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Presence of Water Channels at Different Maturity Stages in Human Oocytes

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Objectives: Important structural and functional modifications occur in mammalian oocytes during their arrival to maturity. During this process the cell switches from a high activity level, implying an important metabolic rate and a coordinated movement of water and solutes, to a lower functional state characterized by significant changes in its membrane structure and function. Full activity will start again after fecundation. It has been recentlyproposed that a broad selectivity " water channel" (aquaporins 9, AQP 9) is responsible for solute and water transfer in highly active cells. We have previously demonstrated that rat oocytes express a water channel that disappears during the arrival to maturity. Because of its potential significance for fertility and cryopreservation, similar studies were performed in human oocytes.

Design: The osmotie water permeability in human oocytes was studied indifferent stages of maturation.

Materials and Method: Oocytes were isolated at different maturity stages: germinal vesicle (GV, n=9), metaphase I (MI, n=3), metaphase II (MII, n=2),
metaphase II after ICSI failure (MII-ICSI, n=4) and metaphase II after IVF failure (MII-IVF, n=6). In all cases an inform consent from donors was obtained.

Volume changes, induced by an osmotic gradient, were followed by video microscopy and osmotic water permeability was calculated and expressed as Posm, em X 10-4.s -1

Results: Osmotic permeability was significantly higher in GV (16.46 +/- 2.24) than in MII-ICSI (6.75 +/- 0.88), mean difference 9.71 +/- 2.40, p‹0.001 and than in MII-IVF (10.01 +/- 1.55, mean difference (6.42 +/- 2.72, p‹0.05). It was also observed that Posm was higher in GV than in MI (9.10 +/- 0.90, mean difference 7.35 +/- 2.41, p‹0.02)

Conclusions: A water channel seems to have been lost during transition from germinal vesicle to metaphase I human oocytes. Furthermore, after unsuccessful ICSI or IVS attempts, water permeability was strongly reduced as compared with the germinal vesicle stage. The molecular characterization of the putative water channels (aquaporins) expressed in mammalians oocytes is the subject of an on-going assay. All of the above contributes to the better understanding of the inner psychological mechanism involved in oocyte cryopreservation and will eventually allow for the improvement of human oocyte cryopreservation.