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The ESHRE conference 2021 saw a second year on the virtual platform for presenters and delegates. There are still no parties, but there is also no running from room to room, trying to catch every presentation of interest.

This year's ESHRE conference provided a truly global update on research and current developments in reproductive medicine, and we have done our best to squeeze all the best insights into this issue of ART Scientific.

Update on the impact of SARS-CoV-2 and COVID-19 on ART

The intervening 12 months of research and clinical data since ESHRE 2020 has provided reassurance in the field of reproductive medicine with respect to SARS-CoV-2 infection and COVID 19.

Whilst Haouzi *et al* (O-141*) identified a high prevalence of genes related to the ACE2 pathway in the endometrium, they also showed gene expression was not impacted by controlled ovarian stimulation.

Additionally, De Miguel-Gomez *et al* (O-142) did not identify SARS-CoV-2 expression in the endometrium of COVID-19 positive symptomatic women. Further reassurance was provided by Philip Romanski (O-001), who evidenced that a delay in treatment of up to 180 days does not affect clinical outcomes in women with diminished ovarian reserve.

A review of current information on the impact of viral infection on male fertility by Allan Pacey (O-037) concluded that while data remains limited and continuing follow-up is needed, the effects appear to be transient and risks of transmission in semen appear very low.

A note of caution was provided with a summary of case reports of vertical transmission from mother to neonate by Ata *et al* (O-119). Whilst this appears rare, the increased risks of ICU admission, invasive ventilation, pre-term delivery, and pre-eclampsia for all COVID-19 pregnant individuals were also noted.

Female fertility preservation and extension

Ana Cobo (O-014) presented an insightful overview of the state of the ART of oocyte vitrification. Recent studies show that oocyte survival and clinical outcome are impacted by maternal age and the clinical indication for vitrification. Maternal age at oocyte retrieval was also shown to strongly affect cryo survival and reproductive prognosis.

Additionally, poorer reproductive outcomes were reported in cancer patients, poor responders, and endometriosis patients when compared to healthy women in age-matched groups. In the future, automation of the vitrification and warming processes will lead to greater consistency among operators and laboratories.

Data was presented by Michel De Vos (O-062) on ovarian tissue cryopreservation (OTC), ovarian tissue oocyte in-vitro maturation (OTO-IVM) and ovum pick up with in-vitro maturation (OPU-IVM) as options for fertility preservation in women requiring urgent chemotherapy or in prepubertal girls. While OTO-IVM must still be considered experimental due to a lack of safety or long-term follow-up data, live births have been reported and it provides options for women with risk of reintroduction of malignancy.

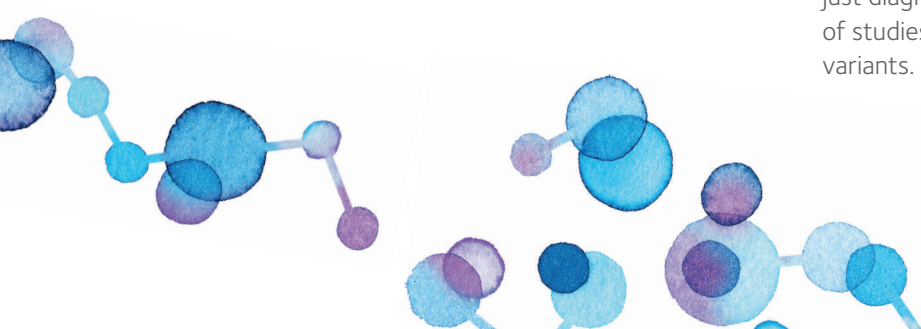
Antonio Pellicer (O-002) examined the same techniques with a view to expanding the ovary's reproductive lifespan. Additionally, approaches including the infusion of stem cells into the ovarian artery are being developed to re-activate follicles in premature ovarian failure and poor responders.

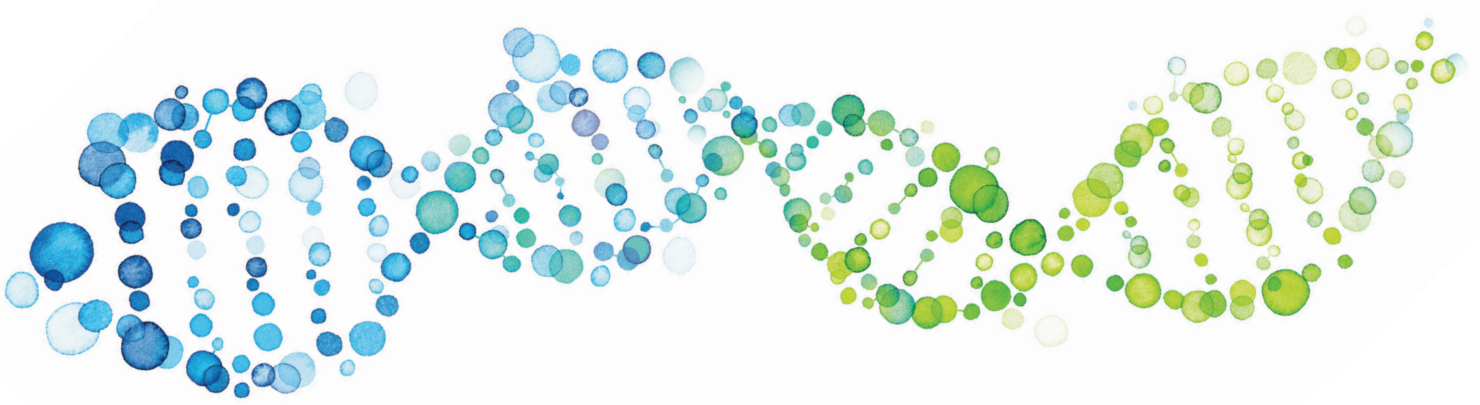
Advancing the understanding and treatment of male factor infertility

The importance of the male factor in ART continues to be recognized, as researchers attempt to redress the imbalance which has historically focussed on the female.

Soubry *et al* (O-011) added to information around the mother's health and diet having inter-generational effects, with similar data on the father. While the father's age, alcohol intake, and smoking have previously been shown to have an impact, paternal obesity is putting children at risk of cardiovascular disease, cancer, obesity, and behavioral problems. There is, however, a possibility that this can be repaired by a healthy diet.

Jackson Kirkman-Brown (O-010) advised looking beyond livebirth as the endpoint for male infertility, highlighting the data linking sperm genetic integrity and miscarriage. He suggested sperm DNA damage was a potential target for not just diagnostic but also therapeutic approaches. A number of studies examined the profiling of genetic mutations and variants.





Cheung *et al* (O-0119) performed a genetic analysis of spermatozoa as opposed to peripheral blood. Concentrating on azoospermic males, aneuploidy rates were reassuringly low. Specific patterns in gene expression and levels of deletions and duplications were seen in obstructive versus non-obstructive samples.

Cervan Martin *et al* (O-118) performed a genome-wide association study and associated the follicle stimulating hormone receptor (FSHR) gene with testicular sperm extraction (TESE) success. Molina *et al* (O-147) took an alternative approach and investigated the seminal metabolomic signature, identifying six candidate metabolites of significance, with differences between normozoospermic and oligozoospermic samples.

Progressing from diagnosis to therapeutic application, Bekaert *et al* (O-090) used CRISPR/Cas 9 at ICSI to correct a phospholipase C zeta (PLC ζ) mutation in the germline but urged caution, not least due to mosaicism and loss of heterozygosity.

Artificial Intelligence (AI) in ART

Nikica Zaninovic (O-049) presented an overview of current applications of AI in ART and potential future directions. Most commonly, AI and machine learning are being applied to embryo evaluation or selection via single image or time-lapse analysis, and many studies explored this area.

In a novel approach, Tan *et al* (O-083) applied hyperspectral imaging to human fibroblast cells to measure the autofluorescence of endogenous molecules as a measure of metabolism in individual cells. Identification of higher levels of nicotinamide adenine dinucleotide phosphate (NADPH) and lower levels of nicotinamide adenine dinucleotide (NAD) equated to lower metabolic activity in aneuploid cells.

Bori *et al* (O-084) examined a novel parameter in basic time-lapse imaging, examining if precise measurement of cell borders over time could reflect cell activity differences during blastulation. The theory that aneuploid embryos would yield higher measurements due to a higher rate of cell movement, more pseudo-mitosis events, and more fragments may be another data point for AI algorithms.

Nikica Zaninovic (O-049) predicts future AI algorithms for embryo evaluation or selection will need to combine multiple non-invasive technologies. An AI model incorporating proteomic profiles and morphological data was tested by Garg *et al* (O-121) to attempt to differentiate between euploid and aneuploid blastocysts.

However, when Ortiz *et al* (O-203) used predictive models for embryo ploidy, incorporating 22 predictor variables covering the patient demographic and clinical history, morphological data, and stimulation, the best predictor variables were shown to be largely expected. Maternal age, embryo quality, day of biopsy, and clinical history of pregnancies with chromosome abnormalities were the best predictor variables for aneuploidy, and male factor additionally played a relevant role in the mosaicism model.

A novel application of image analysis was the application of complex neural networks to individual embryo identification based on images from earlier in development, presented by Bormann *et al* (O-125), with a high degree of accuracy. Nikica Zaninovic (O-049) also highlighted the benefits of objectivity, standardization, precision, and big data analysis in applying AI in embryology and clinical processes.

Mokhtare *et al* (O-124) designed and employed an ultrasonic microfluidic device for oocyte denudation, whilst Costa-Borges *et al* (O-122) developed an ICSI robot integrating AI algorithms, optics, microinjectors, and mechantronics.

Final word

One benefit of continued virtual conference attendance has been the development of improved virtual platforms and the continued availability of all conference content, including pre-congress courses. Whilst the conference has wrapped for another year, all the presentations discussed here remain available online to view on the [ESHRE website](#).

Will we be face-to-face in Milan for ESHRE 2022? Best not count our blastocysts before they hatch....

*You can search for each session using these presentation numbers on the ESHRE website.

DISCLAIMER: Please note that these summaries are being provided as a courtesy to our readers and are based upon the written notes and memory of CooperSurgical employees who attended the ESHRE 2021 conference. The notes are intended to capture only the main points made in the meeting and do not imply a specific opinion or commitment on the part of CooperSurgical or any individual or organization represented at the meeting.

