Yang J.* 2019. Relationship between the positions of cytoplasmic granulation and the oocytes developmental potential in human. Sci. Rep. V. 9: 7215.
- Yu Y. Dumollard R. Rossbach A. Lai F. A. Swann K. 2010. Redistribution of mitochondria leads to bursts of ATP production during spontaneous mouse oocyte maturation. J. Cell Physiol. V. 224. P. 672.
- Zhang L., Zeng L., Liu H., Jia H., Wu Y., He C. 2022. Effects of oocyte cytoplasmic central granulation on embryonic development, blastocyst formation, and pregnancy outcome in assisted reproductive technology and its mechanism. Cell Mol. Biol. (Noisy-le-grand). V. 68. P. 161.

## CYTOPLASMIC GRANULATION OF HUMAN OOCYTES AT THE GERMINAL VESICLE STAGE AS A PREDICTOR OF THEIR ABILITY TO SPONTANEOUS MATURATION IN STIMULATED CYCLES OF IN VITRO FERTILIZATION

D. F. Salimov<sup>a, \*</sup>, I. O. Bogolyubova<sup>b, c</sup>, D. S. Bogolyubov<sup>b, \*\*</sup>

<sup>a</sup>Clinical Institute of Reproductive Medicine, 620014, Yekaterinburg, Russia
<sup>b</sup>Institute of Cytology of the Russian Academy of Sciences, 194064, St. Petersburg, Russia
<sup>c</sup>St. Petersburg State Pediatric Medical University, 194100, St. Petersburg, Russia
\*e-mail: dfsalimov@mail.ru
\*\*e-mail: dbogol@mail.ru

Although in vitro fertilization (IVF) programs usually use mature (metaphase II, MII) oocytes, it is also possible to use diplotene oocytes at the germinal vesicle (GV) stage after their in vitro maturation (IVM). Morphological characteristics of native GV oocytes are promising predictors their capacity of spontaneous maturation in stimulated cycles. The purpose of this work was to analyze the patterns of cytoplasmic granulation of GV oocytes that differ in their ability to resume and complete meiotic maturation in vitro. It has been shown that the central granulation pattern negatively correlates with the ability of GV oocytes to spontaneously mature in vitro.

Keywords: human oocytes, oocyte nucleus, germinal vesicle, cytoplasmic granulation, oocyte maturation