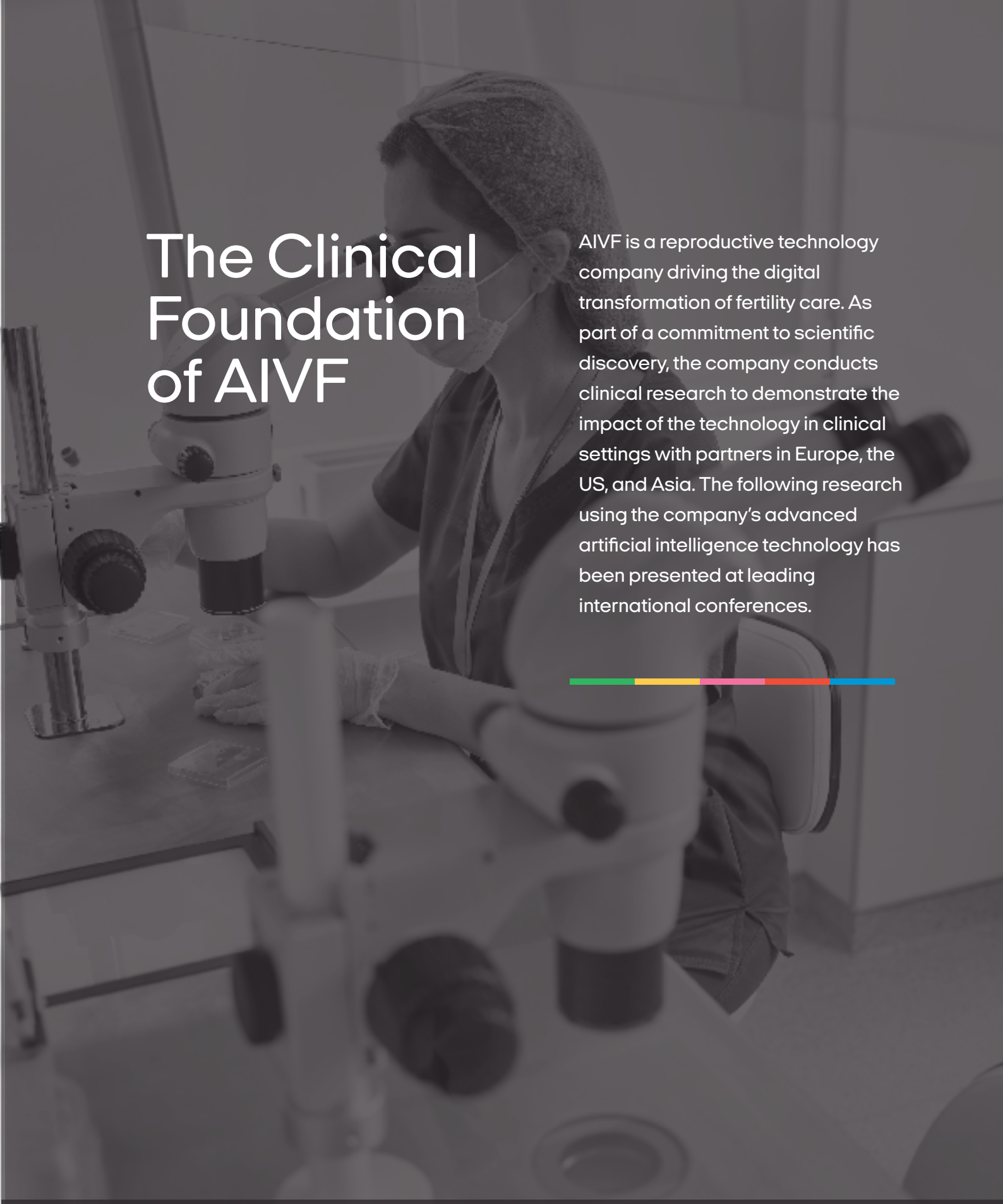

The Clinical Foundation of AIVF

AIVF is a reproductive technology company driving the digital transformation of fertility care. As part of a commitment to scientific discovery, the company conducts clinical research to demonstrate the impact of the technology in clinical settings with partners in Europe, the US, and Asia. The following research using the company's advanced artificial intelligence technology has been presented at leading international conferences.

We are proud to present the company's clinical foundation established over the last few years.

AIVF

1

Can computer vision identify features invisible to the human eye that can assist in non-invasively identifying aneuploid embryos?

D. Gilboa[1], M. Meseguer[2], R. Maor[1], D.S. Seidman[1,3] and G. Harton[4]

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Aneuploidy is the most common explanation for implantation failure in top-quality blastocysts. Yet, top-quality blastocysts with unknown varying ploidies are often indistinguishable at the resolution of the human eye alone. There is a need for non-invasive techniques that detect bio-features in blastocysts, which are indicative of their ploidy status and likelihood of implantation success.

The objective of this study was to assess a unique feature identified only through computer vision that allows non-invasive differentiation between euploid and aneuploid embryos. Our data suggests that the application of computer vision methodology for non-invasive genetic profiling may be useful to striate embryos for clinical transfer and/or genetic testing.

It was concluded that aneuploid embryos were found to more frequently present a less-fluidic cytoplasmic texture in the early blastulation stage than euploid embryos; a difference detected using our proprietary non-invasive computer vision system, which can identify and reject these aneuploids during embryo evaluation.

To read the clinical work ›

2

Embryologist versus machine, measuring efficiency with AI for embryo evaluation

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Embryo grading and annotation are time-consuming parts of an embryologist's day, which could be replaced by automated AI-driven embryo evaluation systems that have been clinically validated for accuracy. In this prospective study, the authors demonstrated that embryo evaluation using the EMA by AIVF™ AI model was 45 times faster than evaluation done by an embryologist, thereby affirming that the adoption of automated embryo evaluation improves efficiency in IVF settings. The AI-based automated evaluation and ranking also markedly shortens the decision time per cohort.

To read the clinical work ›

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3

Personalized pregnancy odds estimation can be obtained by using AI embryo evaluation and individual patients' characteristics

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Reported AI embryo scoring tools are designed for objective embryo ranking based on the likelihood of achieving clinical pregnancy. While useful for embryologists, these scores are not meant to be interpreted as personalized probabilities of pregnancy prediction. We developed an AI-based framework that provides clinic-calibrated pregnancy probabilities. We also conducted variable importance ranking analysis using Shapley Additive Explanations (SHAP) to compute the contribution of clinical variables extracted from the electronic medical record (EMR) to the AI's predictions. The model's predicted probabilities closely matched the expected distribution of probabilities for each clinic (brier score <0.25). A comparison analysis showed that pregnancy odds estimates (POE) for each embryo differed significantly, as expected, even when parameters are fixed for patient age, AI embryo quality score, and clinic source.

To read the clinical work ›

4

Can EMA by AIVF™, an end-to-end artificial intelligence (AI)-powered platform for fertility clinics, aid in the efficiency of conventional embryo evaluation? An efficiency case study.

Achilleas Papatheodorou[1], Daniella Gilboa[2], Maya Shapiro[2], Chara Oraiopoulou[1], Mary Karagianni1, Marianna Papadopoulou[1], Daniel Seidman[2]
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2. AIVF Ltd., Israel

There is a need for more standardized embryo evaluation workflows that optimize efficiency inside the IVF lab. In this study, the authors showed that embryo evaluation performance time was reduced by 83% when the EMA software platform was used. Rate of agreement between embryologists and EMA was higher than previously reported rates of agreement between embryologists.
Benchmarking and comparing efficiency measurements with and without the use of EMA was used to understand how EMA can standardize and aid in the efficiency of repetitive lab workflows.

To read the clinical work [P057], click here ›

5

Hype or reality? Is artificial intelligence (AI) solving the real problem in the IVF laboratory?

Vladimiro Silva[1], Daniella Gilboa[2], Maya Shapiro[2], Inês Couceiro[1], Juliana Simões[1], Daniel Seidman[2]
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2. AIVF Ltd., Israel

Embryo evaluation using an AI-driven clinical decision support tool is still a relatively new and cutting-edge process. It enables automated, objective and accurate assessment of embryo quality. In this research, the performance and clinical utility of EMA by AIVF™ was compared to another commercially available embryo scoring tool.
The authors found that when focusing on a subset of embryos most relevant for AI decision support, EMA more accurately differentiated between implanted/nonimplanted embryo subgroups. This study contributes to an embryologist's confidence in delivering the best possible results for the clinic's patients using EMA.

To read the clinical work [P058], click here ›

6

Comparative performance of EMA by AIVF™, an artificial intelligence (AI) platform for embryo evaluation decision support, and a commercially available embryo scoring tool

Vladimiro Silva1, Daniella Gilboa2, Maya Shapiro2, Inês Couceiro1, Juliana Simões1, Daniel Seidman2
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2. AiVF Ltd., Israel

Embryo evaluation algorithms can be trained using data labeled by scientists or using raw, unlabelled data. In the industry, this is sometimes referred to as supervised or unsupervised learning. Whenever humans label data, they introduce bias, which can affect the accuracy of the AI.
In this research, EMA, an AI tool that uses an automated, unsupervised framework was compared to another commercially available tool that is semi-automated and relies on manual annotations as input parameters. The authors found that without human influence, EMA applies its learned features more robustly and objectively.

To read the clinical work [P060], click here ›

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7

Artificial intelligence (AI) based triage for preimplantation genetic testing (PGT), an AI model that detects novel features in the embryo associated with ploidy

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Published in: "Human Reproduction", Volume 37, Issue Supplement_1, July 2022

When it comes to embryo evaluation, the chromosomal content of the embryo, otherwise known as its ploidy, matters just as much as its morphology. This research looked at the potential of an AI system to noninvasively detect an embryo's ploidy status in high quality embryos, thereby allowing for embryos to be triaged by their genetic competency prior to transfer. An AI system that distinguishes embryos by their ploidy status also has the potential to reduce the number of embryos that require invasive biopsy. The AI models presented here were able to predict embryo ploidy non-invasively and with unprecedented accuracy in high quality blastocysts.

To read the clinical work, click here ›

8

The bias is out of the bag: IVF culture dish well number influences embryo selection decision-making and implantation outcome

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Published in: "Human Reproduction", Volume 37, Issue Supplement_1, July 2022

In this research, we demonstrated that human bias is innate to the embryo selection process. When selecting among high quality embryos, embryologists tend to choose from among the first embryos they assess. When evaluating embryos from higher-numbered wells (in time lapse systems), there is an inverse trend between an embryo's likelihood of being selected for transfer, and its likelihood of implantation. The broader implication of this finding is that technologies such as AI have the potential to reduce human bias and increase objective standardization of embryo evaluation.

To read the clinical work, click here ›

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9

Could the EMA by AIVF™ artificial neural network grade blastocysts as an embryologist?

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Published in "Fertility and Sterility". Volume 116, Issue 3 Supplement, E84, September 01, 2021

The grade given to an embryo is a critical clinical decision made by an embryologist. The grade determines if it falls above or below an IVF lab's cut-off values, and if it will be frozen, biopsied, transferred, left to culture another day, or discarded.

Furthermore, the grades inform the key performance indicators of the IVF lab and are even reported to federal registries, such as SART and CDC. Despite the importance of this activity, grading can vary greatly between embryologists within the same lab and between different labs. Several efforts have been made to standardize grading systems. The ASEBIR system is one of them and was created by experts of the ESHRE embryologist special interest group.

This study aimed to assess the automated EMA AI blastocyst grading model when compared to ASEBIR grading. The EMA model showed high consistency with embryologist grading. Moreover, the model was highly accurate in differentiating between different grades of blastocysts. This study demonstrates that the EMA by AIV™ model can serve as an efficient and objective tool for blastocyst evaluation.

To read the clinical work, click here ›

10

Can computer vision algorithms noninvasively recognize aneuploidy in blastocysts? "Pumping" appears to be strong predictive feature

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Published in "Fertility and Sterility". Volume 116. Supplement, E153, September 1, 2021.

Morphokinetics is the study of time-specific changes in the embryo over the course of its development. One morphokinetic event detected by time-lapse imaging systems is the presence of spontaneous contraction and re-expansion of the embryo during its growth in culture.

The authors report for the first time a computer vision-based analysis model designed to define, measure, and evaluate contraction activity in the embryo, otherwise known as pumping events, using time-lapse image sequences from the first 5 days of embryo development. Also reported is that the presence of a pumping event of any type occurred more than twice as often in aneuploid embryos, indicating their predictive value for embryo ploidy.

To read the clinical work, click here ›

11

Blastocyst “pumping" is a detrimental feature predicting implantation failure: highly accurate assessment by computer vision analysis of time-lapse videos

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Published in “Fertility and Sterility. Volume 116, Issue 3, Supplement, E181, September 1, 2021”

This study demonstrated a link between spontaneous embryo contractions, known as pumping events, and reproductive outcomes.

Pumping events, measured using a computer vision-based methodology, were found to be predictive negative markers for developmental competence and implantation. The authors precisely assessed the number of pumping events recorded, extent of pumping, and the stage of blastulation at which it occurred to inform implantation and PGT-A outcomes.

To read the clinical work, click here ›

12

An artificial neural network is capable of accurately identifying blastocysts within the culture well

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Published in “Fertility and Sterility. Volume 116, Issue 3, Supplement, E181, September 1, 2021”.

Embryos in culture grow, move and eject cells and debris. They also actively metabolize the nutrients in surrounding media, which may cause bubbles to form. Time lapse incubators have to constantly refocus imaging optics to ensure the embryo remains in focus. Detecting and differentiating the round blastocyst from other round objects (the well or bubbles) even when it is out of focus, or obscured by cellular debris is a critical step in applying automated embryo evaluation models.

After training on a large dataset, the EMA by AIVF™ model showed a high capacity to accurately detect blastocysts within the culture dish in time lapse sequences

To read the clinical work, click here ›

AIVF

13

Artificial intelligence is moving closer to reproductive medicine: Prediction of blastulation and embryo implantation

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Published in Fertility and Sterility. Volume 116, Issment, E84, September 1, 2021.

Accurate prognosis of IVF cycle outcomes from the morphology or morphokinetics of reproductive cells and tissues is a critical clinical activity. Embryologists relay these data to physicians and patients, and make clinical decisions (discard, freeze, transfer) based on the prediction.

The promise of AI is that it can detect markers that the human eye cannot. This research focused on if the EMA by AIVF™ automated embryo evaluation platform can predict whether a blastocyst will develop from Day 3 embryo assessment and predict its implantation potential? The authors conclude that time-lapse images of embryo development are highly useful as input data for predictive models in the embryology field. The EMA model achieved promising results for blastocyst and implantation prediction.

To read the clinical work, click here ›

14

Computer vision can distinguish between euploid and aneuploid embryos. A novel artificial intelligence (AI) approach to measure cell division activity associated with chromosomal status.

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5 IVIRMA Global, IVF laboratory, Spain

Published in "Human Reproduction, Volume 36, Issue Supplement 1, July 2021.

This study aimed to answer the following question: Can we distinguish between top-grade euploid and aneuploid embryos by AI measurements of cell edges in time-lapse videos?

The results show for the first time that an AI based system can precisely measure microscopic cell edges in the dividing embryo. Using this novel method, it was possible to distinguish between euploid and aneuploid embryos.

To read the clinical work, click here ›

AIVF

15

In-depth analysis of embryo development: Differences among monosomic, trisomic and chromosomally chaotic embryos compared to euploid embryos

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Published in "Human Reproduction, Volume 36, Issue Supplement 1, July 2021.

Top-quality, euploid embryo selection is a central dogma of current human IVF practice. Aneuploidy rates are remarkably high in in-vitro fertilized embryos, with up to 50% of embryos diagnosed as aneuploid based on preimplantation genetic testing for aneuploidy (PGT-A). However, very little is known about the impact of specific aneuploidies during embryo development.

The authors previously developed a microscopic cell edge detection tool to precisely quantify cell number, size, and distribution in developing embryos. They hypothesized that differential developmental patterns may be observed between embryos, depending on their chromosome status. They found that euploid, monosomic, trisomic and chaotic embryos can be distinguished by analyzing cell edges. This ploidy detection system was then used to quantify the effects of the observed differences in order to develop an AI-based system for rapid and cost-effective non-invasive preimplantation genetic testing (niPGT).

To read the clinical work, click here ›

16

What can we learn from the first 24 hours of embryo development? A fully automated AI-based algorithm for identifying high-quality blastocysts

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Published in "Human Reproduction. Volume 35. Supplement 1, 2020".

In this study, the authors used an AI algorithm to detect subtle features that are undetectable by the human eye in high-quality embryos within the first 24 hours of development. The results demonstrated for the first time that AI algorithms can distinguish between high-quality embryos, solely based on unique visual features identified in the first 24 hours after fertilization.

To read the clinical work, click here ›