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Males can grow egg cells, too

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Laura M Hrastar
Email: lhrastar@the-scientist.com

In mice, female germ cells can develop into viable ova in male testes, Japanese researchers report this week. Their paper in *PNAS* suggests that sex determination occurs early in embryonic development before genomic imprinting takes effect.

"[Our] paper indicated that once the direction of the sex is determined in germ cells, the following influence from the environment seems not to be significant," coauthor Masaru Okabe told *The Scientist* in an E-mail. The research showed that female germ cells encompassed by male tissue with XY gene imprinting continue their programmed development into eggs.

Okabe, from Osaka University's Genomic Information Research Center, and colleagues combined male embryos with female embryos minus the zona pellucida in vitro to create XX-XY chimeric embryos.

Growing the embryos to term, researchers found that the seminiferous tubules of 3-week-old male mice produced meiotic XX germ cells with a normal zona pellucida structure that could fuse with sperm. The so-called "testicular eggs" were smaller and grew more slowly than normal ovarian eggs, and they were present only in anterior and posterior parts of the testis nearby resident Sertoli cells.

Like normal ova, the testicular eggs were heavily methylated and in some cases expressed SCP3, a primary meiotic complex protein. Methylation patterns in cells are characterized as sex specific, according to the authors, and have been shown to turn off gene expression.

"It is difficult to elucidate the role of genomic imprinting in germ cell development, but we consider the imprint as a result of sequential chain events after the initial sex determination of germ cells," Okabe told *The Scientist*.

Previous research has shown that XX spermatogonia-like cells are normally found within the testis but disappear a few days after formation for unknown reasons. Okabe says sex determination in germ cells likely occurs before genomic imprinting because inside the testes, genomic imprinting did not always follow cues from the environmental conditions in which the germ cells were found.

Earlier work in sex-reversed mice by Anne McLaren from the United Kingdom's Cambridge University showed that large, egg-like cells could develop in the testes. The new findings published in *PNAS* lend proof such cells are oocytes by showing they can fuse with sperm, although, Okabe pointed out, they were too small or immature to develop.

"One of the intriguing results of this excellent paper is the failure to find any XY growing oocytes in the chimeric testes," McLaren told *The Scientist* by E-mail. "XY germ cells that are not in a testis have been shown to enter meiosis about 13 days after fertilization, and thenceforth pursue the oogenesis pathway, just like XX germ cells."

"The existence of [these] oocytes in the testes suggests that we can separate folliculogenesis from oocyte maturation, which have traditionally been thought to be one pathway," Jana Koubova, a

researcher from the Massachusetts Institute of Technology in Cambridge, told *The Scientist* in an E-mail.

"Surprisingly, the egg does not seem to need the follicle to develop," said Koubova, who wasn't involved in the study.

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