# *Evaluation of the Metabolomic Fingerprint of Human Embryo-spent-culture Media by FTIR Spectroscopy: A Non-invasive Assessment of Embryo for in vitro Fertilization (IVF) Technology*

Cecilia Figoli[1], Marcelo Garcea[2], Mariana Gomez Peña[2], Claudio Biscioli[2], Fernando Althabe[3], Valeria Tafintseva[4], Volha Shapaval[4], Achim Kohler[4,5], Juergen Schmitt[6], Osvaldo Yantorno[1], Marcos Horton[2], and Alejandra Bosch[1*]

[1]CINDEFI-UNLP-CONICET, CCT La Plata, Facultad de Ciencias Exactas, UNLP, La Plata, Argentina; [2]PREGNA Medicina Reproductiva, Ciudad Autónoma de Buenos Aires, Argentina; [3]IECS, Instituto de Efectividad Clínica y Sanitaria, Ciudad Autónoma de Buenos Aires Buenos Aires; [4]Nofima, Centre for Biospectroscopy and Data modeling, Ås, Norway; [5]Department of Mathematical Sciences and Technology, Norwegian University of Life Sciences, Ås, Norway; [6]Synthon GmbH, Heidelberg, Germany

One of the greatest challenges in *in vitro* fertilization (IVF) is to improve pregnancy and implantation rates, and decrease multiple pregnancy rates[1]. Even though important advances have been made in embryo culture and patient care in the last decades, currently, IVF efficiency is about 30 % per cycle, as not every embryo is competent enough to implant. In order to improve the success rates, simultaneous transfer of multiple embryos are usually performed. This strategy has nevertheless, led to an increased incidence of multiple pregnancies resulting in serious health risks for the mothers, complications for neonates, with also social and financial implications. Thus, a crucial step in the process is to perform a proper embryo selection, in order to select a single, good quality embryo with high implantation potential.

Embryo assessment is currently based on morphological characteristics evaluated at the end or during the embryo culture period. Given the reported limitations of this assay, in recent years research has focused in "OMICS" techniques, among which metabolomics (study of the chemical prints produced during embryo development) has been the most widely investigated approach. Associated with these studies the use of near-infrared (NIR) spectroscopy for the analysis of embryo-culture supernatants has been extensively investigated. Nevertheless, recent trials failed to show a consistent clinical benefit in improving pregnancy rates when embryos were evaluated by NIR-metabolomics[3]. Considering this scenario, and that FTIR spectroscopy has been used in the analysis of human fluids and medical diagnostics[4], we faced to study embryo metabolomics through FTIR spectroscopic analysis of 3-day-embryo-culture supernatants.

The lecture presents our most recent developments in the study of the metabolic difference between embryos that result in pregnancy against those that do not, with the aim to develop a predictive non-invasive FTIR-based model for selection of the embryo with the highest implantation potential.

References

[1] U.M. Reddy, R.J. Wapner, R.W. Rebar, R.J. Tasca, *Obstet Gynecol.* 109, 967-77 (2007).
[2] E. Seli, C.G. Vergow, H. Morita et al., *Fertil Steril* 94, 535-42 (2010).
[3] C.G. Vergouw, M.W. Heymans, T. Hardarson et al., *Human Reproduction* 29 (3), 455–461 (2014).
[4] D. Naumann, Vibrational Spectroscopy in Microbiology and Medial Diagnostics. In: P. Lasch, J. Kneipp (eds.): *"Biomedical Vibrational Spectroscopy"*, p. 1-8, Wiley-Interscience, USA (2008).