Genea BIOMEDX

Geri

FOCUSING ON WHAT MATTERS, THE EMBRYO

Geri®: Award-winning benchtop incubator with continuous embryo monitoring system

Geri

Minimising changes in the embryo's environment and reducing the stress caused by lid openings are critical to support gamete function and embryo development.[1-3]

INTRODUCING Geri®

AWARD-WINNING INCUBATOR WITH INTEGRATED CONTINUOUS EMBRYO MONITORING SYSTEM

Our benchtop incubator — Geri® — is designed to provide individualised and stable culture conditions helping to achieve an optimal environment to improve embryo viability and quality.[1-6]

UNDISTURBED INCUBATION:
Geri® has six, individual, single-patient chambers, each independently controlled.[4]

FAIL-SAFE MECHANISMS:
Safety features, redundancies and alarm functions ensure that stable conditions are maintained.[4]

MONITOR INCUBATION CONDITIONS IN REAL TIME:
Individual sensors in each chamber enable monitoring of critical parameters within the incubator.[4]

IMPROVED LAB EFFICIENCY:
Geri® is designed as an easy-to-use, compact, benchtop incubator with a minimal footprint[4] for easy integration into your lab.

INTEGRATED EMBRYO MONITORING:
A dedicated high-resolution camera in each chamber provides time-lapse views of each embryo's development.[4]

MODULAR SOFTWARE OFFER:
Geri® software is built on a modular approach to allow integration of new functionalities over time.

1. Swain, Jason E., et al. "Optimising the culture environment and embryo manipulation to help maintain embryo developmental potential." Fertility and sterility 105.3 (2016): 571-587. **2.** Zhang, JQ, et al. Reduction in exposure of human embryos outside the incubator enhances embryo quality and blastulation rate Reproductive Biomedicine Online 2010; 20(4): 510–515. **3.** Swain, Jason E. "Decisions for the IVF laboratory: comparative analysis of embryo culture incubators." Reroductive biomedicine online 28.5 (2014): 535-547. **4.** QFRM422 Geri® User Manual. **5.** Bontekoe, S., et al. Low oxygen concentrations for embryo culture in assisted reproductive technologies. Cochrane Database of Systematic Reviews 2012, Issue 7. **6.** Kirkegaard, K., et al. "Effect of oxygen concentration on human embryo development evaluated by time-lapse monitoring." Fertility and sterility 99.3 (2013): 738-744.

CREATING OPTIMAL CULTURE CONDITIONS

Changes in the environmental variables can dramatically impact media efficacy and embryo development.[1]
Geri® is designed to minimise changes in the embryo's environment, reducing the stress caused by lid openings and supporting gamete function and embryo development:[1-5]

1. Swain, JE., et al. "Optimizing the culture environment and embryo manipulation to help maintain embryo developmental potential." Fertility and sterility 105.3 (2016): 571-587. 2. Zhang, JQ, et al. "Reduction in exposure of human embryos outside the incubator enhances embryo quality and blastulation rate." Reproductive Biomedicine Online 2010; 20(4): 510–515. 3. Swain, Jason E. "Decisions for the IVF laboratory: comparative analysis of embryo culture incubators." Reproductive biomedicine online 28.5 (2014): 535-547. 4. QFRM422 Geri® User Manual. 5. Takenaka, M., et al. "Effects of light on development of mammalian zygotes." Proceedings of the National Academy of Sciences 104.36 (2007): 14289-14293. 6. Schultz, RM. "Of light and mouse embryos: less is more." Proceedings of the National Academy of Sciences 104.37 (2007): 14547-14548. *Assuming lid has been open for a maximum of 1 min. 7. Kovacs, P. (2014) "Embryo selection: the role of time-lapse monitoring." Reprod Biol Endocrinol 12 (1): 124-135."

SIX INDIVIDUAL CHAMBERS

- Each chamber is independently controlled and designed to hold a single patient's embryos.[4]

DISRUPTION-FREE ANALYSIS[7]

- State-of-the-art integrated continuous embryo monitoring system.
- Individual microscope with high-resolution camera in each chamber for reduced camera movement.[4]

TEMPERATURE

- Double heating elements in each chamber ensure temperature stability.[4]
- Rapid recovery of user set point within 60 seconds of closing the lid.*[4]
- 4 temperature sensors accurately detect abnormal conditions.[4]
- Audible temperature alarm and option for external alarm connection.[4]
- External temperature probe port.[4]

GAS

- Regulator maintains consistent gas flow.[4]
- Purge functionality for rapid recovery of user-defined values within 3 minutes.[4]
- A CO_2 sensor in each chamber detects abnormal gas conditions.[4]
- Independent gas lines for each chamber.[4]
- External CO_2 probe port.[4]

LIGHT

- Long wavelength light source (550-650nm) in cameras[4] to reduce light-induced damage to vulnerable early developing embryos.[5-7]
- Reduced total energy output compared to traditional microscopy.[8]

HUMIDITY

- Aims to minimise increases in osmolality levels that can impact embryo development.[9-15]
- Option to choose humidified or dry chamber based on customer experience.[4]
- Humidity is continuously tracked by independent sensors and can be monitored on the incubator's parameter screen.[4]
- Humidity alarm can be enabled for each chamber.[4]

4. QFRM422 Geri® User Manual. 5. Takenaka, M., et al. "Effects of light on development of mammalian zygotes." Proceedings of the National Academy of Sciences 104.36 (2007): 14289-14293. 6. Schultz, RM. "Of light and mouse embryos: less is more." Proceedings of theNational Academy of Sciences 104.37 (2007): 14547-14548. * Assuming lid has been open for a maximum of 1 min. 7. Kovacs, P. (2014) "Embryo selection: the role of time-lapse monitoring." Reprod Biol Endocrinol 12 (1): 124-135." 8. QFRM584 Geri® Clinical Evaluation Report. 9. Swain, J. E., et al. "Media osmolality changes over 7 days following culture in a non-humidified benchtop incubator." Fertility and Sterility 106.3 (2016): e362.

DESIGNED FOR STABILITY & RELIABILITY

Geri® is equipped with a number of **redundancies and fail-safe mechanisms**, ensuring that the chamber's set points are reached as quickly as possible after lid openings and stable culture conditions are maintained.[1]

- **Four heating elements per chamber,** located in the base and lid, ensure temperature stability in case of an element failure.[1]
- **Independent gas lines** of each chamber ensures that any chamber line blockages are isolated and will have no impact on other chambers.[1]
- **Separate firmware and software** driving the incubator and the camera respectively ensure any issue with cameras will have no impact on incubation parameters.
- A regulator maintains a **consistent gas flow.**[1]

FAST RECOVERY OF GAS AND TEMPERATURE ENSURE STABILITY OF INCUBATION CONDITIONS IN EACH CHAMBER[1]

The chamber is returned to the temperature set point (+/- 0.2 °C) in **less than 1 minute** after closing the lid.[1]

TEMPERATURE RECOVERY

Gas purge functionality re-establishes optimum gas levels in the chamber in **less than 3 minutes,** after lid closing.[1]

GAS RECOVERY

1. QFRM422 Geri® User Manual.
*Assuming lid has been open for a maximum of 1 minute.

REAL-TIME MONITORING OF ENVIRONMENT

Geri® allows you to **monitor each chamber's environment** and controls incubation conditions with **independent in-built sensors:** temperature, gas and humidity sensors detect abnormal environment conditions.[1]

User has the ability to choose humidified or dry chamber based on their own experience. Humidity is continuously monitored and a humidity alarm can be enabled for each chamber.

Range of CO_2 conditions inside the chambers. CO_2 is monitored in all chambers.

Temperature is monitored in all chambers.

FOR IMPROVED LAB EFFICIENCY

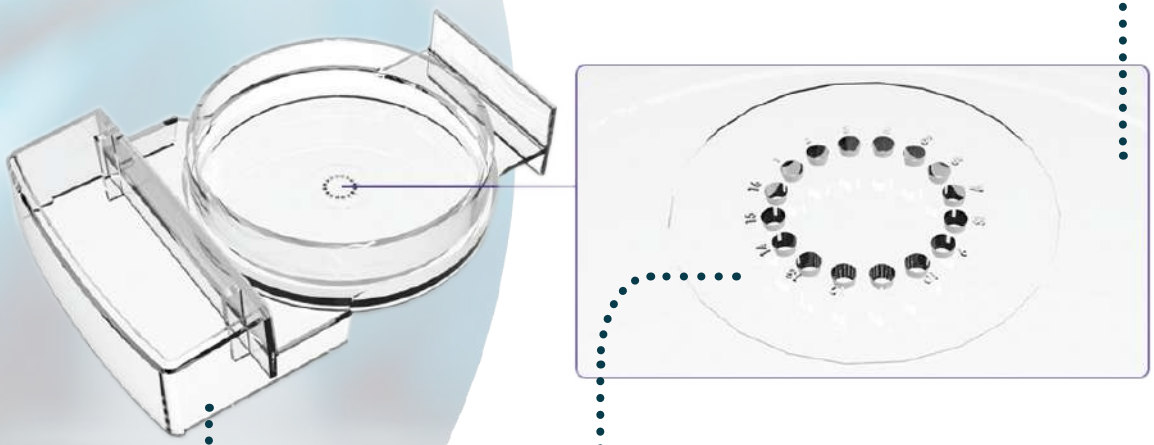
Designed by embryologists for embryologists, there are a number of additional features developed to fit in with **the way you work:**

- **Compact benchtop incubator:** Geri® has a minimal footprint[1] to enable easy integration into your lab (615 x 300 x 500mm/ 40.35kg).
- **Modular chamber design:** Allows a swap-in swap-out servicing model, so that incubator modules are easily replaceable in the lab, resulting in high availability of the system.
- **Single-handed, anti-slam lid opening:** Provides easy access to the chamber, without compromising the handling of culture dishes.
- **Second dish position inside each chamber:[1]** Used either for the equilibration of the next sequential medium or to hold the transfer dish, helping to improve workflow.
- **Easy-to-use interface:** Angled main touchscreen display[1] and individual LCD displays in each chamber that allow you to continuously monitor chamber conditions and access patient information.[1]

1. QFRM422 Geri® User Manual.

SMART INNOVATION: Geri® DISH

The Geri® dish has **16 microwells for individual embryo tracking[1] whilst at the same time shared media permits group culture,** which may be beneficial for improved embryo development.[2]
With 6 chambers, Geri® provides the **capacity to hold up to 96 embryos.**



16 high-precision microwells displayed in a circle for easy dish rotation.[1]

Extra handle for safe grip and can be used for patient identification labels.[1]

Microwells are **500µm in diameter on top and 430µm on base** for easy addition and removal of embryos, and **400µm in depth** to prevent embryos leaving microwells.[1]

1. QFRM422 Geri® User Manual.
2. Ebner T, et al. Reprod Biomed Online. 2010; 21: 762-768.

STATE-OF-THE-ART CONTINUOUS EMBRYO MONITORING TECHNOLOGY

Continuous monitoring of embryo development supports the **identification of abnormal developmental patterns directly correlated with embryo implantation potential.**[1]

A DEDICATED CAMERA PER CHAMBER

Each individual Geri® chamber is fitted with an in-built microscope and high-resolution **camera***, allowing time-lapse images to be taken **without the need to take embryos** out of the incubator.[2]

This innovation **helps to reduce camera movement and lid openings,** resulting in a more stable incubation environment.[1,3]

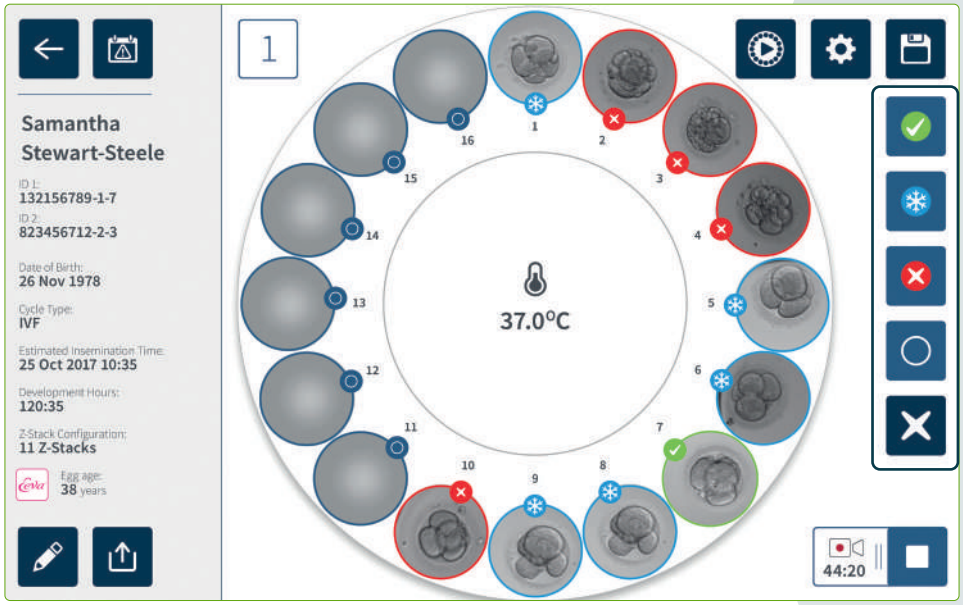
Images of each embryo are captured **every 5 minutes** from across **11 focal planes,**[2] providing **significantly more information** about the development of embryos.**

1. Kovacs, P. (2014) "Embryo selection: the role of time-lapse monitoring." Reprod Biol Endocrinol 12 (1): 124-135.
2. QFRM422 Geri® User Manual.
3. Swain, Jason E. "Decisions for the IVF laboratory: comparative analysis of embryo culture incubators." Reproductive biomedicine online 28.5 (2014): 535-547.

* Monochrome CMOS camera. Resolution at 2 pixels per μm (2560 x 1928 pixels).
** Compared to single point microscopy observation and some other TL systems in the market.

THE Geri® INCUBATOR:

- ✓ Automatically **detects empty microwells.**[2]
- ✓ Automatically **selects the most in-focus images** to provide a best focal plane, embryo cropped video.[2]
- ✓ Offers **customisable camera settings*** per chamber.[2]



** Focus, image contrast and camera alignment.*

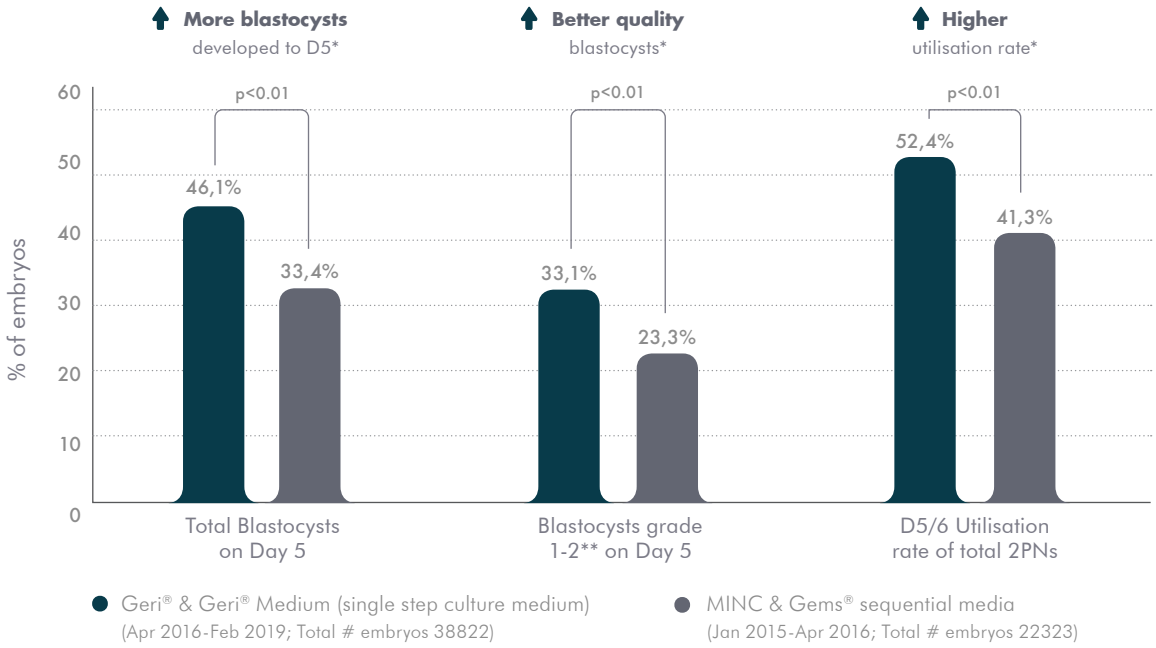
Embryo videos can be reviewed directly in Geri's easy-to-use interface, allowing also to tag each embryo.[2]

MAXIMISE THE POTENTIAL OF CONTINUOUS UNDISTURBED EMBRYO CULTURE1-8

After the implementation of a fully undisturbed culture system in all Genea labs, the use of the **Geri® incubator alongside the Geri® Medium** provided more supportive environmental conditions for embryos* compared to MINC incubator using Gems Sequential media[1]:

GENEA CLINICAL RESULTS BLASTOCYSTS QUALITY AND UTILISATION RATES[1]

(All clinics, all cycles, combined ages)

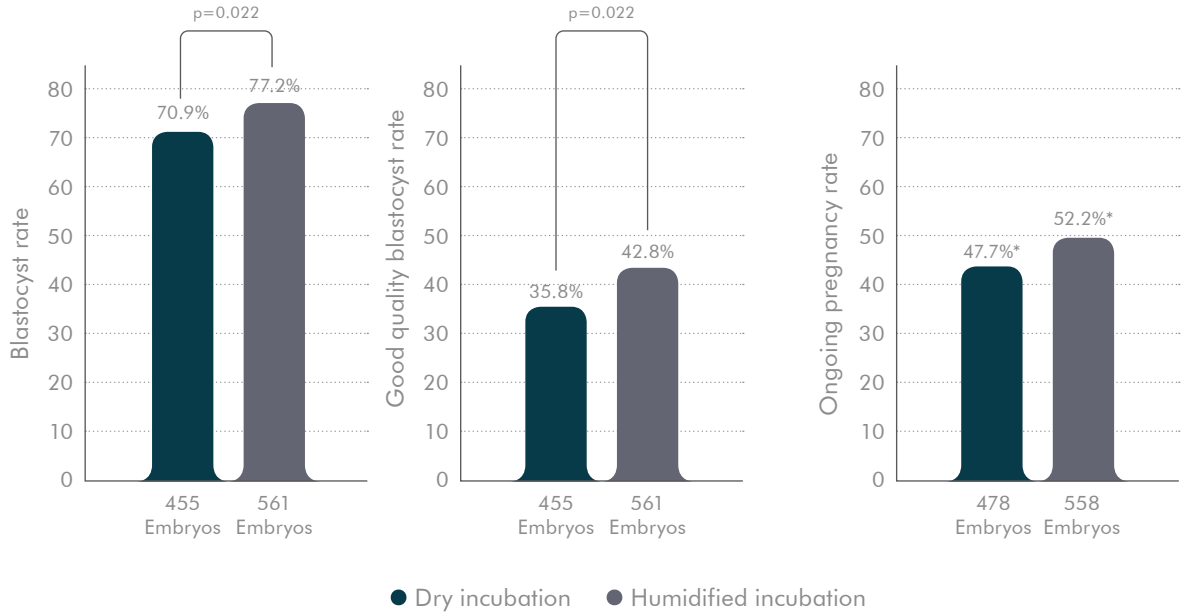


1. Data on file at Genea Biomedx. QRTV318_Human Embryo Culture in Geri®. 2. QFRM422 Geri® User Manual. 3. Swain, JE., et al. "Optimizing the culture environment and embryo manipulation to help maintain embryo developmental potential." Fertility and Sterility 105.3 (2016): 571–587. 4. Zhang, JQ,et al. Reduction in exposure of human embryos outside the incubator enhances embryo quality and blastulation rate. Reproductive Biomedicine Online 2010;20(4):510–515. 5. Swain, JE., et al. "Decisions for the IVF laboratory: comparative analysis of embryo culture incubators." Reproductive biomedicine online 28.5 (2014): 535-547. 6. Bontekoe, S., et al. "Low oxygen concentrations for embryo culture in assisted reproductive technologies." The Cochrane Library (2012). 7. Kovacs, P., et al. "Embryo selection: the role of time-lapse monitoring." Reprod Biol Endocrinol 12 (1) (2014): 124-135. 8. QFRM902 Gems® Technical Specification Geri® Medium. NOTE: Embryos which were transferred or frozen prior to day 5 are excluded from the total 2PN count for the purposes of calculating total blastocysts and grade 1/2 blastocysts because their potential fate is unknown. * Statistically significant differences ($p<0.01$). ** Genea grading.

THE EFFECT OF HUMIDIFIED INCUBATION IN Geri®

In *in vivo* culture, incubation conditions are humid.[9-10] Geri® has been designed to provide an optional humidified culture environment in each of the instrument's chambers.[2] A high **humidity atmosphere helps promote embryo development** and, ultimately **could have an effect in the reproductive outcome.**[9-11]

SIGNIFICANTLY INCREASED BLASTULATION AND GOOD QUALITY BLASTOCYST RATE WITH HUMID CULTURE VS DRY IN Geri®.[11]



HUMIDITY IN Geri® MAY HELP TO INCREASE ONGOING PREGNANCY RATE IN CONTINUOUS CULTURE CONDITIONS[9]

9. De los Santos JM, et al., "The effect of high humidity culture conditions over embryo development: a continuous embryo monitoring assessment", ESHRE 2019 abstract. 10. Fawzy, M., et al. "Humid versus dry incubator: A prospective, randomized, controlled trial." Fertility and sterility 108.2 (2017): 277-283. 11. Perez Albala, S.,et al., "Embryo culture conditions under high humidity significantly enhances blastocysts formation and quality according to an automatic time-lapse algorithm", ESHRE 2019 abstract. * Not statistically significant differences.

GET THE MOST OUT OF Geri® WITH Geri® CONNECT & ASSESS

More than one incubator: Geri® Connect & Assess links several Geri® instruments through a local area network (LAN). Data is synchronized, creating a centralised database for all patients.[1]

Remote access: Users can access and review data and time-lapse videos from multiple PC workstations connected to the LAN simultaneously.[1]

Aids lab efficiencies: Patients can be added, edited or archived online – saving time by storing directly to local network folders.[1]

Quality control: Two levels of user permissions provide clear definition of roles and editing power within the software, with full traceability of actions.[1]

Streamline embryo assessment: One interface to access three different embryo assessment modules to leverage time-lapse information based on your clinic preferences.[1]

Remote monitoring: Displays each Geri® instrument's environmental conditions and connection status, alarm and warnings history.[1]

1. QFRM794 Geri® Connect and Geri® Assess User Manual.

Genea BIOMEDX Geri Connect

Genea BIOMEDX Geri Assess

Geri® Connect & Assess offers **the same functionality** as if you were in the lab, directly operating the Geri® main display and positively impacting workflow and lab management.

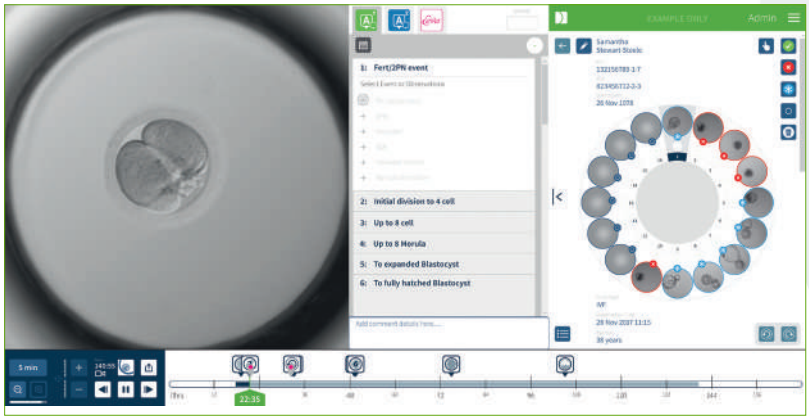
Geri® Connect & Assess supports communication with patients, during consultation or at home. The Patient Review Screen confidentially displays single patient's information only. Data can be exported as take-home videos or images, or shared from this screen interface with patients.[1]

A MODULAR APPROACH TO IDENTIFYING HIGH QUALITY EMBRYOS

Developed with the demands of the clinic in mind, Geri® Connect & Assess helps to **improve workflow** by moving away from a paper-based, manual embryo grading system to **a digital, traceable tool.**

Three different assessment modules support the generation of a morphological and/or morphokinetic score, **helping embryologists to assess embryos with high implantation potential.**

EMBRYO GRADING WITH CUSTOMISED CRITERIA



Geri® Assess 1.0 is a user-defined embryo assessment tool, providing **a cumulative score according to a clinic's unique configuration,** where the weight placed on assessment criteria is based on clinic preferences.[1]

Designed to mimic the manual annotation logic in a digital tool, it is **structured in 'development chapters'** where events (+ score) and negative observations (- score) are added manually to the timeline. Includes free text fields for comments and grades.[1]

1. QFRM794 Geri® Connect & Geri® Assess User Manual. 2. QRTF285_03 Geri 6.0 and GC&GA 2.0 Testing Summary. 3. ALPHA scientists in Reproduction medicine and ESHRE SIG of Embryology (2011). Istanbul consensus workshop on embryo assessment: Proceedings of an expert meeting. Human Reproduction 26 (6): 1270-1283 4. Ciray H.N. et al. (2014). Proposed guidelines on the nomenclature and annotation of dynamic human embryo monitoring by a time-lapse user group. Human Reproduction 29 (12): 2650-2660. 5. Meseguer, M. et al. "Using artificial intelligence (AI) and time-lapse to improve human blastocyst morphology evaluation." Human Reproduction (2018): 125-126. 6. Basile, N. et al. (2015). The use of morphokinet1. ics as a predictor of implantation: a multicentric study to define and validate an algorithm for embryo selection. Human Reproduction 30 (2): 276-283.

AUTOMATED EVENT DETECTION AND CUSTOM SCORING ALGORITHMS

Geri® Assess 2.0 is an **embryo development assessment tool** based on artificial intelligence that **automatically detects and annotates key events and observations as they occur.**[1,2]

Geri® Assess 2.0 also **provides the ability to incorporate a number of custom scoring algorithms,** either individually or as an average, which combine the annotations placed on the embryo timeline with a set of user-defined conditions, to give a final embryo score.[1]

Events

- PN appearance
- PN disappearance
- 2 cell
- 3 cell
- 4 cell
- 5 cell
- 6 cell
- Morula
- Early blastocyst
- Expanded blastocyst
- Hatching blastocyst

Observations

- Reverse Cleavage
- Fragmentation

- ✓ **Standardise annotation practice** with automated event detection based on published recommendations[2-4] vs variability of manual annotations of embryologists.[5]
- ✓ **Time saving and workflow improvements** with Assess 2.0 aiding the embryologist to identify critical embryo developmental milestones in the timeline.[1]
- ✓ **Further aids decision making** prior to transfer* by providing morphokinetic assessment support for embryo ranking.[1,6]

* Compared to Assess 1.0

A MODULAR APPROACH TO IDENTIFYING HIGH QUALITY EMBRYOS

Eeva® AUTOMATED PREDICTION OF EMBRYO VIABILITY

The **Eeva®** System is a prognostic test providing automated evaluation of early embryo development[1-3] and can help to achieve improved ART outcomes when used in conjunction with traditional morphology.*[4-9]

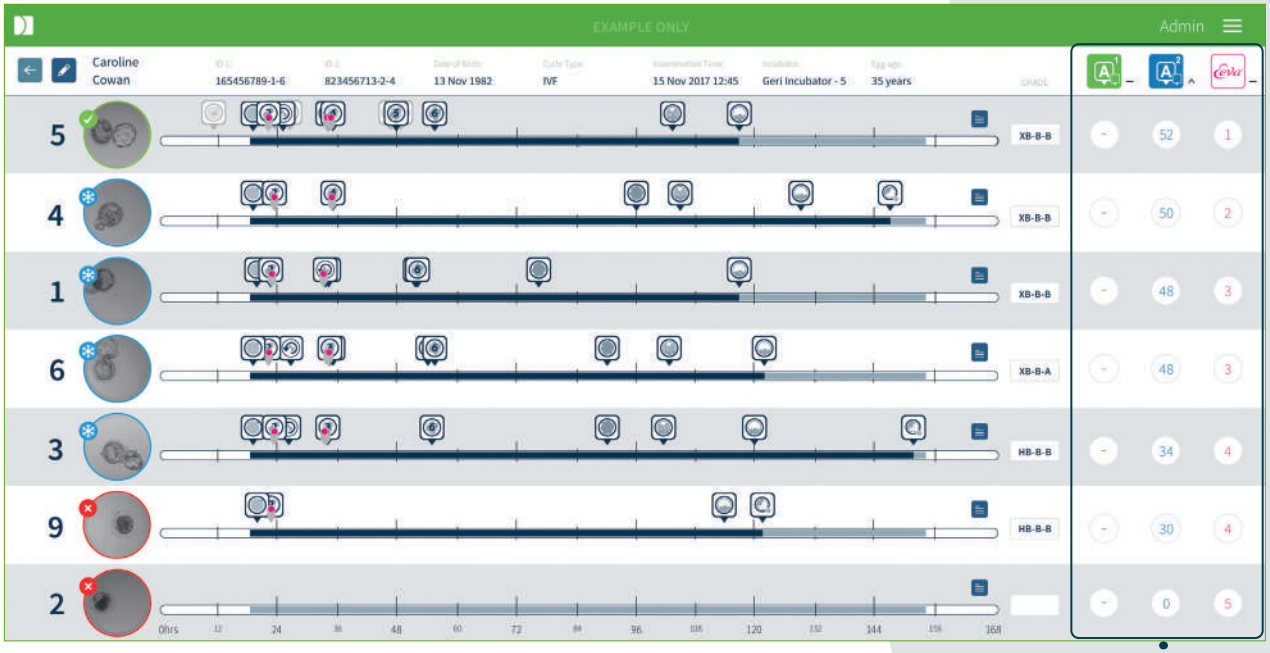
- Geri®+ optics system has been upgraded to capture dark field imagery and transfer these images to the Eeva® server, to enable automated prediction of embryonic development.[2-3]
- For the first time, the validated proprietary algorithm of the Eeva® Test can be applied alongside fully undisturbed culture conditions in the Geri®+ benchtop incubator.[1-3]
- The connection through the Geri® server allows patients Eeva® results to be viewed directly from Geri® Connect.[2]

1. 358_1053_01_Instructions for Use Eeva® System 3.1.
2. QFRM794 Geri® Connect and Geri® Assess User Manual.
3. QFRM422 Geri® User Manual.

* Compared to traditional morphology alone.

STREAMLINE DECISION MAKING IN THE LAB

Geri® Connect and Assess can further assist decision making process by allowing **visual comparison of embryo development within each patient's cohort of embryos.[2]**



The cumulative scores resulting from each of the three grading modules can also be compared and sorted.[2]

4. Adamson, G.D., et al. Improved implantation rates of day 3 embryo transfers with the use of an automated time-lapse–enabled test to aid in embryo selection Fertility and sterility 105.2 (2016): 369-375. **5.** Aparicio-Ruiz, B., et al. Automatic time-lapse instrument is superior to single-point morphology observation for selecting viable embryos: retrospective study in oocyte donation. Fertility and Sterility 106.6 (2016): 1379–1385. **6.** Rocafort, E., et al. "Euploid embryos selected by an automated time-lapse system have superior SET outcomes than selected solely by conventional morphology assessment." Journal of assisted reproduction and genetics 35.9 (2018): 1573-1583. **7.** Behr B, et al. Non-invasive technology combining time-lapse Imaging and statistical modeling: Bringing automation into the lab to improve blastocyst selection. ASRM. 2015. **8.** Pool, TB. et al., "Computer vs. human manual assessment: are we ready to start an automated era in embryology laboratory?", Fertility and Sterility 105.2 (2016): e37 **9.** Aparicio-Ruiz, B., et al. "Clinical validation of an automatic time-lapse algorithm classification system for blastocyst selection", Abstract accepted at ESHRE 2019

Genea BIOMEDX

For healthcare professionals only. Please refer to the instructions for use.

Geri®, Geri®+, Geri® Connect, Geri® Assess, Geri® Medium, Geri® Dish, Geri® Water bottle, and Eeva® comply with the current legislation of medical devices.

Geri®, Geri®+ and Geri® Connect & Geri® Assess are manufactured by Genea Biomedx. Eeva® is manufactured by Planet Innovation.

For further information, please contact your Service Representative or visit:

www.geneabiomedx.com

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QRTM329-02