63: LABEL-FREE DETECTION OF LINEAGE-SPECIFIC DEPLETION OF ANEUPLOID CELLS AND NORMAL DEVELOPMENTAL PRE-IMPLANTATION EMBRYO VIA THE FLUORESCENCE LIFETIME IMAGING AND HYPERSPECTRAL MICROSCOPY

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Objective
Development of quantitative, safe and rapid techniques for assessing embryo quality provides significant advances in Assisted Reproductive Technologies (ART).

Design
Instead of assessing the embryo quality by the standard morphologic evaluation or genetic screening with biopsy, we apply the phasor-FLIM (Fluorescence Lifetime Imaging Microscopy) and hyperspectral microscopy to capture endogenous fluorescent biomarkers of pre-implantation embryos as a non-morphological and non-invasive caliber for embryo quality.

Methods and Materials
Here, we identify the unique spectroscopic trajectories at different stages of mouse preimplantation development, which is referred to as the developmental, or "D-trajectory", that consists of fluorescence lifetime from different stages of mouse preimplantation embryos.

Results
The D-trajectory correlates with intrinsic fluorescent species from a distinctive energy metabolism and oxidized lipids which can be further used to distinguish pre-implantation embryo quality using an artificial intelligence algorithm. Our imaging process can be finished in 3 seconds. This method can be applied to both fresh and frozen embryos.

Conclusions
We show that the phasor-FLIM approach provides a much-needed non-invasive quantitative technology for prediction the success in progression to the blastocyst stage healthy embryos at the early compaction stage with 86% accuracy. Furthermore, we showed the heterogeneity and changes in the normal pre-implantation embryos and aneuploid embryos treated with the spindle assembly checkpoint inhibitor during embryo division can be rapidly distinguished at blastocyst stage via spectra phasor. Our approach and algorithms may provide a non-invasive early assessment tool and increase embryo implantation success in assisted reproduction.

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