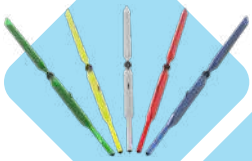
ZEUS

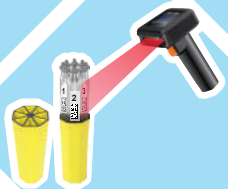
bioscience

Innovative & Unique Technologies for Reproductive Medicine

PULSE STIMULATOR



MISMATCH BLOCKER



SMART CRYO-TOOLS

BLACK-BOX

TIME-LAPSE SYSTEM

Explore Our Innovative Product Portfolio

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Who Are We?

ZEUS Bioscience, founded in 2020 in Türkiye, develops advanced technologies for assisted reproductive treatments, grounded in strong clinical collaboration with leading IVF and genetics centers. The company delivers high-quality, innovative solutions that optimize workflow efficiency, enhance procedural accuracy, and improve overall treatment success in IVF laboratories.

ZEUS prioritizes ergonomic design, clinical reliability, and biosafety, ensuring systems that support user performance, safeguard patient outcomes, and maintain the highest standards of laboratory safety. Committed to research and development, ZEUS Bioscience continues to advance accessible, science-driven innovations that empower fertility professionals and contribute meaningfully to reproductive healthcare.

ZEUS Headquarter in Ankara Türkiye

Prof. Volkan Baltacı, MD, PhD

FOUNDER & CHIEF EXECUTIVE OFFICER

Prof. Volkan Baltacı, MD Founder and CEO of Mikrogen Genetic Diagnosis Center, was born in 1964 in Ankara. He graduated from Ankara University Faculty of Medicine in 1988 and completed his specialization in Medical Genetics at the same university in 1993. He was appointed Associate Professor in 1999 and became a Professor in 2008.

In addition, he earned a Ph.D. in Toxicology in 2003. With over 30 years of experience in the field, Prof. Dr. Baltacı has performed more than 20,000 prenatal genetic diagnostic tests.

Since 1998, he has focused his research on reproductive genetics and preimplantation genetic diagnosis (PGD), publishing numerous national and international scientific articles on these topics.

He gained international experience at Baylor College of Medicine in Houston, USA, where he focused on reproductive genetics and preimplantation genetic diagnosis, and he has also served as a faculty member at several universities.

Prof. Dr. Baltacı is an active member of many professional organizations, including the Genetic Diseases Counseling Society, where he serves as President, as well as the Medical Genetics Association, the Turkish Society for Reproductive Health and Infertility, the Turkish Infertility Foundation, the European Society of Human Reproduction and Embryology, and the American Society for Reproductive Medicine.

His main areas of expertise include medical genetics, reproductive genetics, preimplantation genetic diagnosis, and prenatal diagnosis.

Our Mission

Our mission is to deliver high-quality, reliable, and technologically advanced solutions that create meaningful value for both healthcare professionals and patients.

Each of our products is driven by innovation and engineered with a strong emphasis on usability and operational efficiency. We offer products that streamline workflows, optimize clinical processes, and ensure safe, effective, and reliable treatment options for patients, particularly in the fields of IVF, reproductive medicine, and reproductive genetics, where we have over 25 years of clinical experience and expertise. Our solutions incorporate robust traceability and control mechanisms designed to mitigate critical risks, including the potential misidentification or mixing of biological samples.

Our research and development activities are guided by four core pillars: innovation, usability, patient safety, and clinical and laboratory staff safety. In alignment with these principles, we are committed to ensuring that our continuously evolving solutions are accessible and adaptable across diverse areas of reproductive healthcare.

At ZEUS Bioscience, we recognize that scientific excellence must go hand in hand with a deep responsibility toward human life. With this awareness, we are dedicated to continuous improvement and to advancing healthcare standards every day.

Our Vision

Our vision is to enhance quality of life through innovative biotechnology solutions, delivering healthier and more successful treatment outcomes in the field of reproductive health. We are committed to becoming a globally recognized and trusted brand in reproductive healthcare.

To achieve this, we aim to strengthen our presence in both local and international markets, expand our global footprint, and increase our impact across the healthcare ecosystem. By continuously investing in research and development, we embrace emerging technologies and scientific advancements to drive innovation.

Through our commitment to excellence, we strive to provide healthcare professionals and patients with advanced, reliable, and effective solutions that set new standards in reproductive health.

Volkan Battaci

ZEUS bioscience

SMART CRYO–TOOLS

Zeus Smart Cryo Tools takes your freezing process to the next level.

ZEUS Smart Straw (ZCT25-001FT/ZCT25-001RT)

The ZEUS Smart Straw is a newly designed cryopreservation straw with a triangular cross-section, offering significant functional advantages over conventional round straws.

Four color options for both goblets and straws: orange, blue, yellow and pink supporting visual identification.

Key Features

- Triangular geometry, enabling secure barcode attachment and **improved visibility during storage.**
- Integrated stopper prevents the straw from touching the bottom of the goblet, allowing it to **remain suspended** when placed inside.
- **Shortenable design:** the straw can be broken at the designated area to reduce length and increase liquid nitrogen tank and cane storage capacity.
- Easy **cane compatibility** after shortening, allowing placement into ZEUS canes.
- Compatible with grabber pen once shortened, enabling **safe handling within liquid nitrogen.**

Individually packaged, sterile, ensuring maximum safety and contamination control.

An Integrated System for Safer, More Efficient Cryopreservation in IVF Laboratories

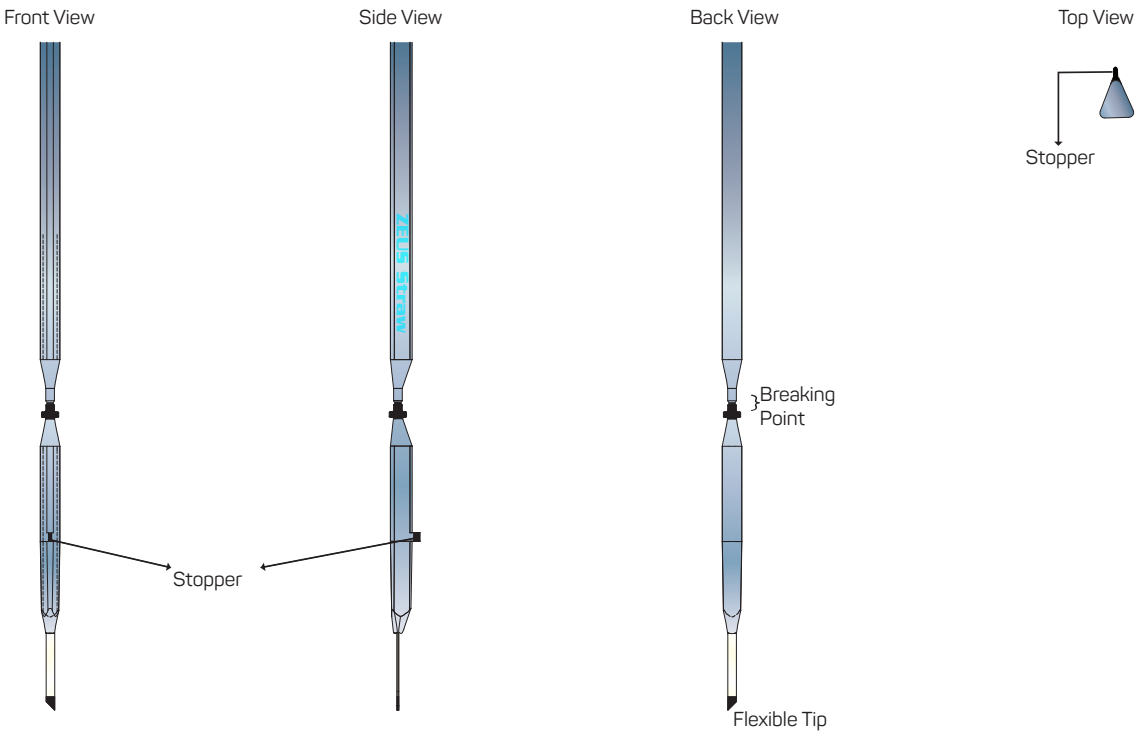
The ZEUS Smart Cryo-Tools system is a comprehensive set of intelligently designed tools developed to improve safety, traceability, and workflow efficiency during cryopreservation and storage of embryos and oocytes. Each component is engineered to work seamlessly with the others, reducing handling risks, minimizing exposure to air, and supporting full digital traceability throughout the IVF cryo process.

The Aluminum Block, Cryo-Box and Tweezers are essential tools in the cryotools system.

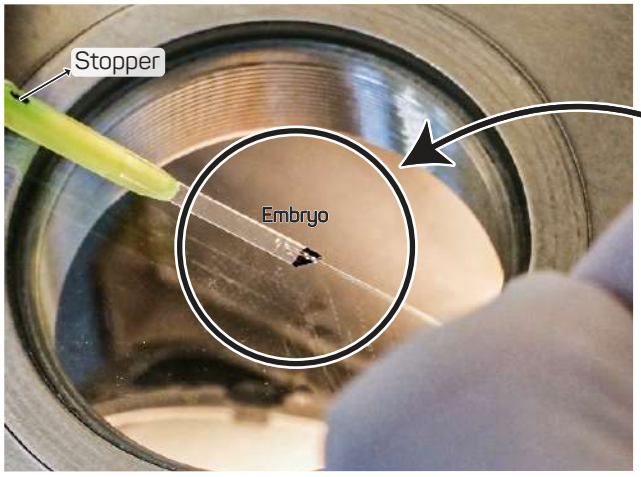
(One Time Purchase)

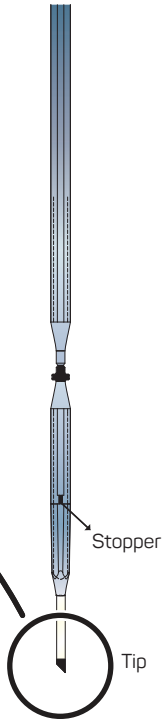
Straw Shape and Embryo / Oocyte Placement Area (Tip)

Soft, transparent tip designed for gentle embryo or oocyte loading under a stereo microscope.



Soft, transparent straw tip designed for precise microdroplet loading under a stereo microscope, ensuring safe and controlled cryopreservation.

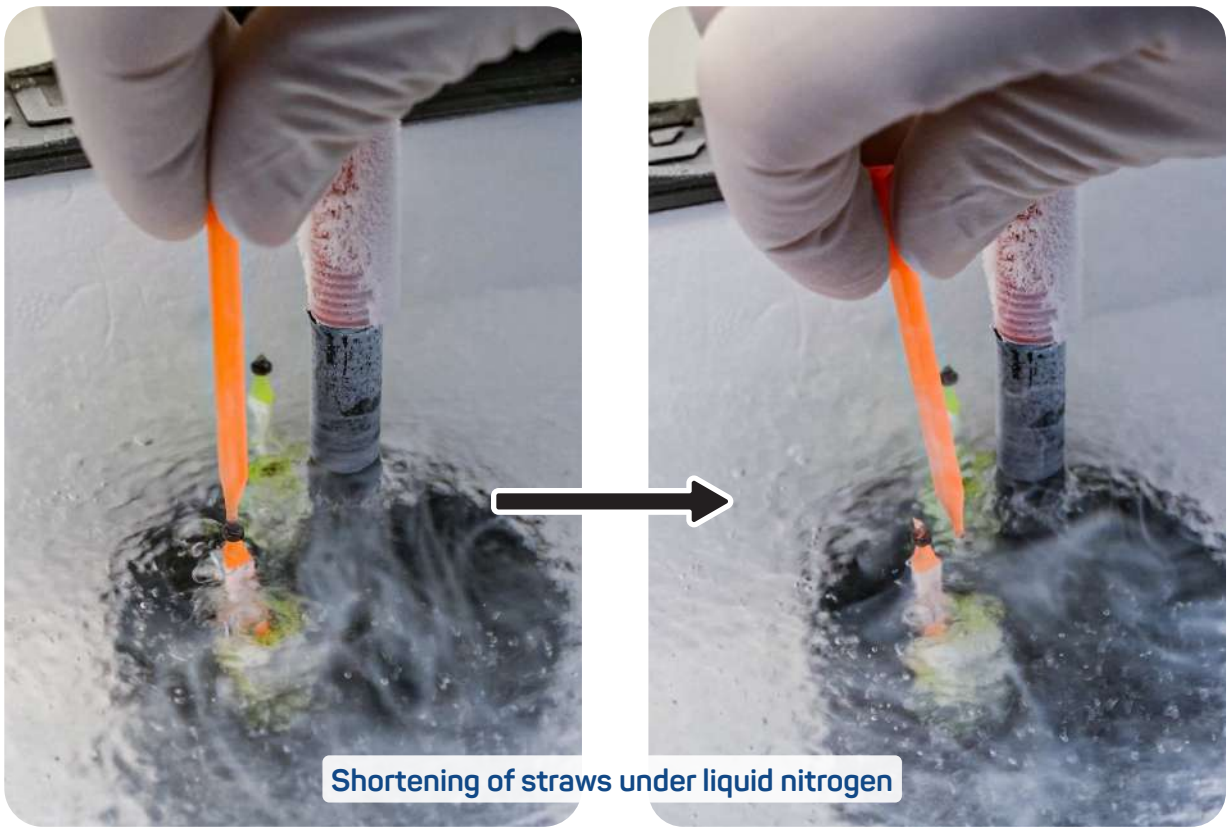




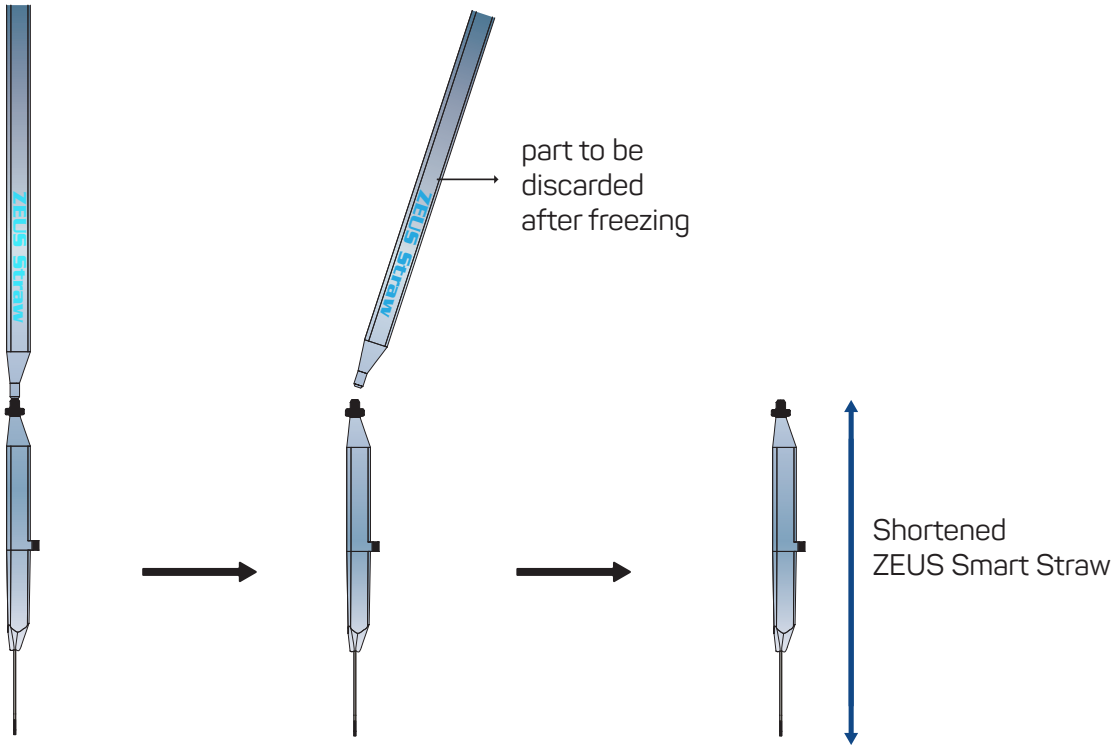
The embryo is loaded on the same side as the integrated stopper.

Straw Breaking/Shortening

After embryo or oocyte placement and freezing under liquid nitrogen, the straw is safely shortened at the designated breaking area once positioned inside the goblet.



Shortening of straws under liquid nitrogen



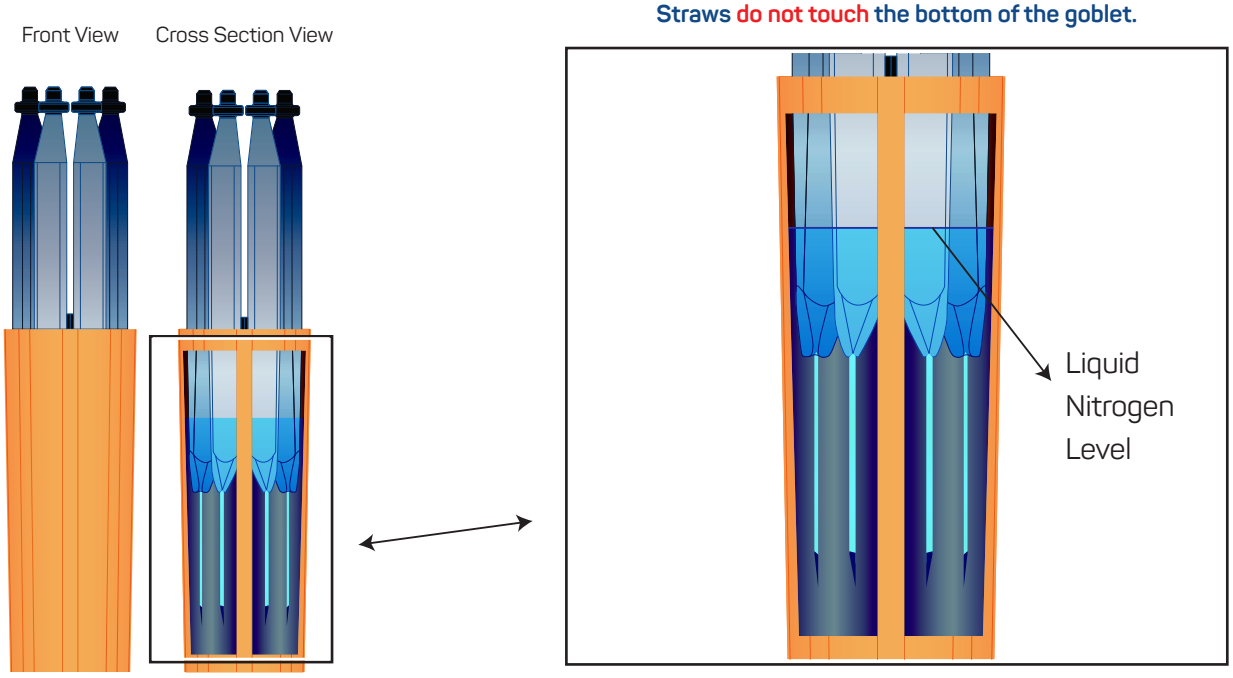
ZEUS Octagonal Goblet (ZCT25-002)

The ZEUS Octagonal Goblet features a unique octagonal design specifically optimized for use with ZEUS Smart Straws.

Four color options: yellow, pink, orange, and blue.

Key Features

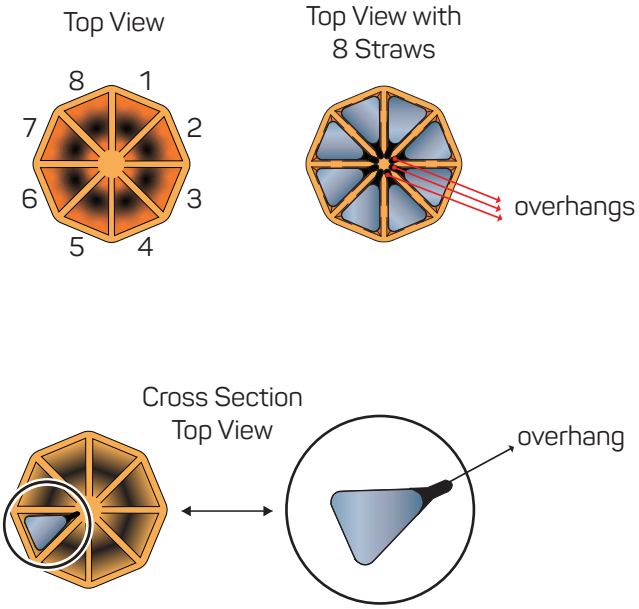
- Capacity for **8 Smart Straws per goblet.**
- **Nitrogen-retaining structure** allows liquid nitrogen to remain inside the goblet during removal from the tank, preventing air exposure.
- **Full barcode visibility:** the triangular straw design ensures all attached barcodes remain visible from outside the goblet.
- Embryos and oocytes **never contact air** during handling, significantly enhancing safety.
- Supplied sterile in protective packaging; each package contains five goblets.



The octagonal goblet design ensures that straw tips (where embryos or oocytes are located) remain continuously submerged in liquid nitrogen during identification and handling.

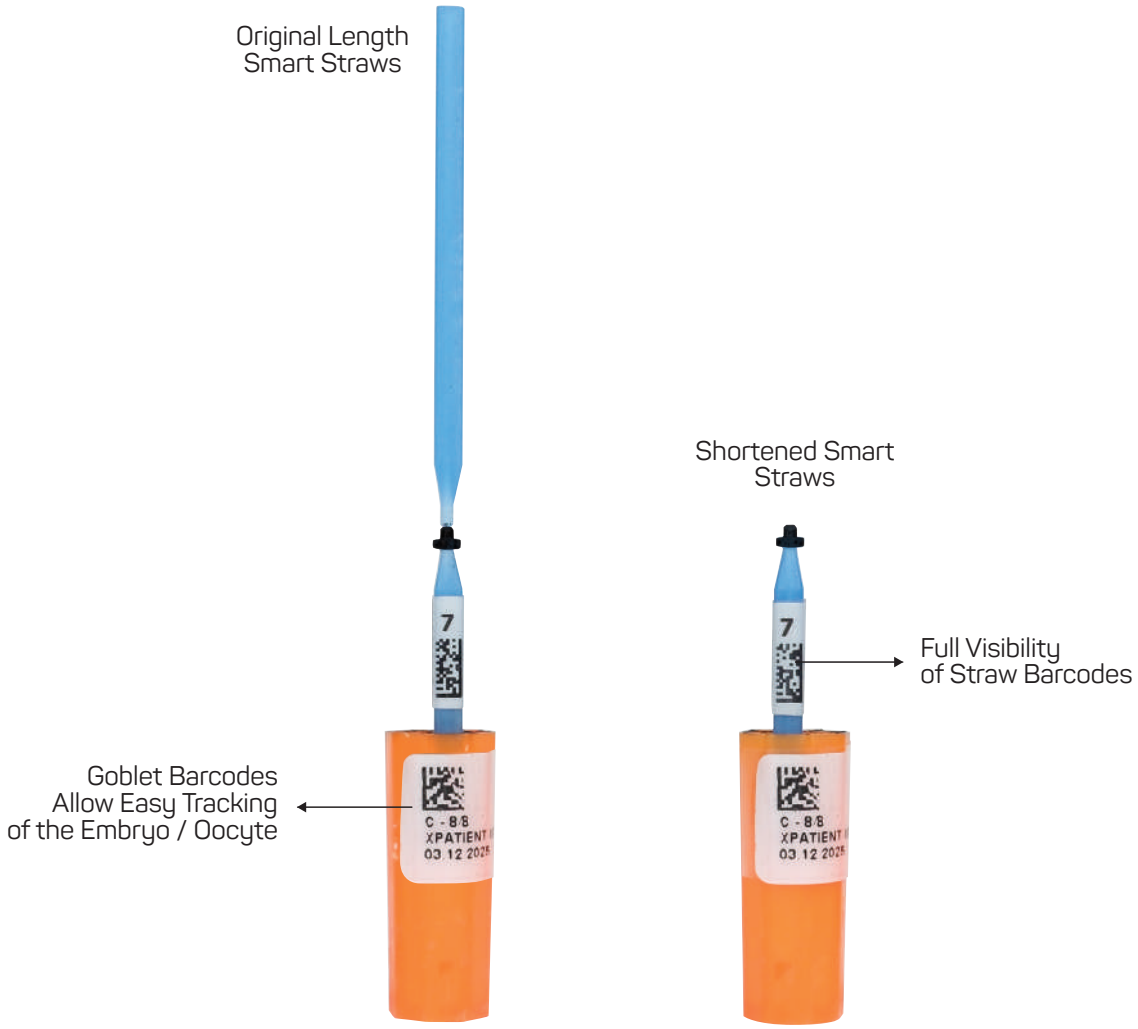
Embryologists can visually confirm and scan straw or goblet barcodes directly at tank-side without removing the straws from nitrogen.

This allows safe selection of the desired embryo or oocyte while maintaining uninterrupted cryogenic protection.



The integrated overhang on the straw body acts as a stopper, maintaining suspension.

Both the tip of the Straw and the Embryo on the tip, face the center of the goblet



ZEUS Grabber Pen (ZCT25-006)

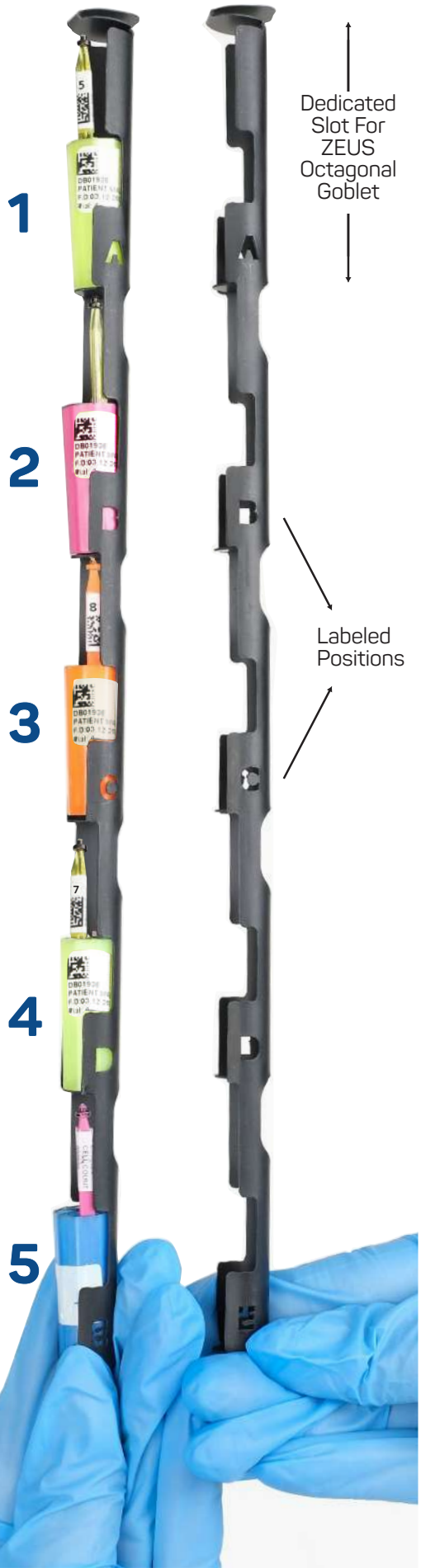
The ZEUS Grabber Pen is a precision handling tool for safe manipulation of shortened Smart Straws.

Key Features

- Grabber Pen functions as an **extension mechanism** during embryo thawing by securely holding and elongating shortened straws.
- Designed for use inside liquid nitrogen.
- Maintains a safe working distance between the user and cryogenic materials.
- Mini four-claw pickup mechanism **securely holds shortened straws.**
- **Enhances control and reduces handling risks.**

ZEUS Cane (ZCT25-004)

The ZEUS Cane is a high-quality aluminum cane designed for secure and organized storage of ZEUS goblets inside liquid nitrogen tanks.



Key Features

- Securely holds five goblets vertically **without contact between them.**
- Dedicated placement slots for each goblet to **prevent movement.**
- **Clearly labeled positions: A, B, C, D, and E.**
- Six color options for visual differentiation.
- **Fully compatible with existing nitrogen tank cane systems.**

8 ZEUS Smart Straws per Goblet

↓

5 Goblet capacity per ZEUS Cane

↓

40 Straws per Cane

Expand Your Tank Capacity by

4×

6 Color Options

ZEUS Cryo Cane Sleeve (ZCT25-016)

For ZEUS Smart Straws, the plastic cylindrical covers specifically designed for ZEUS Canes with an **inner diameter of 15.5 mm are ideal.**

INNER DIAMETER

15.5 mm

Optimised for ZEUS Smart Straws. Ensures secure fit.

⚠ Covers outside this specification are **not suitable** and may compromise safety.

Expanding capacity starts with this step.

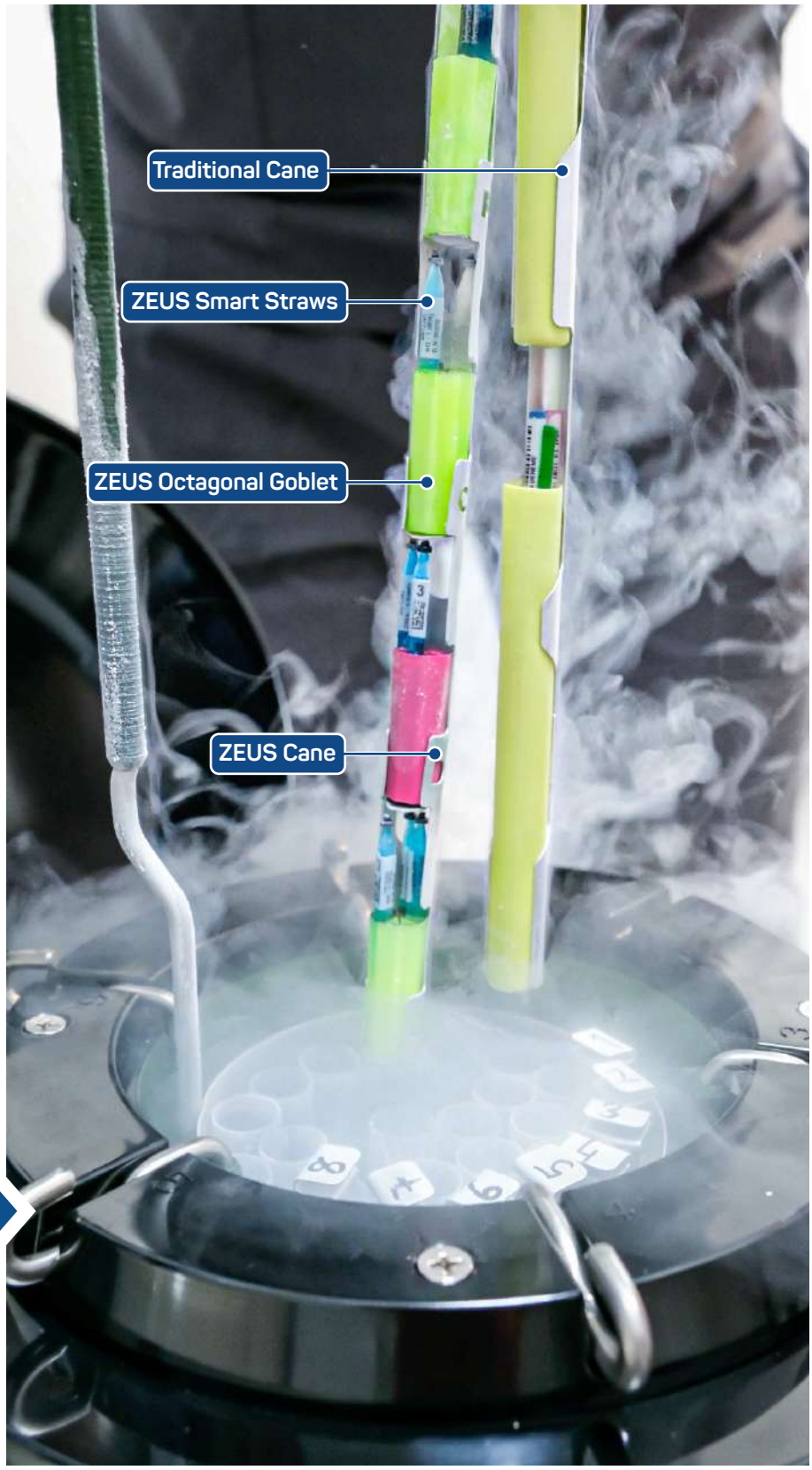
FULL COMPATIBILITY

- Existing nitrogen tank systems
- New & existing canes together

New and existing canes Together in the Same Tank

ZEUS Canes work alongside traditional canes in the same tank, letting you increase storage capacity immediately without replacing your current setup.

No new tank hardware required.



BEFORE USE

Pre-position an appropriate number of Cryo Cane Sleeves inside the canister to prevent goblet displacement and accidental dropping.

ZEUS Cryo-Box (Liquid Nitrogen Box) (ZCT25-010)

The ZEUS Cryo-Box is a specially designed container made from liquid nitrogen-resistant, cryogenic-grade insulating material. It is engineered to maintain a stable environment.

Key Features

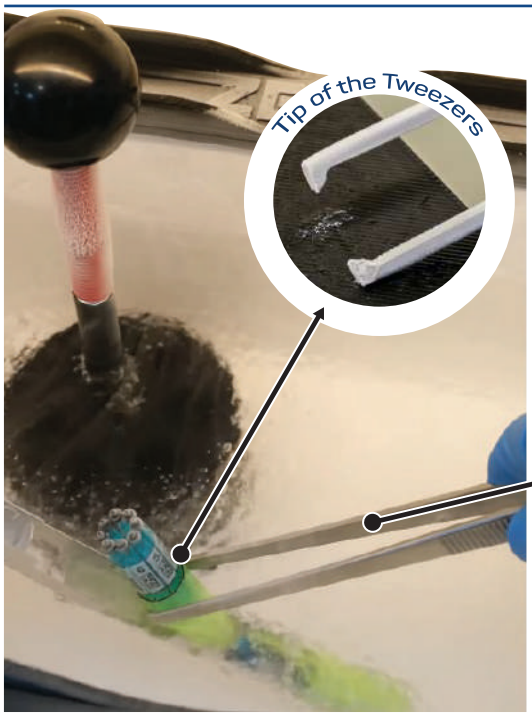
- Designed to **safely hold liquid nitrogen** during laboratory procedures.
- Open-lid design allows **rapid and controlled access.**
- **Maintains goblets submerged in nitrogen** after removal from the main tank.
- Ensures **embryos and oocytes remain protected** while embryologists perform selective thawing or handling tasks.

The goblets which always contain liquid nitrogen that protects the embryo must be placed in the Aluminum Block in the Cryo-Box.

When the **cane** is removed from the storage tank, it must be **placed immediately into the Cryo-Box** to minimize exposure to ambient temperatures and prevent thermal shock.

ZEUS Cane allows easy placement of goblets into the cane within the liquid nitrogen.

Cryogenic Tweezers (ZCT25-009)



Long, high-quality stainless-steel tweezers designed for cryogenic environments.

Key Features

- Suitable for grabbing and positioning goblets **inside the cryo-box.**
- **Corrosion-resistant and durable.**
- Designed for precise manipulation in liquid nitrogen.

ZEUS Aluminum Block with Holder (ZCT25-005)

This heavy-duty aluminum block is engineered to stabilize goblets during cryogenic handling. It acts as a critical interface within the ZEUS Cryo-Box to ensure the highest standards of biosafety and procedural control.

The Aluminum Block must remain inside the Cryo-Box during use to maintain thermal stability.

Key Features

- Features **six octagonal wells, perfectly matched to the ZEUS goblet shape.**
- **Prevents goblets from tipping or drifting** inside liquid nitrogen containers.
- Allows embryologists to **work confidently** within liquid nitrogen without instability concerns.
- Designed for **durability and thermal stability.**

Once the goblet is secured in the Aluminum Block, the specified straw is identified and removed to proceed with the thawing protocol.

ZEUS Touch-Screen Tablet with Software (ZCT25-011)

The ZEUS digital tracking system is the core safety and traceability component of the Smart Cryo-Tools ecosystem.

Key Features

- Touch-screen tablet running dedicated **ZEUS software.**
- Enables patient registration, record management, and barcode generation.
- Tracks the **exact in-tank location of every single embryo and oocyte,** including:
  - Tank number
  - Canister number
  - Cane position
  - Goblet position
  - Straw color
- **Minimizes human error and enhances laboratory safety.**
- **Fully integrated with barcode readers and printers.**

ZEUS Straw & Goblet Barcodes (ZCT25-014/015)

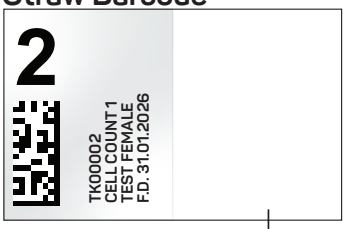
Specially designed, liquid nitrogen–resistant barcodes ensure durability, readability, and long-term traceability.

Straw Barcodes Key Features

- Designed specifically for the three-sided Smart Straw geometry.
- Extended length with a transparent wrap-around protective section.
- Visible section includes:
  - Straw position number (1–8)
  - QR code (links to full digital record in ZEUS software)
- End section displays:
  - Tank (TK) number
  - Patient name
  - Freezing date (DD.MM.YYYY)

LIQUID NITROGEN RESISTANT

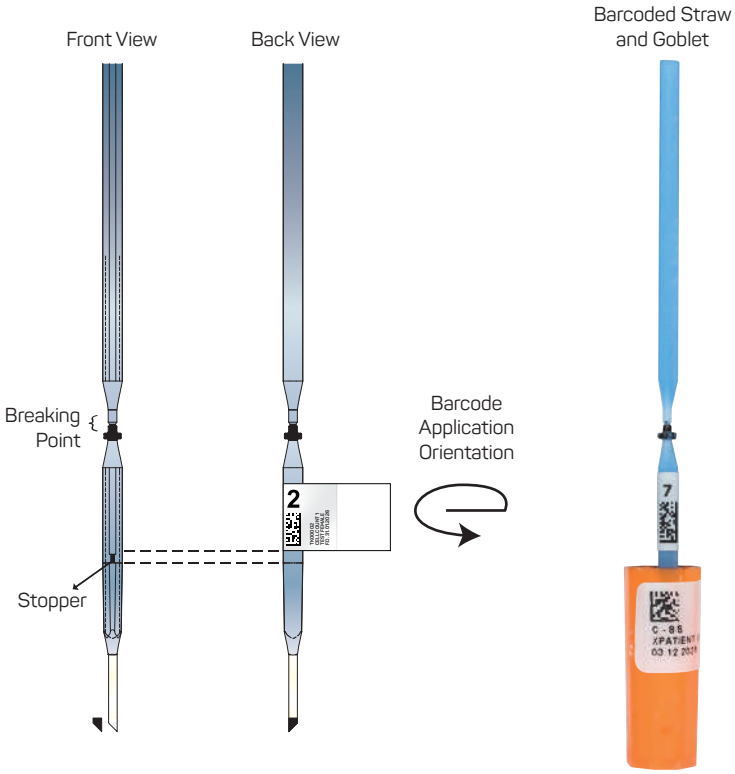
Straw Barcode



Transparent Part

Straw Barcode Application Guidelines

- When applying the barcode to the Smart Straw, **position it directly above the integrated stopper.** The label should not cover the stopper, as the small protruding ledge may prevent proper attachment.
- The barcode must be placed on the **lower section of the straw,** since the upper portion will be discarded after the straw is shortened.
- Application should begin on the **back flat surface** of the triangular straw. This orientation ensures that **the QR code and straw position number remain visible when the straw is placed inside the goblet.**
- The extended label is then wrapped around the straw body, and its transparent wrap-around section provides additional protection and durability for cryogenic storage.



Goblet Barcodes Key Features

- Includes a QR code displaying:
  - Tank and canister location
  - Goblet placement
  - Patient name and gender
  - Freezing date

LIQUID NITROGEN RESISTANT

Goblet Barcode

Transparent Part

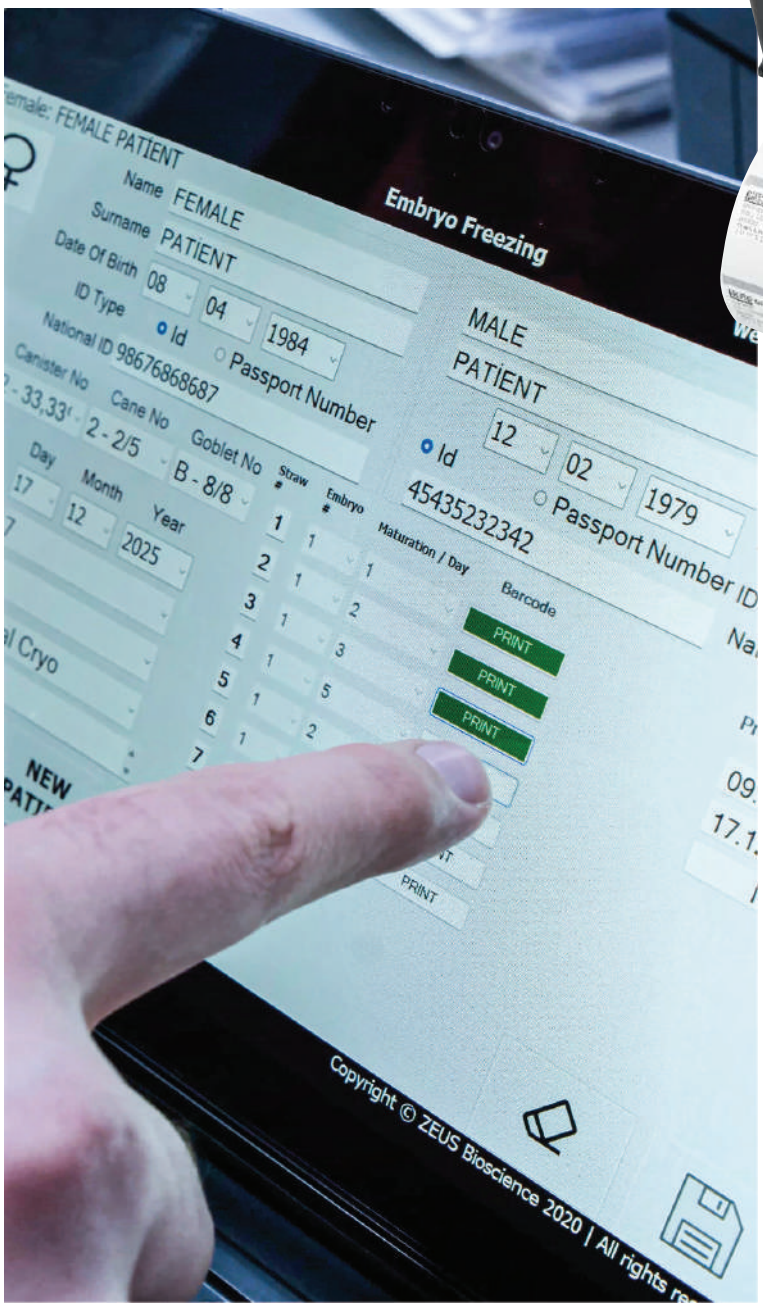
Total package includes 500 straw barcodes and 500 goblet barcodes.

Barcode Printers (ZCT25-012)

Two dedicated printers designed for cryo labeling.

Configuration

- One printer for Smart Straw barcodes.
- One printer for Goblet barcodes.
- Barcodes are generated and printed directly **via the ZEUS Touch-Screen Tablet.**
- These printers ensure clear, durable labels suitable for cryogenic storage conditions.



Wireless Barcode Reader (ZCT25-013)

The wireless barcode reader is fully integrated with ZEUS software. The system uses a Touch-Screen Tablet running dedicated ZEUS software. It is paired with **liquid nitrogen-resistant** barcode labels and a mobile barcode reader.

This integration provides full in-tank addressing and library location indexing.

The system enables accurate tracking of each sample's exact storage location, including:

- Tank
- Canister
- Cane
- Goblet
- Straw

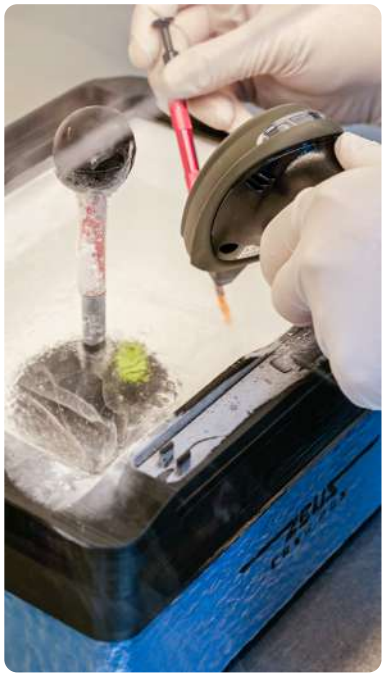
During the thawing process, users can pinpoint and verify sample locations in real time.

Samples can be identified without removing them from liquid nitrogen, helping maintain safety, traceability, and workflow efficiency.

Key Features

- Enables fast and accurate barcode scanning.
- Reduces manual data entry errors.
- Enhances safety and workflow efficiency.

Confirm the correct straw before thawing.
Especially critical in PGT cycles.



Scanning inside tank

Real-time confirmation

Barcodes remain readable even under liquid nitrogen

Real-time verification ensures the **correct embryo or oocyte** is selected before every thawing procedure.

Scans goblets and straws **directly inside the tank**, instant verification without removing samples from nitrogen.

ZEUS Smart Cryo-Tools *complete system overview*

Elevating cryopreservation and warming by enabling real-time confirmation, full traceability, and maximum storage efficiency directly at the liquid nitrogen tank.

BRINGS SOLUTIONS TO 4 MAJOR IVF CHALLENGES

Challenge 1:
Sample mix-up risk during freezing & warming

Challenge 2:
Limited tank storage capacity

Challenge 3:
Poor visibility under liquid nitrogen

Challenge 4:
Slow, error-prone manual documentation

SYSTEM COMPONENTS

Five integrated tools work together to create a fully connected tank-side workflow.

Touch-Screen Tablet & ZEUS Software

Manages in-tank movement, addresses, and patient history

Wireless Barcode Reader

Scans goblets and straws directly inside the liquid nitrogen

Ribbon Barcode Printer

Produces cryo-specific, liquid nitrogen resistant labels for every straw

ZEUS Smart Straws

Shortenable, triangular; barcode-verifiable at every step

Octagonal Goblets

Holds up to 8 straws with a structured design, keeps patient information visible, improving organization, traceability, handling efficiency

TANK-SIDE WORK FLOW

Freezing

1. **Register patient & print label**
   Patient data entered into ZEUS software; cryo-specific barcode label printed for each straw.
2. **Load embryo under microscope**
   Ergonomic straw body and soft transparent tip allow precise microdroplet handling under stereo microscope.
3. **Assign tank address & confirm barcode**
   System assigns a precise tank location. Wireless reader confirms correct straw before placement.
4. **Shorten straw in goblet**
   After freezing in the ZEUS Cryo-Box, straw is rotated and shortened at the breaking point, maximising storage.

Thawing

1. **Recall tank address**
   ZEUS software retrieves the precise storage location of the sample from patient records.
2. **Scan & verify inside tank**
   Wireless reader scans the barcode of the straw inside the nitrogen tank — no removal required for verification.
3. **Retrieve with ZEUS grabber pen**
   Shortened straws are safely retrieved using the grabber pen, then extended before transfer.
4. **Transfer to warming solution**
   Straw is extended and transferred to warming solution. Final barcode confirmation completes the audit trail.

4x
TANK CAPACITY

Thanks to their **shortenable structure,** ZEUS Smart Straws increase liquid nitrogen tank capacity by up to four times. Combined with the octagonal goblet system and existing cane compatibility, labs gain maximum storage without purchasing new tanks or hardware.

BLACK–BOX

(ZBB25-001)

BioPSafe: A Safe and Traceable Procedure Solution for Embryo

ZEUS Black-Box Witness Systems is an integrated verification and traceability platform designed for IVF laboratories. It enhances procedural safety during embryo biopsy and all stereomicroscope-based manipulations by combining sensor-based monitoring, barcode tracking, workflow logic control, and synchronized video recording.

The system operates through two dedicated modules:

1. **BioPSafe Module –** Embryo biopsy verification and PCR tube matching
2. **Multi-Purpose Module –** Secure management of routine IVF manipulations and dish-to-dish transfers

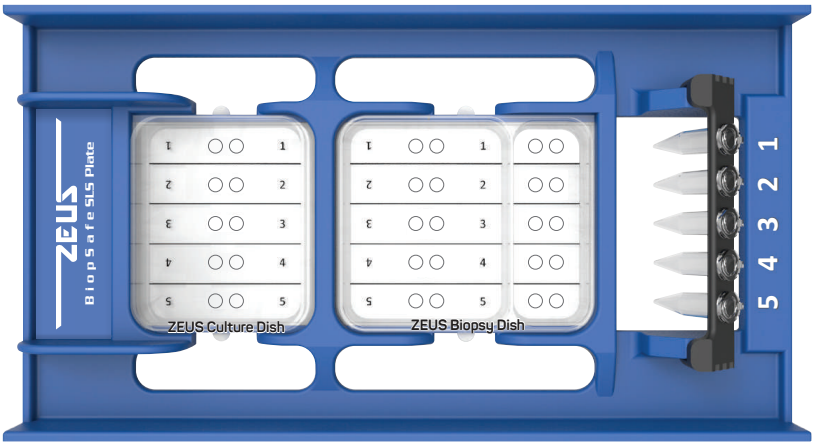
Under the Stereomicroscope
In the Laminar Cabinet

System Architecture

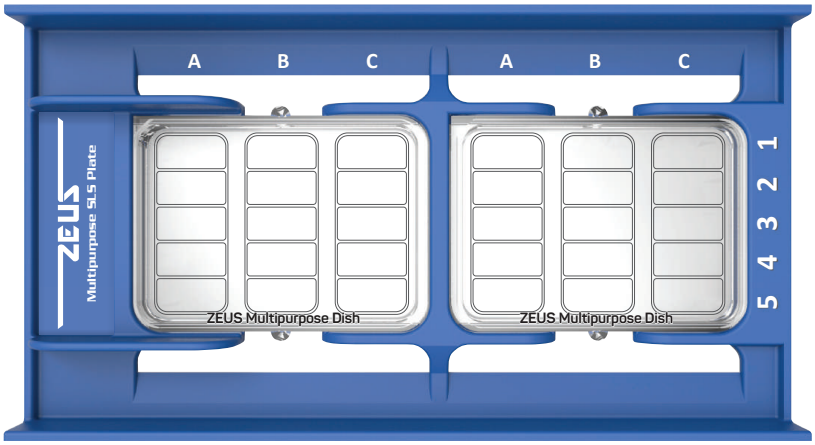
The platform integrates mechanical, digital, and verification components into a unified workflow:

Carrier Plates

BioPSafe Plate:
Aluminum carrier compatible with heated stages; accommodates biopsy dish, culture dish, and PCR tube holder.

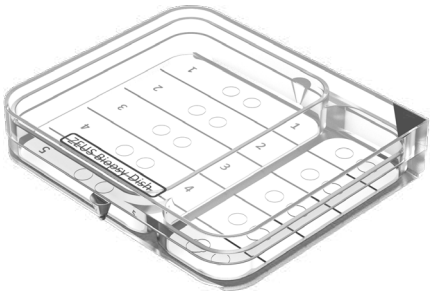


Multi-Purpose Plate:
Aluminum carrier designed for two multipurpose dishes.



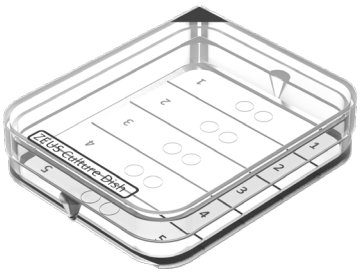
Dishes

ZBB25-002



Biopsy dish with dedicated oil-free washing area

ZBB25-003



Culture dish for post-biopsy transfer

ZBB25-004

Multipurpose dish for ICSI and routine procedures

ZBB25-005

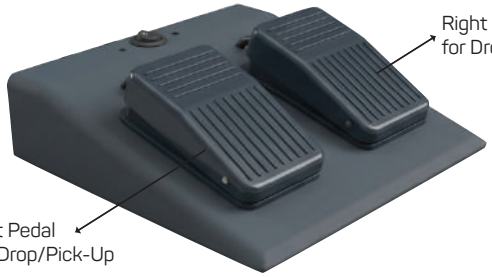
A specialized holder for **barcoded PCR tubes** designed with an ergonomic angle to facilitate precise placement of embryo biopsy material into PCR tubes under a stereo microscope.

ZBB25-006

Integrated camera for continuous visual recording and traceability of embryology procedures

ZBB25-006

Foot Pedal for Pick-Up (aspiration) and Drop (dispensing)



ZBB25-008

Barcode Reader for final PCR tube verification

Integrated Control Tablets and Sensor System

Right Control Tablet – Procedure Management Interface

The right tablet hosts the ZEUS Black-Box software, which manages the procedural workflow and monitors lane activity during the operation.

The system interface displays the indexed lane structure and tracks each step as the embryologist performs Pick-Up and Drop actions.

Patient information and procedure data are also displayed on this interface.

Left Control Tablet – Recording and Visual Monitoring

The left tablet functions as the visual monitoring and documentation interface. It displays the live camera feed of the working area.

All procedures performed within the Black-Box workspace are continuously recorded, and the user can capture snapshots when required. The recordings can be reviewed later for documentation, verification, and traceability purposes.

Sensor-Based Lane Detection

The ZEUS Black-Box also incorporates multiple integrated sensors that detect the position of the BioPSafe Plate and identify the exact location of each lane and droplet. These sensors track plate movement and confirm that Pick-Up and Drop actions performed via the pedal or interface occur at the correct positions, enabling the system to verify each step of the procedure.

Operational Logic of the System

Regardless of module, ZEUS Black-Box operates on three integrated control layers:

1. **Positional Verification:**
Sensors monitor the exact position of dishes, droplets, and PCR tubes. The system verifies both source and target locations during every transfer.

2. **Sequence Control:**
At the beginning of the procedure, the embryologist defines the initial dish order. All subsequent transfers are controlled according to this predefined sequence.

3. **Digital Documentation:**
Every Pick-Up and Drop action is recorded. Video, timestamps, and user identity are securely stored, creating a complete audit trail.

If any deviation occurs:

The system immediately alerts the user

The process is automatically halted

Continuation is permitted only after corrective action

BioPSafe Module – Detailed Operational Workflow

The BioPSafe Module is designed to actively monitor, verify, and digitally document every stage of embryo biopsy transfer and PCR tube matching. The system eliminates human-dependent matching by combining positional tracking, infrared detection, pedal-based command logging, and barcode verification.

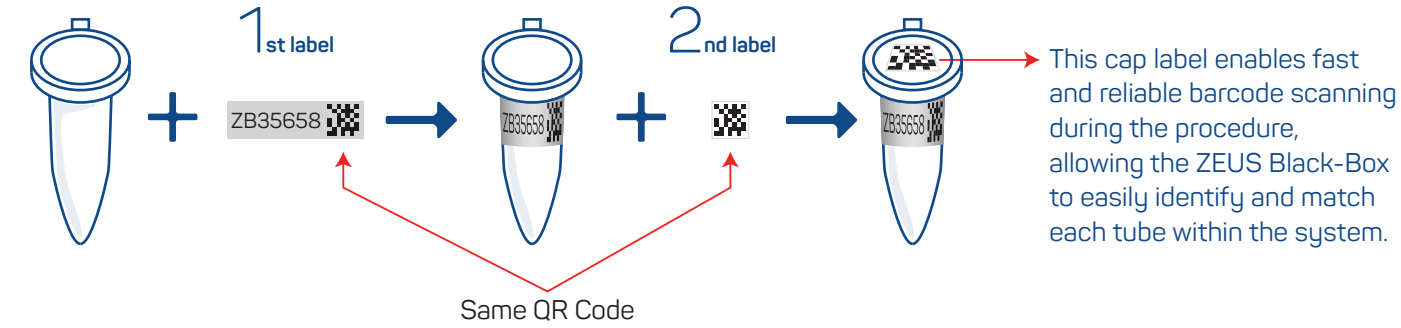
1. PCR Tube Preparation and System Initialization

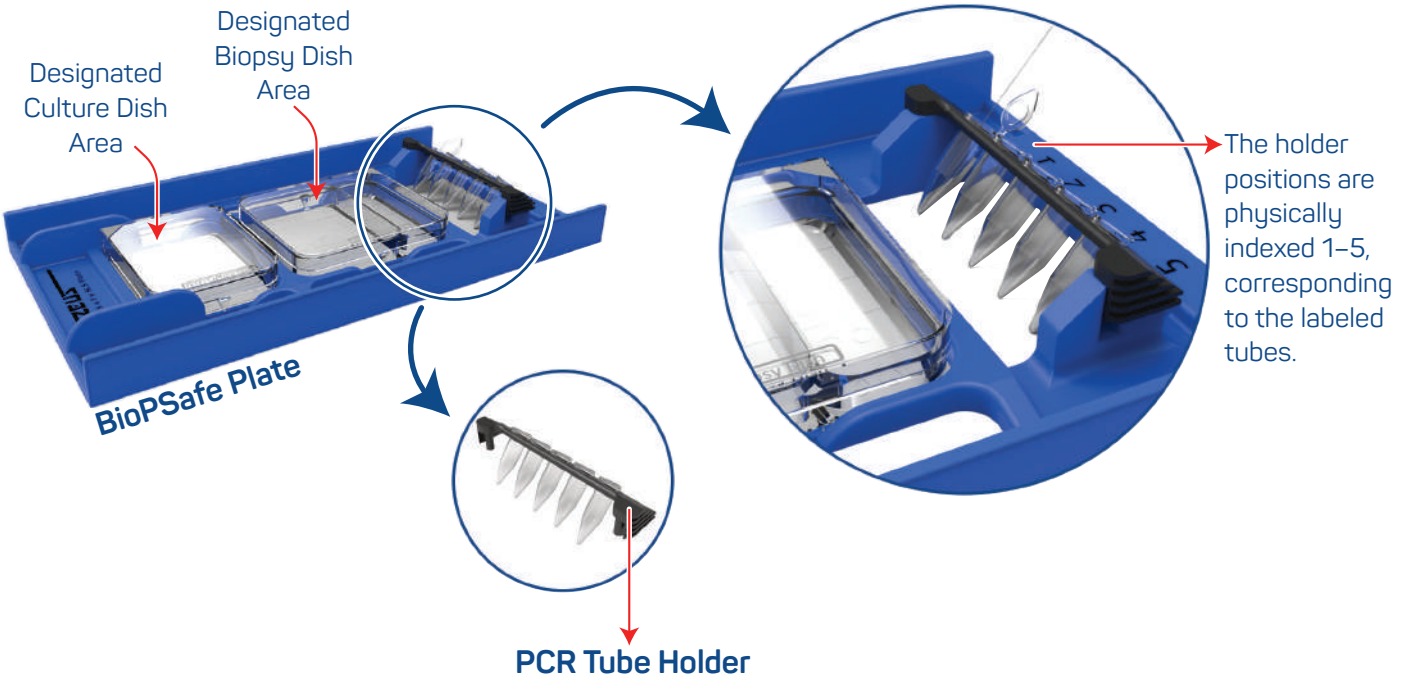
Prior to the biopsy procedure, the embryologist prepares five PCR tubes and labels them using two patient-specific barcode labels provided by ZEUS.

The first label is wrapped around the body of the PCR tube and includes:

- A numeric identifier (1–5) corresponding to the biopsy lanes
- A QR code compatible with the ZEUS Black-Box barcode reader

The second label is attached to the cap of the PCR tube and contains the same QR code.

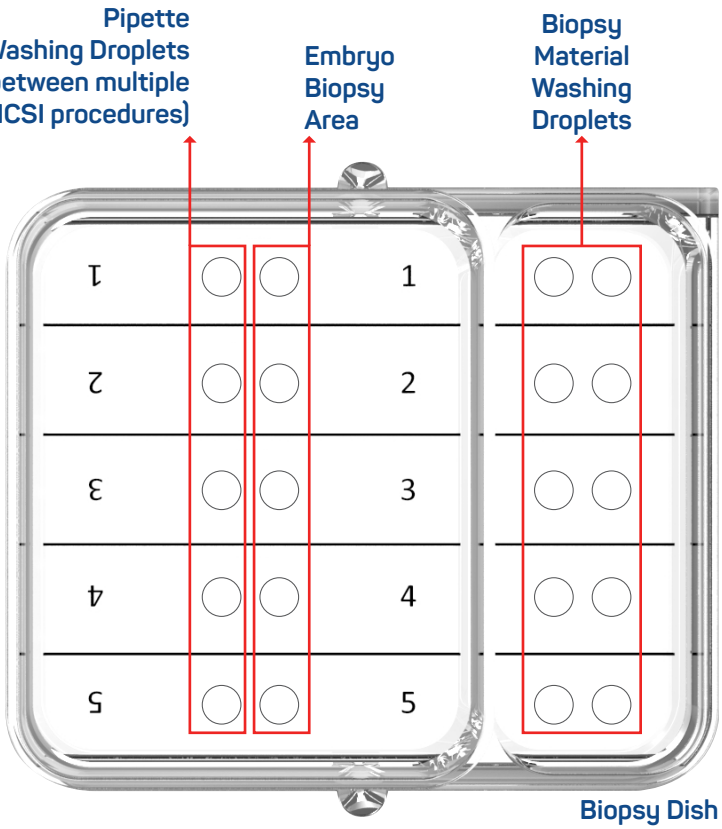




After labeling, the PCR tubes are placed into the dedicated tube holder on the BioPSafe Plate.

This preparation step establishes the physical and digital identification framework required for secure biopsy sample tracking before the procedure begins.

2. Embryo Selection and Biopsy Preparation



Embryologists perform embryo assessment and selection for biopsy according to their laboratory's established clinical protocols and standard operating procedures.

- Oocytes/embryos are evaluated under a microscope using routine morphological criteria.
- Embryos selected for biopsy are transferred into the ZEUS Biopsy Dish, which contains **five indexed lanes** (capacity: five embryos).
- The biopsy dish includes dedicated **washing droplets** to allow pipette rinsing between manipulations (ICSI procedures), reducing contamination risk.
- Biopsy is performed under a standard inverted microscope equipped with a micromanipulator and laser system, following the laboratory's normal biopsy methodology.

3. Plate Placement and Black-Box Activation

After biopsy:

- The ZEUS Biopsy Dish is positioned in its designated slot on the BioPSafe Plate.
- The Culture Dish is placed in its assigned position.
- Foot pedal is underneath and is connected to Black-Box software via Bluetooth.

The entire plate is placed under the ZEUS Black-Box system inside the laminar flow cabinet.

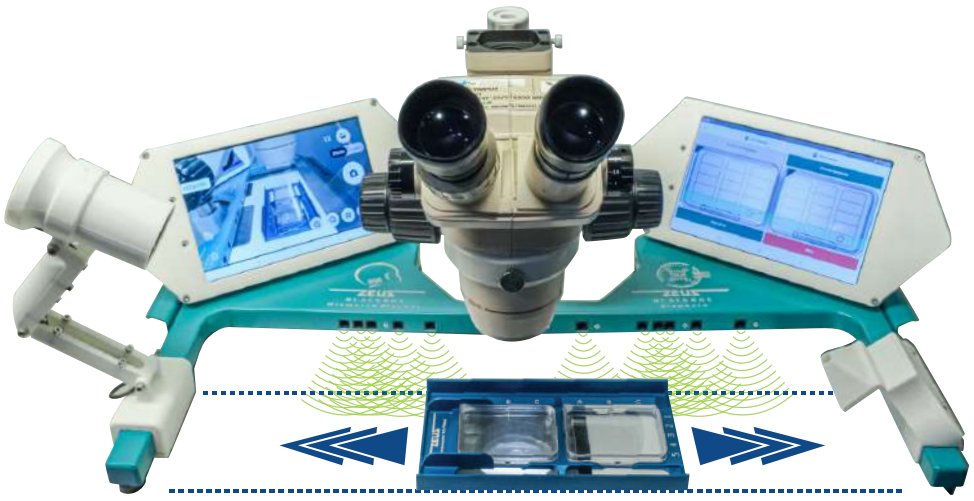
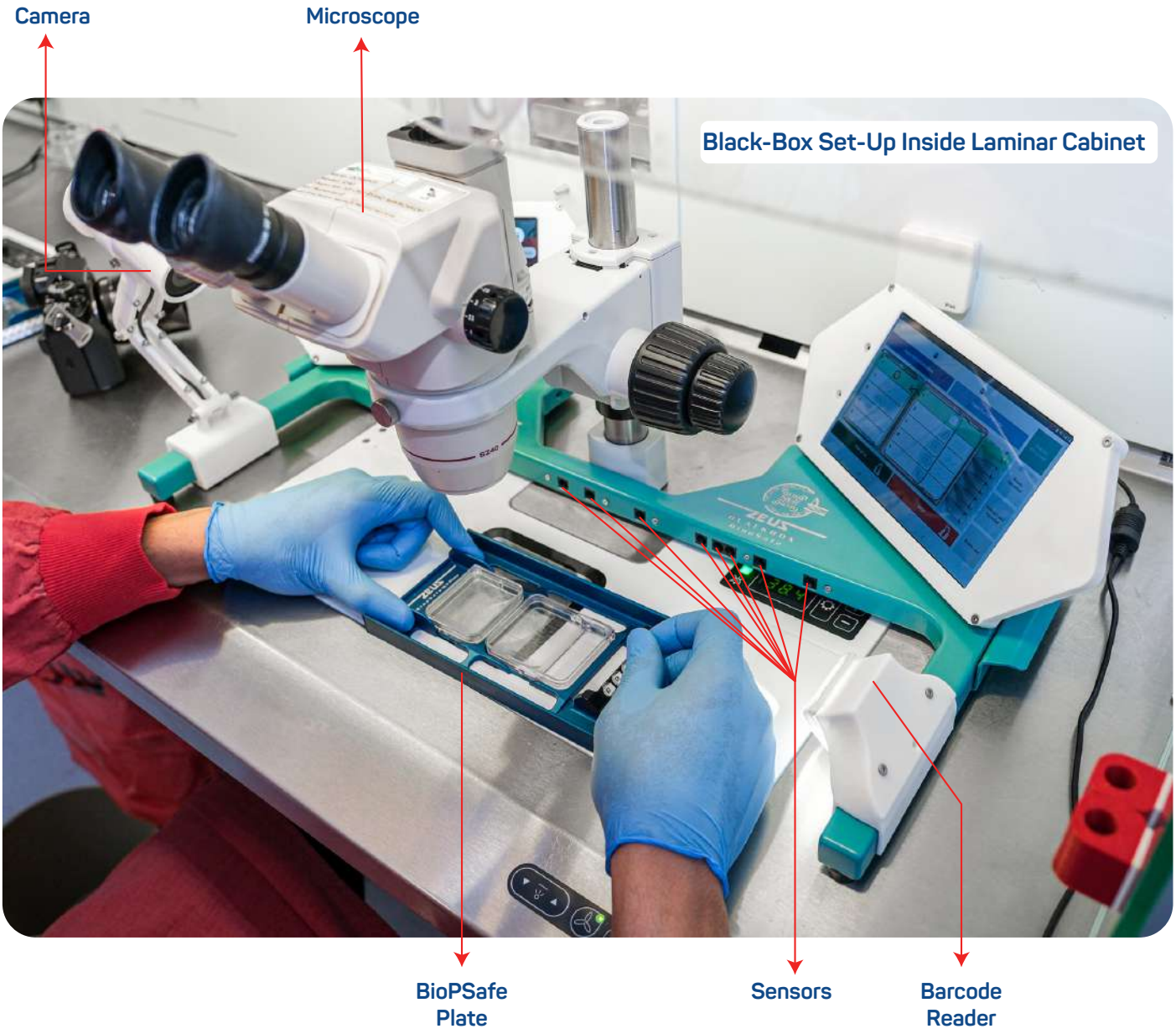


Plate movement: **horizontal in both directions** (right-to-left and left-to-right) for lane alignment under the microscope.



System Configuration:

- The microscope is positioned behind the Black-Box to avoid signal interference.
- Two tablets are positioned on either side of the microscope.
- The camera records the full procedure.
- Infrared-based signals detect material movement and pipette activity.

Once the plate is positioned:

- The system recognizes plate alignment via its 13 infrared sensors.
- Continuous positional monitoring begins.
- Video and action logging are activated.

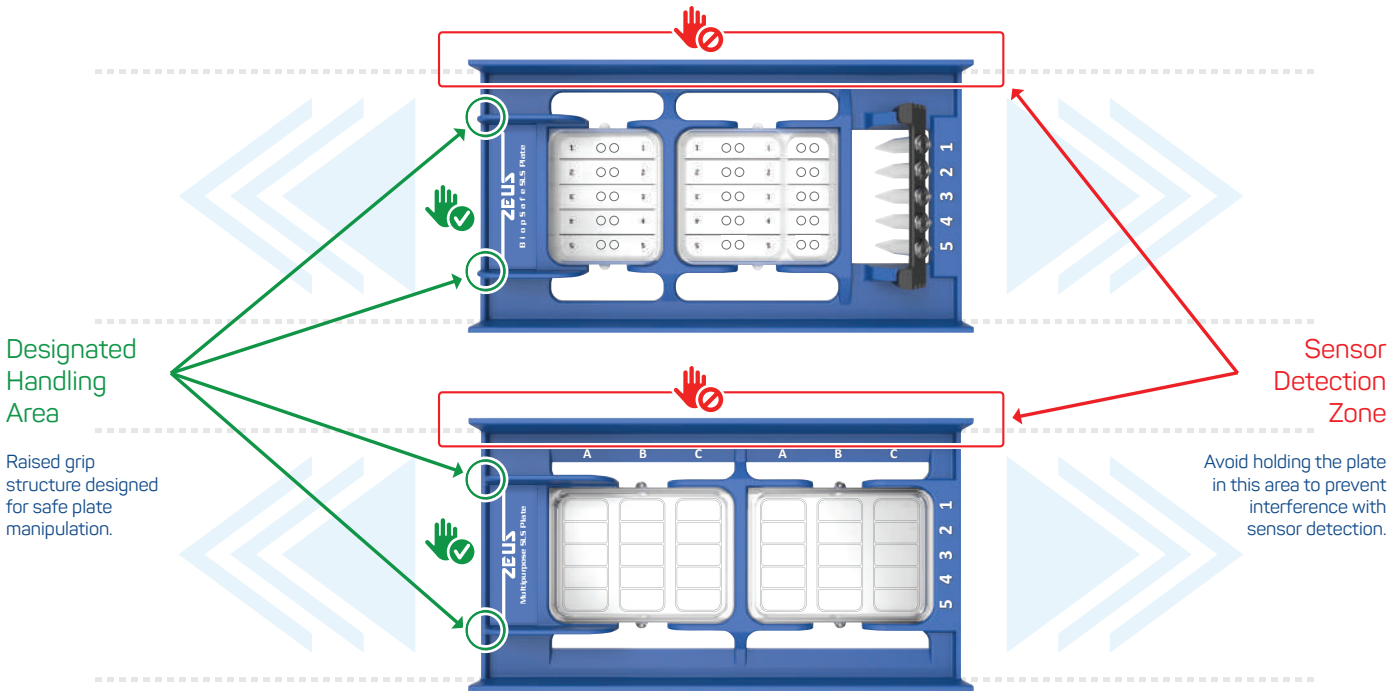
The embryologist operates using foot pedals:

Left Pedal
Drop (dispensing)

Right Pedal
Pick-Up (aspiration)

4. Designated Plate Handling Area

- Both the **BioPSafe Plate** and **the Multi-Purpose Plate** are designed with **a dedicated protruding handling area that allows safe manipulation of the plate during procedures.**
- This raised handling structure is specifically engineered to enable the embryologist to move the plate comfortably while maintaining uninterrupted sensor detection.
- To ensure accurate system operation:
  - The plate should only be held and moved **from the designated protruding handling area.**
  - Handling the plate from other regions, particularly the **sensor detection zone between the plate and the Black-Box,** may interfere with the sensor signals.
- Using the designated handling area allows the embryologist to reposition the plate under the microscope while ensuring continuous and reliable sensor tracking by the ZEUS Black-Box system.

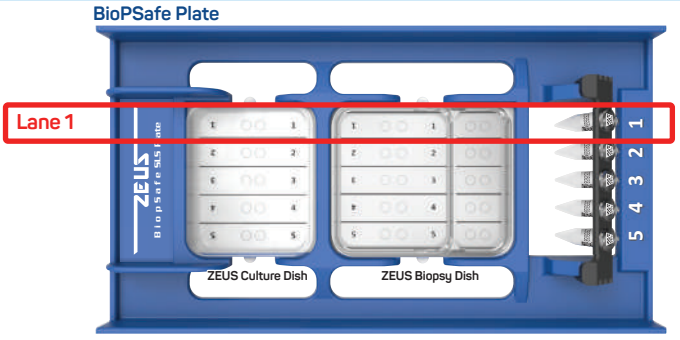


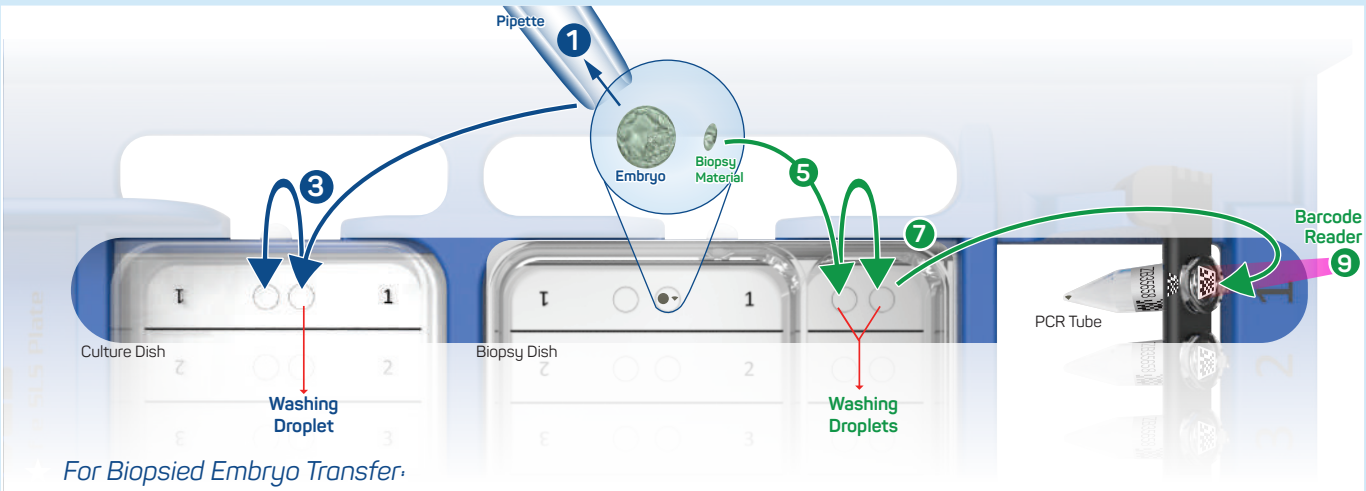
BioPSafe Plate Workflow

The plate is moved horizontally to align droplets under the microscope while the system tracks positional changes. For each procedure, embryos are first transferred from the biopsy dish to the culture dish **sequentially for all lanes (1–5).** Only after all embryos are placed in the culture dish are the biopsy materials transferred to their corresponding PCR tubes.

Embryo 1 (Lane 1)

- The embryologist aligns Lane 1 of the biopsy dish under the microscope.





For Biopsied Embryo Transfer:

1. The embryo is aspirated from ZEUS Biopsy Dish – Lane 1.
2. Right pedal is pressed → the system logs Pick-Up from Lane 1 of the Biopsy Dish.
3. The embryo is washed in washing droplet and deposited into the culture droplet on Culture Dish – Lane 1.
4. Left pedal is pressed → the system logs Drop into Lane 1 of the culture dish.

This embryo transfer sequence is repeated for lanes 2–5 until all embryos are placed in the culture dish.

Culture dish is removed and returned to the incubator, only biopsy materials remain on the biopsy dish. Proceed with transferring the biopsy into the PCR tubes with the following procedure:

For Biopsy Material Transfer:

5. The biopsy material is aspirated from Biopsy Dish – Lane 1 droplet.
6. Right pedal is pressed → the system logs Pick-Up from Lane 1 of the Biopsy Dish.
7. The biopsy material is washed in the washing droplet and transferred into the PCR Tube in Lane 1.
8. Left pedal is pressed → the system logs the Drop into PCR Tube 1.
9. The tube lid is closed and the plate is moved horizontally to the right till barcode reader can read the barcode. The correct QR code is scanned using the barcode reader to confirm correct sample identification.

The same procedure is repeated for lanes 2–5, ensuring correct embryo-to-PCR tube matching.

Thanks to the ZEUS Black-Box multi-sensor signalling system, **each transfer step is actively monitored** rather than visually verified alone.

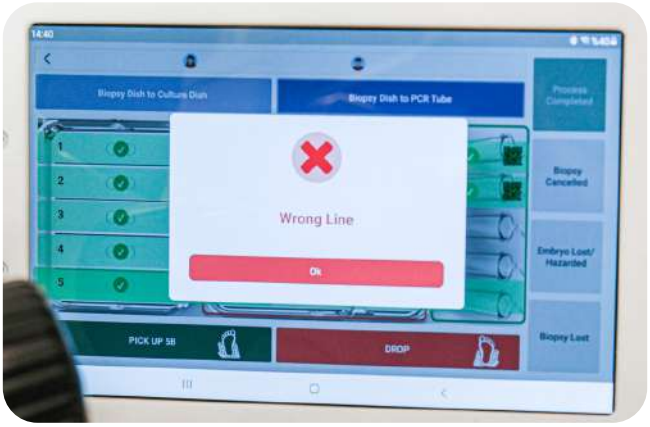
Multiple integrated sensors continuously track:

- Plate alignment and movement
- Source and target lane positions
- Foot pedal Pick-Up and Drop commands

The software instantly cross-checks the aspirated embryo's lane with the intended culture lane and predefined sequence order.

If any **mismatch or positional deviation** is detected, the system immediately **alerts the user** and **pauses the procedure** until the **correct alignment is restored.**

This multi-layered sensor signalling architecture converts routine embryo transfer into a digitally validated and error-controlled workflow.



The system is designed to enable **quick and reliable QR code scanning of PCR tubes** during the biopsy workflow. The PCR tube holder on the BioPSafe Plate positions the tubes so that their caps are **precisely aligned with the barcode reader** of the ZEUS Black-Box.

After depositing the biopsy material into the PCR tube, the embryologist can simply **move the BioPSafe Plate horizontally toward the scanning position** and scan the QR code located on the tube cap.

The scan is then recorded by the system, and the ZEUS Black-Box software automatically matches the scanned **QR code with the corresponding embryo and lane in the procedure record.**

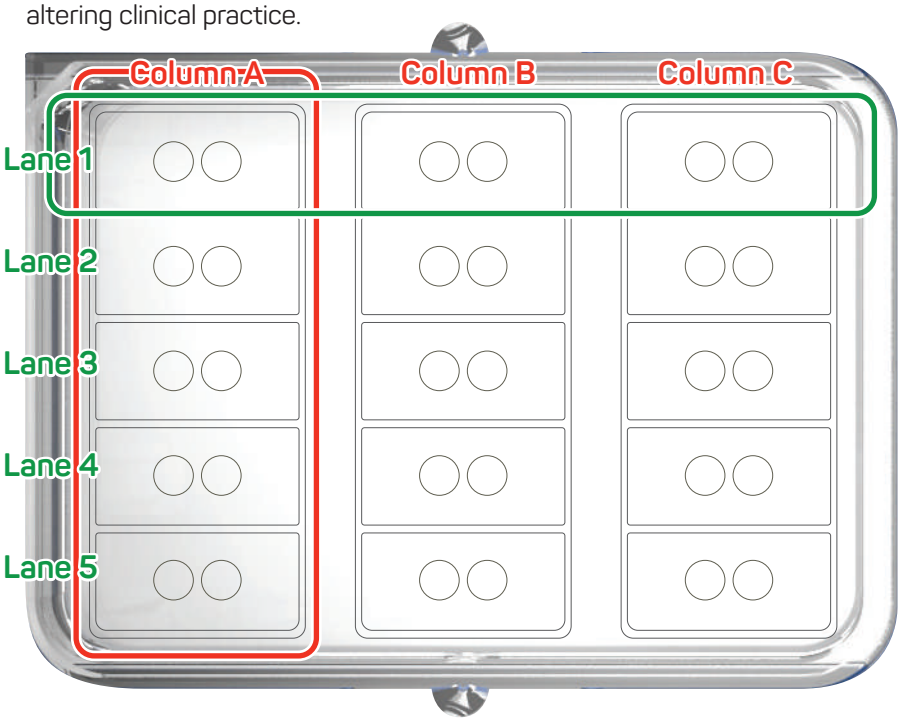
Multi-Purpose Module – Detailed Operational Workflow

The Multi-Purpose Module is designed to ensure **continuous identification and traceability of individual embryos** during routine IVF procedures and embryology practices including **ICSI, medium change, washing, and dish-to-dish transfer.**

Unlike conventional methods that track embryos only at the patient level, the ZEUS Black-Box enables **lane-based tracking of each individual embryo**, which is particularly critical in PGT workflows where embryos must be distinguished based on genetic results.

Embryo Handling and Preparation

Embryologists perform all procedures according to their standard laboratory protocols, including embryo selection, washing, and medium exchange. The ZEUS Multi-Purpose Dish is designed to support these routine workflows without altering clinical practice.



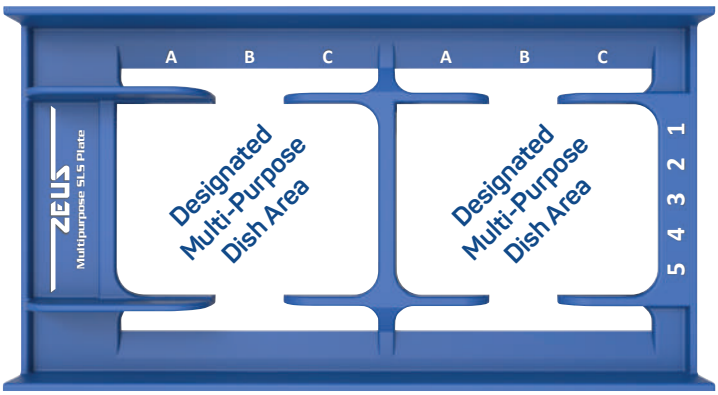
Multi-Purpose Dish

Each dish features:

- 5 lanes (1–5) for individual embryo tracking
- 3 columns for sequential handling steps
- Capacity for 15 double droplets per dish

This structured layout allows embryos to be followed at both lane and column level throughout the procedure.

Plate Placement and Black-Box Activation



Two ZEUS Multi-Purpose Dishes are placed on the Multi-Purpose Plate:

- One dish is designated as the source dish (current medium)
- One dish is designated as the target dish (new medium)

The plate is positioned under the ZEUS Black-Box system within the laminar flow cabinet.

Once positioned:

- The system detects dish placement and lane structure
- Sensor-based tracking is activated
- The camera begins continuous recording
- Workflow monitoring is displayed on the control tablet

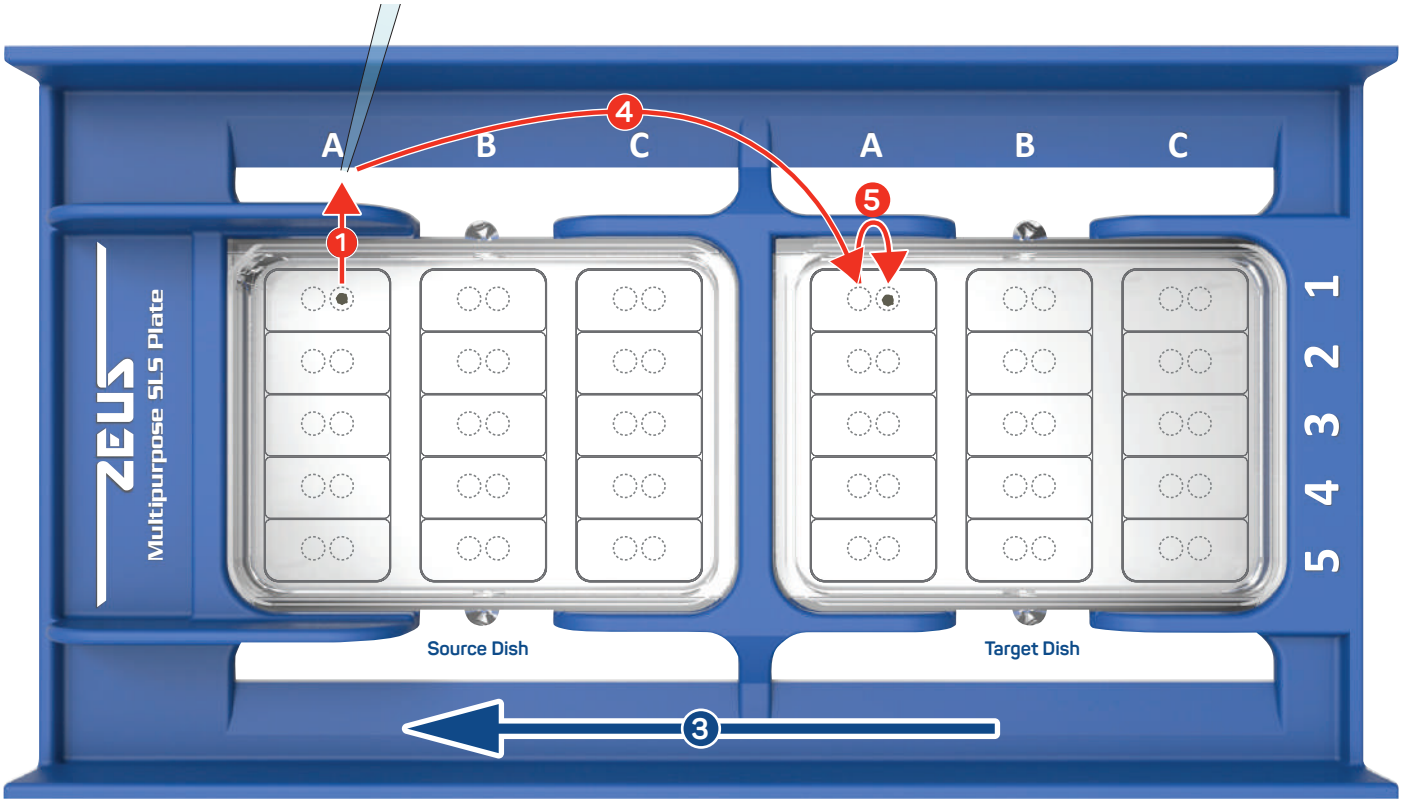
Multi-Purpose Plate Workflow

Workflow Initialization

The embryologist defines the starting dish and lane order via the system interface. The ZEUS Black-Box registers all lane (1–5) and column (A–C) positions.

Embryo Transfer (Lane-to-Lane Tracking)

Within each lane, embryos are moved between columns A, B, and C as required by the procedure (e.g., washing, medium transition).



The dotted circles shown on the Multi-Purpose Dish indicate **suggested droplet placement areas**.

For each embryo:

1. The embryo is aspirated from the source dish (e.g., Lane 1)
2. Right pedal pressed → system logs Pick-Up from Lane 1
3. The plate is moved horizontally to left to align the target dish under the microscope
4. The embryo is washed in the washing droplets in first column of the target dish
5. Then it is transfered into the next droplet in the same column of the target dish (Lane 1)
6. Left pedal pressed → system logs Drop into Lane 1

The procedure is repeated for all embryos, maintaining strict positional consistency.

ZEUS bioscience

PULSE STIMULATOR

Piezoelectric Oocyte Activation System

Controlled Electroporation for Physiological Oocyte Activation

The ZEUS Pulse Stimulator is an advanced electroporation system designed for controlled oocyte activation in assisted reproductive technologies (ART). By delivering precisely regulated electrical pulses, the system enables physiological-like calcium signaling, supporting fertilization processes in challenging IVF cases.

Developed for in vitro applications, the device integrates seamlessly into standard embryology workflows and provides a reliable, reproducible, and operator-controlled activation method.

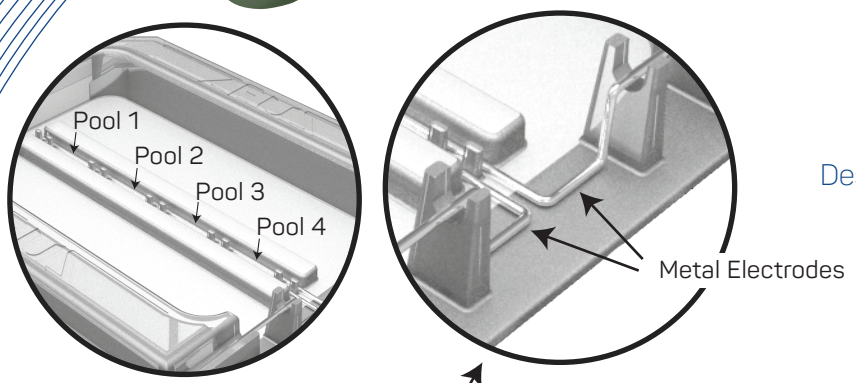
CE

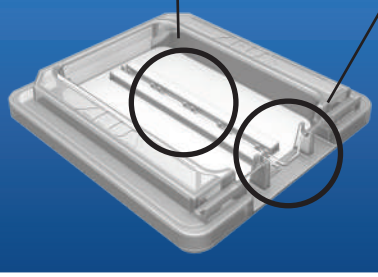
DC & AC/DC Mode
Dual-mode electrical stimulation

Touchscreen Control
4.3" digital interface, zero user error

24V / 3A Output
Fixed, stable pulse delivery

IVF Ready
Designed for oocyte activation & fusion





Disposable Electrode Wired Dish

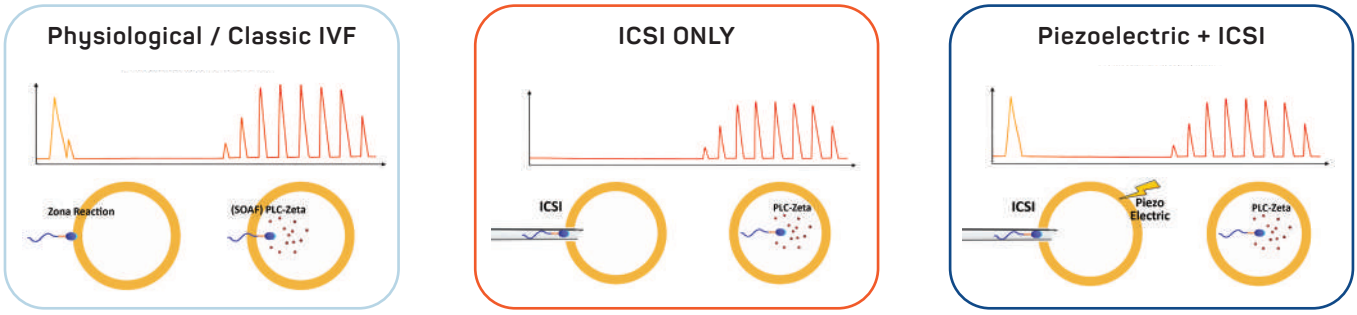
The ZEUS Electro Dish provides a sterile, ready-to-use environment for each procedure.

Multiple oocytes can be positioned within each pool and activated simultaneously.

Why Piezoelectric Activation?

The most significant advance in IVF has been the development of ICSI. Yet total fertilization failure (TFF) and sub-optimal fertilization remain persistent clinical problems. The fundamental reason lies in calcium signalling.

Natural Fertilization	ICSI (without Artificial Oocyte Activation)	ICSI + Piezo (with Artificial Oocyte Activation)
Sperm binds to zona pellucida	**Membrane interaction is bypassed**	Electrical pulse **opens transient pores**
Membrane interaction triggers first Ca^{2+} peak	First Ca^{2+} peak may be **absent or delayed**	Extracellular Ca^{2+} rushes in immediately
PLCζ released into ooplasm	PLCζ release onset is **delayed**	**First peak restored, mimics physiology**
Repetitive Ca^{2+} oscillations begin	Oscillation pattern may be **impaired**	**Sperm PLCζ continues oscillations**
Meiosis completes → pronuclei form	**Risk of TFF or suboptimal activation**	**More complete, rhythmic activation**



Principle of Operation

The ZEUS Pulse Stimulator applies the principle of electroporation, a precisely controlled electrical field that creates reversible pores in the oocyte membrane, triggering the calcium cascade essential for fertilization.

1 Electrical Field Applied

A micro-pulse (DC: 70 µs; AC/DC: 5 s AC + 70 µs DC) is delivered between the electrodes of the Electro Dish. The field is fixed, stable, and unaffected by mains voltage fluctuations.

2 Transient Membrane Pores Form

The electric field directs charged proteins toward the plasma membrane (oolemma). Temporary pores open across the membrane, this is electroporation. Pore formation is reversible and does not cause lasting structural damage.

3 Extracellular Ca^{2+} Rushes In

Extracellular calcium (Ca^{2+}) floods through the newly formed pores into the ooplasm. Intracellular Ca^{2+} concentration rises rapidly. This is visible as an oocyte contraction under the microscope, a sign of successful activation.

4 Endoplasmic Reticulum Releases Ca^{2+}

The initial Ca^{2+} rise triggers the ER to release its own calcium stores, amplifying the oscillation. The calcium wave propagates through the cell, driving the activation cascade.

5 Meiosis Resumes → Pronuclei Form

Rising Ca^{2+} waves inactivate MAPK and MPF, the enzymes keeping the oocyte arrested at Metaphase-II. The meiotic block is lifted, cortical granule exocytosis prevents polyspermy, meiosis completes, and pronuclei form, fertilization is confirmed.

Why Not Only Chemical Activation?

Chemical agents (e.g. ionomycin) typically produce a single, large Ca^{2+} spike; monophasic and non-physiological. Electroporation produces repetitive oscillatory Ca^{2+} waves, more closely mimicking natural fertilization.

Clinical Indications for AOA

Assisted Oocyte Activation (AOA) with the ZEUS Pulse Stimulator is indicated across a range of clinical scenarios where natural or ICSI-induced calcium oscillations are absent, impaired, or insufficient.

Total Fertilization Failure (TFF)

Zero fertilization across all retrieved oocytes following standard ICSI. AOA is the primary intervention in subsequent cycles. Clinical evidence shows fertilization can increase from ~12% to over 62% with Piezo-ICSI (Baltaci et al.).

Low Fertilization Rate (<30%)

Consistently poor fertilization across cycles suggests subclinical oocyte activation deficiency. Piezoelectric activation provides supplemental calcium signalling to rescue marginal cases (Akashi et al.).

Severe Male Factor / Globozoospermia

Round-headed sperm (globozoospermia) lack acrosomal PLCζ, the key enzyme for natural oocyte activation. These sperm cannot trigger calcium oscillations. AOA is not optional — it is mandatory for any hope of fertilization (Bonte et al.).

Round Spermatid Injection (ROSI)

~30% of Non-Obstructive Azoospermia patients have only round spermatids recoverable. Round spermatids lack PLCζ entirely. Electrical activation in ROSI doubles fertilization rates (Tanaka: 32.8% → 64.3%) and has produced 90+ healthy live births.

Totally Immotile Spermatozoa

Immotile sperm from surgical extraction (TESE/PESA) may have compromised PLCζ release. Electroactivation after ICSI significantly improves fertilization rates (Mansour et al.: 68% vs 60% control).

Cleavage Arrest / Embryo Development Problems

Repeated failure of embryos to progress past early cleavage stages may reflect suboptimal activation. Piezo-ICSI provides a more physiological oscillation pattern supporting early embryo quality (Yin et al.).

Rescue ICSI / PLC-ζ Depletion

When sperm-specific PLCζ is depleted or absent (detectable by immunofluorescence), electrical stimulation substitutes for the missing sperm-derived activation signal (Kashir et al.).

Advanced Maternal Age

Mitochondrial dysfunction in aged oocytes reduces ATP availability. Emerging evidence (Tao, 2022) suggests mechanical-electrical stimulation may redistribute high-energy mitochondria toward the ooplasm centre, improving local energy supply for fertilization.

Two Application Modes

The ZEUS Pulse Stimulator offers two distinct clinical protocols. Mode selection depends on patient indication and the embryologist's clinical judgment.

MODE 1 — DC MODE (Pre/Post-ICSI)

ICSI Performed	Wait 20–30 Minutes	Transfer to Electro Dish	Apply DC Pulse	Return to Culture
Standard ICSI procedure is carried out. The oocyte is injected with a single sperm.	Oocytes are returned to culture medium. The embryologist waits 20–30 minutes post-ICSI.	Oocytes are washed through 4 × 40 µl ES droplets then placed in the electrode pools (30 µl ES per channel).	Select DC Mode on the touchscreen. Press LOAD then APPLY. A 70 µs direct current pulse is delivered.	Immediately aspirate oocytes, wash in culture medium, and continue conventional embryo culture.
1	2	3	4	5

DC Mode Pulse: 70 µs direct current | Single pulse per activation | Default factory setting

MODE 2 — AC/DC MODE (For ROSI Purpose)

Prepare Oocyte	Place in Electro Dish	Apply AC then DC	Wait 20–30 Minutes	ICSI Performed
Mature MII oocyte is prepared for activation before sperm injection.	Oocyte is washed through ES droplets and positioned in the electrode channel.	AC phase: 5 seconds of alternating current aligns the cell. DC phase: 70 µs pulse opens membrane pores.	Oocyte is returned to culture medium for 20–30 minutes to allow activation response.	Standard ICSI is now carried out on the pre-activated oocyte.
1	2	3	4	5

AC/DC Mode Pulse:
AC phase 5 s (cell alignment) + DC phase 70 µs (membrane poration) | Sequential dual-current delivery

Clinical Evidence

Electric stimulation has been used in human IVF for over 25 years. Yanagida et al. (1999) were the first to use piezoelectric stimulation for human oocyte activation post-ICSI, reporting a live twin birth. The evidence base has grown substantially since.

62%
Fertilization rate ICSI+Piezo in TFF (vs 12% standard ICSI)

×2
Fertilization rate in ROSI with electrical activation

68%
Fertilization rate electroactivation (vs 60% control)

90+
Healthy live births from ROSI with electrical AOA

STUDY 1 — BALTACI ET AL. (PROSPECTIVE CONTROLLED TRIAL) [1]


IN VITRO FERTILIZATION

The effectiveness of intracytoplasmic sperm injection combined with piezoelectric stimulation in infertile couples with total fertilization failure

Volkan Baltaci, M.D.,[a] Özge Üner Ayvaz, Ph.D.,[b] Evrim Ünsal, Ph.D.,[b] Yasemin Aktuğ, M.Sc.,[b] Aysun Baltacı, M.D.,[b] Fevziha Turhan, M.Sc.,[b] Sarp Özcan, M.D.,[b] and Murat Sönmezer, M.D.[c]

[a] Faculty of Medicine, Department of Medical Genetics, Ufuk University; [b] Ceo An Woman Health and Reproductive Biotechnology Center; and [c] Ankara University School of Medicine, Department of Obstetrics and Gynecology, Ankara University Center for Research on Human Reproduction, Ankara, Turkey

Objective: To assess the effectiveness of intracytoplasmic sperm injection (ICSI) combined with piezoelectric stimulation in infertile couples with a history of total fertilization failure (TFF).
Design: Prospective controlled trial.
Setting: Clinical IVF laboratory.
Patient(s): Seventy-one couples undergoing ICSI on sibling oocytes having at least one previous ICSI attempt with TFF.
Intervention(s): ICSI or ICSI with piezoelectric activation.
Main Outcome Measure(s): Fertilization rate.
Result(s): The patients were allocated to two groups: group I included 21 patients with only one previous TFF and group II included 50 patients with more than one previous TFF. Collectively, a total of 823 metaphase II (MII) oocytes were retrieved in 78 oocyte retrievals. In Group I, combined ICSI with piezoelectric stimulation was applied to 123/211 (58.2%) of MII oocytes (group IA), whereas standard ICSI procedure was applied to 88/211 (41.8%) of MII oocytes (group IB). The fertilization rate was 62% and 12% in group IA and group IB respectively. In group II, piezoelectric activation was applied in all 612 MII oocytes, of which 296 (48.3%) were fertilized. The rates for implantation and pregnancy/embryo transfer were obtained as 30.6% and 44.1%, respectively.
Conclusion(s): Piezoelectric activation seems to improve IVF outcome in patients with previous TFF history. (Fertil Steril® 2010;94:900–4. ©2010 by American Society for Reproductive Medicine.)
Key Words: ICSI, electrical activation, fertilization rate, embryo grade, pregnancy

Fertility and Sterility® Vol. 94, No. 3, August 2010
Copyright ©2010 American Society for Reproductive Medicine, Published by Elsevier Inc.
0015-0282/$36.00
doi:10.1016/j.fertnstert.2009.03.107

Population: 71 couples with history of Total Fertilization Failure (TFF) — 21 with one prior TFF, 50 with multiple TFF
Design: Sibling oocytes randomized: Piezo-ICSI vs standard ICSI — 823 MII oocytes across 78 retrievals

	ICSI + Piezo Activation (Group IA)	Standard ICSI Control (Group IB)	Significance (P-Value)
Fertilization Rate	**62%**	12%	<0.001
Top Quality Embryos (Grade 1-2)	**37%**	20%	0.01
Lower Quality Embryos (Grade 3-4)	**63%**	80%	0.01

Implantation rate: 30.6% | Pregnancy per embryo transfer: 44.1% | Ongoing pregnancy: 42.8%

Conclusion: Piezoelectric activation significantly improves IVF outcome in patients with prior TFF history.

STUDY 2 — TANAKA ET AL. 2015 (ROSI WITH ELECTRICAL ACTIVATION vs. WITHOUT) [2]


PNAS

Fourteen babies born after round spermatid injection into human oocytes

Atsushi Tanaka[a,1], Motoi Nagayoshi[a], Youichi Takemoto[a], Izumi Tanaka[a], Hiroshi Kusunoki[a], Seiji Watanabe[a], Keiji Kuroda[a], Satoru Takeda[a], Masahiko Ito[a], and Ryuzo Yanagimachi[b,1]

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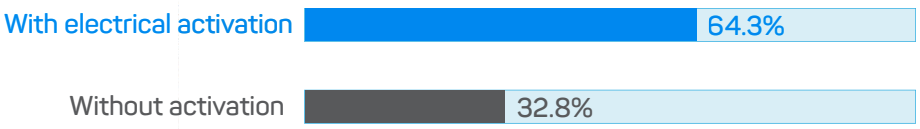
Contributed by Ryuzo Yanagimachi, September 25, 2015 (sent for review July 26, 2015; reviewed by J. Michael Bedford and Martin M. Matzuk)

During the human in vitro fertilization procedure in the assisted reproductive technology, intracytoplasmic sperm injection is routinely used to inject a spermatozoon or a less mature elongating spermatid into the oocyte. In some infertile men, round spermatids (haploid male germ cells that have completed meiosis) are the most mature cells visible during testicular biopsy. The microsurgical injection of a round spermatid into an oocyte as a substitute is commonly referred to as round spermatid injection (ROSI). Currently, human ROSI is considered a very inefficient procedure and of no clinical value. Herein, we report the birth and development of 14 children born to 12 women following ROSI of 736 oocytes previously activated by an electric current. The round spermatids came from men who had been diagnosed as not having spermatozoa or elongated spermatids by andrologists at other hospitals after a first Micro-TESE. A key to our success was our ability to identify round spermatids accurately before oocyte injection. As of today, all children born after ROSI in our clinic are without any unusual physical, mental, or epigenetic problems. Thus, for men whose germ cells are unable to develop beyond the round spermatid stage, ROSI can, as a last resort, enable them to have their own genetic offspring.

human | round spermatid | ROSI | azoospermia | male infertility

Population & Design: Round spermatid injection (ROSI) in Non-Obstructive Azoospermia patients where no mature spermatozoa were recoverable. Oocytes were divided into two groups — with and without electrical activation.



Conclusion: Round spermatids carry insufficient PLCζ and cannot trigger natural calcium oscillations — making electrical activation essential. This study demonstrates that electrical AOA nearly doubles the fertilization rate in ROSI, turning previously failed cycles into viable embryos for patients with no other path to biological parenthood (14 healthy babies born in the full series).

STUDY 3 — MANSOUR ET AL. (FERTILITY AND STERILITY — RANDOMIZED) [3]


Fertility and Sterility
Volume 91, Issue 1, January 2009, Pages 133-139

In vitro fertilization

Electrical activation of oocytes after intracytoplasmic sperm injection: a controlled randomized study

Ragaa Mansour M.D., Ph.D., Ibrahim Fahmy M.D., Nevine A. Tawab B.Sc., Ahmed Kamal M.D., Yehia El-Demery B.Sc., Mohamed Aboulghar M.D., Gamal Serour M.D., F.R.C.O.G.

Population: 246 patients with severe oligoasthenospermia, non-obstructive azoospermia, total teratospermia, or totally immotile spermatozoa. Patients with previous TFF or limited fertilization also included.

Design: 241 ICSI cycles, sibling oocytes randomized: electroactivation (n=1,640) vs control (n=1,435)

Total fertilization failure: 5 cycles in control group, 0 in electroactivation group. Clinical pregnancy rate: 46.5%.

Conclusion: Electroactivation significantly improves fertilization in severe male factor cases. Most critically, no cycle resulted in total fertilization failure in the electroactivation group — confirming that electrical activation serves as a clinical safety net against complete fertilization failure.

STUDY 4 — TANAKA ET AL. 2018 (LARGEST ROSI SERIES — SAFETY & EFFICACY) [4]


Fertility and Sterility
Volume 110, Issue 3, August 2018, Pages 443-451

Original article

Ninety babies born after round spermatid injection into oocytes: survey of their development from fertilization to 2 years of age

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Design: The largest published ROSI series combining electrical oocyte activation. Reports both clinical outcomes and 2-year developmental follow-up of all children born.

14,214	57.2%	23.2%	90
oocytes treated	overall fertilization rate (8,132 oocytes)	live birth rate per embryo transfer	healthy babies born from the series

Conclusion: At 2 years of age, all 90 children born through ROSI with electrical activation showed normal physical and cognitive development — comparable to children born from standard IVF and ICSI. This is the most important safety reference for electrical AOA: not only does it work, it produces healthy children. For NOA patients with only round spermatids recoverable, this series represents proof that biological parenthood is achievable.

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[2] Tanaka, A., Nagayoshi, M., Takemoto, Y., Tanaka, I., Kusunoki, H., Watanabe, S., … Yanagimachi, R. (2015). Fourteen babies born after round spermatid injection into human oocytes. Proceedings of the National Academy of Sciences, 112(47), 14629–14634. doi:10.1073/pnas.1517466112

[3] Mansour, R., Fahmy, I., Tawab, N. A., Kamal, A., El-Demery, Y., Aboulghar, M., & Serour, G. (2009). Electrical activation of oocytes after intracytoplasmic sperm injection: A controlled randomized study. Fertility and Sterility, 91(1), 133–139. doi:10.1016/j.fertnstert.2007.08.017

[4] Tanaka, A., Suzuki, K., Nagayoshi, M., Tanaka, A., Takemoto, Y., Watanabe, S., … Yanagimachi, R. (2018). Ninety babies born after round spermatid injection into oocytes: Survey of their development from fertilization to 2 years of age. Fertility and Sterility, 110(3), 443–451. doi:10.1016/j.fertnstert.2018.04.033

System Components

The ZEUS Pulse Stimulator is delivered as a complete, ready-to-use system. Each component is purpose-built to work together, ensuring safe, reproducible electrical stimulation at the cellular level.

Pulse Stimulator (ZPS24-001)

Touchscreen-controlled device producing stable AC and DC pulses. 24V / 3A output. Factory defaults: DC Mode 70 µs · AC/DC Mode 5 s. Adjustable via the Settings menu. Stores charge internally before delivery — completely unaffected by mains voltage fluctuations.

(ZPS13-002) Electro Dish

Single-use sterile petri dish with integrated metal electrodes and four separate cell pools. Electrode cable connection points exit at the front between the two bridges.

Dish Fastener (ZPS13-006)

U-shaped metal block that fits into the side channels of the Electro Dish. Stabilizes the dish during procedures and acts as a thermal block. Its U-shaped structure enables the petri dish to be viewed under a stereo microscope.

(ZPS26-003) Electroliquid Solution Powder

Sterile electrolyte formulation supplied in powder form for preparation prior to use. The solution contains Mannitol, $MgSO_4$, $CaCl_2$, HSA, and HEPES and is designed to support controlled electrical conductivity during electroporation procedures.

Preparation instructions are provided in the user manual to ensure standardized solution preparation and reproducible electroporation conditions.

MISMATCH BLOCKER

Barcoding Witnessing For ART

Complete Safety for Your Clinic & Your Patient in IVF Treatment

The ZEUS Mismatch Blocker is a data matrix-based witnessing system specifically designed for IVF (In Vitro Fertilization) applications. Its primary goal is to prevent human-induced errors and mismatches within the gamete-embryo-patient triangle by controlling the passage of biological materials between various plates and tubes.

Key Features and Technology

Trust from the Start: In IVF, trust begins with the very first step. The system ensures the expectant mother and father are digitally verified before any procedure commences.

- **Cost-Efficient Technology:** The system is based on QR codes rather than expensive chips, resulting in very low operating costs per patient.
- **Unlimited Barcode Usage:** ZEUS Bioscience provides unlimited free of charge barcode usage for one credit per cycle.
- **Advanced Hardware:** It features a mobile, 8-inch touch screen terminal with an integrated barcode reader that does not require a trigger, increasing operational speed.
- **Safety & Hygiene:** The design is wireless to avoid cables on laminar cabin surfaces, eliminating contamination risks.
- **Nitrogen Tank Management:** It acts as a "conductor" for liquid nitrogen tanks, creating a library/map of samples to ensure the correct sample is thawed without damaging others.
- **Data Transparency:** All retrospective logs (who, when, and what time) are stored as digital reports.
- **Keyboard-Free Login:** Spouses simply scan their Identity Cards; the system uses autofocus to capture info and photos instantly.
- **Patient Bracelets:** Each patient receives a barcoded bracelet that is verified at every touchpoint (OPU, sperm delivery, transfer) to ensure a closed-loop safety system.

Prevent Mismatches

Eliminate Human Errors

Secure IVF End-to-End

Errors are unacceptable in IVF. ZEUS Mismatch Blocker: Full control throughout the entire process.

Safety Safeguards

Active Patient Lock: Only the patient currently being treated is active on the screen, ensuring 100% focus and zero cross-contamination of data.

Instant Warning Alerts: If a barcode from a different patient is scanned, the system issues an immediate, high-visibility alert to prevent sample mixing.

Zero-Lift Scanning: Dishes can be registered without being lifted from the work surface, maintaining the integrity and temperature of the samples.

Intelligent Warning System: If a barcode from a different patient is scanned, the system immediately issues a high-visibility alert, notifying the user instantly that the container belongs to another patient to prevent sample mixing.

The 7-Terminal Specialized Network

Standard systems often leave critical gaps in the workflow. ZEUS utilizes a set of seven specialized mobile touchscreen terminals, providing dedicated witnessing at every possible touchpoint:

Terminal Location	Functional Role
Sperm Collection Room	Ensures initial sample security and identity matching.
Andrology Room	Continuous verification during sample processing.
OPU Entrance	Digital patient verification immediately prior to the procedure.
OPU Room	Real-time egg count tracking for the gynecologist. The OPU room and laboratory operate simultaneously for seamless verification.
Embryology Lab	Integrated witnessing within the laminar flow cabinet.
Micromanipulator Desk	Precise under-the-micro-stereo tracking during ICSI.
Freezing Room	Intelligent cryo-management and nitrogen tank mapping.

For Embryologists:

The ergonomic design supports both right and left-handed use. Petri dishes can be registered without being lifted off the surface, ensuring **security and efficiency.**

For Gynecologists:

Real-time tracking of collected eggs during OPU via a mobile terminal. It ensures **the right embryo for the right patient** during transfer.

The Mobile Ecosystem

For Physicians: Access embryo development data and patient files anytime, anywhere via the smartphone app.

For Patients: Transparency builds trust. Patients can view their own embryo tracking information in real-time with secure password access.

Full-Cycle Workflow Control

The system acts as an intelligent safeguard, preventing any procedure from commencing without digital verification. It monitors **12 critical stages of the IVF cycle**, ensuring each patient and sample is digitally verified at every step:

1. Maternal Confirmation
2. Paternal Confirmation
3. Oocyte Pick-Up (OPU) Control
4. Sperm Sample Verification
5. Fertilization (ICSI) Stage Control
6. Embryo Culture Initiation
7. Medium Exchange Follow-up
8. Vessel/Dish Exchange Follow-up
9. Embryo Transfer Stage Control
10. Pre-PGT-M/PGT-A Stages
11. Cryopreservation/Freezing Stage
12. Clinic-Specific Custom Stages

While barcode usage is entirely free and unlimited, the system operates on a **coin-based model per cycle.** Credits (coins) can be purchased through a virtual POS and are credited instantly to your account for immediate use.

Because in IVF, even the smallest mistake is unacceptable. ZEUS Mismatch Blocker provides the full control and trust your clinic deserves.

ZEUS Bioscience

aims to ensure that all IVF centers benefit from this security system by offering affordable installation and usage costs.

COMING SOON

1 AUTOMATED VITRIFICATION DEVICE

2 AI POWERED TIME-LAPSE SYSTEM

Q&A FOR ZEUS BIOSCIENCE DEVICES

ZEUS Smart Cryo-Tools

What is the ZEUS Smart Cryo-Tools System?

It is an integrated set of tools designed to improve safety, traceability, and efficiency during the freezing and thawing process, and quadruple (4X) the storage capacity of the Nitrogen tanks.

How does the Smart Cryo-Tools system increase laboratory storage capacity?

The system utilizes ZEUS Smart Straws, which feature a patented unique shortenable design that can be broken at a designated point after freezing. This, combined with the triangular design and octagonal goblet system, can quadruple (4X) the storage capacity of existing liquid nitrogen tanks.

How does the ZEUS Octagonal Goblet protect embryos from thermal shock?

The goblet is designed with a nitrogen-retaining structure that allows liquid nitrogen to remain inside when removed from the tank, preventing air exposure. Its octagonal shape ensures that straw tips containing embryos or oocytes are continuously submerged during handling and scanning.

What features ensure sample safety during the thawing process?

The system ensures embryos never contact air during handling, maintaining a continuous cryogenic chain. The octagonal goblet is placed within the ZEUS Aluminum-Block inside the ZEUS Cryo-Box, allowing straw tips to remain safely submerged in liquid nitrogen while barcodes are scanned with a wireless reader. Once verified, the shortened straws are safely retrieved using a precision grabber pen, which maintains appropriate protection to the sample's integrity throughout the thawing process.

Are the barcodes resistant to cryogenic conditions?

Yes, the system uses specially designed, liquid nitrogen-resistant barcodes. These labels are durable, remaining readable even while submerged in nitrogen to ensure long-term traceability.

How does the system prevent mismatches?

The system utilizes dedicated software to record all data from the initial stages of the freezing and thawing process. A mobile barcode reader next to the Nitrogen tank then confirms the embryo's identity at every subsequent step. This ensures an exact match between the cryopreserved or thawed embryo and the corresponding PGT report, verifying the correct sample identity prior to thawing.

How are samples digitally tracked?

The system uses a Touch-Screen Tablet running dedicated ZEUS software paired with liquid nitrogen-resistant barcode labels and a mobile barcode reader. This integration provides full in-tank addressing and library location indexing, enabling the system to track the exact tank, canister, cane, goblet, and straw location of every sample. Consequently, for thawing process users can pinpoint and verify sample locations in real time without the need to remove them from the nitrogen.

ZEUS Black-Box Witness Systems

What is the primary purpose of the ZEUS Black-Box Witness System?

The ZEUS Black-Box is an integrated verification and traceability platform designed to eliminate human error and sample mix-ups during embryo biopsy and other IVF manipulations performed under a stereomicroscope. It uses a multi-layered sensor signaling system to monitor procedures and in the event of a deviation, the system issues an immediate alert and suspends the procedure, resuming only once the error is rectified in real time.

What are the main modules of the Black-Box?

The system has two modules: The BioPSafe Module (for embryo biopsy verification and PCR tube matching) and the Multi-Purpose Module (for managing routine IVF manipulations and dish-to-dish transfers)

What are the three control layers the Black-Box uses to prevent errors?

The system operates on three integrated control layers:

1. **Positional Verification:** Sensors monitor the exact position of dishes and droplets.
2. **Sequence Control:** Transfers must follow a predefined sequence via interface set by the embryologist.
3. **Digital Documentation:** Every action is recorded with video, timestamps, and operator identity. If any deviation occurs, the system triggers an alert and automatically halts the process until corrected.

How is the system operated without using hands?

Embryologists use a Bluetooth-connected Conformation Foot Pedal. Pressing the right pedal logs a "Pick-Up" (aspiration) action, and pressing the left pedal logs a "Drop" (dispensing) action in the software.

What documentation is provided for each procedure?

The system generates a complete audit trail by recording all Pick-Up and Drop actions. This includes synchronized video recordings, timestamps, and operator identity captured via the tablet's front camera.

How does the system handle procedural errors during a transfer?

The system continuously monitors source and target locations using infrared distance sensors. If any deviation from the predefined sequence or a positional mismatch is detected, the system immediately alerts the user, automatically halts the process, and only allows continuation once the error is corrected.

How does the system prevent sample mixing or errors during a procedure?

It utilizes multiple integrated infrared sensors that detect the exact position of dishes, lanes, and droplets. If any mismatch or positional deviation occurs during a transfer step, the system immediately alerts the user and halts the procedure until corrected.

How does the system address the "blind spot" in standard witnessing?

While conventional systems confirm the identity between the patient and the petri dish, they often do not track individual embryos inside the dish. ZEUS BioPSafe ensures the right embryo reaches the right patient by verifying the link between a specific embryo and its designated PCR tube.

ZEUS Pulse Stimulator (ZPS 24)

What is the function of the ZEUS Pulse Stimulator?

It is an electroporation system that delivers precisely regulated electrical pulses to create reversible pores in the oocyte membrane. This triggers physiological-like calcium signaling necessary for fertilization.

What components are included in the Pulse Stimulator system?

The system includes the touchscreen stimulator unit, sterile Electroliquid Solution powder, a U-shaped metal Dish Fastener for thermal stability under the microscope, and single-use Electro Dishes with integrated metal electrodes.

What are the main clinical indications for using the Pulse Stimulator?

The device is indicated for cases where natural or ICSI-induced calcium oscillations are insufficient, including Total Fertilization Failure (TFF), low fertilization rates (<30%), severe male factor infertility (globozoospermia), Round Spermatid Injection (ROSI), and totally immotile spermatozoa or severe male factors.

How does the ZEUS Pulse Stimulator align with international clinical guidelines?

The system is aligned with the latest ESHRE guidelines, which recognize electroporation (piezoelectric activation) as one of the few recommended "add-on" technologies in IVF. Unlike chemical methods, our device is designed to mimic physiological calcium spikes, providing a safer and more effective alternative for oocyte activation.

Why is Artificial Oocyte Activation (AOA) necessary in certain IVF cases?

In physiological fertilization, the sperm triggers calcium oscillations within the oocyte to initiate development. In cases such as Round Spermatid Injection (ROSI) or severe male factor infertility, the sperm may lack the necessary factors (like PLCζ) to trigger this activation. AOA is clinically indicated in these instances to mimic the natural fertilization process and prevent fertilization failure.

How does electrical activation compare to chemical activation?

These oscillations more closely mimic natural fertilization rhythms, which are critical for embryo development and quality. Unlike traditional chemical ionophores, which may involve toxicity risks and longer incubation times, the ZEUS Pulse Stimulator delivers a stable, standardized pulse that induces physiological-like calcium oscillations within seconds. This non-toxic method more closely replicates natural fertilization compared to monophasic chemical activation.

Does the device offer different application modes?

Yes, the system offers two distinct clinical protocols: DC Mode (standard 70 µs pulse typically used pre/post-ICSI) and AC/DC Mode (5-second cell alignment followed by a 70 µs pulse, designed for ROSI purposes).

Is the procedure safe for the future development of the child?

Yes. Clinical reality and follow-up studies, including those for ROSI, show that physical and cognitive development at two years of age is comparable to children born via standard ICSI. With over 90 healthy live births reported through these specialized methods, the ZEUS Pulse Stimulator remains a safe and reliable option for patients with Non-obstructive Azoospermia (NOA) [1], [2].

[1] Tanaka, A., et al. (2018). Ninety babies born after round spermatid injection into oocytes: survey of their development from fertilization to 2 years of age. Fertility and Sterility, 110(3), 443-451. doi:10.1016/j.fertnstert.2018.04.033.

[2] Vanden Meerschaut, F., et al. (2014). Assisted oocyte activation following ICSI: a 17-year retrospective study of its efficiency and safety. Human Reproduction, 29(10), 2165–2173. (Note: This study and subsequent updates confirm the safety and neonatal outcomes of over 100 children born via AOA).

ZEUS Mismatch Blocker

What sets the ZEUS Mismatch Blocker apart from chip-based witnessing systems?

The ZEUS Mismatch Blocker is a witnessing system designed to secure the Gamete–Embryo–Patient triangle. Unlike expensive chip-based technologies that rely on high per-procedure costs, our system utilizes QR codes to provide a low-cost, high-security solution for the entire IVF process.

While the system offers unlimited and free barcode usage, it operates on a coin-based model per cycle. This allows clinics to maintain a cost-predictable model by purchasing credits (coins) via a virtual POS, which are credited instantly to the account for immediate use. This approach ensures complete end-to-end traceability without the burden of expensive, recurring consumable fees.

What kind of alerts does it provide?

It features an Intelligent Warning System that triggers an immediate, high-visibility alert if a barcode from a different patient is scanned, preventing any cross-contamination

What are the key hardware and mobile advantages?

The system uses mobile, wireless touchscreen terminals integrated with barcode readers, eliminating contamination risks from cables on laminar surfaces. In addition, Physicians and even patients can access embryo development information 24/7 through a dedicated smartphone application.

How is patient identity verified and maintained throughout the workflow?

Verification begins with a keyboard-free login where spouses scan their identity cards. Patients receive barcoded bracelets verified at every touchpoint. An "Active Patient Lock" ensures that only the patient currently being treated is active on the terminal screen to prevent cross-contamination of data.

What locations are covered by the 7-terminal specialized network?

Providing complete witnessing at every stage and in every location, from the OPU room to the nitrogen tank.

1 × Sperm Collection Room

1 × Andrology Room

1 × OPU Entrance

1 × OPU Room (in front of the physician)

1 × Embryology Laboratory (laminar flow cabinet)

1 × Micromanipulator Desk

1 × Freezing Room

Cutting-Edge Product Provider for Next Generation IVF

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