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PhD in Medical Sciences
2022-2023

INVITATION to the Public defence of

Wafaa ESSAHIB

To obtain the academic degree of

'DOCTOR OF MEDICAL SCIENCES'

Modelling embryo-endometrial crosstalk to reduce time to pregnancy (in times of health and pandemic)

The defence will take place on

Thursday, 6 October 2022 at 5 p.m.

In Auditorium Vanden Driessche

Faculty of Medicine and Pharmacy, Laarbeeklaan 103, 1090 Brussel

and can be followed online, accessible through the following link:

https://gf.vub.ac.be/redirects/PhD_defense_Wafaa_Essahib.php

Summary of the dissertation

Embryo implantation is a bottleneck for pregnancy in many couples. The need to better understand the crosstalk between the embryo and the endometrium is crucial for IVF patients' management. To identify crucial pathways for pre- and peri-implantation more *in vitro* study is required. In the first part of this thesis, we studied the role of CD147, a well-described player for implantation in mice, using a 2D model for adhesion. Blastocysts were co-cultured with CD147 receptor blockers. This resulted in impaired adhesion of the blastocysts, indicating a crucial role during implantation. To investigate the role of trophoctoderm during implantation we analysed human blastocysts using RNA Sequencing and linked the RNA expression to the implantation capacity of the embryo *in vitro*. We set up a new multicellular 3D model for invasion, which sustained embryo development until 11 days post fertilisation. We identified differential expression when comparing embryos. In the second part of this thesis, we investigated the impact of SARS-CoV-2 infection on human reproduction. Firstly, we reported the presence of viral receptors on human cumulus cells, oocytes and embryos. This highlights their vulnerability to the virus. Secondly, we investigated the transmission of the virus *in vivo* to reproductive tissues in IVF patients with an active infection. We could report a viral absence in all the samples, reassuring the safety of ART during COVID19. In conclusion, we studied the role of CD147 in the process of implantation in human embryos using a well-established model for adhesion and we developed a new multicellular 3D model to study invasion *in vitro*. In addition, we demonstrated the vulnerability of embryos to SARS-CoV-2 infection, but we confirmed that in female IVF patients with an active infection there is no transmission of the virus to reproductive tissues. The results of this thesis will contribute to progress in the management of IVF patients in times of health and pandemic.

Curriculum Vitae

Wafaa Essahib was born on 6 May 1988 in Brussels. She is married and has two daughters and a son. She followed a secondary education (high school) at the Heilig Hart College in Tervuren and obtained a BSc degree in Biomedical Sciences at VUB. For her MSc degree, she joined the team of Prof. Dr. Van de Velde where she studied the regulators of second lineage differentiation in the human embryo. In 2013, she obtained her MSc degree in Biomedical Sciences at VUB and started a PhD with Prof. Dr. Van de Velde in Reproduction and Immunology research group. In 2014, she officially commenced her PhD project after being awarded an IWT fellowship. Her main aim was to understand the process of human embryo implantation on the endometrium. She has created a unique *in vitro* 3D model representing the endometrial tissue that supported human implantation up to day 11 of embryonic development. This new model then enabled her to study the regulatory genes in embryos that determine their ability to implant. During the COVID19 epidemic, Wafaa also studied the vulnerability and consequences of SARS-CoV-2 infections on the human embryo and the fertility of IVF patients at the UZ clinic in Brussels. During her PhD, she had the opportunity to collaborate with several national and international groups. Her research results have been published in numerous peer-reviewed high-impact factor journals and presented at several international conferences. She also won the best oral presentation award at the BSRM conference in 2019.