Disclosures & Disclaimers

Disclosures: Dr Jonathan Hall

Relevant Financial Relationships

- Cofounder and shareholder of Presagen, which manufactures Life Whisperer, which is the topic of this presentation.

Relevant Non-Financial Relationships

- Co-led the AI development and international clinical studies discussed in this presentation.

Disclaimer: Life Whisperer

Authorized for sale in Australia, New Zealand, Canada, Europe (EEA), UK, Turkey, Israel, Japan, India, Hong Kong, Malaysia, Thailand, Vietnam, Singapore, UAE, and Trinidad & Tobago. Not commercially available in the USA.

Only available for sale to healthcare professionals.

The information provided in this presentation/webinar is for educational purposes only, and does not substitute for professional medical advice.

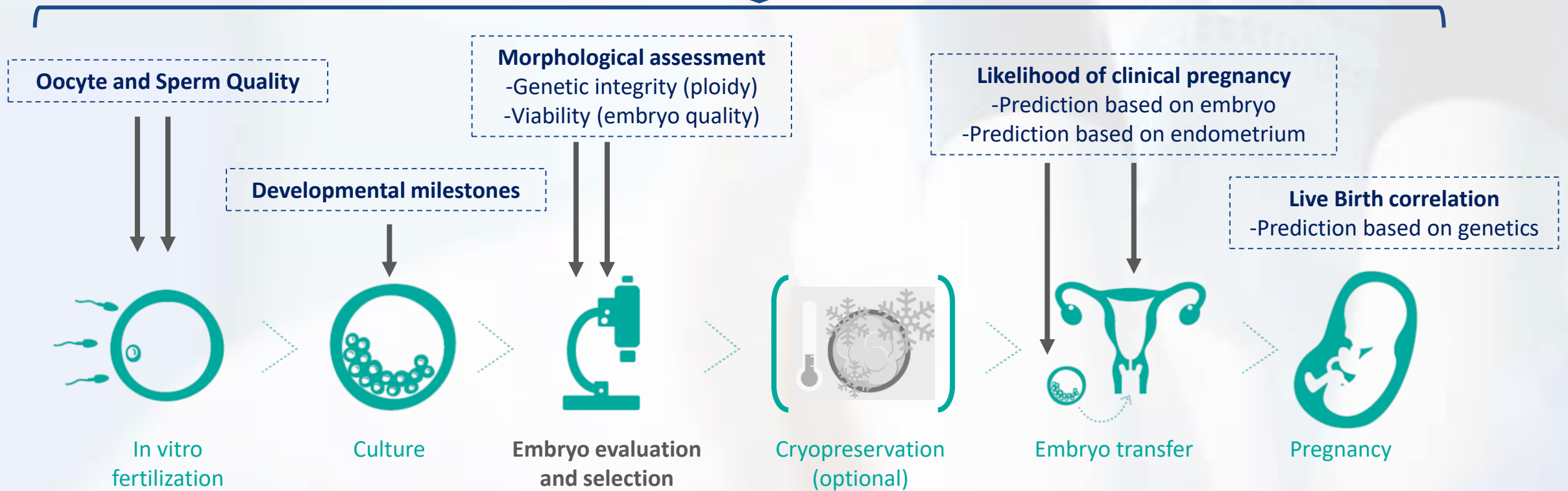HIPAA and GDPR compliant and ISO 13485 certified C€

1

AI Enhanced Fertility

Where can AI help in the IVF process?

ARTIFICIAL INTELLIGENCE

Oocyte and Sperm Quality

Morphological assessment
-Genetic integrity (ploidy)
-Viability (embryo quality)

Likelihood of clinical pregnancy
-Prediction based on embryo
-Prediction based on endometrium

Developmental milestones

Live Birth correlation
-Prediction based on genetics

In vitro fertilization

Culture

Embryo evaluation and selection

Cryopreservation (optional)

Embryo transfer

Pregnancy

Life Whisperer: embryo quality assessment from a single Day 5 image

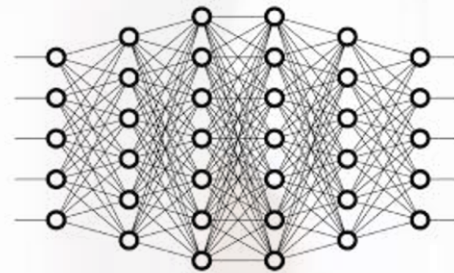Life Whisperer is **objective & non-invasive**

Computer Vision AI can provide
-the likelihood of **clinical pregnancy**
-the likelihood of an embryo **being euploid**

It looks at the end-point, just before transfer (Day 5)
It may detect features which may be difficult or **even impossible** for the human eye to detect.
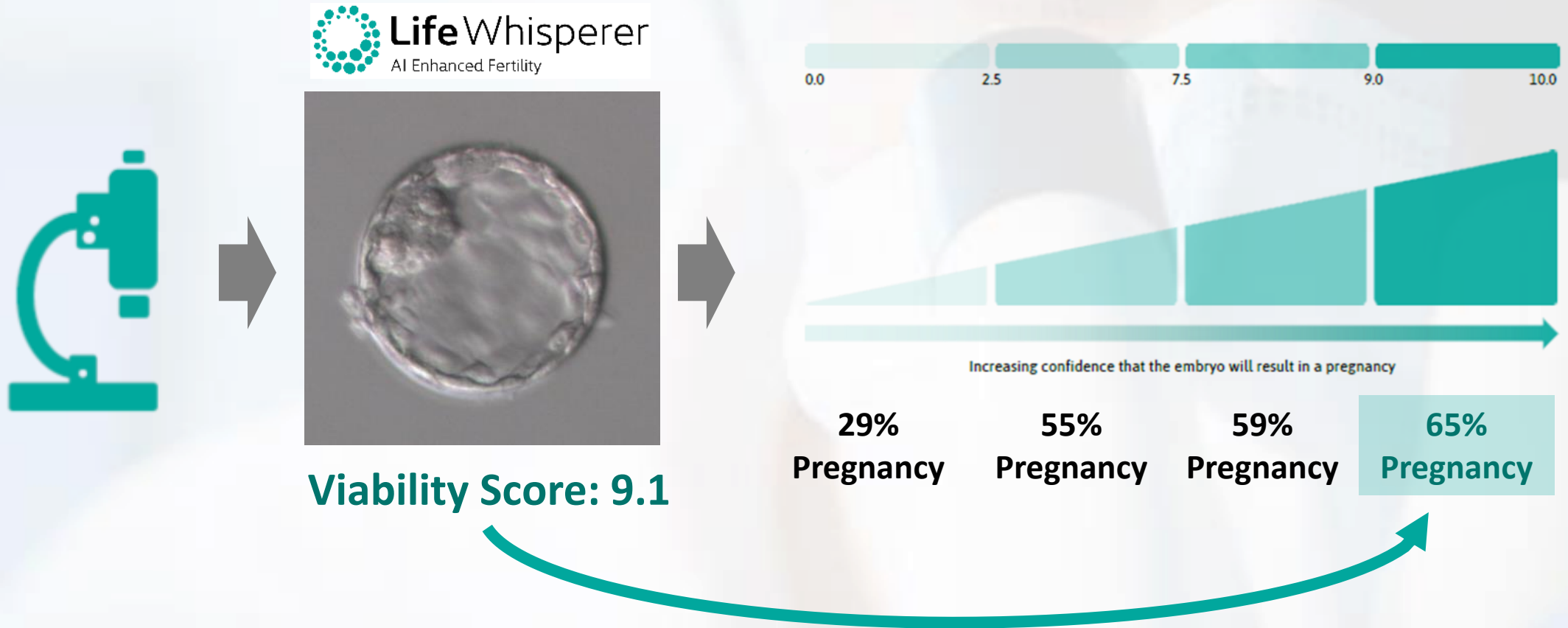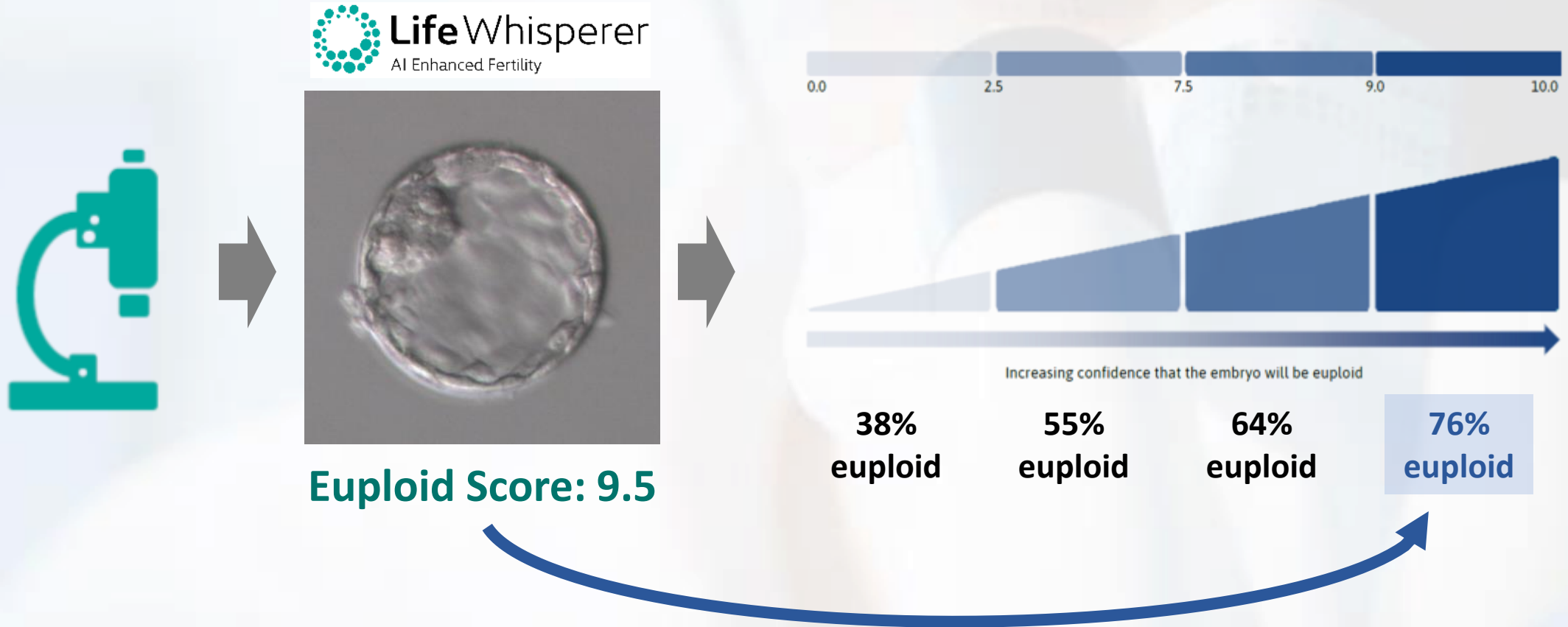
Day 5

Add Embryos
Click to select images or drag them here.

7.2 / 10 for Day 5 Embryo Viability

4.7 / 10 for Day 5 Embryo Viability

3.1 / 10 for Day 5 Embryo Viability

Validated ensembles of AI models

LifeWhisperer
AI Enhanced Fertility

Life Whisperer Viability Score

7.5/10

Life Whisperer Genetics Score

9.0/10

Life Whisperer Viability uses a single embryo image

Viability Score: 9.1

29% Pregnancy 55% Pregnancy 59% Pregnancy 65% Pregnancy

Increasing confidence that the embryo will result in a pregnancy

Life Whisperer Genetics uses a single embryo image

Euploid Score: 9.5

Increasing confidence that the embryo will be euploid

38% euploid   **55% euploid**   **64% euploid**   **76% euploid**

Life Whisperer AI has been tested internationally

82%
Probability of selecting a euploid embryo*

25%
Up to 25% increased accuracy for pregnancy prediction

12%
Reduction in cycles needed to achieve pregnancy compared to manual grading*

Evaluated using simulated cohort ranking methods

2

Computer Vision

Automated segmentation to analyse embryo features

The Life Whisperer AIs consists of multiple neural networks that look at different parts of the embryo

Whole embryo

Zona Segmentation

Central Embryo Segmentation

Expansion grade

ICM   **TE**
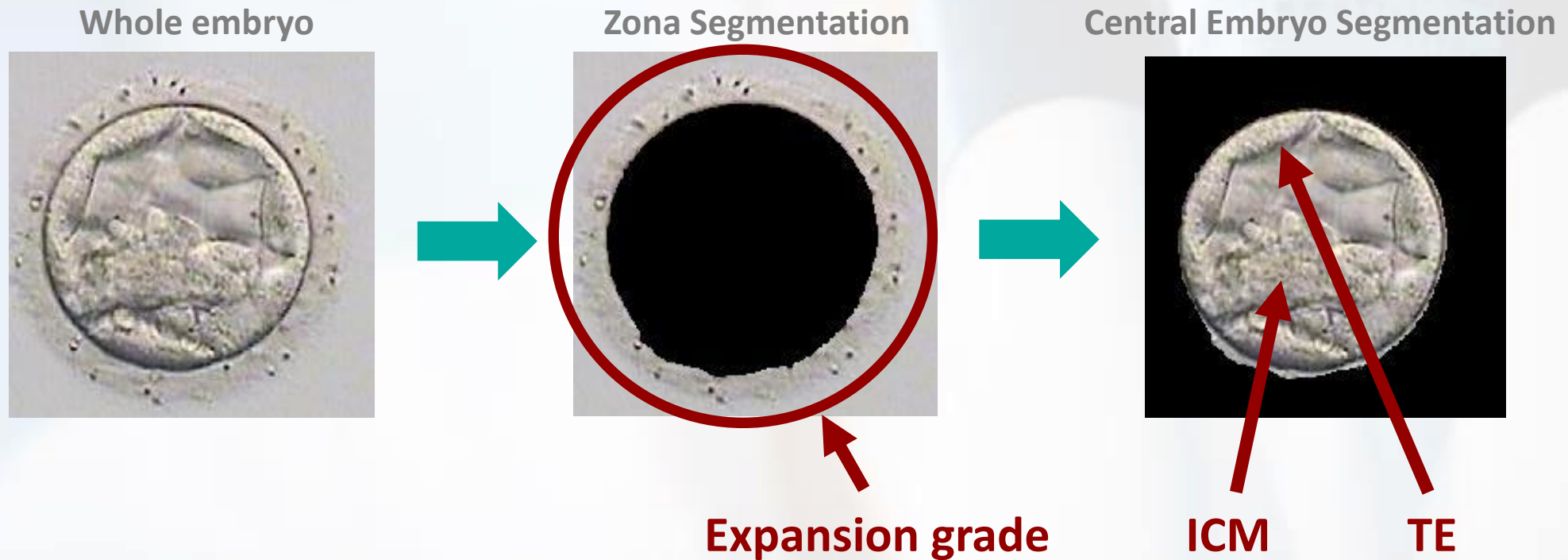
Life Whisperer AI has predictive ability in ICM and TE groups

Viability AI

	N correct	Total	Sensitivity/Recall
All grades	754	888	84.9%
ICM-A	580	647	89.6%
ICM-B	160	221	72.4%
ICM-C	13	16	81.3%
TE-A	447	510	87.6%
TE-B	266	325	81.8%
TE-C	40	49	81.6%

Genetics AI

	N correct	Total	Sensitivity/Recall
All grades	1566	1780	88.0%
ICM-A	690	737	93.6%
ICM-B	780	919	84.9%
ICM-C	138	202	68.3%
TE-A	470	484	97.1%
TE-B	927	1043	88.9%
TE-C	168	252	66.7%

Life Whisperer Viability

Sensitivity for viable embryos **~70-90%**

Life Whisperer Genetics

Sensitivity for euploid embryos **~65-95%**
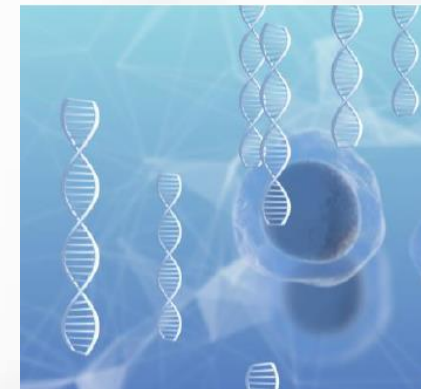
Morphological grading is subjective

→ *Take the Life Whisperer Viability AI challenge!* *https://www.lifewhisperer.com/lw-challenge/*

So... what's the AI seeing?
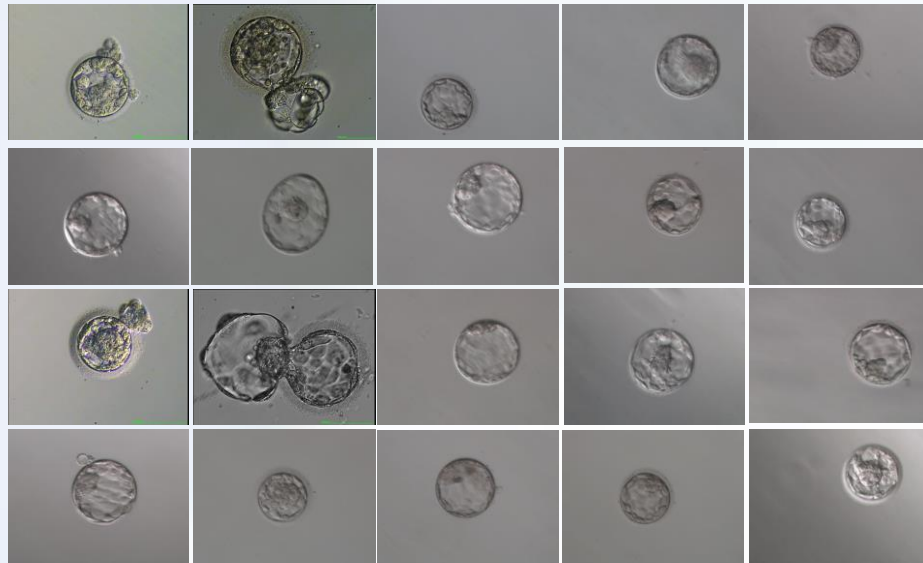
20 Day-5 embryos

158 Embryologists

Vs

Life Whisperer
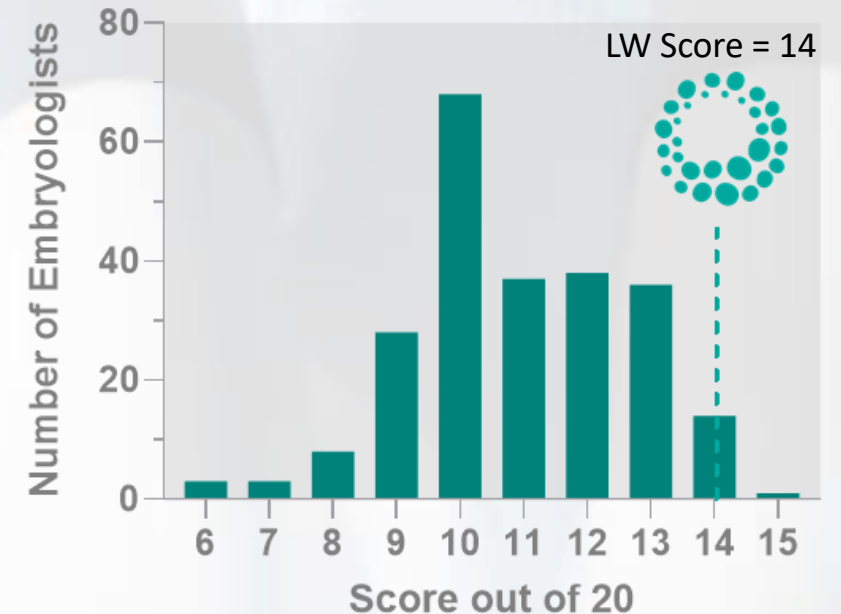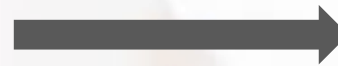
Life Whisperer AI detects features, both known and novel

Life Whisperer Viability AI = combination of 4 neural networks – heatmap of areas of relevance

Input image

Traditional: 4BA
LW Viability: 9.1 out of 10
Outcome: Clin. Preg.

Life Whisperer AI detects features, both known and novel

Life Whisperer Viability AI = combination of 4 neural networks – heatmap of areas of relevance

Full embryo model

Zona model

Central embryo model 1

Central embryo model 2

Features of viability

Input image

Traditional: 4BA
LW Viability: 9.1 out of 10
Outcome: Clin. Preg.

Life Whisperer AI detects features, both known and novel

Life Whisperer Viability AI = combination of 4 neural networks – heatmap of areas of relevance

Full embryo model   **Zona model**   **Central embryo model 1**   **Central embryo model 2**

Input image

Features of viability

Features relating to non-viability

Traditional: 4BA
LW Viability: 9.1
Outcome: Clin. Preg.

Life Whisperer AIs detects features, both known and novel

Life Whisperer Genetics AI = combination of 3 neural networks – heatmap of areas of relevance

Full embryo model 1

Full embryo model 2

Central embryo model

Input image

Features of euploidy

Traditional: 4BA
LW Genetics: 9.9
Outcome: Unknown

Life Whisperer AIs detects features, both known and novel

Life Whisperer Genetics AI = combination of 3 neural networks – heatmap of areas of relevance

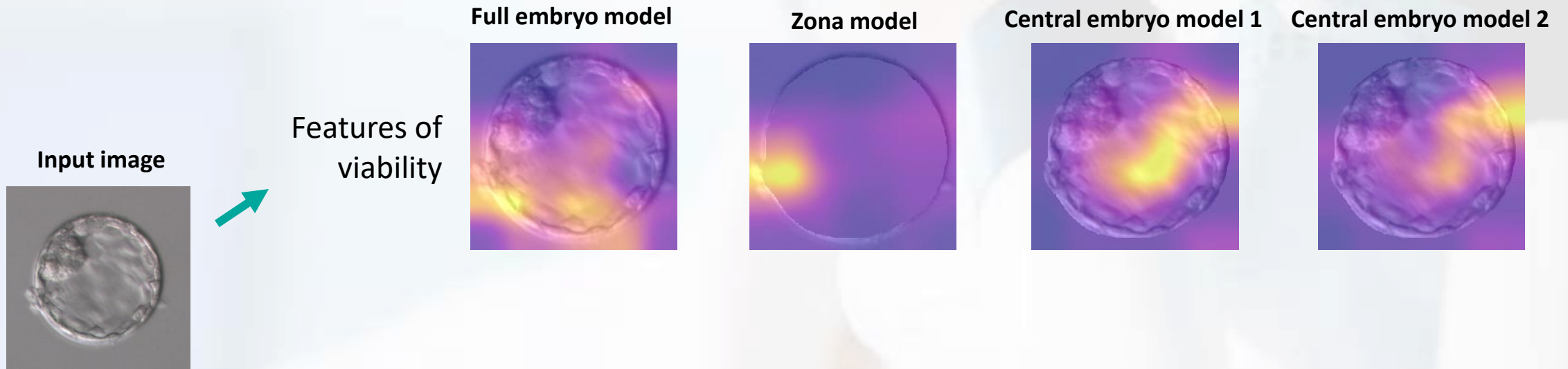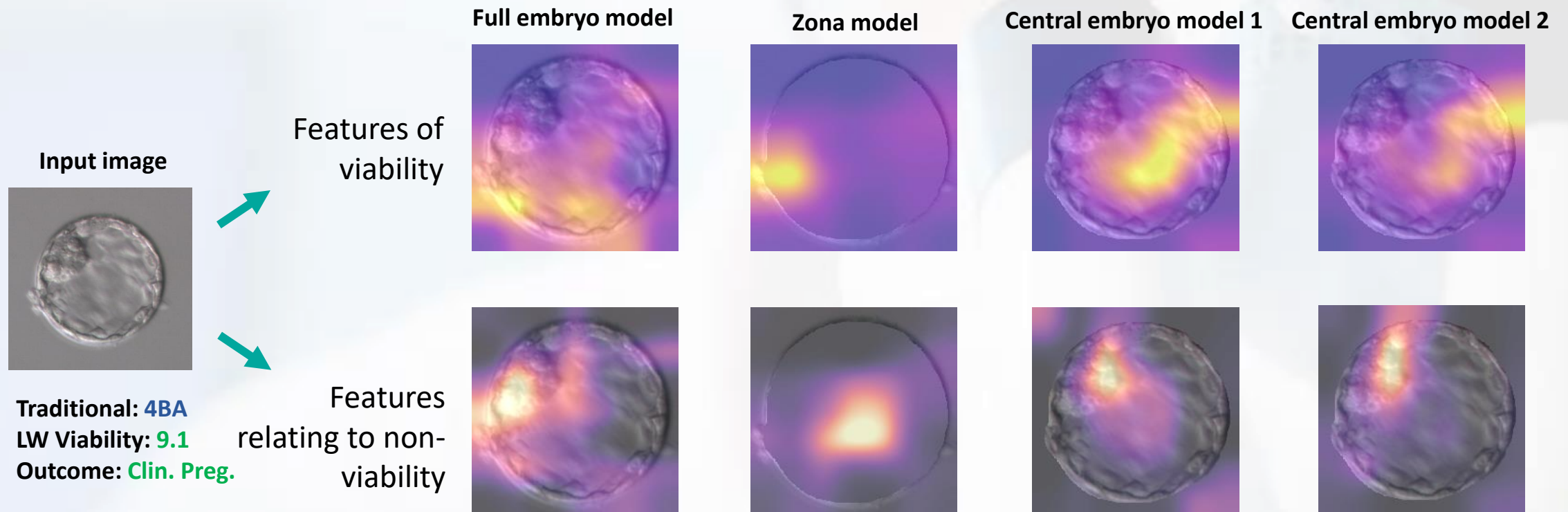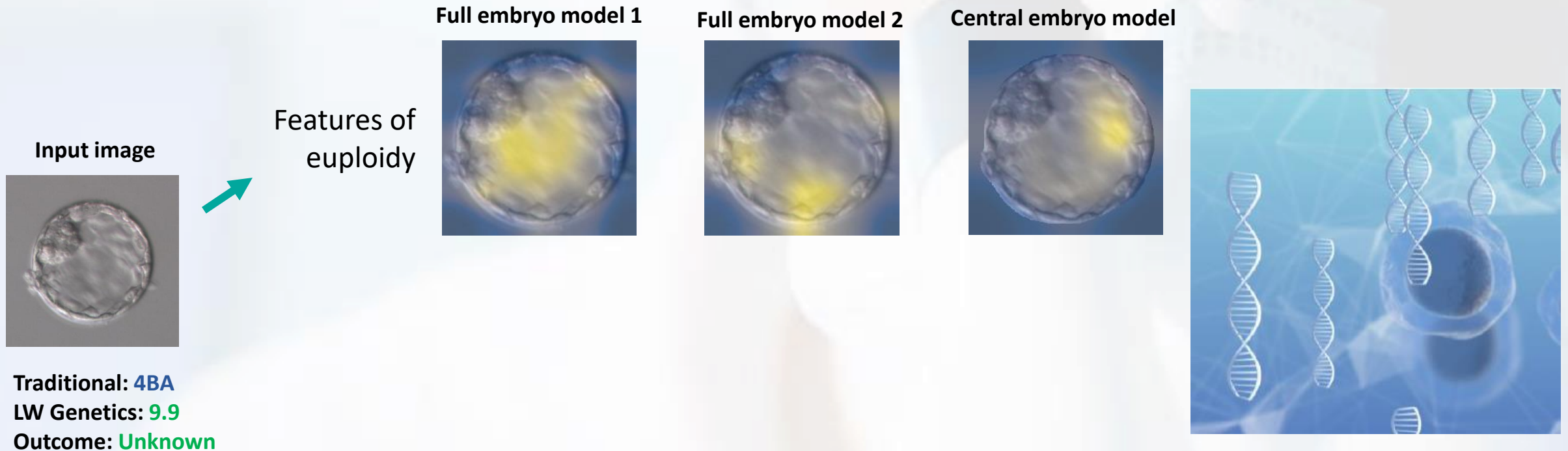**Full embryo model 1**   **Full embryo model 2**   **Central embryo model**

Input image

Features of euploidy

Traditional: **4BA**
LW Genetics: **9.9**
Outcome: **Unknown**

Areas of attention for aneuploidy

3
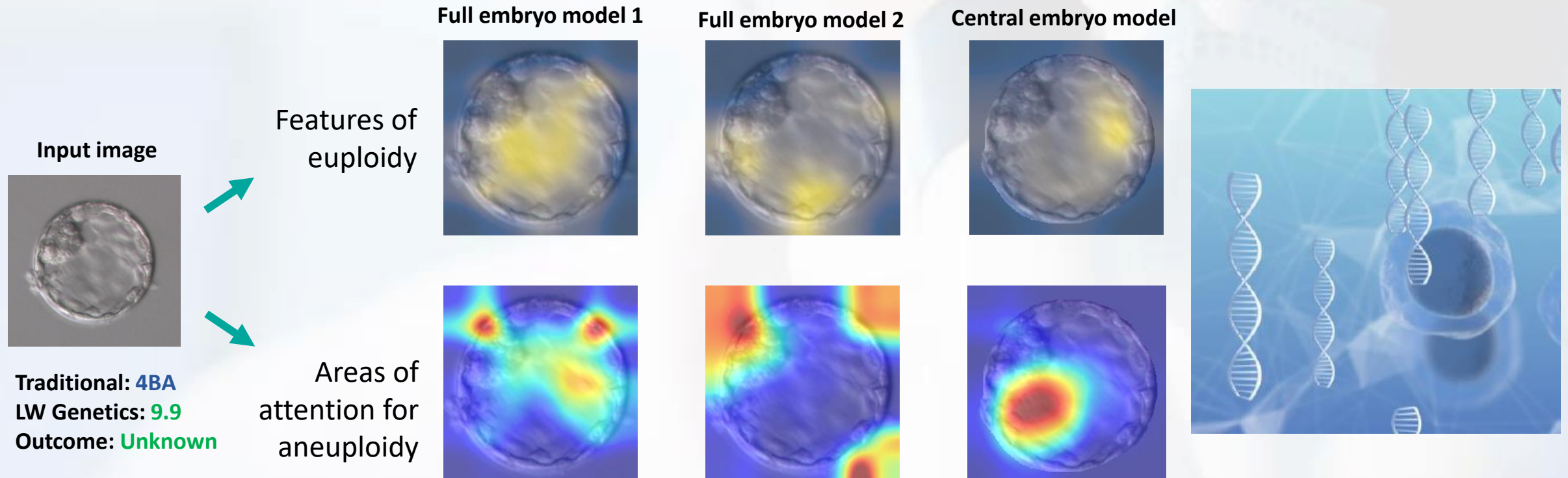
AI Synergies

New studies show how AI can add synergy in IVF
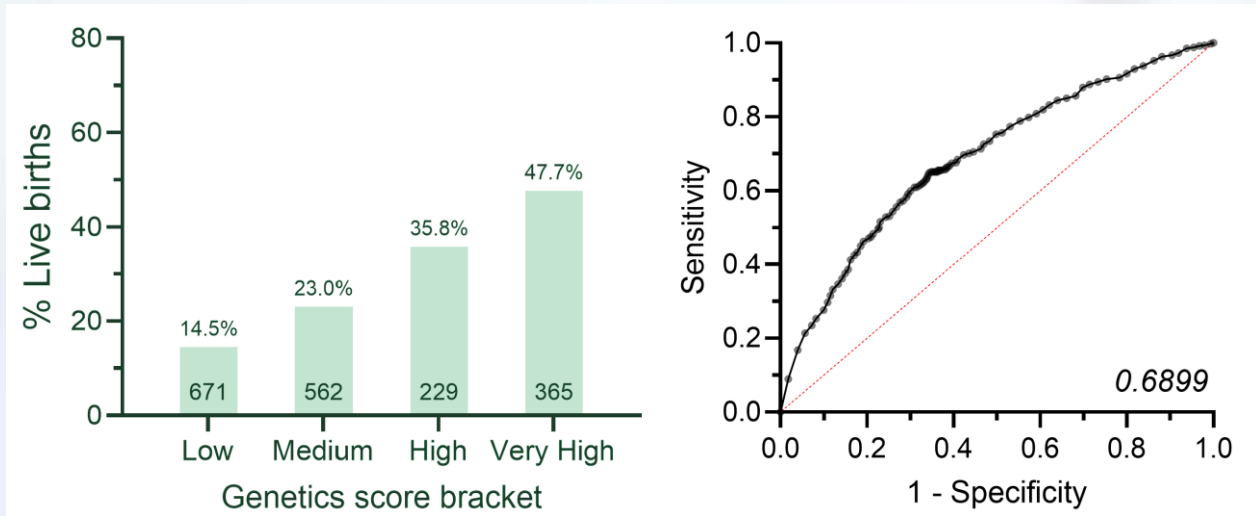
Left: Live birth success for each genetics score bracket: Low (0.0-2.5), Medium (2.5-7.5), High (7.5-9.0) Very High (9.0-10.0). *Right:* Corresponding ROC curve.

Ranking method	Improvement over random	Improvement over Gardner
Viability AI alone (unknown ploidy)	**19.9%**	**5.8%**
3/10 genetics AI threshold + viability AI	19.3%	4.9%
5/10 genetics AI threshold + viability AI	20.6%	6.5%
7.5/10 genetics AI threshold + viability AI	21.9%	8.1%
9/10 genetics AI threshold + viability AI	**24.3%**	**10.8%**
Viability AI alone (known ploidy)	**20.9%**	**ND**
3/10 genetics AI threshold + viability AI	20.0%	ND
5/10 genetics AI threshold + viability AI	20.1%	ND
7.5/10 genetics AI threshold + viability AI	20.3%	ND
9/10 genetics AI threshold + viability AI	**20.2%**	**ND**

Life Whisperer Genetics is predictive of *Live Birth*

Combined use of Viability and Genetics AI can ***double*** the reduction in time to pregnancy

4

AI Open Projects

Presagen's UDC and FedAI methods have been tested internationally

nature
SCIENTIFIC REPORTS

www.nature.com/scientificreports

scientific reports

OPEN **Automated detection of poor-quality data: case studies in healthcare**

M. A. Dakka[1,2], T. V. Nguyen[1,3], J. M. M. Hall[1,4], S. M. Diakiw[1], M. VerMilyea[5,6], R. Linke[7], M. Perugini[1,8] & D. Perugini[1]

The detection and removal of poor-quality data in a training set is crucial to achieve high-performing AI models. In healthcare, data can be inherently poor-quality due to uncertainty or subjectivity, but as is often the case, the requirement for data privacy restricts AI practitioners from accessing raw training data, meaning manual visual verification of private patient data is not possible. Here we describe a novel method for automated identification of poor-quality data, called Untrainable Data Cleansing. This method is shown to have numerous benefits including protection of private patient data; improvement in AI generalizability; reduction in time, cost, and data needed for training; all while offering a truer reporting of AI performance itself. Additionally, results show that Untrainable Data Cleansing could be useful as a triage tool to identify difficult clinical cases that may warrant in-depth evaluation or additional testing to support a diagnosis.

www.nature.com/scientificreports

scientific reports

OPEN **A novel decentralized federated learning approach to train on globally distributed, poor quality, and protected private medical data**

T. V. Nguyen[1,2], M. A. Dakka[2,3], S. M. Diakiw[1], M. D. VerMilyea[4,5], M. Perugini[1,6], J. M. M. Hall[1,7,8,9] & D. Perugini[1,9]

Training on multiple diverse data sources is critical to ensure unbiased and generalizable AI. In healthcare, data privacy laws prohibit data from being moved outside the country of origin, preventing global medical datasets being centralized for AI training. Data-centric, cross-silo federated learning represents a pathway forward for training on distributed medical datasets. Existing approaches typically require updates to a training model to be transferred to a central server, potentially breaching data privacy laws unless the updates are sufficiently disguised or abstracted to prevent reconstruction of the dataset. Here we present a completely decentralized federated learning approach, using knowledge distillation, ensuring data privacy and protection. Each node operates independently without needing to access external data. AI accuracy using this approach is found to be comparable to centralized training, and when nodes comprise poor-quality data, which is common in healthcare, AI accuracy can exceed the performance of traditional centralized training.
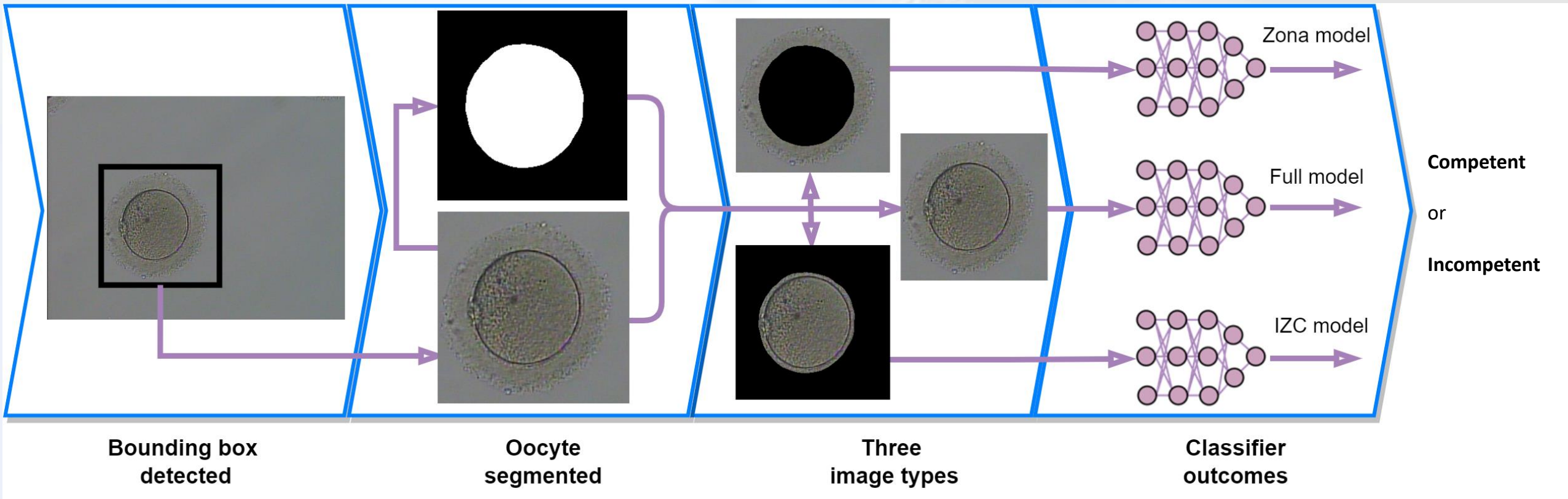

-Uniquely **increased** accuracy ability for pregnancy prediction
-**Robustness** in AI training using our outlier detection technology

https://www.nature.com/articles/s41598-021-97341-0

-Unique ability to access the learnings of siloed, distributed data **whilst keeping data protected**

https://www.nature.com/articles/s41598-022-12833-x

Life Whisperer is adding – Oocyte Assessment!

Bounding box detected → **Oocyte segmented** → **Three image types** → **Classifier outcomes**

Zona model

Full model

IZC model

Competent

or

Incompetent

Upcoming manuscript in preparation
New developments, see www.lifewhisperer.com/science-and-training

Summary

- AI can be used across the **whole IVF process** in different ways

- AI for embryo selection is **objective** and **non-invasive**

- AI can identify **known** and **unknown features** related to embryo viability and genetics

- Life Whisperer Viability has **improved prediction** over morphological grading, **strongly outperforming** it when they differ

- Features identified for viability, non-viability, euploidy and aneuploidy are different from one another but **both aid in embryo selection**

- Combining multiple AI methods can **lead to synergies** across the IVF workflow

ICM (grade B)

TE (grade A)

Feature 3
TE?

Feature 4
TE?

Feature 5
New feature?

Feature 6
TE?
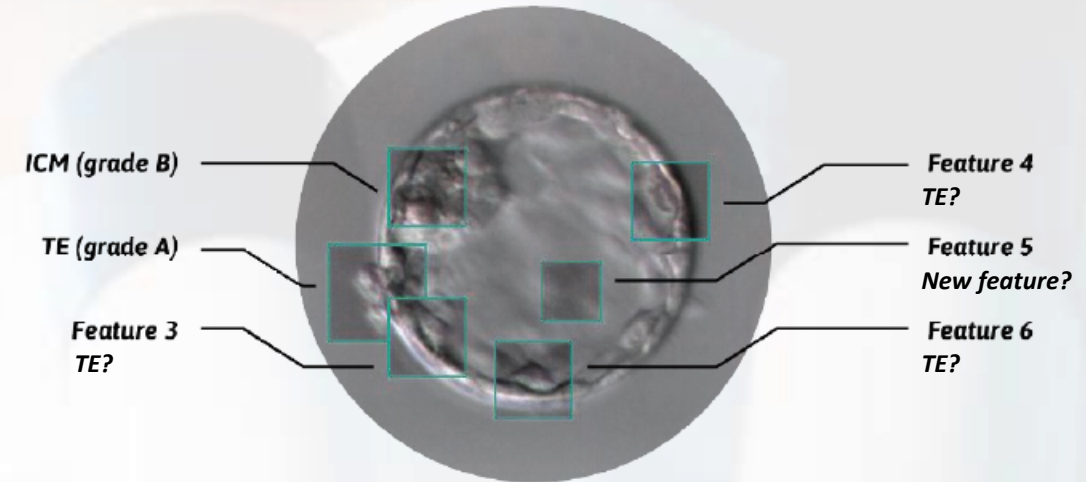
www.lifewhisperer.com

info@lifewhisperer.com