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Editorial

# New Oocytes from Ovarian Stem Cells: A Revolutionary Discovery in an IVF World

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The world is changing fast. Nowadays many factors could decrease the potential of achieving a future fertility. This new trend mainly affected women's fertility patterns. This is due not only to a significant change in lifestyle, prioritizing career rather than family, but also to the increasing incidence of cancer in women. The latter reflects on women's fertility because certain types of cancer, and even some therapies used against them, may affect the reproductive system, potentially causing its failure.

The methods adopted for later pregnancy and diminished ovary reserve includes IVF procedures. The IVF procedure must have sources of mature oocytes. In this environment, the discovery of Ovarian Stem Cells (OSC) has great potential to be a source of fresh and genetically safe oocytes. The possibility of the existence of OSC was first considered after Tilly et al. observed discordance between the follicle loss rate and the atresia rate [1]. His further analysis and studies revealed the presence of germline cells inside the ovarian tissue, which he proved using histological, immunohistochemical and cellular differentiation testing approaches. This possibility first presented itself as an opportunity to obtain fresh oocytes, with the right stimulation of these germline cells, becoming a source for IVF procedures.

Following the OSC discovery, some groups have provided interesting and positive facts regarding oocyte creation. In 2009, Tilly et al. [2] proved that the transplantation of germline cells from aged mice into young mice organism resulted in oogenesis. In addition, in the same year, Zou et al. [3] published the successful generation of mice offspring from an OSC. By 2010, Tilly et al. had also published the achievement of OSC by environmental manipulation, that is, without genetic manipulation. Generally, techniques involving genomic manipulation are related to higher damage risk [4].

However, the protocol to obtain new oocytes from stem cells in humans was only established in 2012 by Tilly et al. [6] . In this same article, the group finally achieved a consistent parallelism between human and mice potential germline cells. Those experimental results may be transferred as a real opportunity for human beings. Later, in the same year, a study published by Tilly et al. demonstrated that OSC was a better source of fresh oocytes than Embryonic Stem Cells, which is one of the alternatives for IVF procedures. The advantage rests in the fact that OSC is produced from germline lineage. The cell lineage does not entail risk of developing teratomas [6].

Additionally, the researchers have raised another possibility to obtain those fresh oocytes, believing that cytoplasmic transplantation is able to turn aged, bad quality oocytes into fresh and viable eggs. This theory was already proven successful, with a healthy cytoplasm taken from a donor's oocyte and transplanted into an aged receptor oocyte [7,8]. However, this implies in human genetic manipulation to accomplish reproduction, which is currently ethically banned [6].

The proposal of OSC is that those cells would be obtained from the ovarian tissue of the receptor and then be the cytoplasm donors, which does not imply in human genetic manipulation. The authors [6] named this technique AUGMENT (Autologous Germline Mitochondrial Energy Transfer), a technique which could be a great alternative for aged women who decide to have genetic offspring and have not cryopreserved their ovarian tissue for whatever reason. The fresh, healthy and genetically identical obtained oocyte would then be submitted to an ART procedure, such as IVF, to form the embryo.

On the other hand, the AUGMENT technique has not yet been tested in a consistent study, and even the other properties of OSC are experimentally determined. It is very difficult to determine the real clinical implications because those cells are considerably rare in the ovarian tissue [6], and its true origin is still being speculated [4]. In addition, the pathways that regulate the OSC are unknown. Current literature leads to the statement that OSC is a reality. Its high potential to generate healthy oocytes for IVF procedures, whether directly or through AUGMENT shows the importance to continue this line of research. More research is needed to better understand how the OSC are affected by certain important pathologies, such as endometrioma, is crucial.

There is a wide spectrum of women who would profit from its options, including aged women that have not cryopreserved their ovarian tissue, oocytes or chosen another fertility preservation method. The AUGMENT technique, however, offers an alternative for those needing a short-term resolution. Regardless of the method to obtain viable oocytes from OSC, the most likely subsequent procedure is the *In Vitro* Fertilization, establishing a straight link between OSC and IVF. All aspects considered, it is possible to conclude that women can now face their challenges as they please, with OSC and IVF as important potential allies to plan their families' future.

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