

# Overall Direction of Reproductive Technology in the Near and Not So Near Future?

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# Disclosures

- Founder of Auxogyn (Progyny)
- Founder of Ivigen
- Grant recipient to develop “Robotic” IVF
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# Where have they (Embryologists) gone?

- To work!
- More demand
- Less supply
  - No formal training programs

# Where do embryologists come from?

- Animal Science
- Clinical Laboratory Scientist/ Medical Technologist
- Cell biology/Research

# How many professions have no formal path in?

- Several MS programs
- On the job training
- Major challenge is getting the hands on training and experience.

# IRB and consents

- Do we need patient consent to train new staff?
- Do we need patient consent to test new materials/equipment?

# Best Practice for training

- What is it based on?
  - Clinic specific methods?
- Not a lot of data avail on the nuances.
  - IVF: 40% voodoo, 40% Dogma, 20% Science

# IVF lab (today) can't change the “raw materials”

- Have to consider the “front end” of the process
- The patient never dies in the OR
  - Always the labs “fault”



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# Example of what happens over time

- Genetic testing of Embryos



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# Advances in PGD/S

- Embryo biopsy techniques
  - Move from Day 3 to Day 5 biopsy
  - Acid tyrodes to Laser
- Single cell genetics
  - FISH
  - Snps
  - Arrays
  - Sequencing
- Cryopreservation
- Higher implantation rates



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# What a difference a decade makes

|                                                          | 2000*  | 2015*   |
|----------------------------------------------------------|--------|---------|
| Implantation Rate<br>(live birth per embryo transferred) | 10-20% | 30-50+% |
| Number of embryos transferred                            | 2-4    | 1-2     |
| Error rates                                              | 2-11%  | 1-2%    |
| Miscarriage rate                                         | 20+%   | 5-10%   |



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Gleicher N, et al. Reprod Biol Endocrinol 15;12:22, 2014.

# Embryology v1.0

- Long OPU's
  - Laparoscopic
  - Then GIFT
- Semen Prep
  - Swim up/heavy insemin vs Donor sperm
- Open Culture
- 5% CO<sub>2</sub>
- Day 2 ET
- No Regulatory



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# Current “definition” of a Clinical Embryologist

Clinical embryologists are scientists who work in fertility treatment and reproductive research. They perform routine diagnostic services and therapeutic embryological procedures, such as in vitro fertilisation (IVF), at hospitals and clinics. They communicate with patients about specific treatment options regarding fertility and research infertility solutions with other medical, nursing, counselling and administrative staff.

Clinical embryologists need a practical and theoretical understanding of human reproductive biology, embryology, infertility and assisted reproductive technology (ART). They also need to keep up to date with current regulations and legislation involving these subjects.

Embryology is a rapidly developing field that has seen enormous growth in the last 20 years. It is anticipated that it will continue to expand and more educated clinical embryologists will be needed as a result.



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# Embryology v1.0 cont.

- No SART, CAP, FDA, CLIA
- No micromanipulation
- Little to no QA/QC
- Only Autologous cycles
- IVF was like research



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# Changes in Awareness



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# Example of changes in awareness.

- FDA and Donor Eligibility Determination (DED) and labeling
- Effects of air quality on IVF outcomes
- How FET effects ectopic rates and birth weights



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# New Generation Cultures to manage

- Growth factors
  - Will we be dealing with pharmaceuticals?
  - Microfluidics
    - Realtime measurements
    - Substrates
    - DNA/RNA separation
- Bioreactors



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# Move to Non-invasive PGD/S

- RT technology
- Blastocoel fluid
- Culture media
- Cumulus cells
- Polar Body

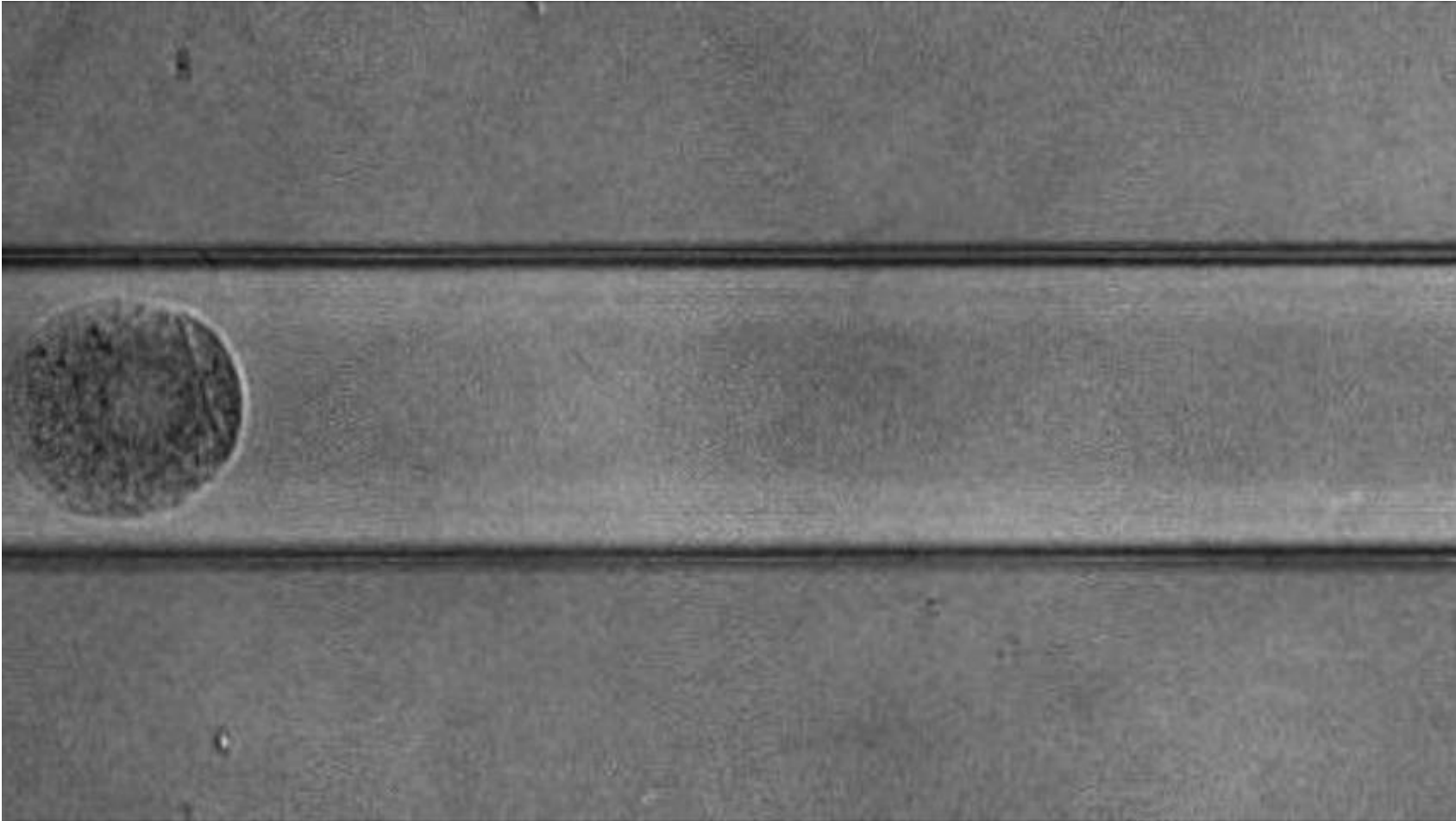


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# Blastomere: DNA/RNA Separation

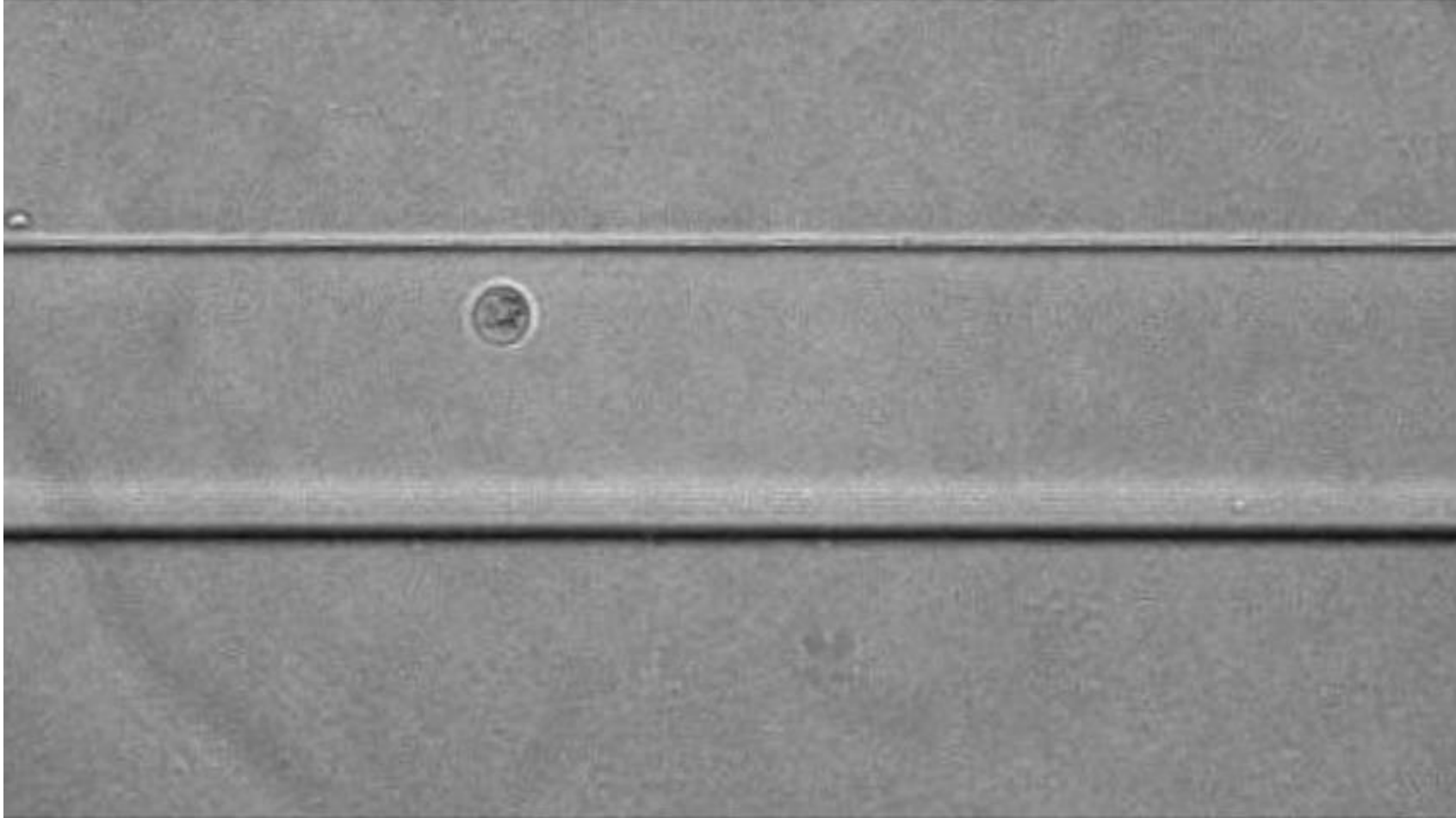


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# TE cell: DNA/RNA Separation



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# Embryology 2.1

- Heavy Regulatory:
  - CAP, JACHO, COLA, SART, CDC, NASS, CLIA, FDA, States, Tissue Bank, PT
- EMR documentation
- Heavy Micromanipulation
  - AH
  - ICSI
  - PGD/S



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# Embryology 2.1 cont.

- Time Lapse
- Freeze all
- Banking
- Oocyte Cryo
- 3<sup>rd</sup> Party IVF
- Heavy QA/QC
- TESE, PESA
- Ovarian tissue cryo
- P4 rise → change in plan
- ERA → change in plan



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# Ultimate (short term) Goal

- Achieve a healthy singleton pregnancy
- Transfer of a single embryo



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# What should we expect in 2027?

- Impact of Biotech
- Molecular Genetics (gene editing?)
- Change in culture vessels/technology
- Robots/automation
- But must have improved implantation rates



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# Killing a fly with a sledgehammer

- Is there such a thing as overkill
  - i.e., is it “better” or is one more “successful” if you do more with less?
- How do we interpret success when unnecessary technology is applied?



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# Conclusion

- There are more embryologists than ever (they haven't gone)
- Trained embryologists are in still in demand
- No formal “pipeline” for embryologists
- Embryologists skills and proficiencies will change over time