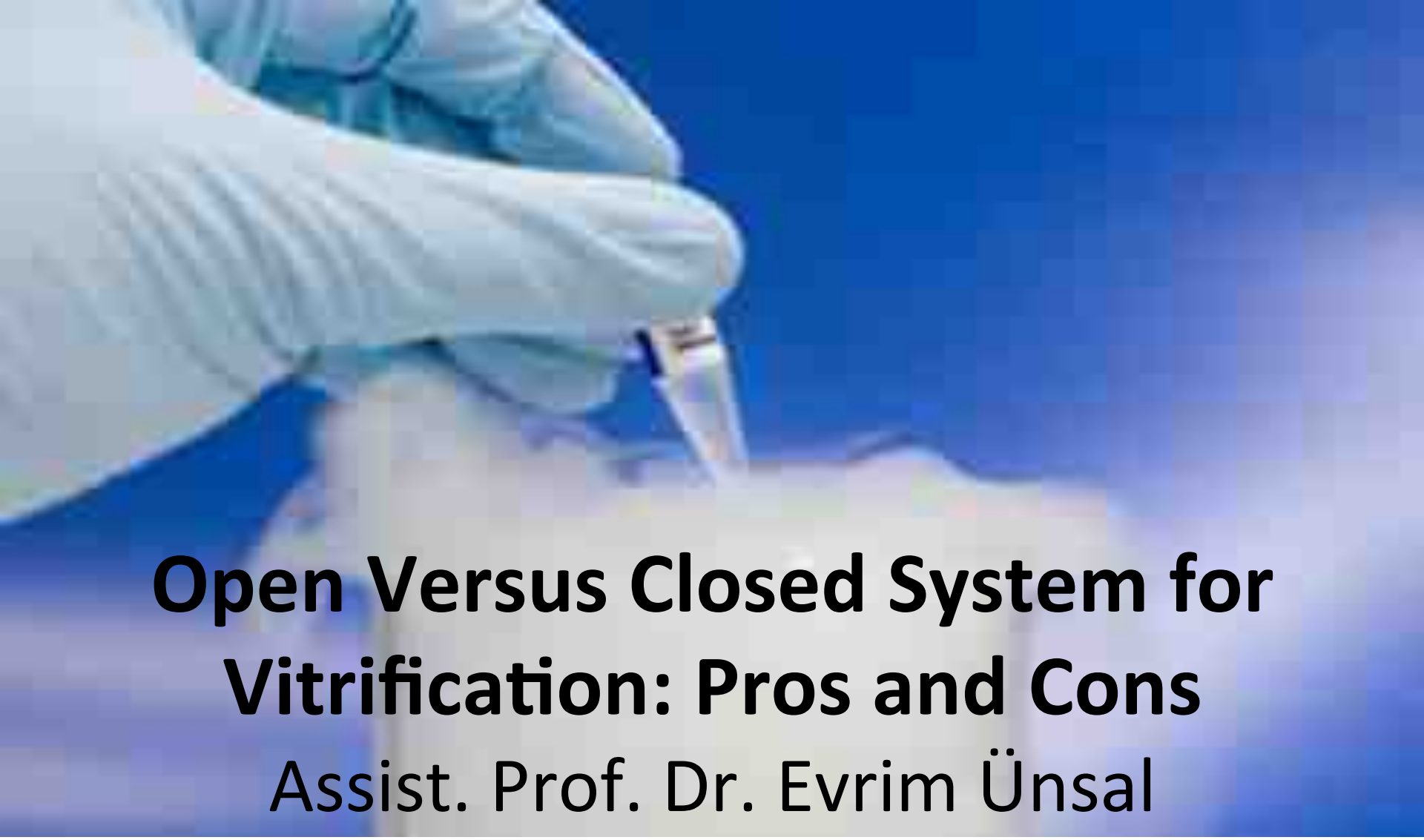


Open Versus Closed System for Vitrification: Pros and Cons

Assist. Prof. Dr. Evrim Ünsal

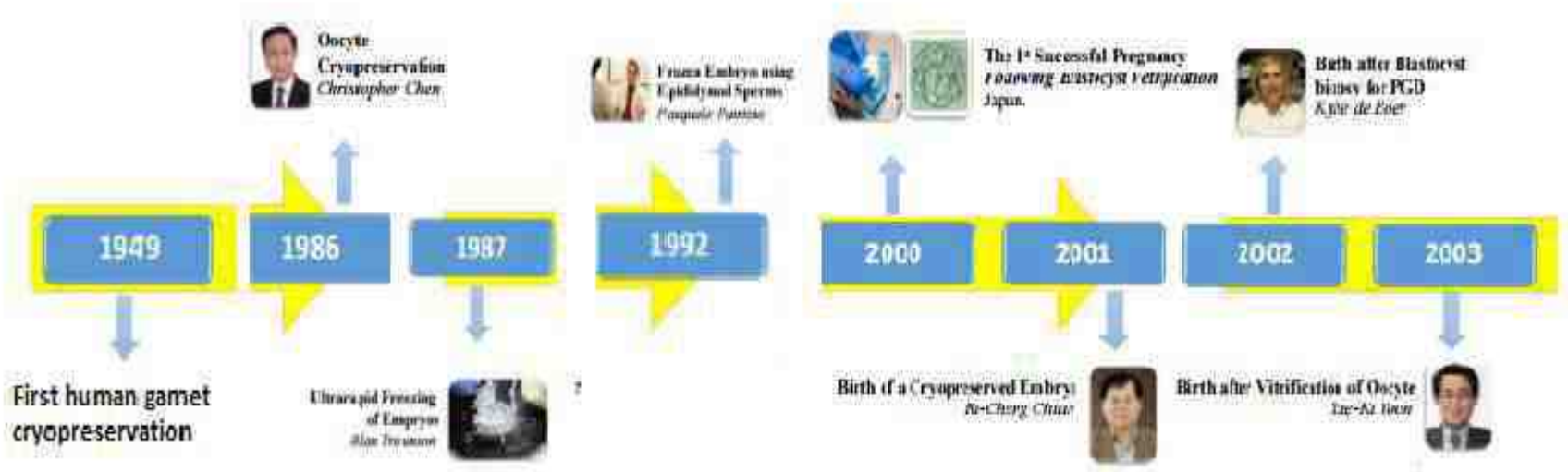
L.E.S. MİKROGEN
GENETİK HASTALIKLAR TANI MERKEZİ

Gen - Art
TÜP BEBEK
KADIN SAĞLIĞI VE
BİYOTEKNOLOJİ MERKEZİ

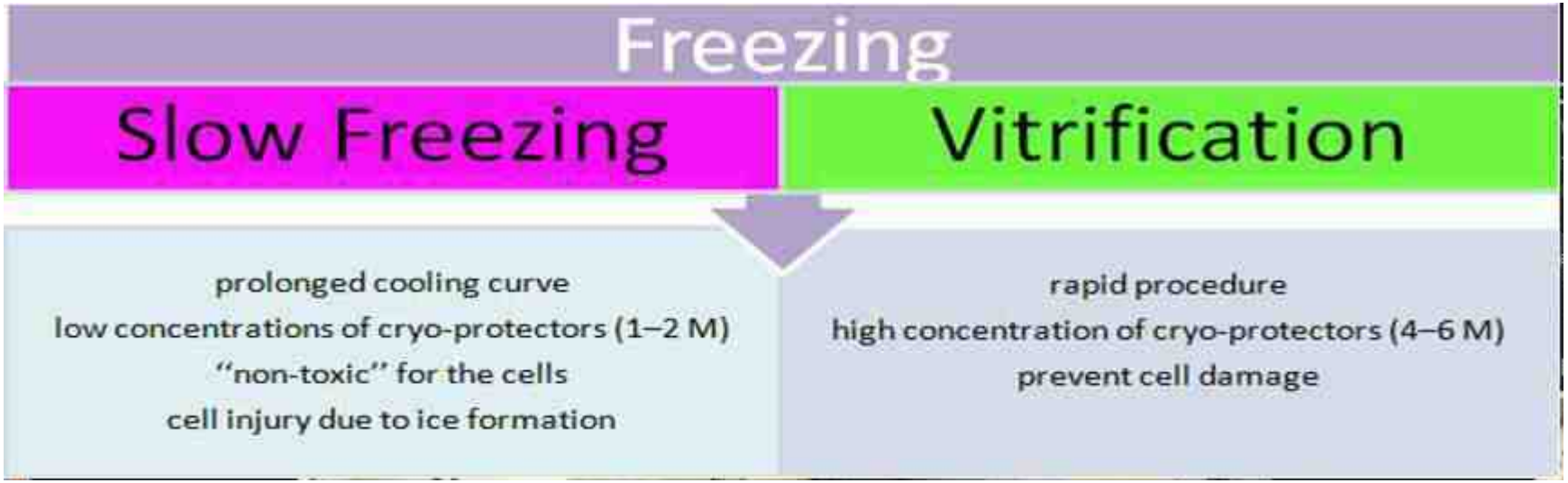
Outlines…

- What is the definition of an open versus closed system?
- Are closed systems as efficient as open systems
- Fellowship of vitrification and PGD/PGS applications

Early history of freezing human gametes and embrvos



- 1949 : First human gamet cryopreservation
- 1984 : First live birth with FET
- 1985 : First pregnancies with thawed blastocyst
- 1986 : First live birth with thawed oocytes.
- 2007 :The first birth after human blastocysts vitrification of biopsied embryos for PGD (Parriego et al.)



- Over the last five years there has been a dramatic worlwide shift to vitrification from slow freezing.
- Up to 2008 it is estimated that approximately half a million IVF babies have been born with slow freezing technique.
- Additionally, Thousands of births have been obtained from vitrified oocytes
  (Cobo et al., Fertil Steril. 2014 Oct)

Currently used vitrification techniques differ from each other in many technical details

- solutions,
- equilibration and dilution parameters,
- carrier tools,
- cooling,
- storage,
- warming methods.

Wide variety of methods makes the selection of the best technique difficult, and causes serious problems when cryopreserved samples are transferred between laboratories.

The use of safe cryopreservation protocol is very important to avoid human cell contamination or cross contamination in common LN2 tanks.

CONTAMINATION

The contamination

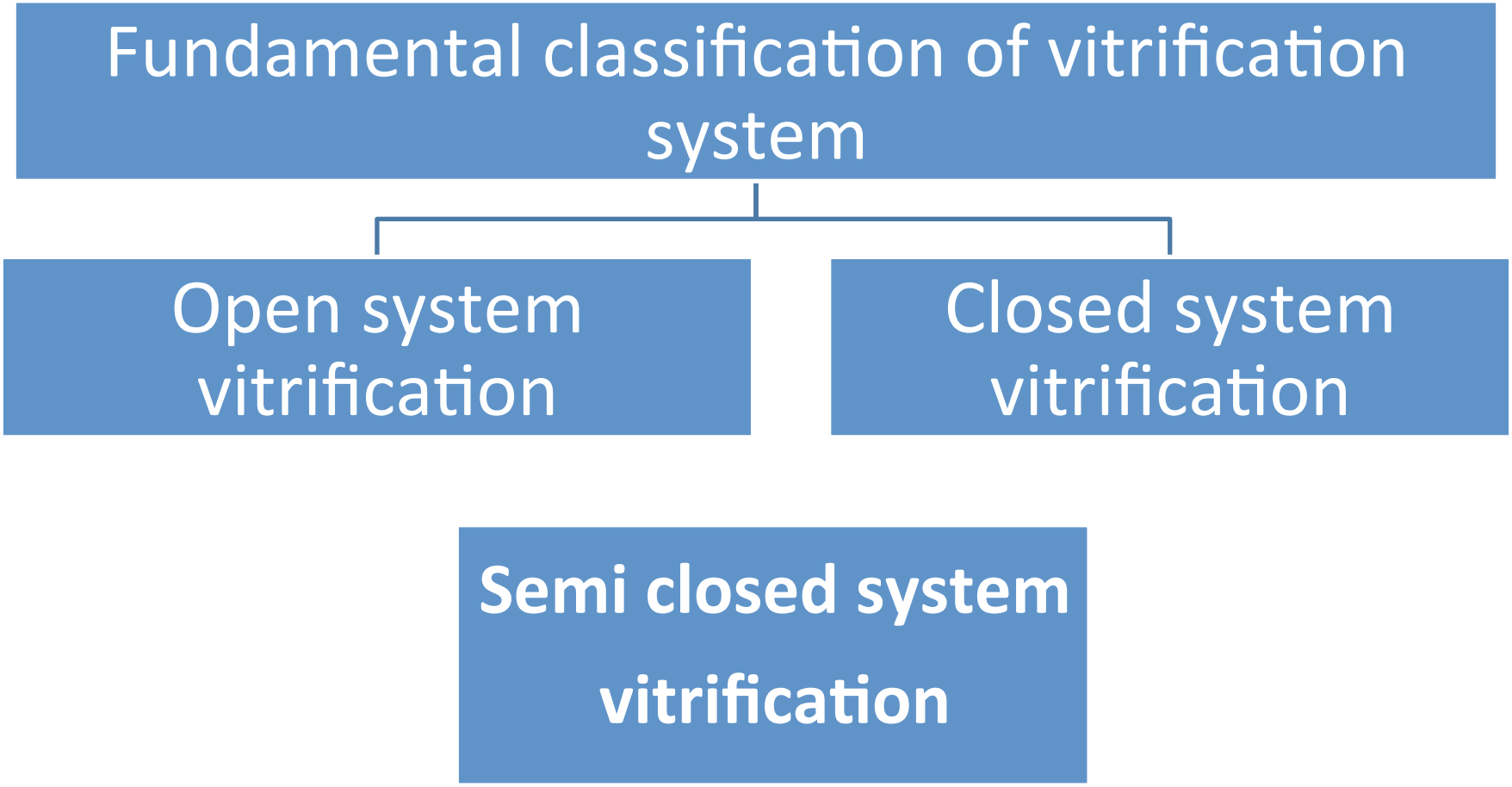
of the sample by freezing or by direct contact with the cooling solution

CROSS CONTAMINATION

The contamination of the sample within the common container

Possible contamination /cross contamiantion factors

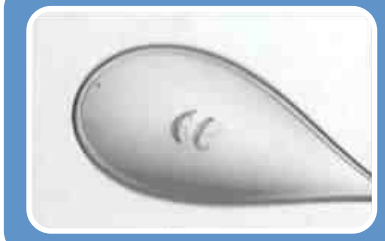
- Handling contaminated biological samples (semen, follicular fluid, tissue, etc.),
- Use of contaminated culture media,
- Use of contaminated nitrogen,
- Ineffective heat sealing,
- The air in the room,
- Operators,
- Use of open devices.


Fundamental classification of vitrification system
Open system vitrification
Closed system vitrification
Semi closed system vitrification

30 different carrier tools have been published, 15 versions are commercially available.

Cryotop

- (Kitazato –Japan)



Cryoloop

- (LaneandGardner,2001;Laneetal.,1999)

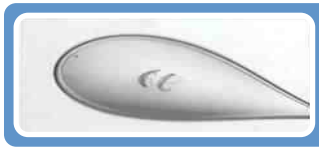
Open Pulled Straw

- (Vajtaetal.,1998)

Most claimed closed system are the results of the modifications of these open systems.

Fully Open Systems

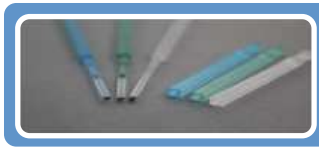
Cryotop
- Kitazato-Japan



Cryoloop
- (LaneandGardner,2001;Laneetal.,1999)

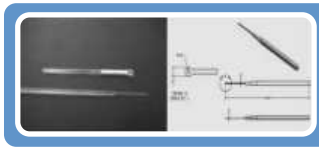
OpenPulledStraw
- (Vajtaetal.,1998)

Cryotech
- (Gutnisky et al.,2013)



Cryolock
- (Garcia et al.,2011)

Cryoleaf
- (Chian et al., 2009)



Vitri-Inga
- (Almodulin et al.,2010)

samples contact liquid nitrogen directly during cooling,

not safely protected potential cross-contamination during storage.	both cooling and warming rates can be extremely high

Semi Closed System

- Open cooling and closed storage systems

Cryotop

- Kitazato -Japan

Open Pulled Straw

- (Vajtaetal.,1998)

- Avoides contact of the biological sample with the cooling solution
- Achieves cooling rates in a high rate
- Avoid cross contamination during storage.

Closed System

Cryotop SC

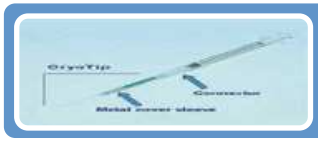
Kitazato - Japan

Rapid-I

- (Larman and Gardner, 2011)

Vitrisafe

- (Vanderzwalmenetal., 2009)



Cryotip

- (Kuwayama et al., 2005)

Cryopette

- (Parmegiani et al., 2012)

Several publications shows survival rate depends on the warming rate regardless the cooling rate. (Seki and Mazur, 2011, Seki et., al, 2014)

- Since cooling rate is always lower in closed systems the survival rate will be proportional to the warming rate. This dominance of the warming rate over the cooling rate is the base of the Kitazato Cryotop SC Closed System.

Both Cryotop devices, open Cryotop and Cryotop SC have the same warming rate (42.000ºC/min)

Other contamination factors in IVF

- **collection of semen is not a sterile procedure**;
- oocytes are contaminated with blood during collection;
- many containers are inappropriately sealed or closed by non-hermetical methods;
- The outer surface of straws and vials is always infected;
- storage tools (canisters, holders) are not sterilized;
- Openings of dewars mix air with LN2 vapour and may cause infection;
- Factory derived LN2 isusually not transported undera septic conditions, and, accordingly, can not be regarded as sterile, even if during production the infective agents are usually destroyed;
- Contaminated samples (sperm cells, oocytes) cannot be decontaminated;
- in most IVF laboratories, dewars are not decontaminated regularly;
- Acordingly, LN2 tanks and LN2 in tanks should always be regarded as contaminated.
- **Scissors or blades used to cut the straws are usually not sterilized between straws and patients**,
- (Gabor et al 2015)

- No such disease transfer has yet been reported, although an estimated ~1,000,000 vitrified embryos or embryos derived from vitrified oocytes by using open systems have been transferred.

At present,most embryos and oocytes are vitrified with open systems worldwide, indicating a high overall efficiency and consistency,

The reports describing the use of closed devices for both vitrification and storage of human zygotes and embryos

- Vanderzwalmen et al., 2012
- Kuwayama et al., 2005;
- Isachenko et al., 2007;
- Stachecki et al., 2008;
- Vanderzwalmen et al., 2009,
- 2010; Liebermann, 2009;
- Schiewe, 2010;
- Van Landuyt et al., 2011.

- **Vitrification in closed systems is a feasible procedure and can lead to reasonable clinical outcomes.**

- Nevertheless, the use of closed systems is still not totally accepted by IVF practitioners, under the perception that it leads to reduced clinical outcomes in contrast to their open variations.

The major drawback of these systems is the reduction in the cooling rate and, in a few cases, the warming rate.

Cryobiology 62 (2011) 1–7

Contents lists available at ScienceDirect

Cryobiology

journal homepage: www.elsevier.com/locate/ycryo

Survival of mouse oocytes after being cooled in a vitrification solution to −196 °C at 95° to 70,000 °C/min and warmed at 610° to 118,000 °C/min: A new paradigm for cryopreservation by vitrification ☆

Peter Mazur*, Shinsuke Seki

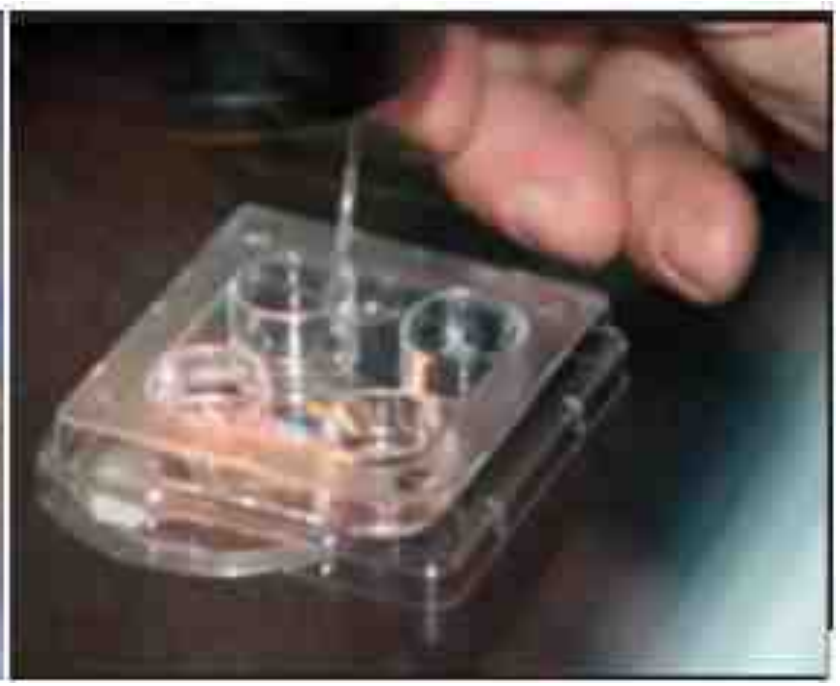
Fundamental and Applied Cryobiology Group, Department of Biochemistry and Cellular and Molecular Biology, The University of Tennessee, Knoxville, TN 37996-0840, USA

- very high rates of cooling are not mandatory during vitrification
- warming rate is of fundamental importance for survival

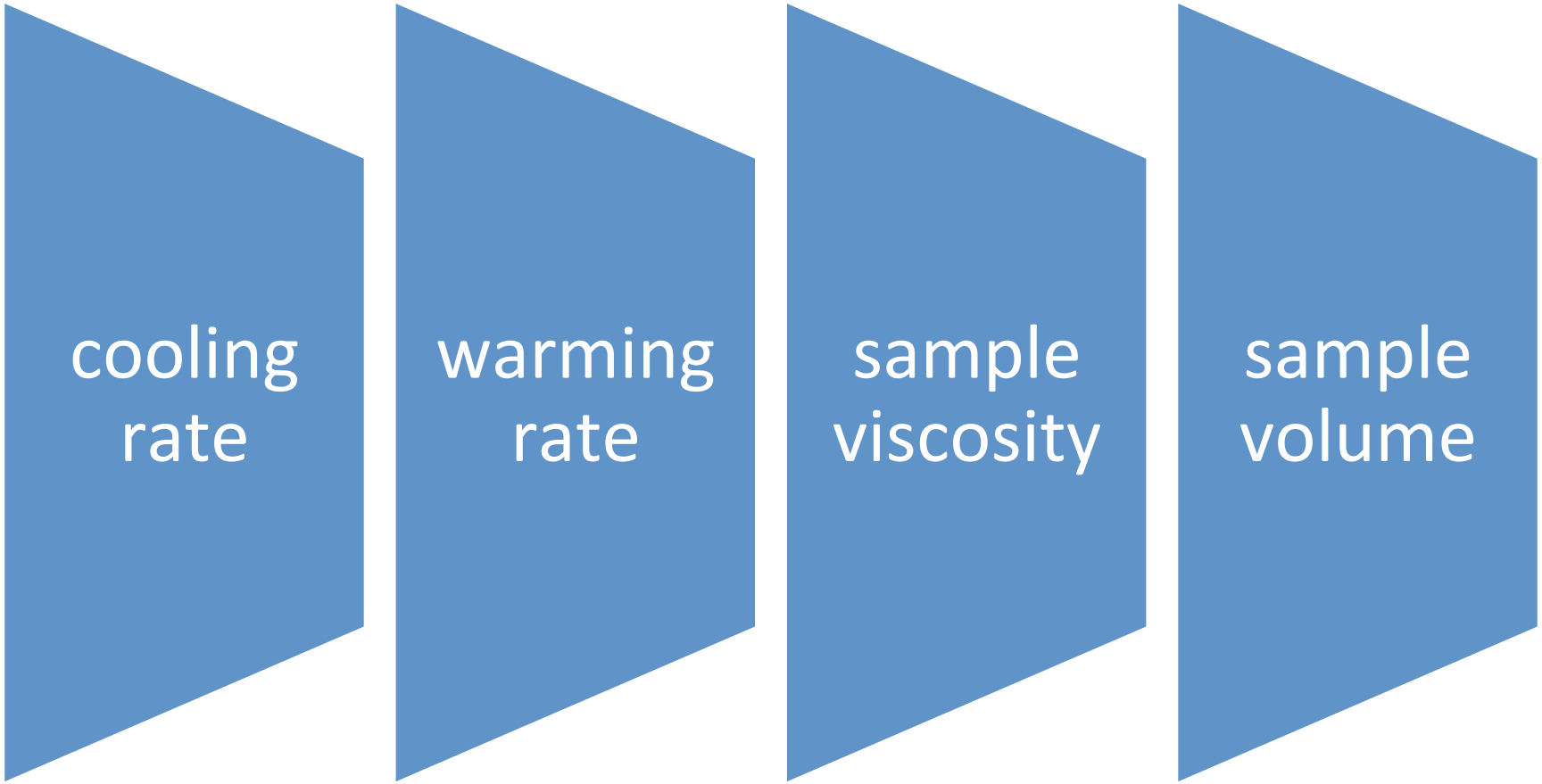
closed devices, even though their insulation leads to a lower cooling rate, can perform efficiently if warming rates are properly adjusted

The rapid warming is a crucial point for successful vitrification.

- Removal of the sample from the insulating container whilst still submerged in liquid nitrogen and subsequent direct immersion of the cells into the warming solution.



Successful vitrification is an equation with four variables;



AbdelHafez et al. BMC Biotechnology 2011, 11:29
http://www.biomedcentral.com/1472-6750/11/29

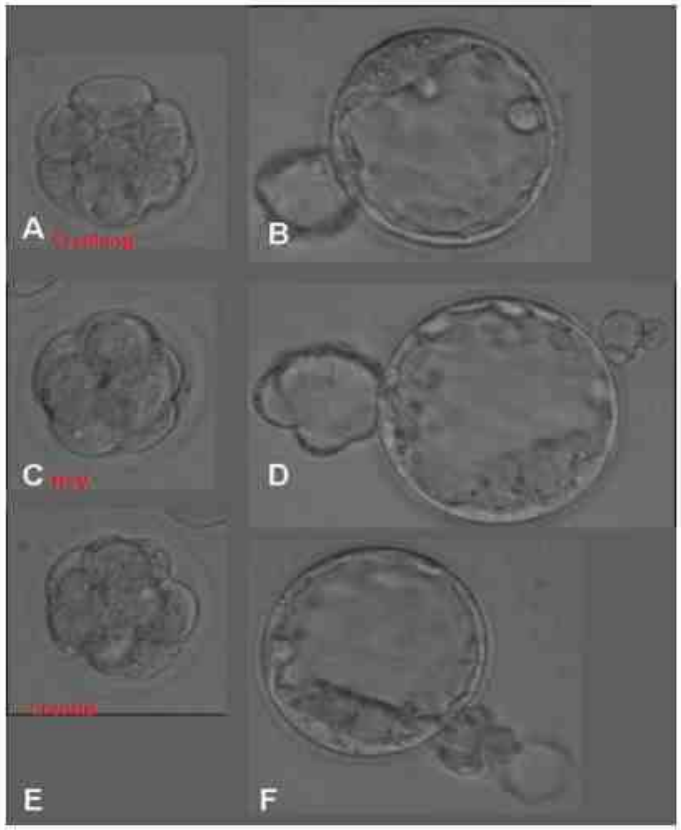
BMC Biotechnology

RESEARCH ARTICLE Open Access

Vitrification in Open and Closed Carriers at Different Cell Stages: Assessment of Embryo Survival, Development, DNA Integrity and Stability during Vapor Phase Storage for Transport

Faten AbdelHafez, Jing Xu, Jeffrey Goldberg and Nina Desai*

- Cryoloop (Vitrolife, Sweden)
- Cryotip (Irvine Scientific, CA, USA),
- High Security Vitrification (HSV) straw (Cryo BioSystem, Paris, France),



The open versus closed vitrification systems did not overtly affect the degree of cryo-injury.

The only parameter that appeared to be significantly affected by the type of carrier is the percentage of embryos recovered after warming.

Cleavage Stage Vitrification						
Carrier	**Total embryos (n)**	**Recovery (%)**	**Survival (%)**	**Blastocyst formation after 48 hour culture (%)**	**Total blastomeres (mean ± SD)**	**% DNA Damage (mean ± SD)**
Cryoloop	60	100	100	95	81.9 ± 14.0	1.85 ± 2.05
HSV	52	100	100	94	82.5 ± 15.6	2.06 ± 1.50
Cryotip	67	85*	100	98	78.6 ± 17.9	2.12 ± 2.04

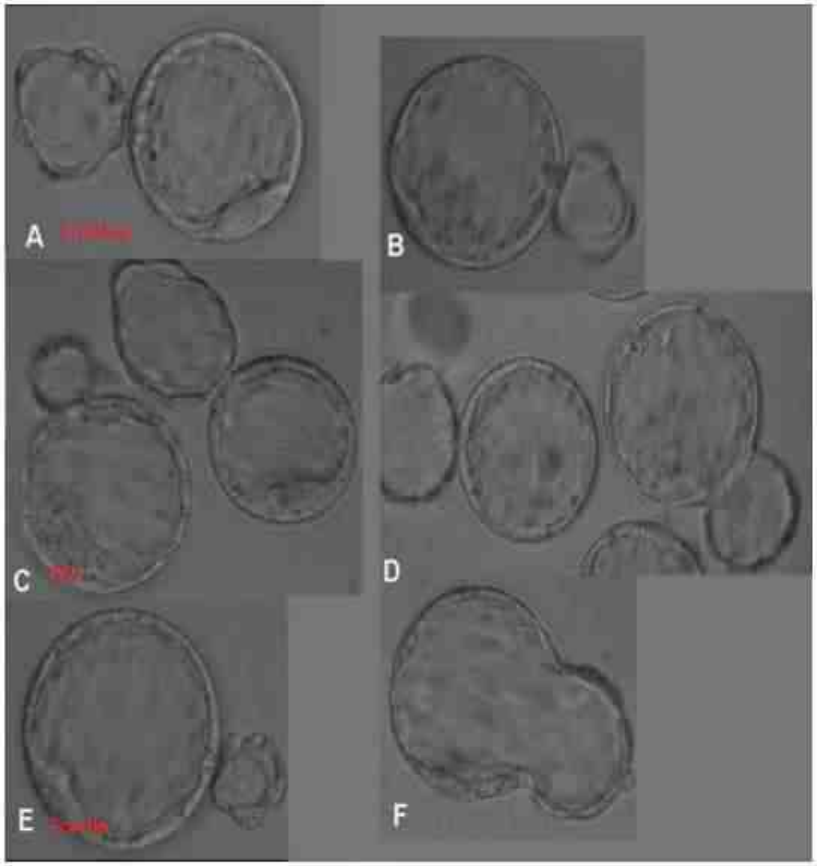


Figure 2
Blastocysts vitrified on different carriers and stored in liquid nitrogen. Photographed before vitrification (A, C, E) and three hours after warming (B, D, F). A-B: Cryoloop, C-D: HSV straw, E-F: CryoTip.

Vitrification of both cleavage and blastocyst stage embryos in the Cryotip resulted in significantly lower recovery rates.

The Cryotip was a bit more vulnerable to technical difficulties during recovery.

The percentage of blastomeres per embryo showing DNA damage was similar between carriers.

However, there was a significantly higher rate of DNA damage after vitrification at the blastocyst stage compared to cleavage stage embryos.

Blastocyst Stage Vitrification						
Carrier	Total embryos (n)	Recovery (%)	Survival (%)	Re-expansion (%)	Total blastomeres (mean ± SD)	% DNA Damage ** (mean ± SD)
Cryoloop	44	100	100	100	86.4 ± 25.8	4.36 ± 2.72
HSV	55	100	100	100	85.9 ± 23.7	3.34 ± 2.79
Cryotip	52	75 *	79	79	88.0 ± 19.2	3.41 ± 2.66

Reproductive BioMedicine Online (2013) 26, 470–476

Open versus closed vitrification of blastocysts from an oocyte-donation programme: a prospective randomized study

Y Panagiotidis [a,e,*], P Vanderzwalmen [b,c], Y Prapas [a], E Kasapi [a], M Goudakou [a], A Papatheodorou [a], T Passadaki [a], S Petousis [a], N Nikolettos [d], S Veletza [e], N Prapas [a], G Maroulis [e]

Yannis Panagiotidis is a graduate of the Biology School of the Aristoteles University of Thessaloniki. In 1998, he joined the IVF team of Iakentro Advanced Medical Center as laboratory manager. His current scientific interest includes vitrification of human embryos, which is also his objective in his PhD study.

group I, blastocysts were exposed to two solutions of ethylene glycol/dimethylsulphoxide,

group II, blastocysts were pretreated with a solution of lower concentration (5%/5%).

Table 2 Clinical outcomes according to the different vitrification protocols.

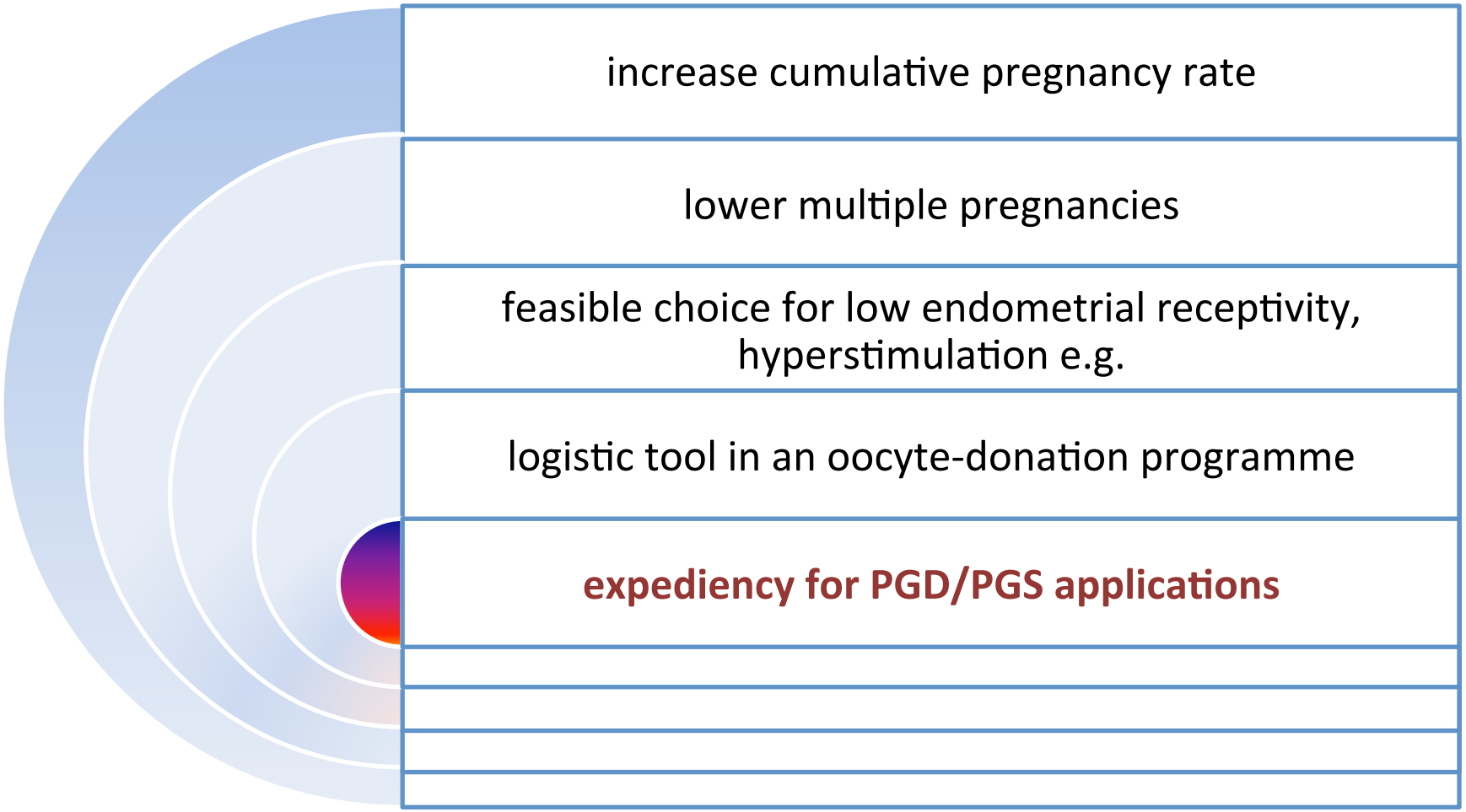
	Open vitrification (208 cycles, 492 embryos)	*Closed vitrification (224 cycles, 513 embryos)*
Cancellation rate	14 (6.7)	19 (8.5)
Blastocyst survival rate	414/492 (84.1)	421/513 (82.1)
Positive HCG/transfer	108/194 (55.7)	110/205 (53.7)
Clinical pregnancy rate/transfer	89/194 (45.9)	87/205 (42.4)
Twins	17/89	14/87
Triplets	0	1
Implantation rate/transferred blastocysts	106/414 (25.6)	103/421 (24.5)
Miscarriage rate/pregnancy	7/89 (7.9)	2/87 (2.3)
Ongoing pregnancy after 22 weeks/transfer	82/194 (42.3)	85/205 (41.5)
Live birth/transfer	80/194 (41.2)	84/205 (41.0)
Babies born/transferred blastocysts	94/414 (22.7)	98/421 (23.2)

Values are *n* (%) or *n*/total (%). No statistically significant differences were found between the two groups.
HCG = human chorionic gonadotrophin.

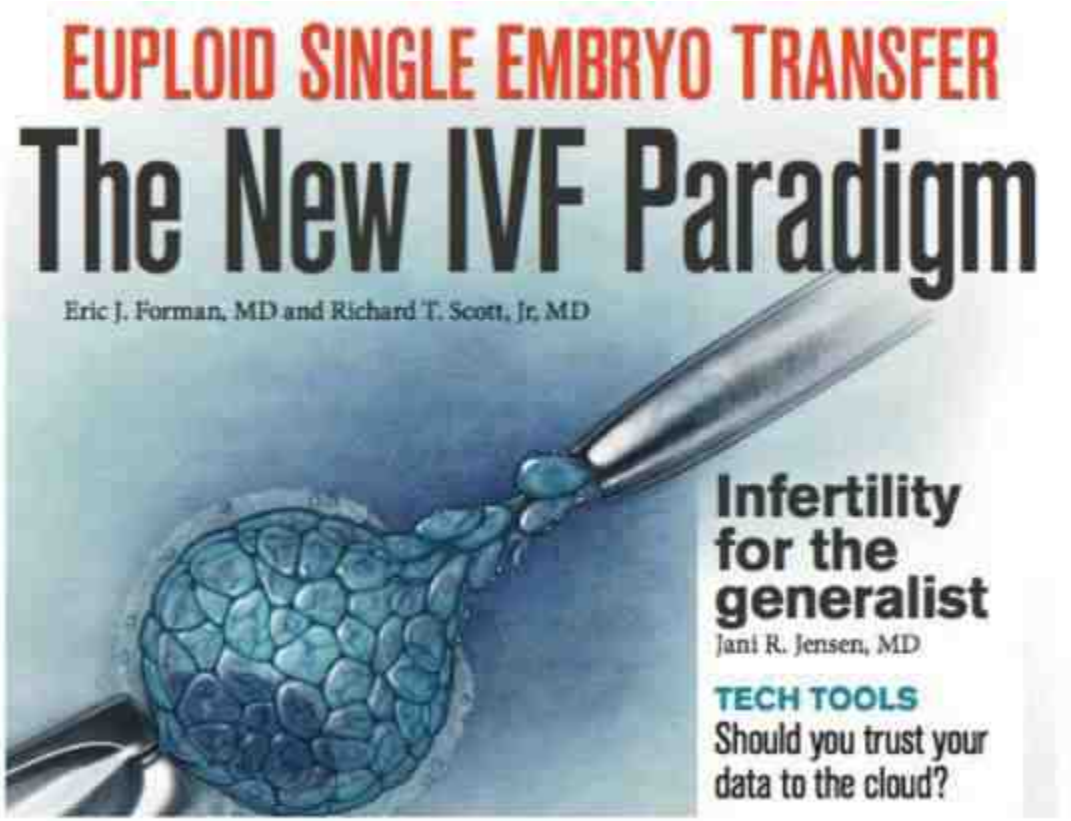
- Although a short exposure (4 min) of embryos to the non-vitrification solution (NVS) is enough when applying ultra-rapid vitrification, it can lead to lower survival and implantation rates when closed conditions are applied.
  (Vanderzwalmen et al. 2009)

- In order to compensate for this reduction, the blastocysts allocated to the closed vitrification group were exposed to an additional solution of lower concentration, aiming at increasing the intracellular amount of the cryoprotectants and the viscosity of the cytoplasm.

A robust cryopreservation set up is mandatory for IVF clinics



- The first birth after human blastocysts vitrification of biopsied embryos for PGD was reported by Parriego et al (2007).



- With this development the time limitation was eliminated and an important improvement has been observed in the fields of PGD and especially PGS.

Potential Sources of genetic material

1. Polar Body

Verlinsky et al., (1990) Human Reproduction 5: 826-829

2. Polar body

Verlinsky et al., (1990) Human Reproduction 5: 826-829

Blastomeres

- Handyside et al., (1990) Nature 344: 768-770

Trophectoderm

Kokkali et al, (2005) Human Reproduction 20:1855-1859 McArthur et al., (2005) Fertility and Sterility 84(6):1628-36

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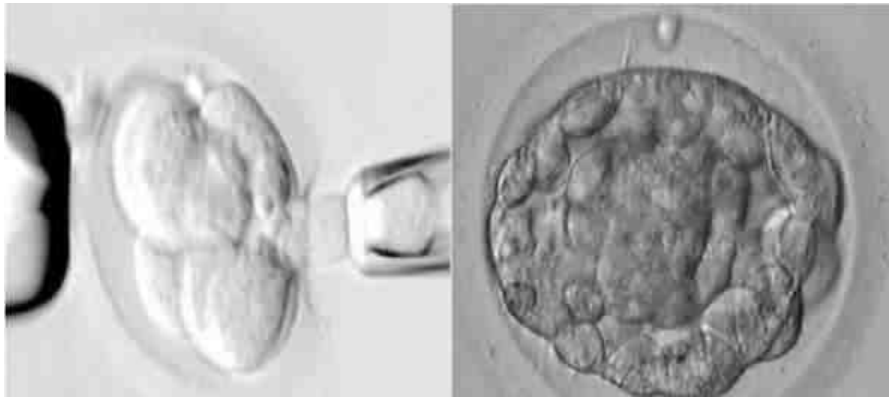
Blastocyst Stage Biopsy	
Advantages	More DNA = less no results Less mosaicism = less error rate Reduced/ no impact of embryo biopsy Less embryos to process = decreased workload, decreased costs Facilitates single embryo transfer Compatible with fresh embryo transfer or vitrification Re-biopsy option for failed polar body or cleavage stage PGD analysis
Disadavantages	Not all embryos reach blastocyst the same day Frozen embryo transfer requirement

We only perform blastocyst freezing for biopsied embryos



RBM Online - Vol 19. No 4. 2009 526–531 Reproductive BioMedicine Online; www.rbmonline.com/Article/3919 on web 19 August 2009

Article

Vitrification of biopsied embryos at cleavage, morula and blastocyst stage

Dr Xiao Zhang received his M.D. from Xin Xiang Medical University, China and began his career in reproductive medicine through the Ph.D. program of Peking University, China. Initially, he concentrated on oocyte slow freezing, and in 2003 he achieved the first pregnancy from frozen oocytes in China. He is currently an embryologist in the Pedieos IVF Center, specialising in vitrification and PGD. His research interests focus on the role of reactive oxygen species in female reproductive aging.

Dr Xiao Zhang

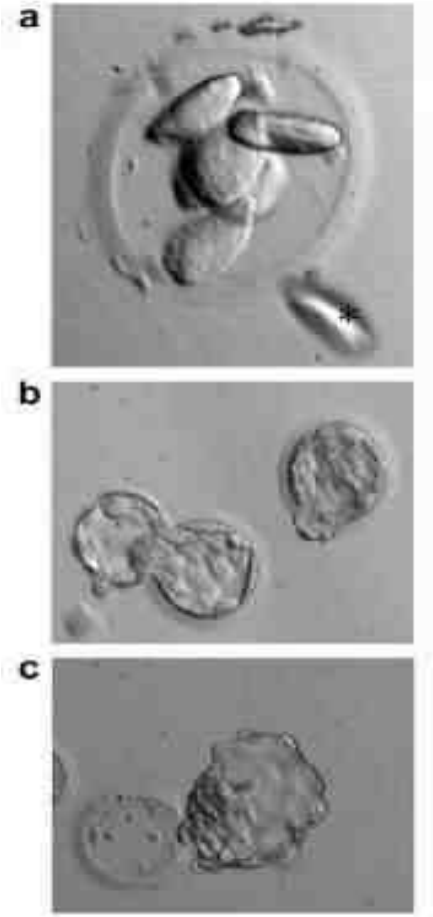
Table 1. Survival of embryos vitrified at different developmental stages.

Group	*No. of embryos vitrified*	*No. of surviving embryos (%)*
Cleavage control	25	23 (92.0)[a]
Cleavage biopsy	25	16 (64.0)[a]
Morula control	25	23 (92.0)
Morula biopsy	24	21 (87.5)
Blastocyst control	59	48 (81.4)[b]
Blastocyst biopsy	47	45 (95.7)[b]

Values with the same superscript letter are significantly different.
[a] $P = 0.037$.
[b] $P = 0.035$.

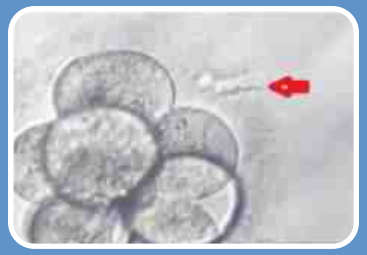
- The survival rate after warming in the non-biopsied cleavage control group was significantly higher than in the biopsied cleavage group (92.0% versus 64.0%, P = 0.037).
- At the morula stage, both biopsied and non-biopsied embryos had similar survival rates.
- However, a significantly higher survival rate (95.6%) was observed in the biopsied blastocyst group compared with the control group (81.3%, P = 0.035).

Most of the biopsied cleavage stage embryos were destroyed due to blastomeres escaping.



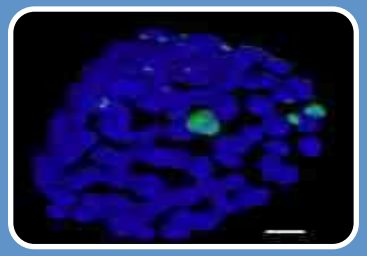
- The high osmotic potential of the medium caused the blastomeres to shrink dramatically.
- Cell connection loose of blastomeres after biopsy contributes greatly to the unsuccessful vitrification of biopsied cleavage embryos.
- 94% survival rate without blastomeres escaping (Zheng et al., 2005).
- Slit opening on the zona, with PZD can block blastomeres escaping.

Increasing the vitrification success without the zona pellucida barrier.



Biopsy allows better exposure of the expanded blastocoele to the cryoprotectant and results in better dehydration of the blastocoele (Cervera et al 2003)

Blastocysts with a larger blastocoelic cavity survived vitrification better when they had partially or completely hatched (Zech et al 2005) .



Vitrification of blastocysts results in lower DNA damage to the blastomeres following zonal hatching before vitrification (Kader et al., 2007).

Vitrification at advanced embryo stages is an efficient method for biopsied embryo cryopreservation.

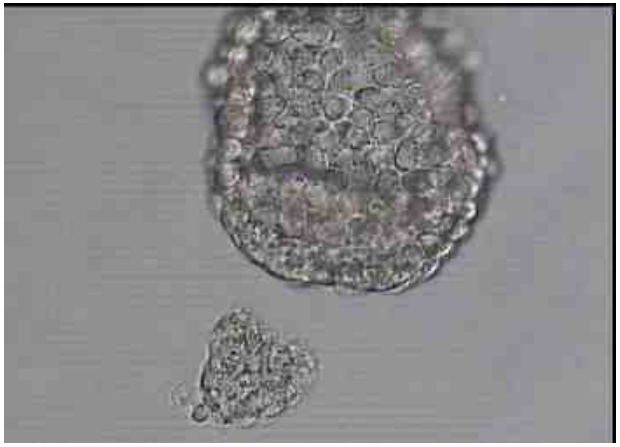
- This strategy provides an opportunity to select viable embryos for transfer.
- A blastocyst has a greater capability of withstanding cell loss in the vitrification procedure.
- Waiting for blastocyst formation in PGD/PGS cycles enables us to vitrify reduced numbers of embryos.

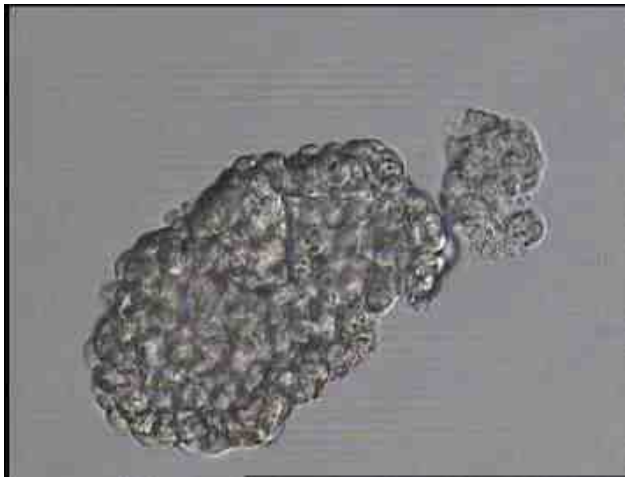
Fully Hatched Blastocyst Freezing

Pictures of thawed, biopsy performed full hatched blastocysts	Total Frozen embryo#	Frozen Full hatched Embryo#	Thawed Full hatched Embryo#	ET#	pregnancy
	10	1	1	1 FULL HATCHED BLAST	NEGATİF
	7	2	1	1 FULL HATCHED BLAST	POZİTİF
	4	2	1	1 FULL HATCHED BLAST	POZİTİF
	7	1	1	1 FULL HATCHED BLAST	NEGATİF

#	PREGNANCY	THAWED EMBRYO#	ET#	TEST PERFORMED
patient 1	NEGATIVE	2	2	24 CHROMOSOME
patient 2	POSITIVE	2	2	ANEUPLOIDY FISH
patient 3	POSITIVE	1	1	HLA TYPING
patient 4	POSITIVE	1	1	SINGLE GENE DISORDER
patient 5	POSITIVE	2	2	ANEUPLOIDY FISH
patient 6	POSITIVE	1	1	24 CHROMOSOME
patient 7	POSITIVE	1	1	24 CHROMOSOME
patient 8	NEGATIVE	1	1	24 CHROMOSOME
patient 9	NEGATIVE	1	1	24 CHROMOSOME
patient 10	POSITIVE	1	1	24 CHROMOSOME
patient 11	NEGATIVE	1	1	ANEUPLOIDY FISH
patient 12	POSITIVE	2	2	SINGLE GENE DISORDER
patient 13	NEGATIVE	2	2	24 CHROMOSOME
patient 14	NEGATIVE	1	1	24 CHROMOSOME
patient 15	POSITIVE	1	1	SINGLE GENE DISORDER

Trophectoderm biopsy on fully hatched embryos





- Trophectoderm biopsy can be performed on fully hatched embryos and vitrified for further applications succesfully

Concurrent PGD for Single Gene Disorders and Aneuploidy on Single Cells

- Two blastomere biopsy on day 3
- Simultaneous biopsy on day 3 and on day 4
- Splitting trophectoderm cells into two pieces
- Karyomapping

Simultaneous biopsy on day 3 and on day 4

Emb #	MUTATION	MUTATION MARKERS				SINGLE GENE RESULTS	TRANSLOCATION RESULTS
	p.Val9Ala	D11S1883	D11S4191	D11S4076	D11S4205		
1	N/N	144/150	252/231	290/280	300/302	NORMAL	NORMAL
2	p.Val9Ala/ N	142/150	248/231	288/280	300/302	HETEROZYGOUS	AFFECTED EMBRYO. Translocation screening was not performed.
5	p.Val9Ala/ N	142/144	248/231	288/280	300/300	HETEROZYGOUS	AFFECTED EMBRYO. Translocation screening was not performed.
BABA	p.Val9Ala/ N	142/144	248/252	288/290	300/302	HETEROZYGOUS	
ANNE	N/N	144/150	231/231	280/280	300/302	NORMAL	
HASTA ÇOCUK	p.Val9Ala/ N	142/144	248/231	288/280	300/300	HETEROZYGOUS	

Splitting trofectoderm cells into two pieces

Emb #	Single gene disorder results	24 Chromosome screening results	EMBRYO TRANSFER	Suggestions
1	NORMAL	NORMAL	YES	
2	HETEROZYGOUS	NOT TESTED	NO	
3	NORMAL	NORMAL	YES	
4	HETEROZYGOUS	NOT TESTED	NO	
5	NORMAL	MONOZOMI 14 MONOZOMI 21	NO	
8	HETEROZYGOUS	NOT TESTED	NO	
9	NORMAL	NORMAL	YES	
10	HETEROZYGOUS	NOT TESTED	NO	

Emb #	MUTATION MARKERS					RESULT
	D17S2218	D17S918	4A	9A	D17S261	
1	204/198	246/258	120/114	108/119	160/158	NORMAL
2	196/198	246/258	124/114	104/119	160/158	HETEROZYGOUS
3	204/198	246/258	120/114	108/119	160/158	NORMAL
4	196/198	246/258	124/114	104/119	160/158	HETEROZYGOUS
5	204/202	246/246	120/120	108/108	160/160	NORMAL
8	196/198	246/258	124/114	104/119	160/158	HETEROZYGOUS
9	204/202	246/246	120/120	108/108	160/160	NORMAL
10	196/202	246/246	124/120	104/108	160/160	HETEROZYGOUS
FATHER	196/204	246/246	124/120	104/108	160/160	HETEROZYGOUS
MOTHER	198/202	246/258	114/120	108/119	158/160	NORMAL
BROTHER OF MALE PARTNER	196/206	246/258	124/114	104/108	160/162	HETEROZYGOUS

Splitting trophectoderm cells into two pieces

Emb #	SICKLE CELL RESULTS	24 CHROMOSOME RESULTS
1	HETEROZYGOUS	MONOSOMY 15, TRIZOMY 19
2	HETEROZYGOUS	NORMAL
3	NORMAL	TRIZOMY 21, MONOSOMY 4
4	NORMAL	PARTIAL TRIZOMY 19
5	HETEROZYGOUS	MONOSOMY 1 22
6	NORMAL	MONOSOMY 9, TRIZOMY 20
7	MUTANT	NOT TESTED

Emb #	HBS	MARKER D11S2362	MARKER D11S4181	MARKER D11S1760	MARKER D11S1338	ORAK HÜCRE SONUÇLARI
1	N/ HBS	216/212	108/112	82/86	141/144	HETEROZYGOUS
2	N/ HBS	216/212	108/112	82/86	141/144	HETEROZYGOUS
3	N/N	216/219	108/108	82/86	141/137	NORMAL
4	N/N	216/219	108/108	82/86	141/137	NORMAL
5	HBS /N	212/219	112/108	86/86	144/137	HETEROZYGOUS
6	N/N	216/219	108/108	82/86	141/137	NORMAL
7	HBS/ HBS	212/212	112/112	86/86	144/144	MUTANT
FATHER	HBS /N	212/216	112/108	86/82	144/141	HETEROZYGOUS
MOTHER	N/ HBS	219/212	108/112	86/86	137/144	HETEROZYGOUS

The application of vitrification for blastocysts and oocytes, opened new perspectives

- Extended embryo culture,
- Single blastocyst transfer,
- Blastocyst biopsy,
- Alternative ways for fertility preservation,
- Oocyte donation.

Warming-Biopsy-PGS-Revitrification-Rewarm-ET: A viable strategy for patients who want to minimize the number of frozen cycles before becoming pregnant

O. Oliana[1], C.F.L. Hickman[1], D. Gwinnett[1], T. Wilkinson[1], A. Carby[2], G. Trew[3], S. Lavery[3].
[1]Boston Place Clinic, Embryology, London, United Kingdom. [2]Boston Place Clinic, Clinical, London, United Kingdom. [3]IVF Hammersmith, Clinical, London, United Kingdom.

Cases & Results

The following table shows or pictures the sequence of procedures performed in Case C, from the initial embryo storage, the subsequent embryo warming, biopsy, re-vitrification, re-warming, embryo transfer and final positive outcome.

Case	Stored	Warmed	Biopsied	Re-vitrified	PGS result	Re-warmed	Benefits for the patient
A	6	6	6	6	6 x Euploid	1[1]	Scenario 1
B	8	8	8	8	3 x Euploid, 5 x Aneuploid	1[1]	
C	7	7	7	7	2 x Euploid, 7 x Aneuploid	1[2]	
D	8	8	8	8	2 x Euploid, 6 x Aneuploid	0[4]	Scenario 2
E	6	6	6	6	6 x Aneuploid	0	Scenario 3
F	8[*]	8	8	8	8 x Aneuploid	0	
G	5	5	5	5	5 x Aneuploid	0	

[*] The patient requested PGS after embryo transfer, no previous warming was performed.
[1] Ongoing pregnancy.
[2] No foetal heart found at pregnancy scan. At second scan 11 positive urine test, awaiting for pregnancy scan.
[4] A second PGS cycle with euploid embryos identified and cryopreserved was performed for embryo banking.

Scenario 1

- Patient reassurance that embryos in storage were euploid
- Maximise chance of FERC success by avoiding aneuploid embryo transfer
- Euploid embryos identified -> eSET
- Reduced time to pregnancy
- Clinical pregnancy rate 2/3

Scenario 2

- Maximise chance of FERC success by avoiding aneuploid embryo transfer
- Option of euploid embryo batching
- Reduced time to pregnancy

Scenario 3

- All embryos aneuploid
- Avoid unnecessary failed FERCs
- Saving the patient time, money and emotional distress
- Reduced time to pregnancy

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ASSISTED REPRODUCTION TECHNOLOGIES

Reproductive outcome is optimized by genomic embryo screening, vitrification, and subsequent transfer into a prepared synchronous endometrium

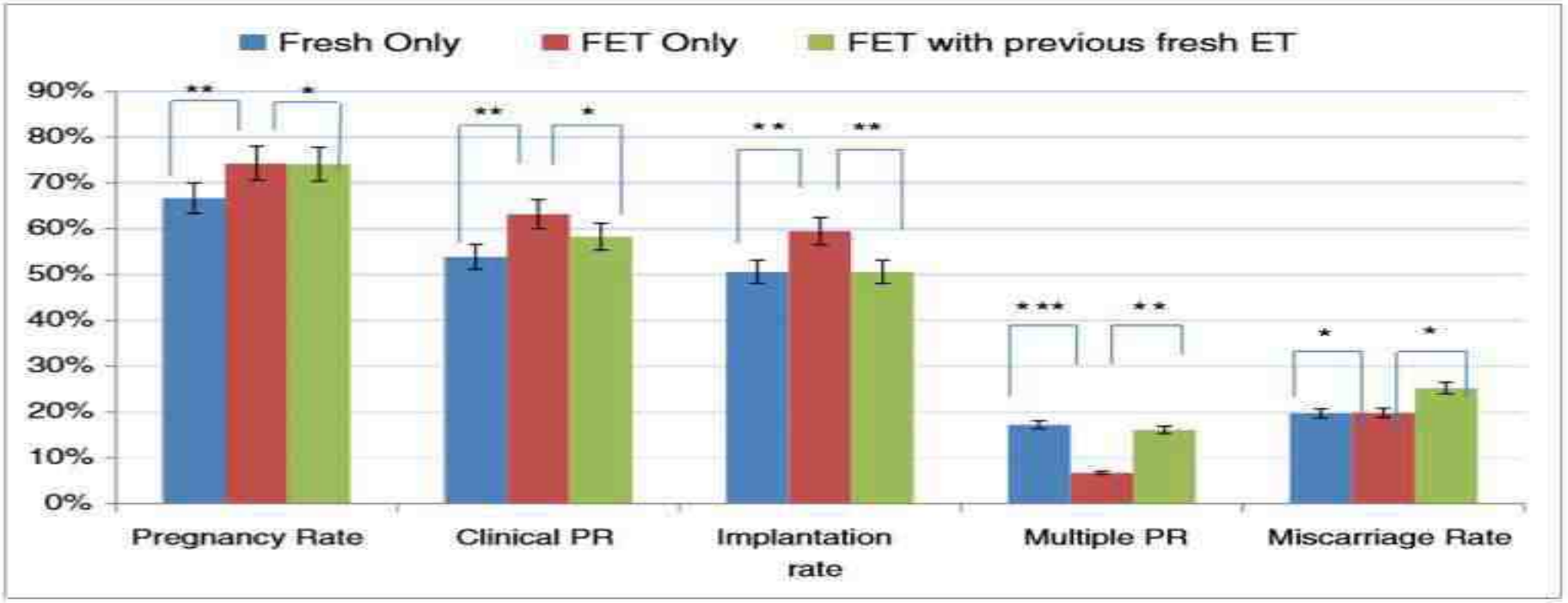
Jorge Rodriguez-Purata[1] · Joseph Lee[1] · Michael Whitehouse[1] · Marlena Duke[1] · Lawrence Grunfeld[1,2] · Benjamin Sandler[1,2] · Alan Copperman[1,2] · Tanmoy Mukherjee[1,2]

A total of 837 patients underwent 998 cycles and an embryo transfer

solely fresh (n=345)

solely frozen (n=514) transfer

139 underwent a fresh ET followed by a FET cycle.



Patients with embryos transferred only in a fresh cycle had statistically lower implantation and live birth rates than those transferred during FET

These findings suggest the transfer of the best available embryo under a synthetically prepared endometrium is more recommended that transferring fresh.

Advantages of FET cycles over fresh IVF/ET cycles

1. Freeze-all strategy offers an opportunity to control the implantation window.

2. FET cycles increase the number of biopsied embryos for patients utilizing PGS and increase the chance of single embryo transfer in subsequent cycles.

3. Decrease in multiple PRs.

4. IRs of “FET with a previous fresh ET” group were the same as those in the “Fresh Only” group (50.9 vs. 50.9 %), but significantly lower than “FET Only” group (50.9 vs.59.5%).

5. Elective embryo cryopreservation has been described as a potential prevention/risk-reducing approach for OHSS.

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human reproduction ORIGINAL ARTICLE *Embryology*

Closed blastocyst vitrification of biopsied embryos: evaluation of 100 consecutive warming cycles

L. Van Landuyt*, W. Verpoest, G. Verheyen, A. De Vos, H. Van de Velde, I. Liebaers, P. Devroey, and E. Van den Abbeel

The aim of this study to analyse the efficiency of the vitrification of biopsied embryos at the blastocyst stage using closed vitrification and storage.

Group 1 : vitrified blastocyst transfer without biopsy

Group 2 : fresh blastocyst transfer of biopsied embryos

The closed system vitrification is a feasible method for cryopreserving day 5 and day 6 blastocysts biopsied at the cleavage stage.

L.E.S. MİKROGEN
GENETİK HASTALIKLAR TANI MERKEZİ

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Kurumsal İlişkiler

Orhan DOĞAN

MSc. İlkiz DURUKAN

Muhasebe - Satınalma

Murat ŞİŞGİNOĞLU

Hesna Kalaycı

Sekreterya

Burcu DOĞAN

Zehra ÇATAL

Nazife ASLAN

Teknik Personel

Samet ASLAN

Gülten MUTLUER