Origin, Incidence and Outcomes:

Piecing Together the Patterns of Embryonic Mosaicism

PCRS 2024

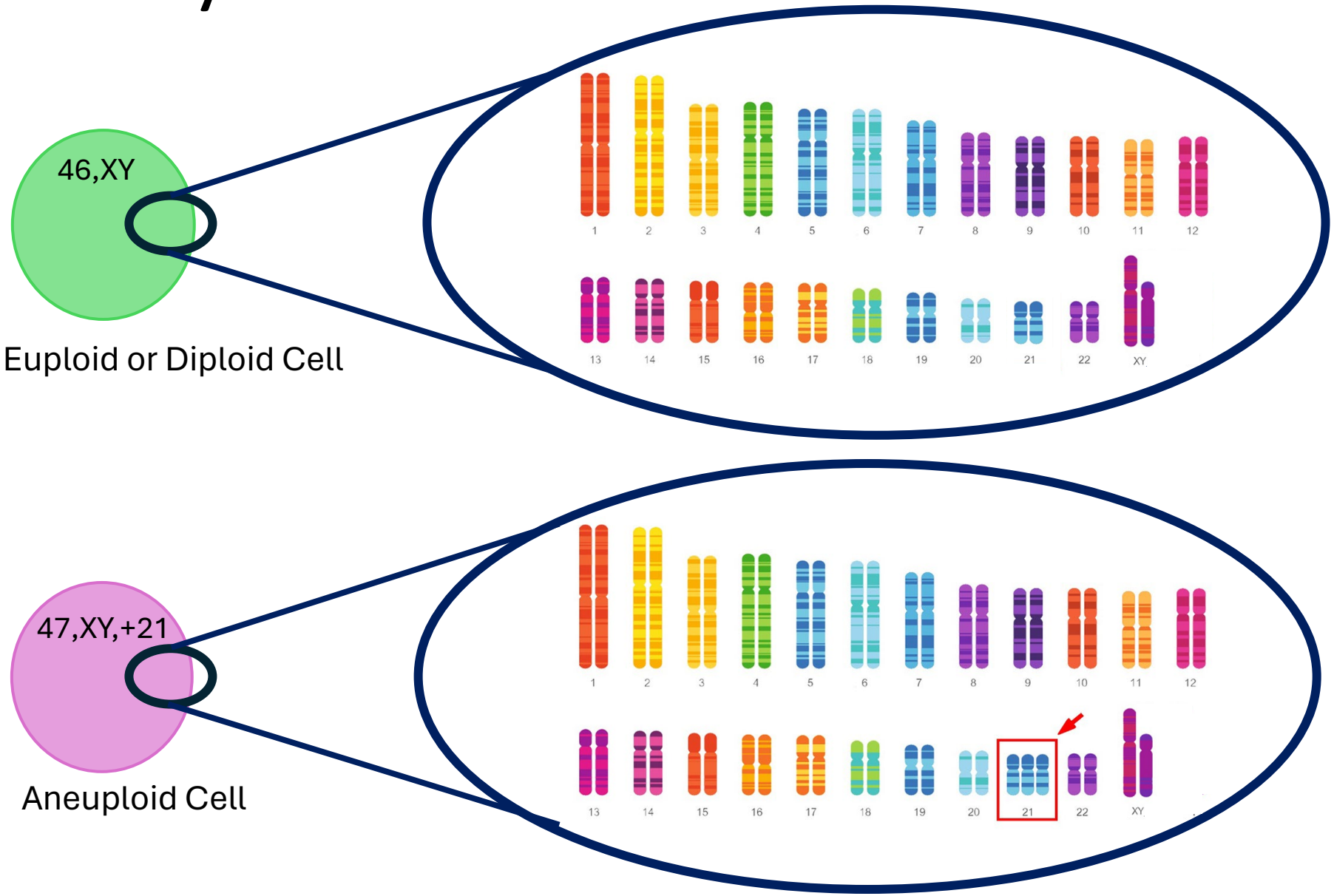
Andrea Victor, PhD

Nothing to disclose.

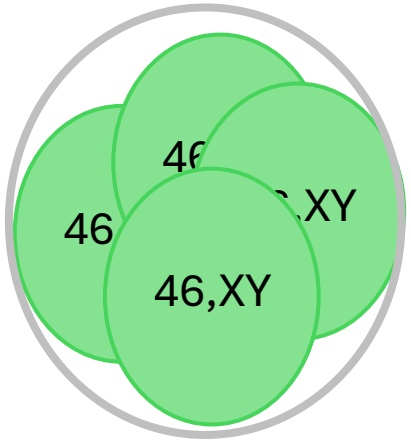
Learning Objectives

- Define the incidence of embryonic mosaicism.
- Review the cellular mechanisms by which embryonic mosaicism can arise
- Review outcomes of mosaic embryo transfers.

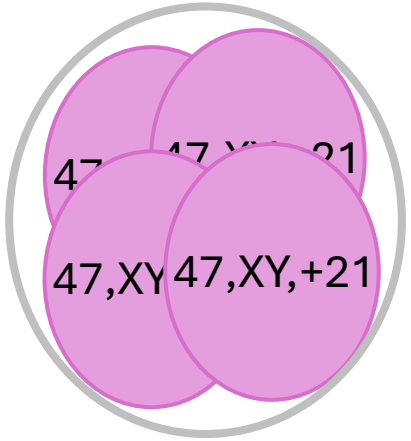
Cellular Ploidy



Embryo Ploidy

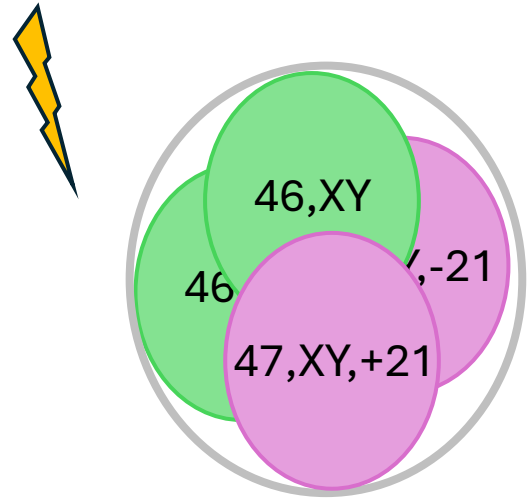


Euploid Embryo



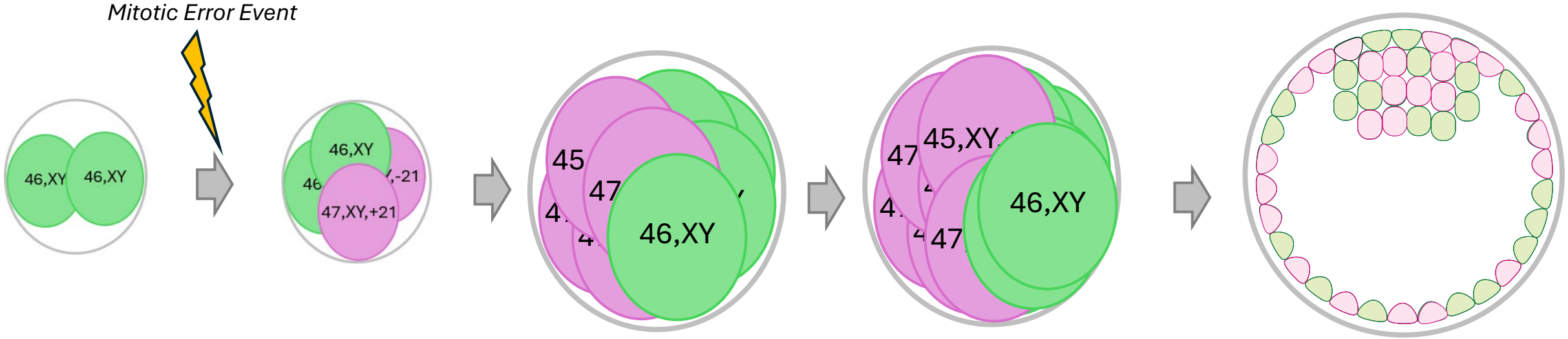
Aneuploid Embryo

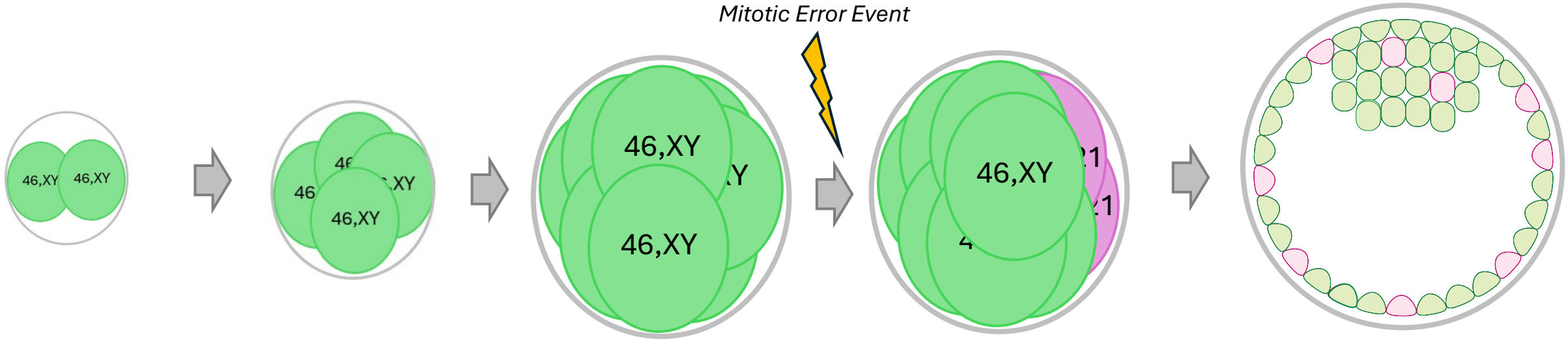
Embryo Ploidy: Mosaicism



Mosaic Embryo

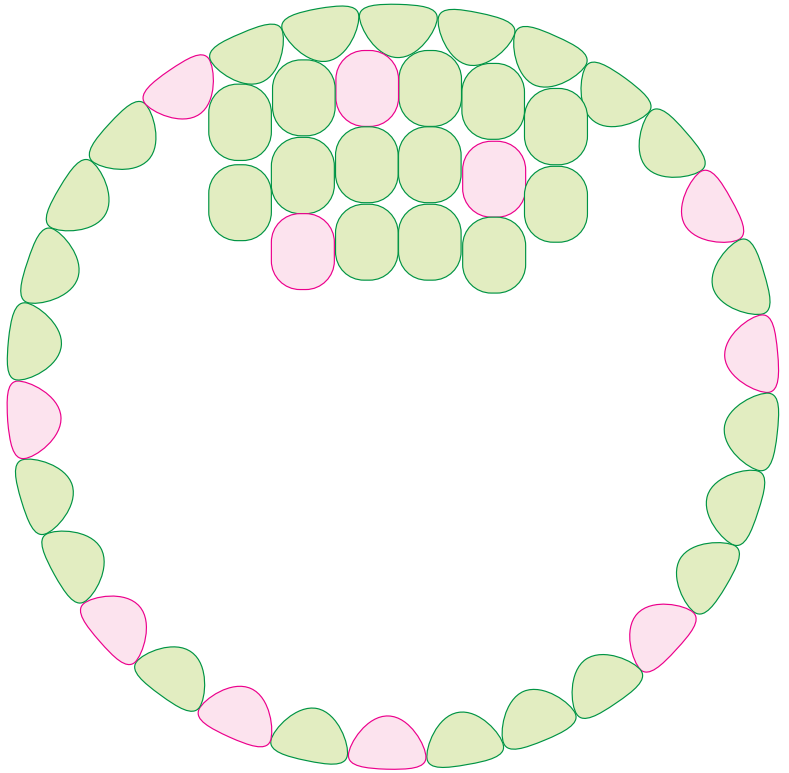
Embryo Ploidy: Mosaicism





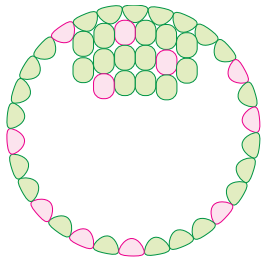
Overview

- Biological mechanisms of embryonic mosaicism
- Can mitotic errors be induced?
- Artifactual mosaic results
- Incidence of embryonic mosaicism
- Outcomes of mosaic embryo transfers



Embryonic Mosaicism: Biological Mechanisms

- First detected in human embryos by FISH
  - Griffin et al 1991
- Confirmed in cleavage and blastocyst embryos
- Many mechanisms that can cause a mitotic event and induce embryonic mosaicism

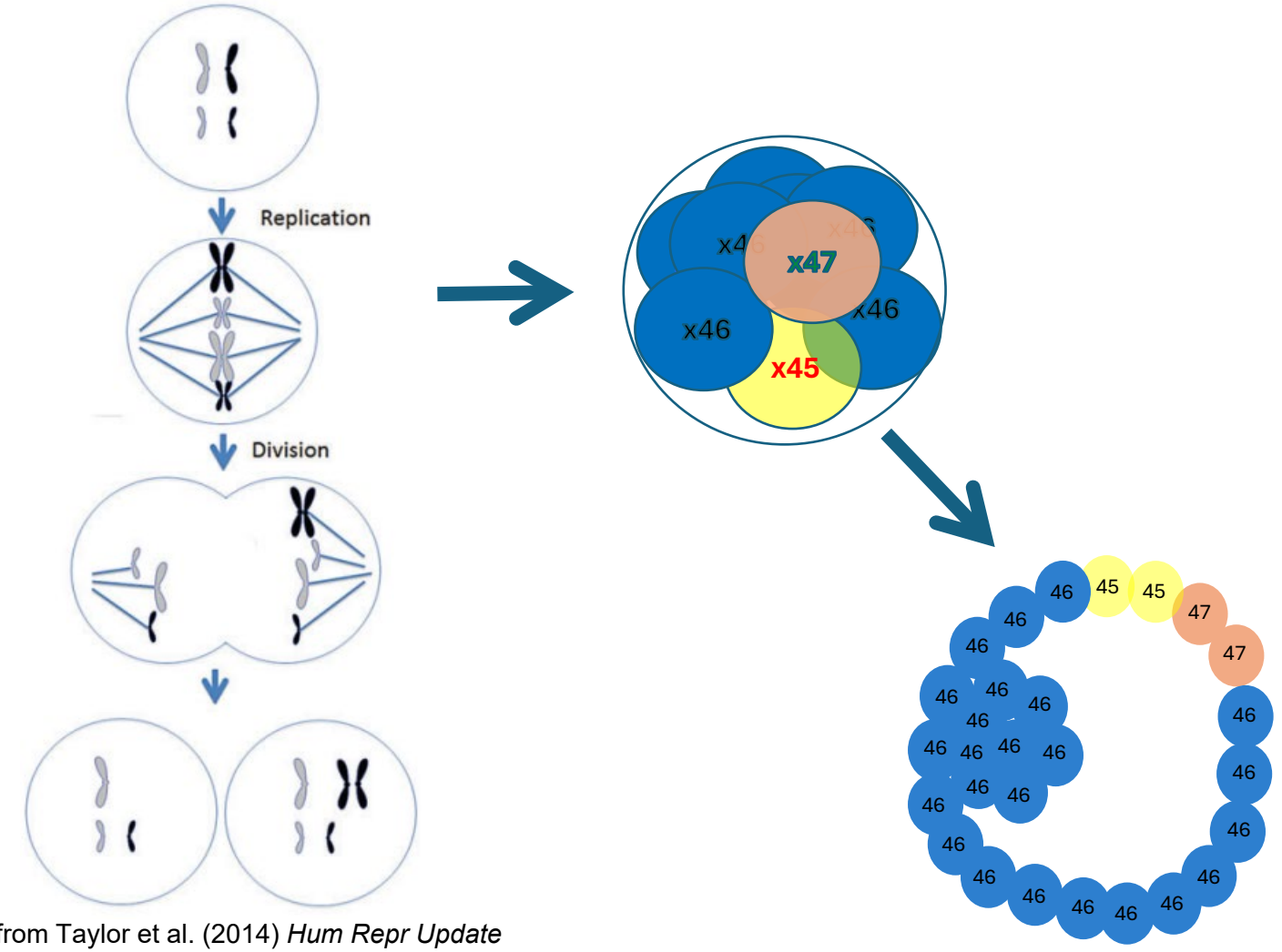


Biological Mechanisms:
How does mosaicism arise?

- Altered recombination pattern
- Anaphase lag
- Cell cycle control breakdown
- Centriole dysregulation
- Chaotic divisions
- Chromosome loss
- Chromosome gain
- Chromothripsis
- Cohesin depletion
- Cohesion exhaustion
- Embryo correction
- Endoreplication
- Insufficient crossover maturation
- Inter-chromosomal effect
- Mitotic non-disjunction
- Precocious sister chromatid/dyad separation
- Reverse segregation
- Trisomy rescue
- Weakened centromere cohesion
- Etc, etc, etc……

Biological Mechanisms:
How does mosaicism arise?

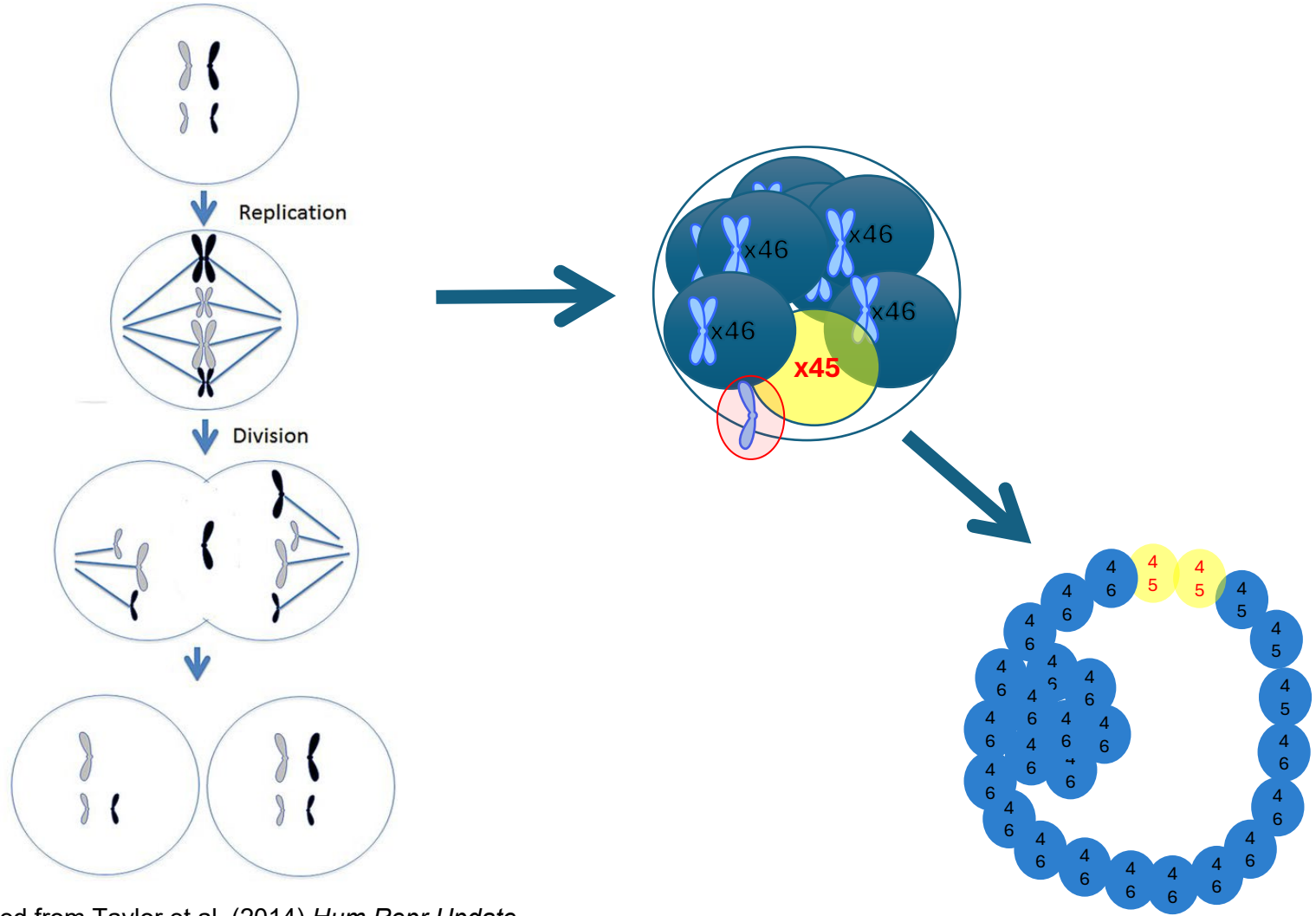
Mitotic Non-Disjunction



Adapted from Taylor et al. (2014) *Hum Repr Update*

Biological Mechanisms:
How does mosaicism arise?

Anaphase Lag



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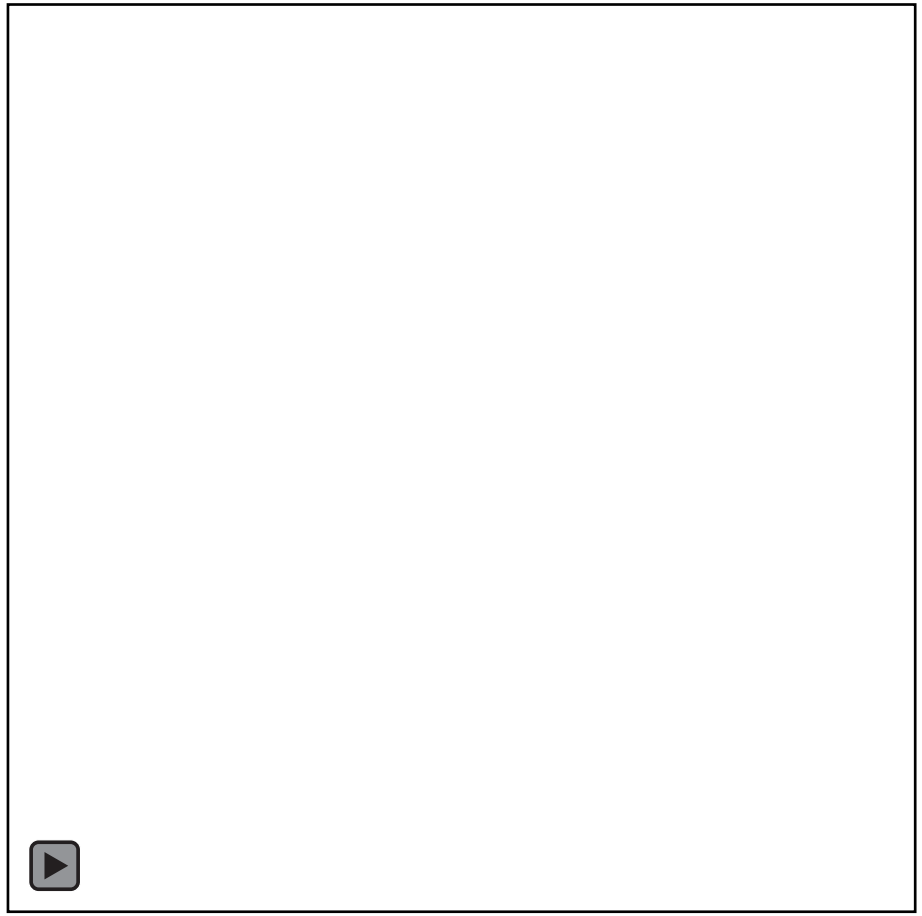
Biological Mechanisms:
How does mosaicism arise?

Anaphase Lag



Nicholson et al. (2015) *eLife*

Biological Mechanisms:
How does mosaicism arise?

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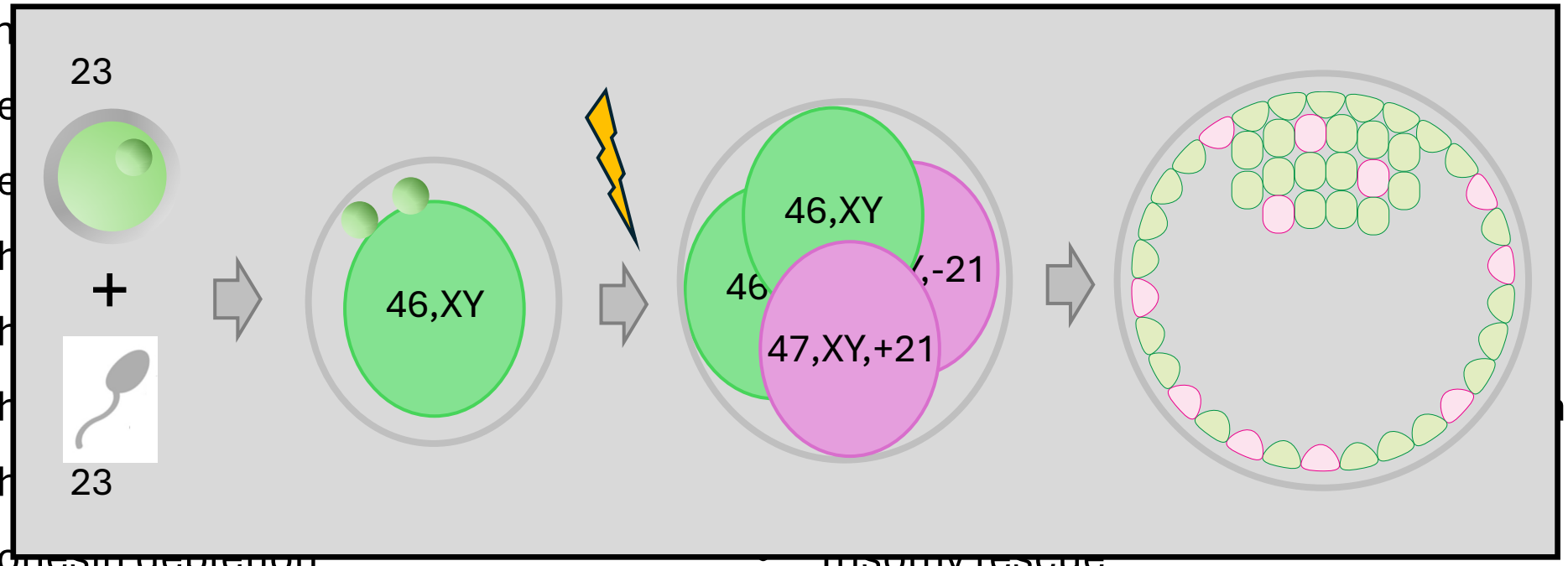


Biological Mechanisms:
How does mosaicism arise?

sciencemag.org **SCIENCE**

10 APRIL 2015 • VOL 348 ISSUE 6231

Common variants spanning *PLK4* are associated with mitotic-origin aneuploidy in human embryos

Rajiv C. McCoy[1], **Zachary Demko**[2], **Allison Ryan**[2], **Milena Banjevic**[2], **Matthew Hill**[2], **Styrmir Sigurjonsson**[2], **Matthew Rabinowitz**[2], **Hunter B. Fraser**[1], and **Dmitri A. Petrov**[1]

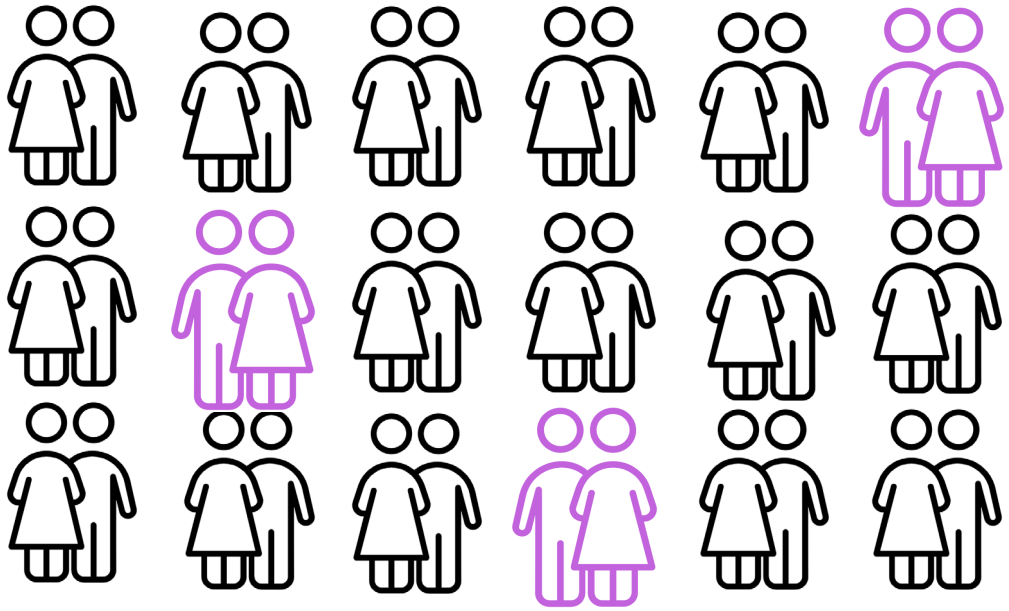
[1]Department of Biology, Stanford University, Stanford, California, USA

[2]Natera, Inc., San Carlos, California, USA

Biological Mechanisms:

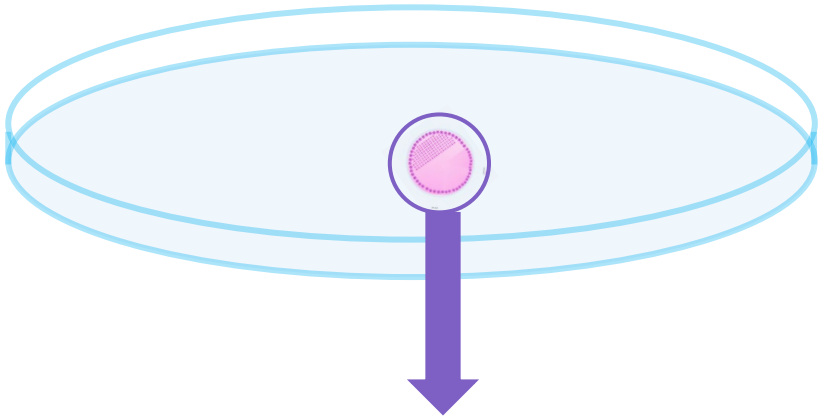
How does mosaicism arise?

Endogenous



Page, Fertility and Sterility 1989

Exogenous



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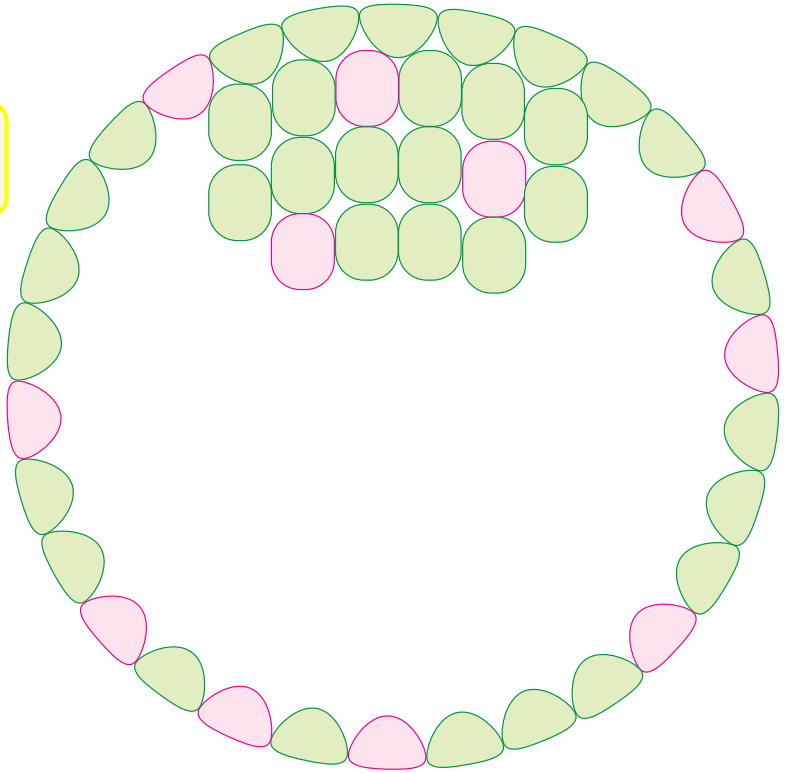
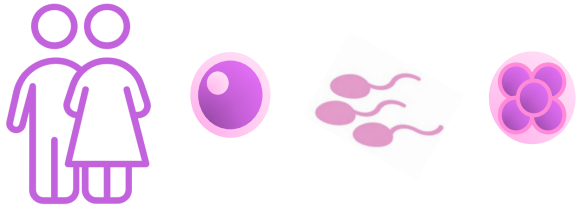


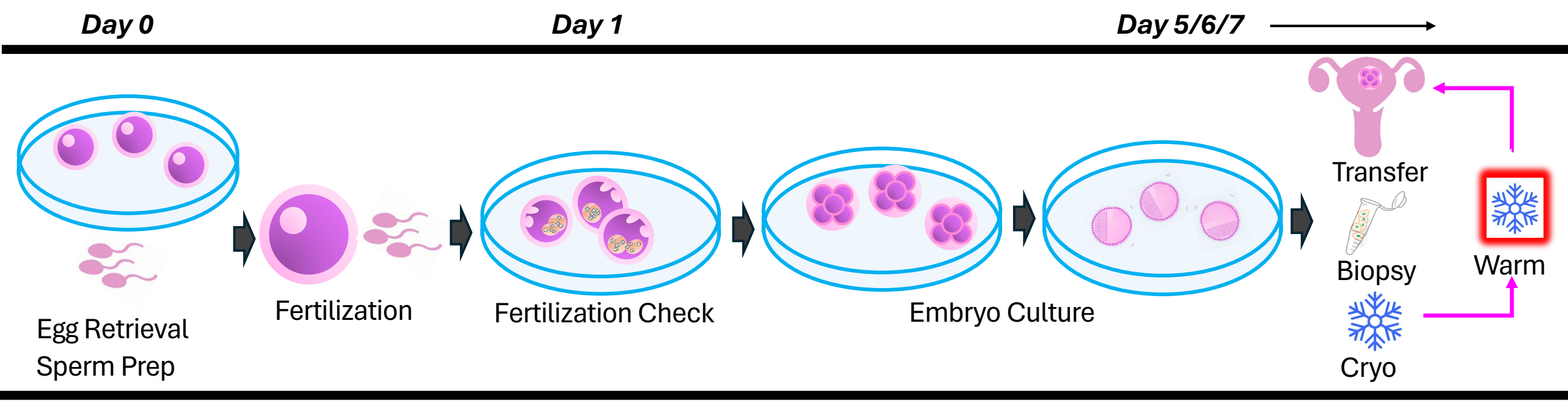
Mosaicism: What causes mitotic errors?

Endogenous

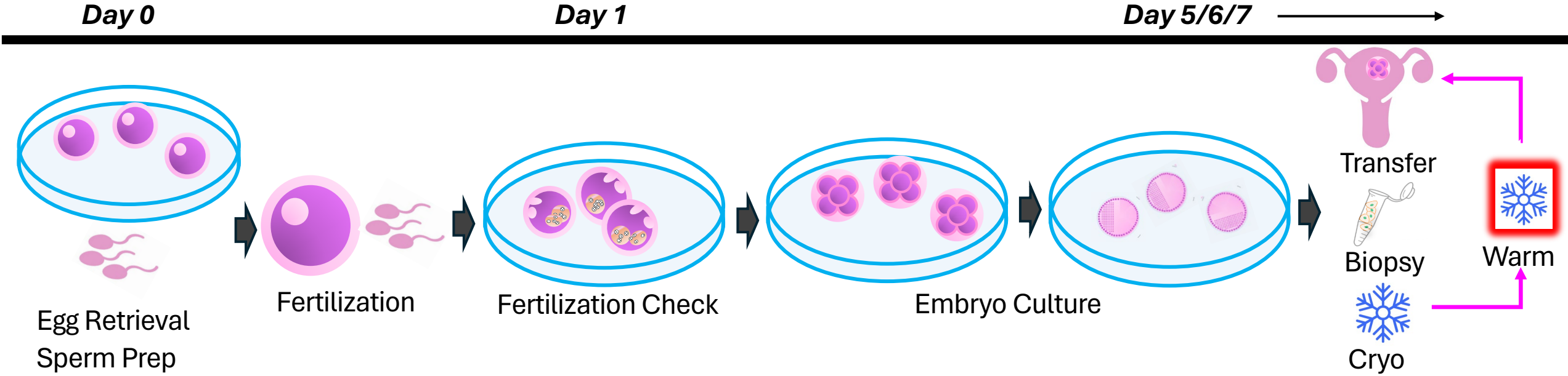


Exogenous

Mosaicism: What causes mitotic errors?



Mosaicism: What causes mitotic errors?



Retrieval Technique
Fresh/Frozen sperm
Sperm prep (microfluidics/gradient)

Journal of Assisted Reproduction and Genetics
https://doi.org/10.1007/s10815-018-1347-6

GENETICS

Minimizing mosaicism: assessing the impact of fertilization method on rate of mosaicism after next-generation sequencing (NGS) preimplantation genetic testing for aneuploidy (PGT-A)

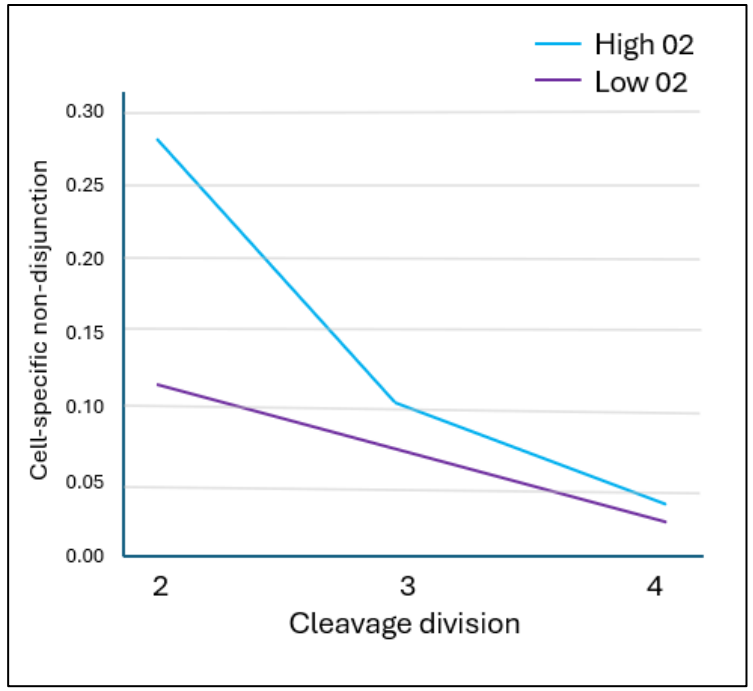
Katherine L. Palmerola[1,2] · Sally F. Vitez[2] · Selma Amrane[1,2] · Catha P. Fischer[3] · Eric J. Forman[1]

Received: 27 July 2018 / Accepted: 16 October 2018

ICSI cases resulted in fewer mosaic embryos than insem cases.

Primary outcome			
NGS PGT-A diagnosis	Conventional insemination (251 blastocysts)	ICSI (724 blastocysts)	*p* value*
Euploid	70 (27.9)	217 (30.0)	0.59
Aneuploid	104 (45.4)	312 (43.1)	0.70
Mosaic	65 (25.9)	151 (20.9)	0.12
No result	11 (4.4)	45 (6.2)	0.36
Secondary outcomes			
Mosaic subtypes	Conventional insemination (65 blastocysts)	ICSI (151 blastocysts)	*p* value*
Simple	35 (53.8)	106 (70.2)	0.03
Double	15 (23.1)	25 (16.6)	0.35
Complex	15 (23.1)	20 (13.2)	0.11
Aneuploid subtypes	Conventional insemination (104 blastocysts)	ICSI (312 blastocysts)	*p* value*
Simple	49 (47.1)	125 (40.1)	0.25
Double	13 (12.5)	46 (14.7)	0.69

Mosaicism: What causes mitotic errors?



Adapted from Bean et al, Human Reproduction 2002

Human Reproduction Vol.17, No.9 pp. 2362–2367, 2002

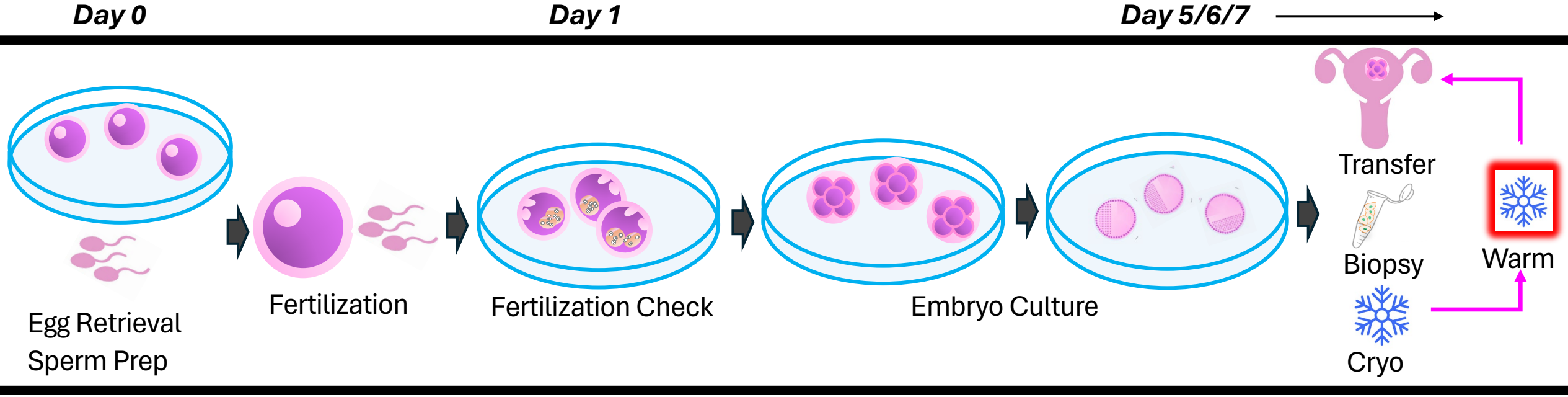
Fertilization *in vitro* increases non-disjunction during early cleavage divisions in a mouse model system

Christopher J.Bean, Terry J.Hassold, LuAnn Judis and Patricia A.Hunt[1]

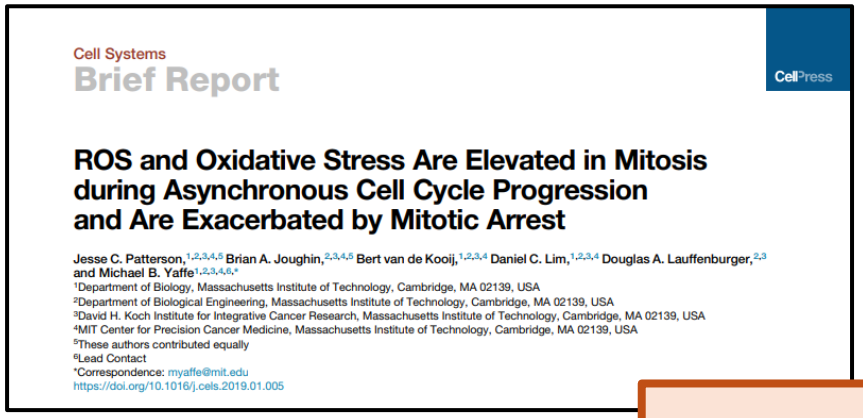
Department of Genetics and the Center for Human Genetics, Case Western Reserve University and University Hospitals of Cleveland, Cleveland, OH, USA

[1]To whom correspondence should be addressed at: Department of Genetics, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106, USA. E-mail: pah13@po.cwru.edu

Mosaicism: What causes mitotic errors?



Mosaicism: What causes mitotic errors?



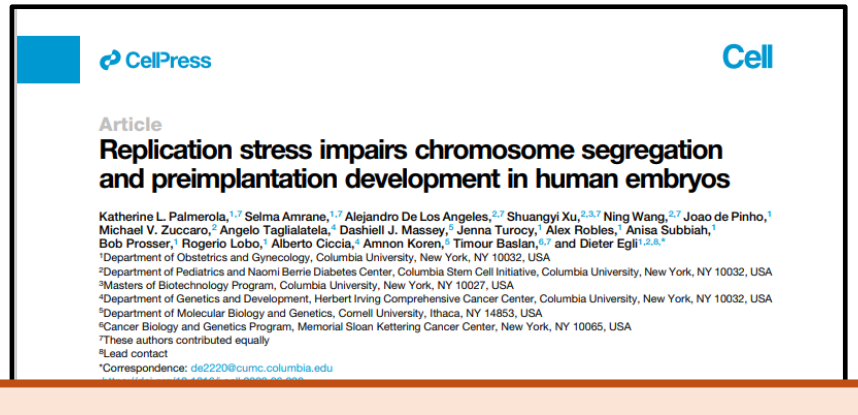
Cell Systems

Brief Report

ROS and Oxidative Stress Are Elevated in Mitosis during Asynchronous Cell Cycle Progression and Are Exacerbated by Mitotic Arrest

Jesse C. Patterson,[1,2,3,4,5] Brian A. Joughin,[2,3,4,5] Bert van de Kooij,[1,2,3,4] Daniel C. Lim,[1,2,3,4] Douglas A. Lauffenburger,[2,3] and Michael B. Yaffe[1,2,3,4,6,*]

[1]Department of Biology, Massachusetts Institute of Technology, Cambridge, MA 02139, USA
[2]Department of Biological Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA
[3]David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology, Cambridge, MA 02139, USA
[4]MIT Center for Precision Cancer Medicine, Massachusetts Institute of Technology, Cambridge, MA 02139, USA
[5]These authors contributed equally
[6]Lead Contact
*Correspondence: myaffe@mit.edu
https://doi.org/10.1016/j.cels.2019.01.005



CellPress

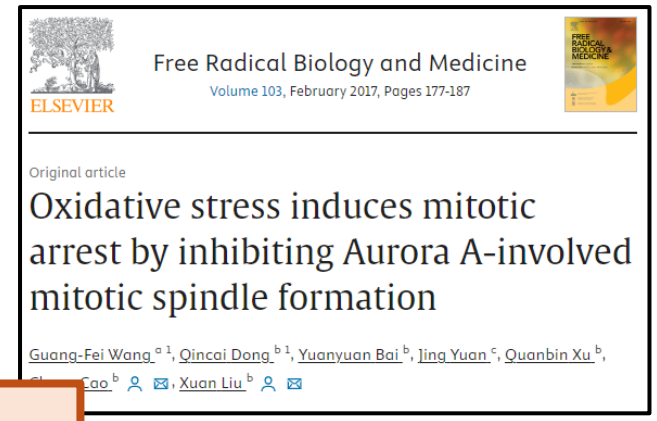
Cell

Article

Replication stress impairs chromosome segregation and preimplantation development in human embryos

Katherine L. Palmerola,[1,7] Selma Amrane,[1,7] Alejandro De Los Angeles,[2,7] Shuangyi Xu,[2,3,7] Ning Wang,[2,7] Joao de Pinho,[1] Michael V. Zuccaro,[2] Angelo Taglialatela,[4] Dashiell J. Massey,[5] Jenna Turocy,[1] Alex Robles,[1] Anisa Subbiah,[1] Bob Prosser,[1] Rogerio Lobo,[1] Alberto Ciccia,[4] Amnon Koren,[6] Timour Baslan,[6,7] and Dieter Egli[1,2,8,*]

[1]Department of Obstetrics and Gynecology, Columbia University, New York, NY 10032, USA
[2]Department of Pediatrics and Naomi Berrie Diabetes Center, Columbia Stem Cell Initiative, Columbia University, New York, NY 10032, USA
[3]Masters of Biotechnology Program, Columbia University, New York, NY 10027, USA
[4]Department of Genetics and Development, Herbert Irving Comprehensive Cancer Center, Columbia University, New York, NY 10032, USA
[5]Department of Molecular Biology and Genetics, Cornell University, Ithaca, NY 14853, USA
[6]Cancer Biology and Genetics Program, Memorial Sloan Kettering Cancer Center, New York, NY 10065, USA
[7]These authors contributed equally
[8]Lead contact
*Correspondence: de2220@cumc.columbia.edu



ELSEVIER

Free Radical Biology and Medicine

Volume 103, February 2017, Pages 177-187

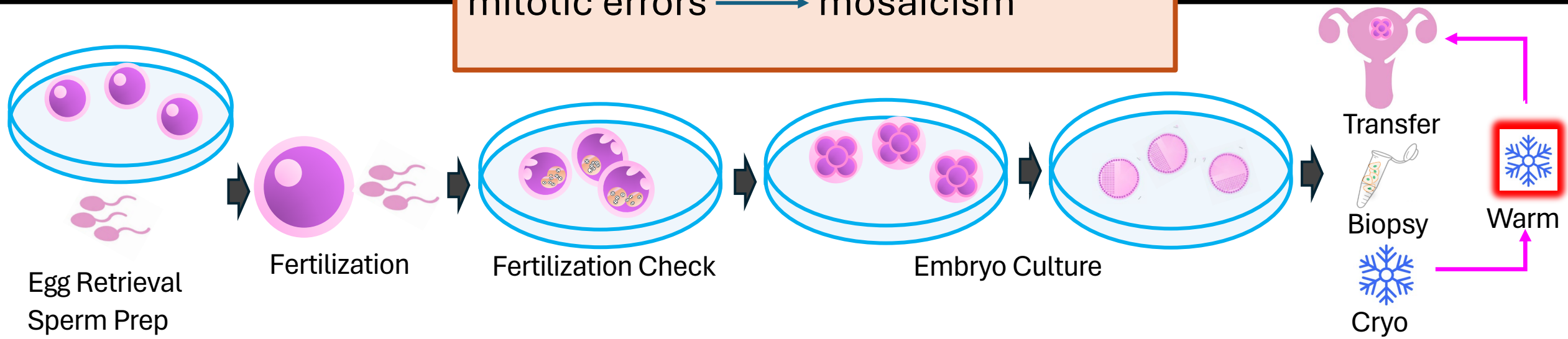
Original article

Oxidative stress induces mitotic arrest by inhibiting Aurora A-involved mitotic spindle formation

Guang-Fei Wang [a 1], Qincai Dong [b 1], Yuanyuan Bai [b], Jing Yuan [c], Quanbin Xu [b], [illegible] Cao [b], Xuan Liu [b]

Cellular stress can contribute to mitotic errors ⟶ mosaicism

Day 0 ***5/6/7*** ⟶



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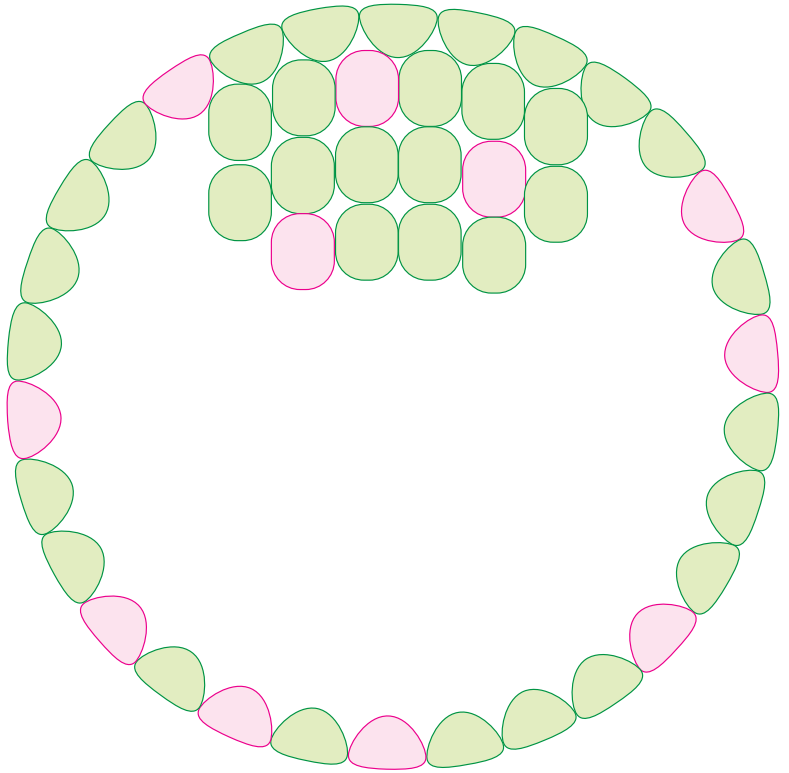
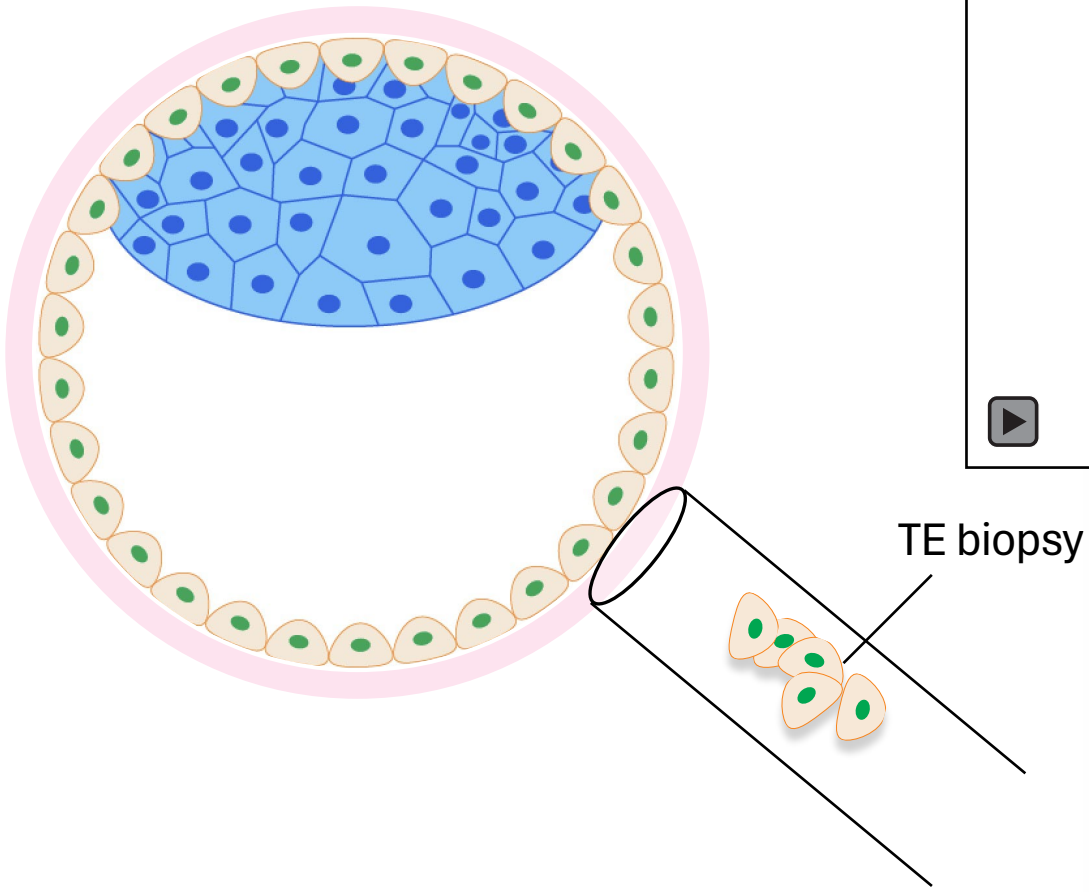


Identifying Mosaic Embryos:

Artifactual mosaic results



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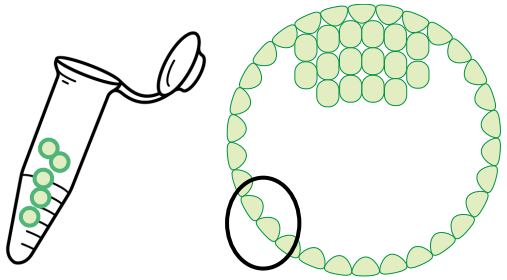
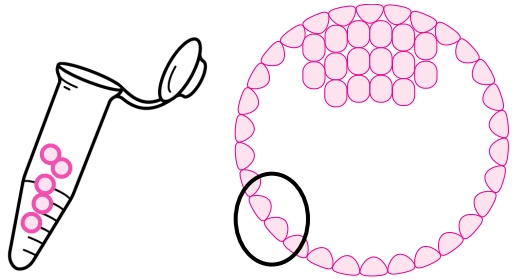
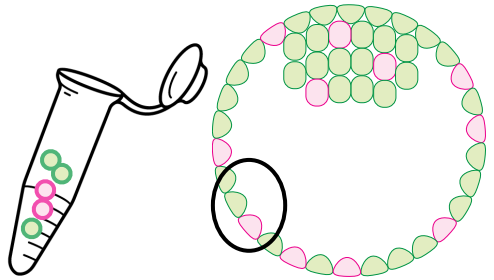


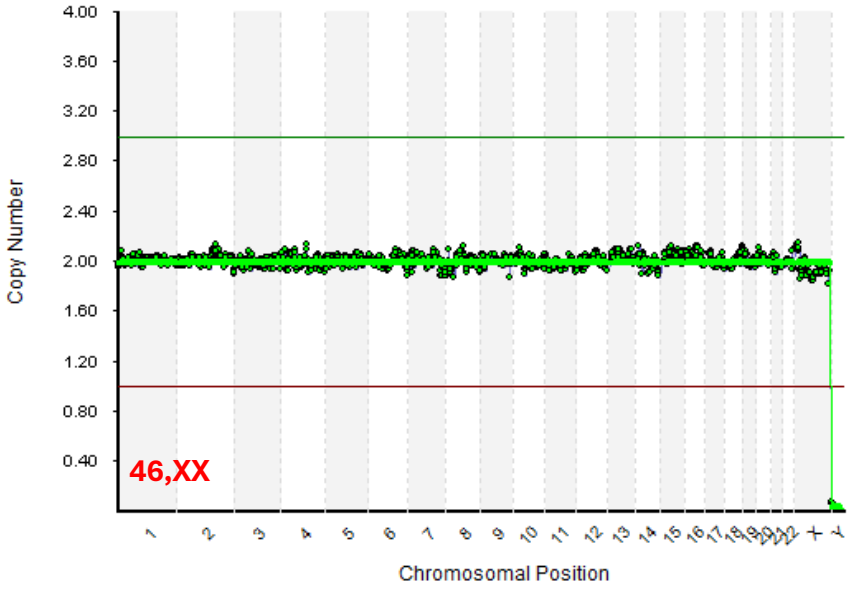
Euploid

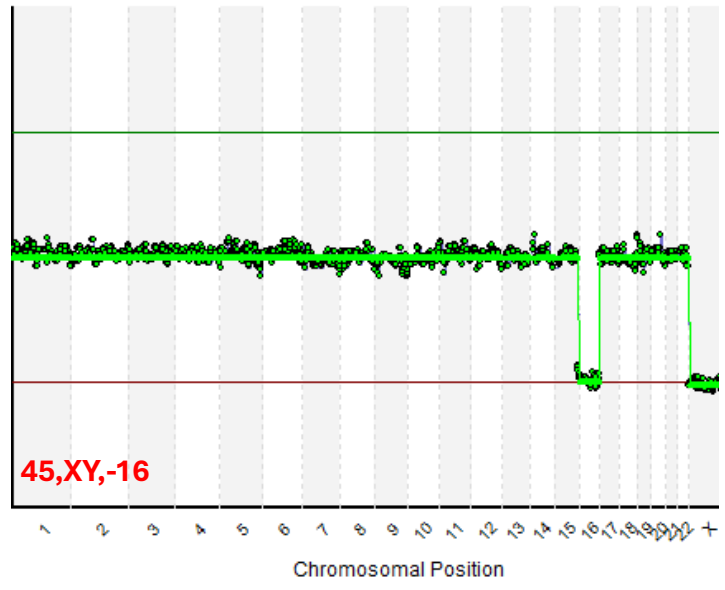


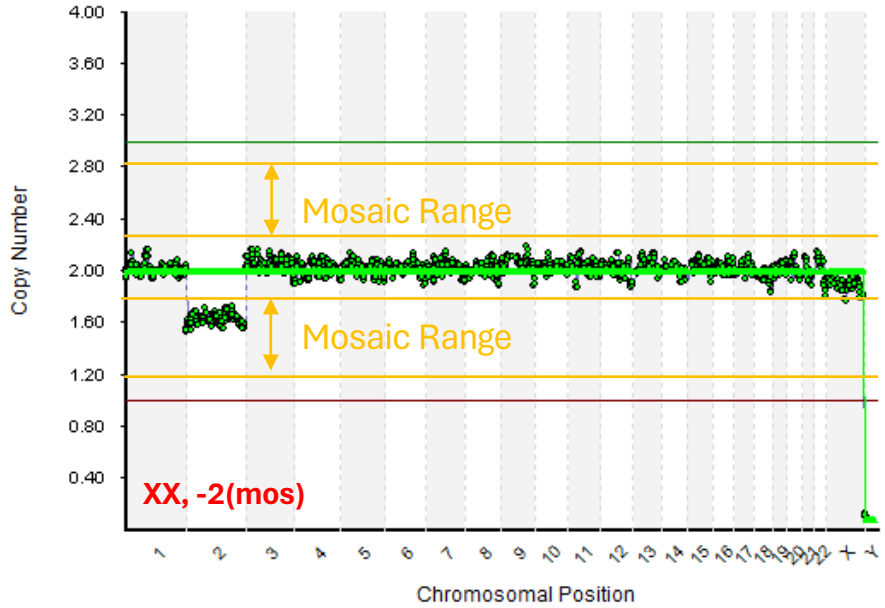
Aneuploid



Mosaic







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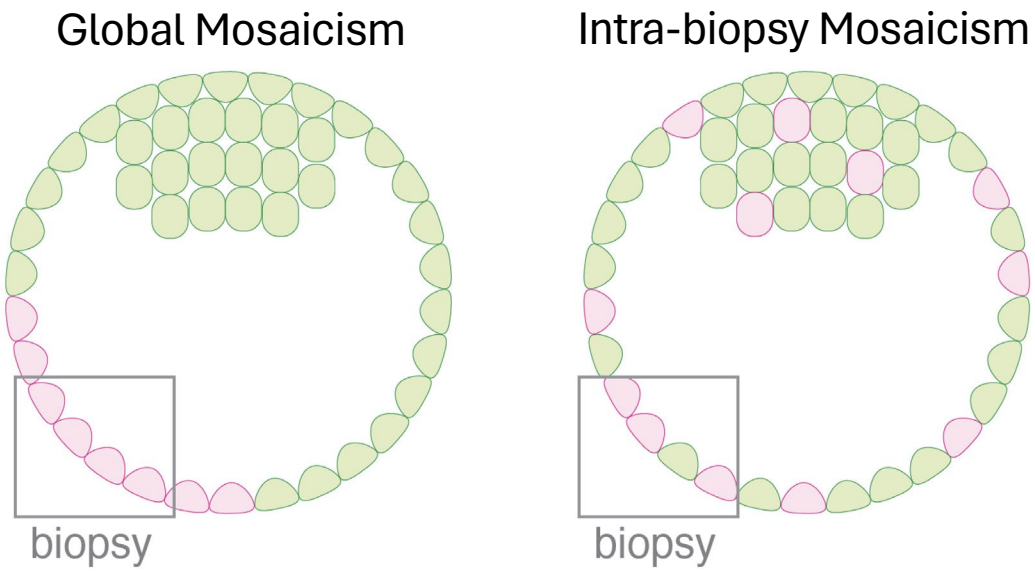

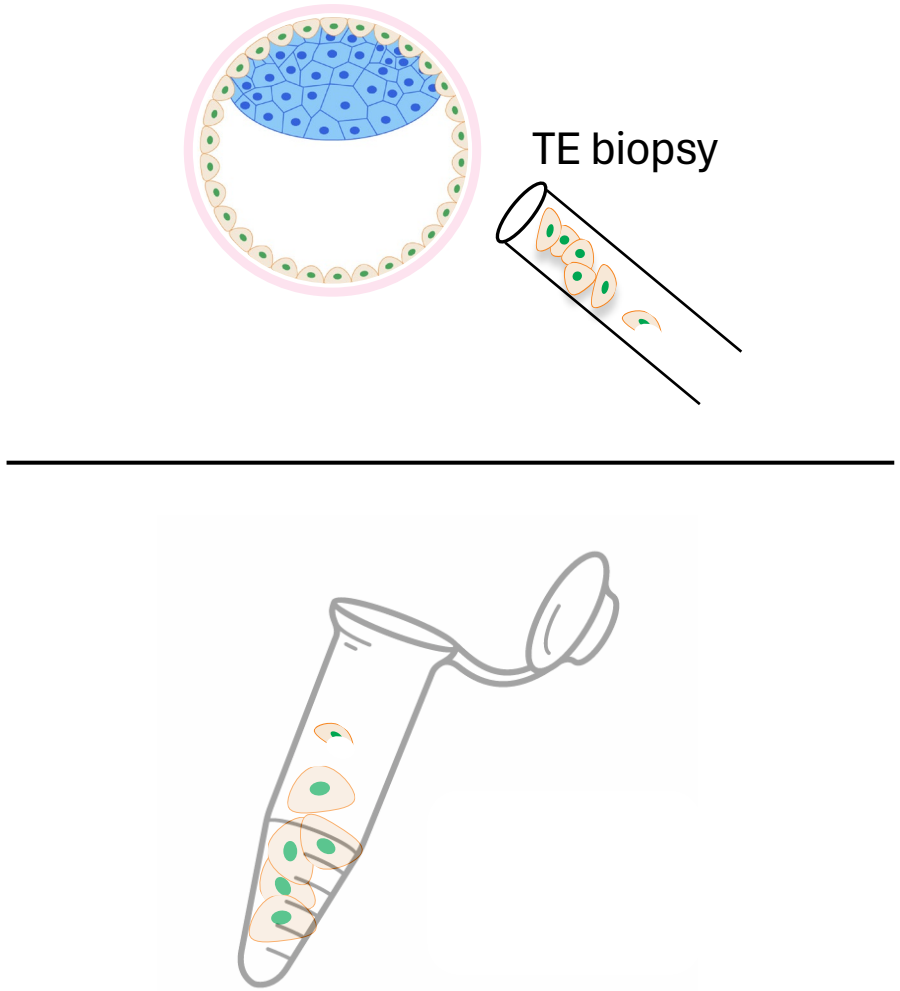

Identifying Mosaic Embryos:

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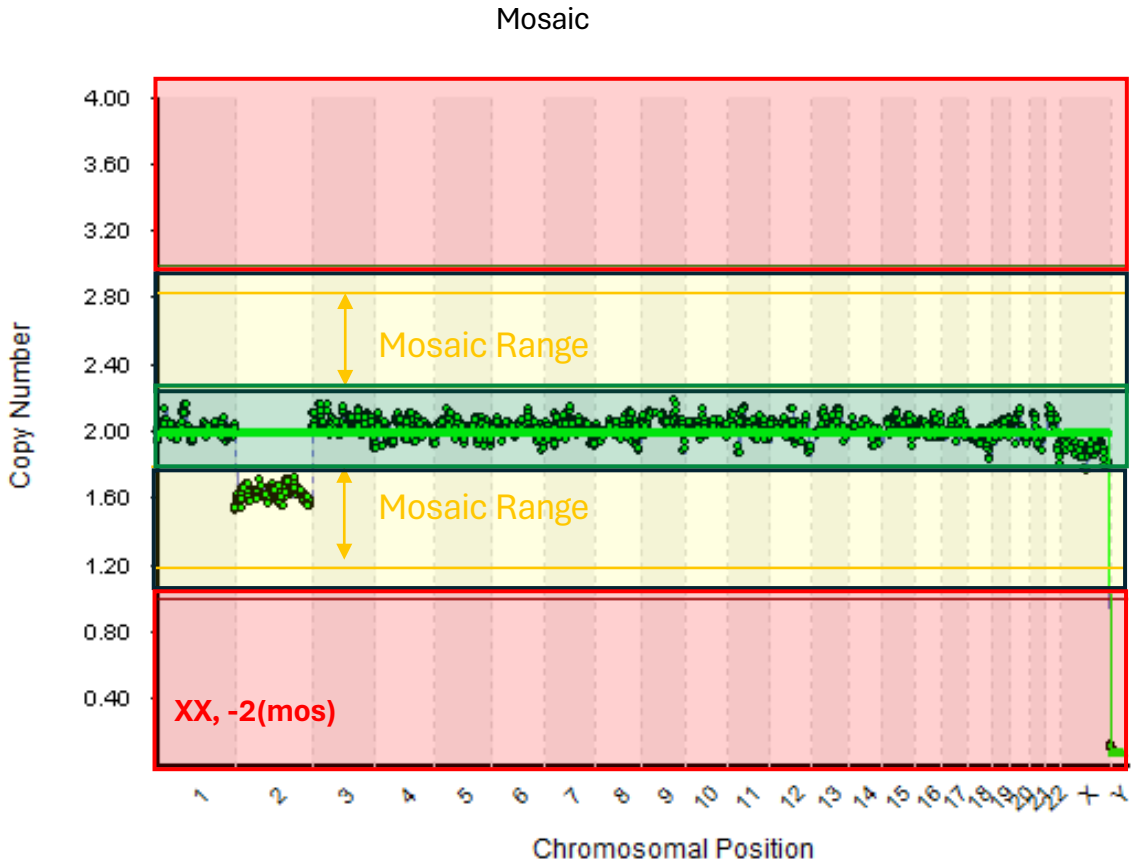


Euploid
Mosaic
Aneuploid

Identifying Mosaic Embryos:

Artifactual mosaic results

Human Reproduction Open, pp. 1–18, 2022
https://doi.org/10.1093/hropen/hoac044

human reproduction open

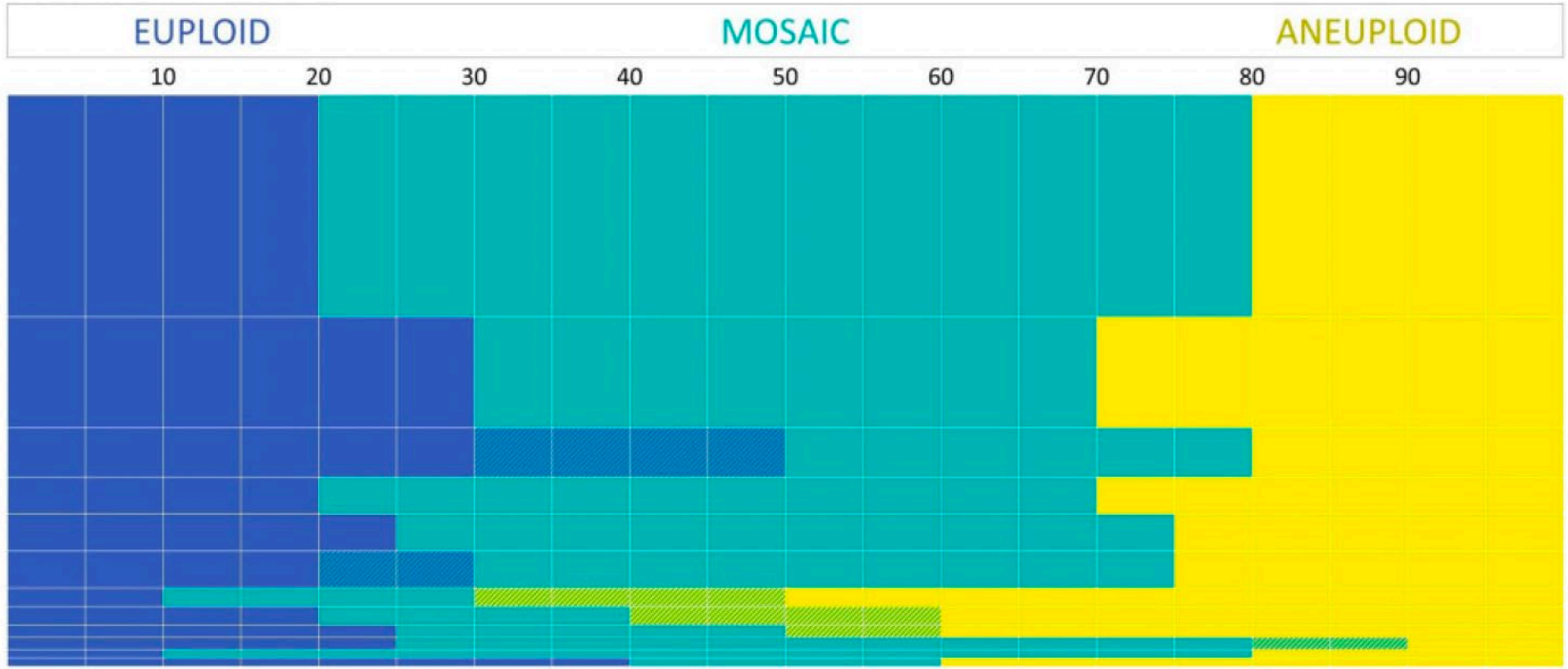
ESHRE PAGES

ESHRE survey results and good practice recommendations on managing chromosomal mosaicism†

ESHRE Working Group on Chromosomal Mosaicism, Martine De Rycke [1,*], Antonio Capalbo[2], Edith Coonen[3,4], Giovanni Coticchio [5], Francesco Fiorentino [6], Veerle Goossens [7], Saria Mcheik [7], Carmen Rubio[8], Karen Sermon [9], Ioannis Sfontouris [10], Claudia Spits [9], Joris Robert Vermeesch [11], Nathalie Vermeulen [7], Dagan Wells[12,13], Filippo Zambelli,[14] and Georgia Kakourou[15]

[1]Centre for Medical Genetics, UZ Brussel, Reproduction and Genetics, Vrije Universiteit Brussel (VUB), Brussels, Belgium [2]JUNO Genetics, Rome, Italy [3]Departments of Clinical Genetics and Reproductive Medicine, Maastricht University Medical Centre, Maastricht The Netherlands [4]GROW School for Oncology and Developmental Biology, Maastricht University Medical Centre, Maastricht, The Netherlands [5]9.baby, GeneraLife IVF, Bologna, Italy [6]Rome, Italy [7]ESHRE Central Office, Strombeek-Bever, Belgium [8]PGT-A Research Igenomix, Valencia, Spain [9]Research Group Reproduction and Genetics, Vrije Universiteit Brussel, Brussels, Belgium [10]Hygeia IVF Embryogenesis, Athens, Greece [11]Laboratory for Cytogenetics and Genome Research, Department of Human Genetics, KU Leuven Leuven, Belgium [12]Nuffield Department of Women's & Reproductive Health, John Radcliffe Hospital, University of Oxford, Oxford, UK [13]Juno Genetics, Oxford, UK [14]Eugin Group, Barcelona, Spain [15]Laboratory of Medical Genetics, National & Kapodistrian University o Athens, Choremio Research Laboratory, "Aghia Sophia" Children's Hospital, 11527 Athens, Greece

Range of mosaicism (% abnormal cells) considered diagnostically indicative of an aneuploid, euploid or mosaic embryo.



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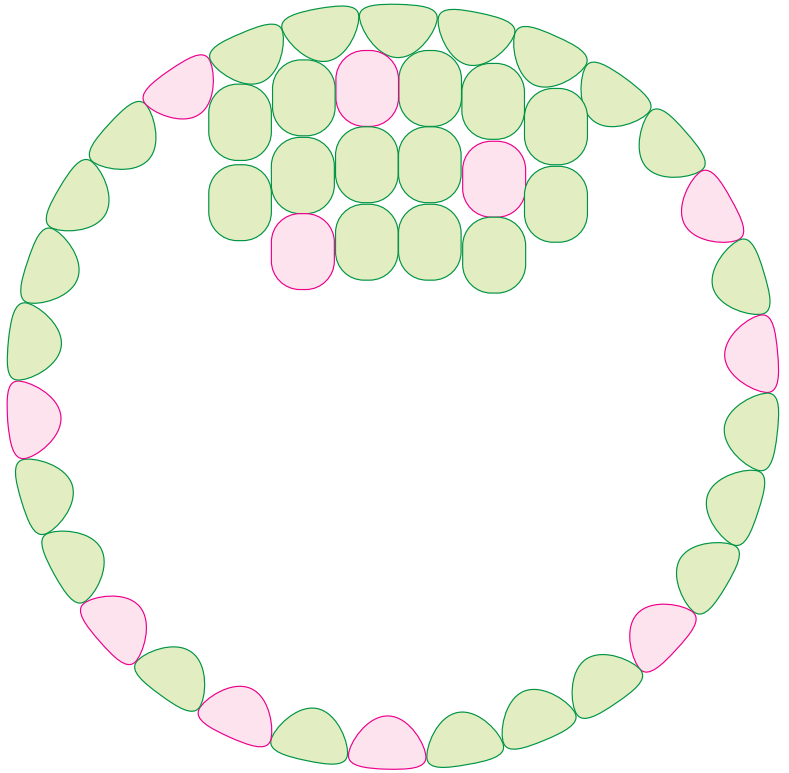
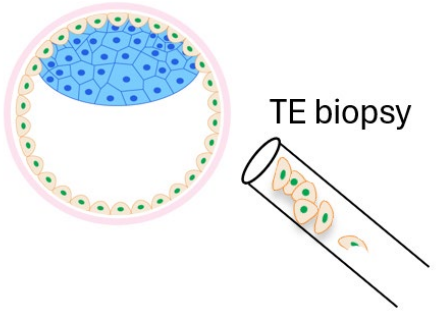


Incidence of Embryonic Mosaicism:

Clinical mosaicism rates by Biopsy and PGT-A



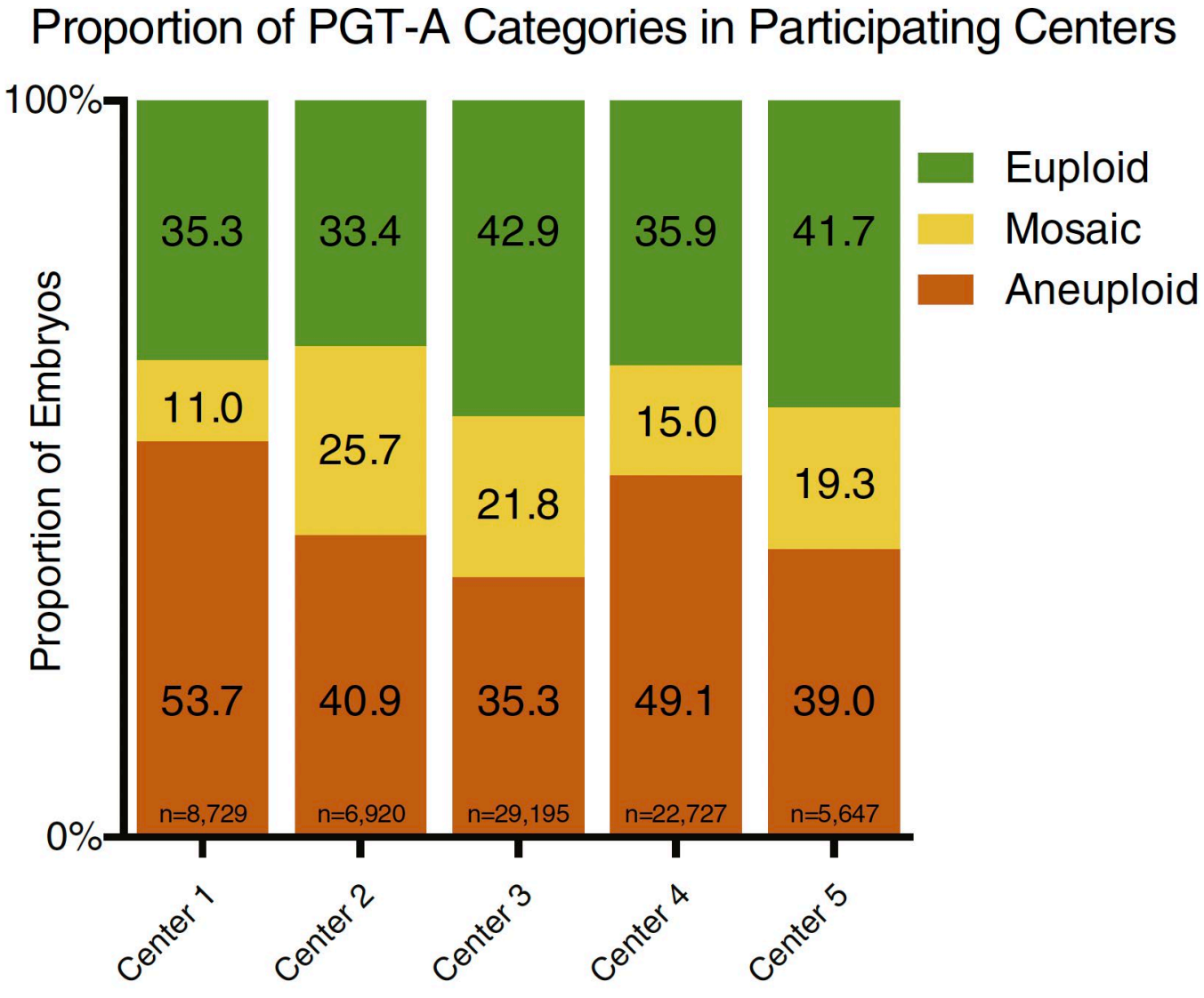
ORIGINAL ARTICLES: ASSISTED REPRODUCTION

Check for updates

Using outcome data from one thousand mosaic embryo transfers to formulate an embryo ranking system for clinical use

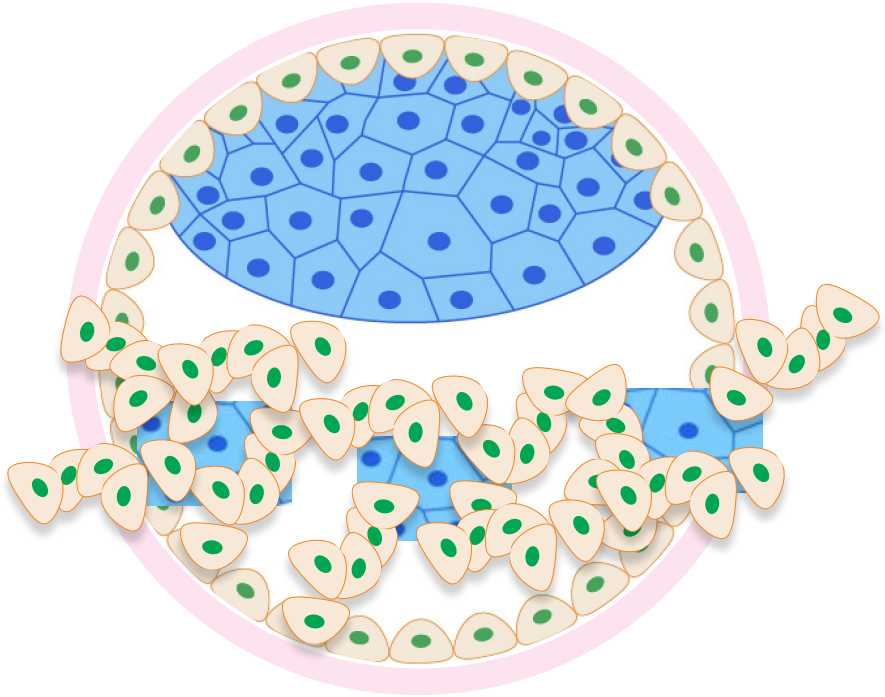
Manuel Viotti, Ph.D.,[a,b] Andrea R. Victor, M.S.,[a] Frank L. Barnes, Ph.D.,[a,b] Christo G. Zouves, M.D.,[a,b] Andria G. Besser, M.S.,[c] James A. Grifo, M.D., Ph.D.,[c] En-Hui Cheng, Ph.D.,[d] Maw-Sheng Lee, M.D., Ph.D.,[d,e] Jose A. Horcajadas, Ph.D.,[f] Laura Corti, M.Sc.,[g] Francesco Fiorentino, Ph.D.,[h] Francesca Spinella, Ph.D.,[h] Maria Giulia Minasi, M.Sc.,[i,j] Ermanno Greco, M.D.,[i,j] and Santiago Munné, Ph.D.[k]

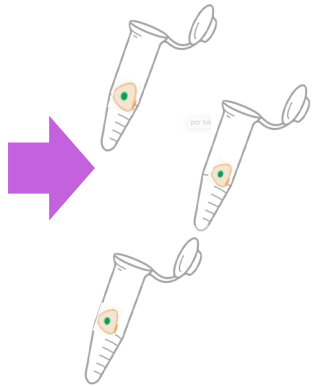
[a] Zouves Foundation for Reproductive Medicine, Foster City, California; [b] Zouves Fertility Center, Foster City, California; [c] New York University Langone Fertility Center, New York, New York; [d] Lee Women's Hospital, Taichung, Taiwan; [e] Chung Shan Medical University, Institute of Medicine, Taichung, Taiwan; [f] Overture Life, New York, New York; [g] IRCCS San Raffaele Scientific Institute, Milan, Italy; [h] Eurofins Genoma Group, Molecular Genetics Laboratories, Rome, Italy; [i] European Hospital, Centre For Reproductive Medicine, Rome, Italy; [j] Villa Mafalda, Center For Reproductive Medicine, Rome, Italy; [k] Cooper Genomics, Livingston, New Jersey

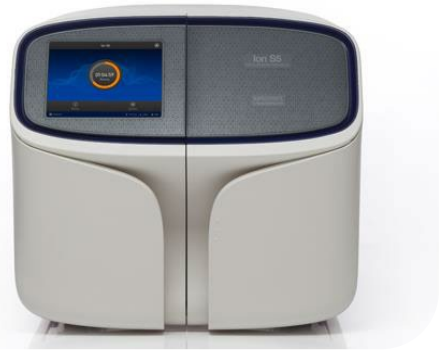


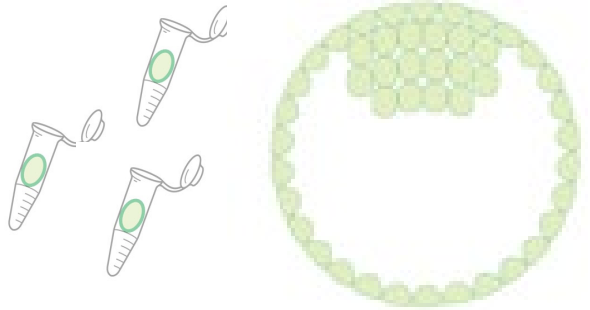
Incidence of Embryonic Mosaicism:

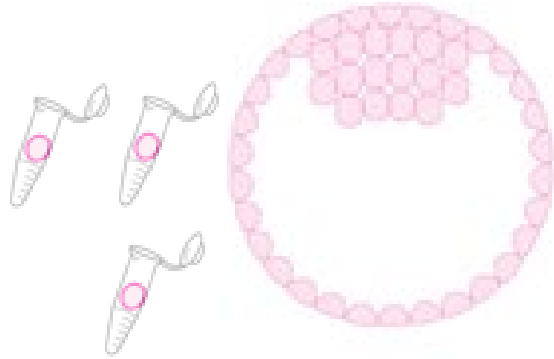
Whole embryo analysis

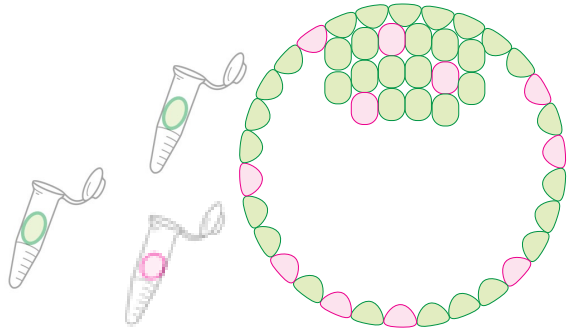




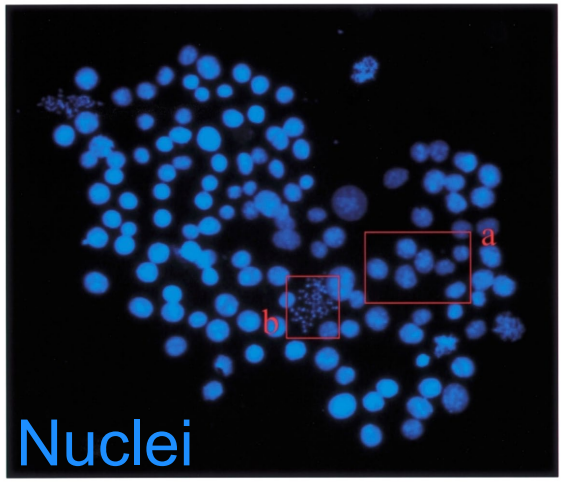








FISH Studies In Whole Embryos Identify Mosaicism



Sandalinas et al. 2001 Hum Rep

Reference	Number of chromosomes analysed	Number of embryos in sample	Method	Euploidy Rate (%)	Aneuploidy Rate (%)	Mosaicism Rate (%)	No result (%)	Re-analysis
Munne et al., 1998	6	67	Methanol: acetic acid, 3:1	29.9	23.9	46.2	n/a	Yes
Gianaroli et al., 1999	9	148	Methanol: acetic acid, 3:1	5.4	71.0	23.6	n/a	Yes
Magli et al., 2000	6	143	Methanol: acetic acid, 3:1	49	51.0	n/a	n/a	No
Sandalinas et al., 2001	9	215	Methanol: acetic acid, 3:1	14.9	47.0	38.1	n/a	Yes
Bienlanska et al., 2002	9	216	Tween 20	29.6	22.2	48.1	n/a	Yes
Ziebe et al., 2003	7	103	Tween 20	31.1	8.70	55.3	4.90	No
Abdelhadi et al., 2003	13	426	Methanol: acetic acid, 3:1	23.2	44.1	32.6	n/a	Yes
Munne et al., 2003	9	1071	Methanol: acetic acid, 3:1	29.7	45.4	25.0	n/a	Yes
Jones et al., 2004	7	411	n/a	34.8	62.5	n/a	2.70	No
Ying-hui et al., 2004	5	54	Tween 20	44.4	50.0	n/a	5.60	No
Baart et al., 2005	10	196	Tween 20	35.7	33.2	31.1	n/a	Yes
Li et al., 2005	5	660	Tween 20	55.6	42.6	n/a	1.80	Yes
Cooper et al., 2006	8	51	Methanol: acetic acid, 3:1	31.4	33.3	35.3	8.10	Yes
Mantzouratou et al., 2007	6	354	Tween 20	0.28	5.37	94.9	9.00	Yes
DeUgarte et al., 2008	5	241	Tween 20	24.5	68.0	7.50	n/a	Yes
Hanson et al., 2009	7	149	Tween 20	4.00	65.8	30.2	n/a	Yes
Alegretti et al., 2009	9	75	n/a	30.7	69.3	n/a	n/a	No
Barbash-Hazan et al., 2009	8	83	Tween 20	0.00	79.5	18.1	2.40	Yes
Mir et al., 2010	9	2477	Methanol: acetic acid, 3:1	42.7	56.8	0.60	n/a	Yes
Ebrahimian et al., 2020	8	68	Methanol: acetic acid, 3:1	67.6	17.7	14.7	n/a	Yes

adapted from Darren Griffin and Lauren Kelly

Incidence of Embryonic Mosaicism:

Whole embryo analysis

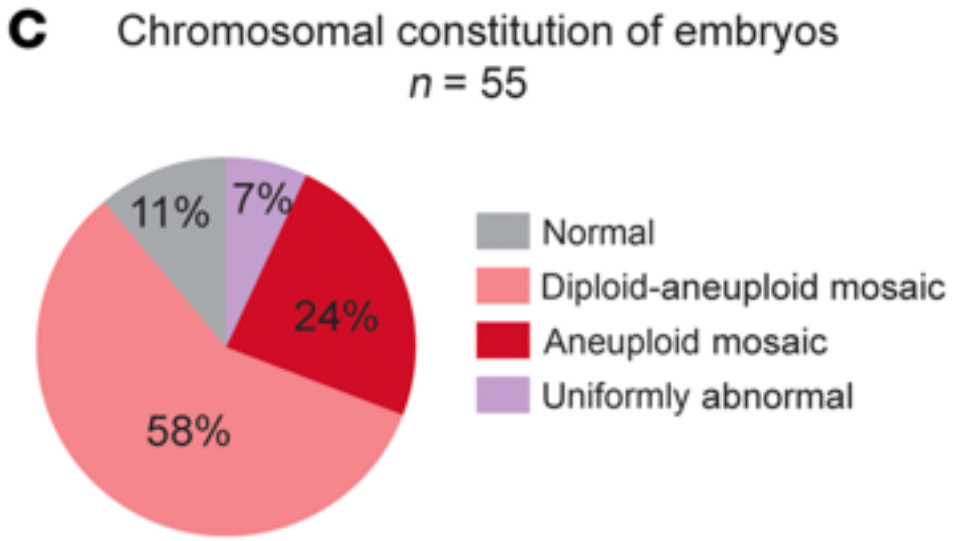
The Journal of Clinical Investigation

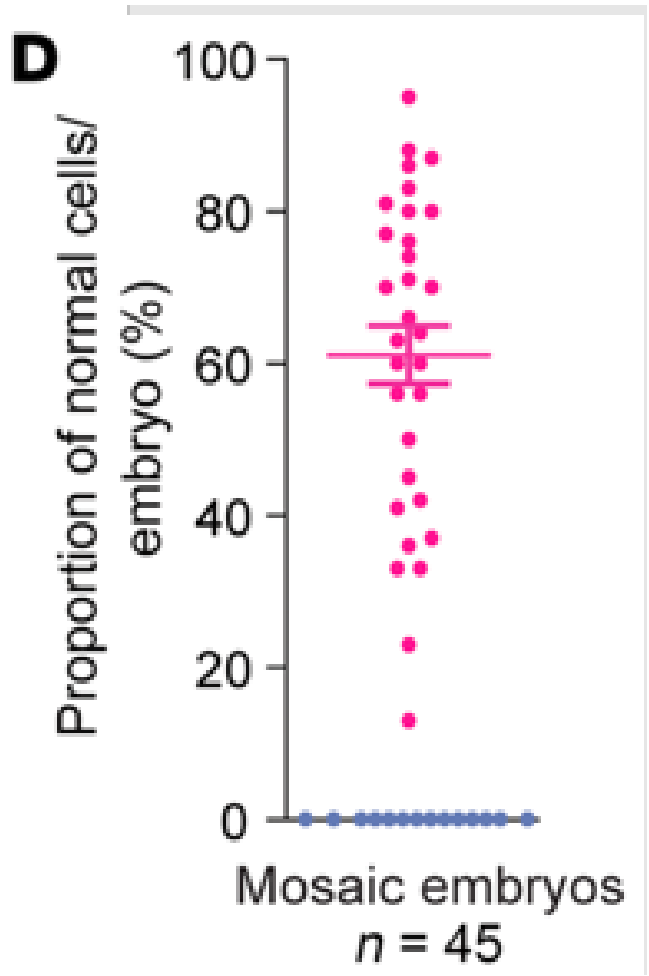
RESEARCH ARTICLE

Single-cell DNA sequencing reveals a high incidence of chromosomal abnormalities in human blastocysts

Effrosyni A. Chavli,[1] Sjoerd J. Klaasen,[2,3] Diane Van Opstal,[4] Joop S.E. Laven,[1] Geert J.P.L. Kops,[2,3] and Esther B. Baart[1,5]

[1]Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Erasmus MC, University Medical Center Rotterdam, Rotterdam, Netherlands. [2]Hubrecht Institute-KNAW (Royal Academy of Arts and Sciences) and University Medical Center Utrecht, Utrecht, Netherlands. [3]Oncode Institute, Utrecht, Netherlands. [4]Department of Clinical Genetics and [5]Department of Developmental Biology, Erasmus MC, University Medical Center Rotterdam, Rotterdam, Netherlands.





Incidence of Mosaic Embryos:
Biological

McCoy et al. Genome Medicine (2023) 15:77
https://doi.org/10.1186/s13073-023-01231-1

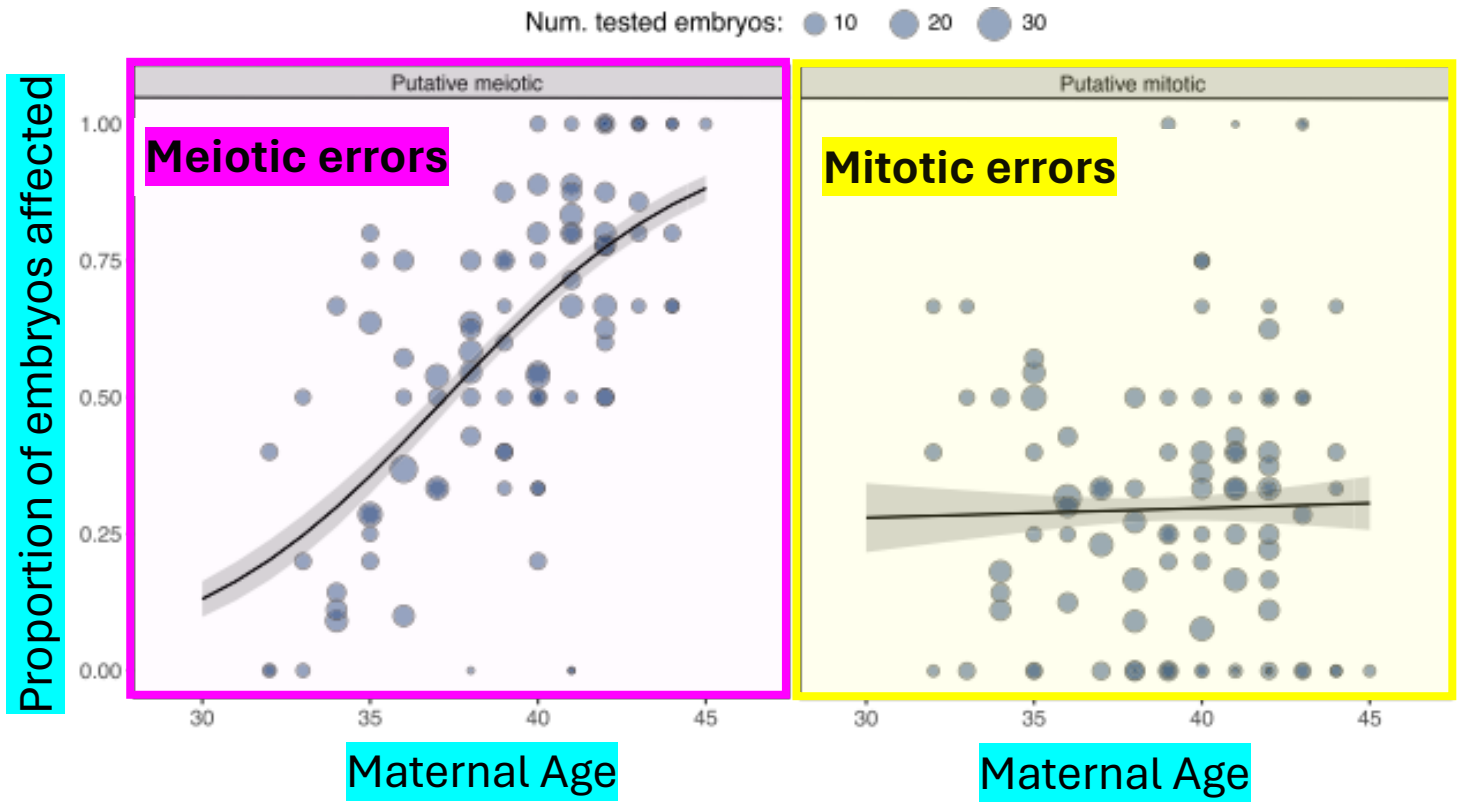
Genome Medicine

RESEARCH Open Access

Meiotic and mitotic aneuploidies drive arrest of in vitro fertilized human preimplantation embryos

Rajiv C. McCoy[1*], Michael C. Summers[2,3,4], Abeo McCollin[2,3], Christian S. Ottolini[2,5,6], Kamal Ahuja[2] and Alan H. Handyside[3]

Incidence of mitotic error not associated with maternal age.



Adapted from McCoy et al, Genome Medicine 2023

Incidence of Mosaic Embryos:

Biological

McCoy et al. Genome Medicine (2023) 15:77
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Genome Medicine

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Meiotic and mitotic aneuploidies drive arrest of in vitro fertilized human preimplantation embryos

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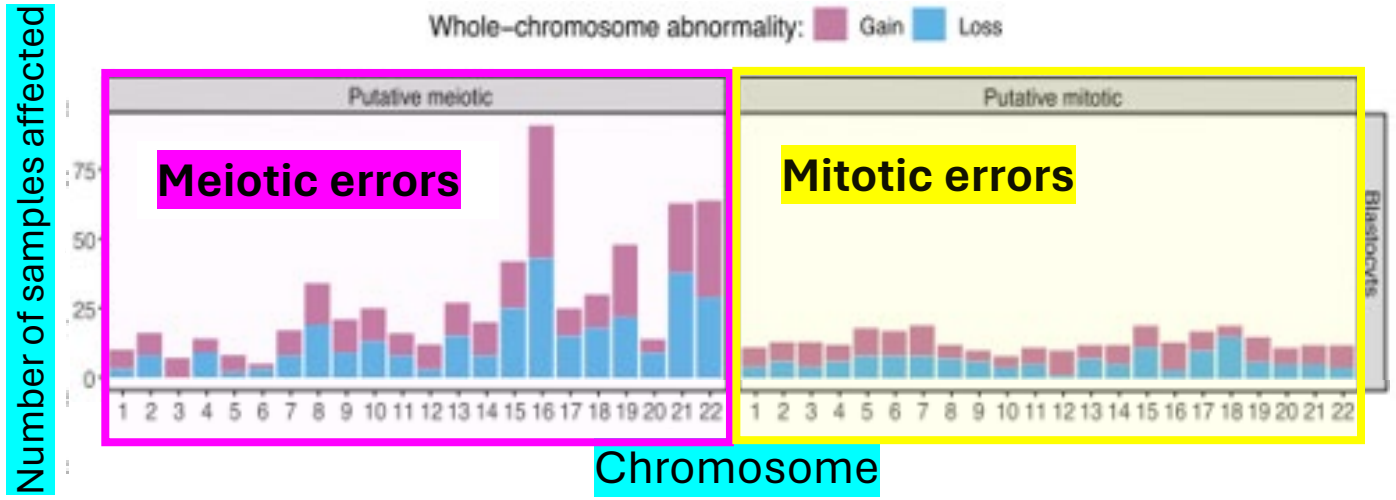
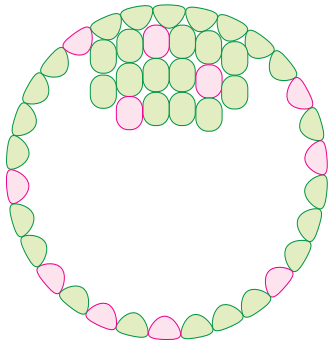
Mitotic errors affect all chromosomes at similar frequencies.



Adapted from McCoy et al, Genome Medicine 2023

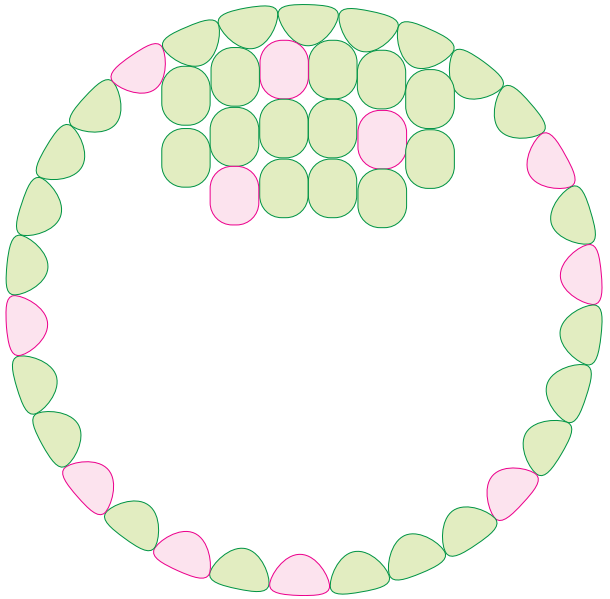
Incidence of Mosaic Embryos



~ ≤100%

Overview

- Biological mechanisms of embryonic mosaicism
- Can mitotic errors be induced?
- Artifactual mosaic results
- Incidence of embryonic mosaicism
- Outcomes of mosaic embryo transfers

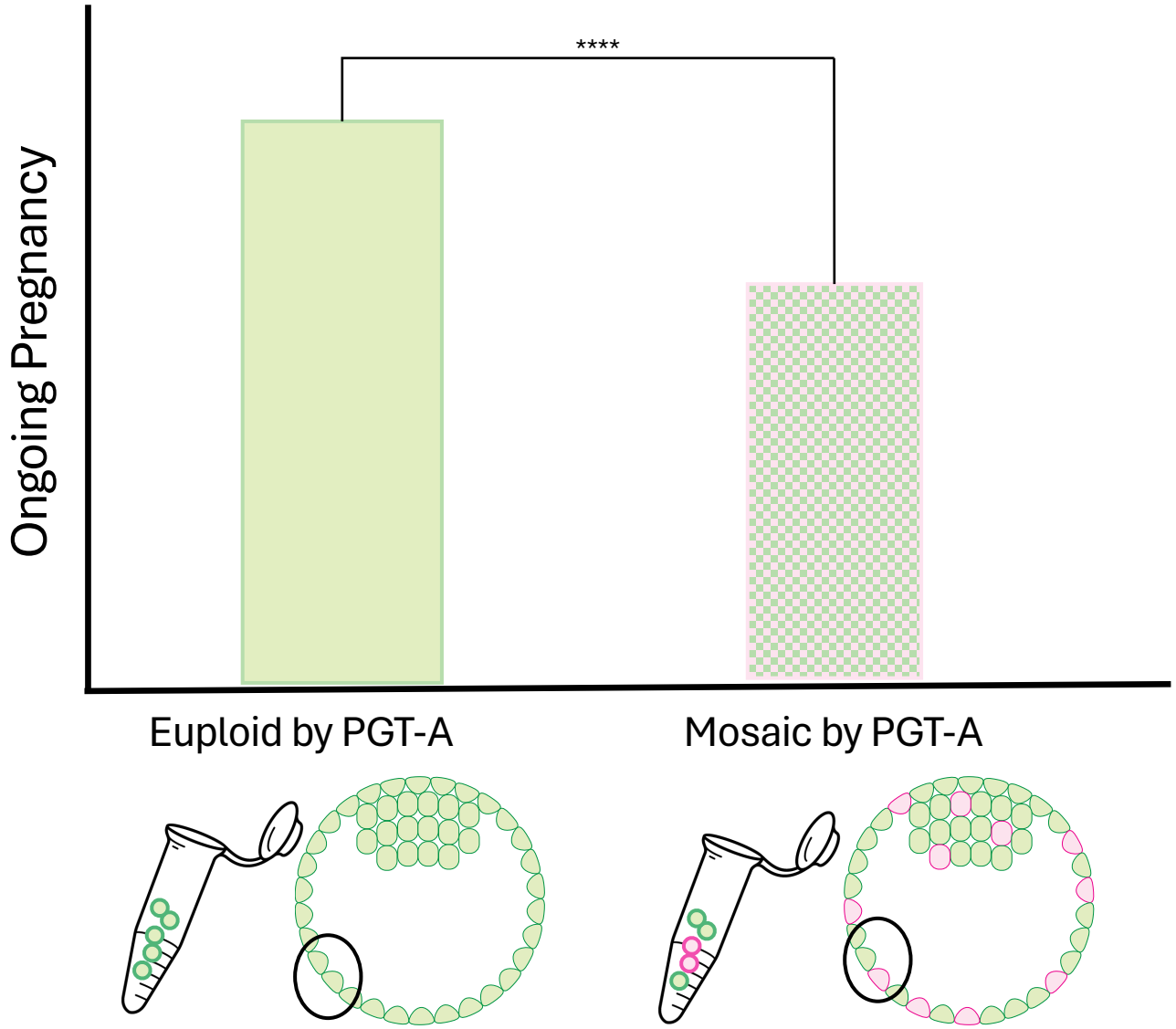


Mosaic embryo transfer

Healthy Babies after Intrauterine Transfer of Mosaic Aneuploid Blastocysts

TO THE EDITOR: Chromosomal aneuploidy is recognized as a factor that contributes to unsuccessful embryo implantation and spontaneous abortion. It provides an explanation for the relatively low success rate of in vitro fertilization (IVF) treatments. Preimplantation genetic screening is widely used to identify chromosomally normal (euploid) embryos and select them for intrauterine transfer in order to improve the clinical outcome of IVF.[1]

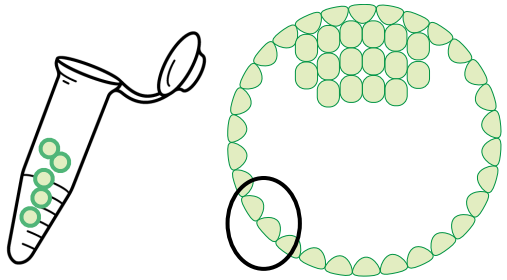
Greco et al NEJM 2015

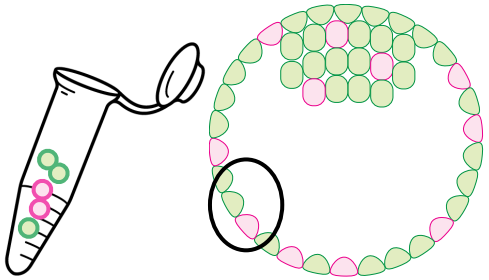


Mosaic embryo transfer

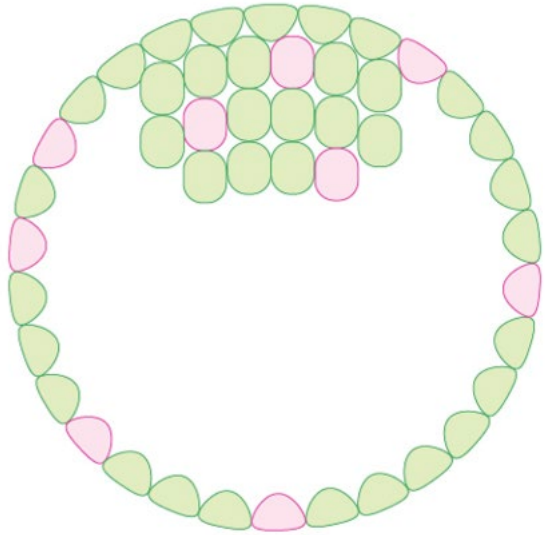
Euploid by PGT-A

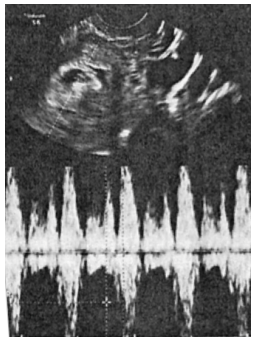
Mosaic by PGT-A



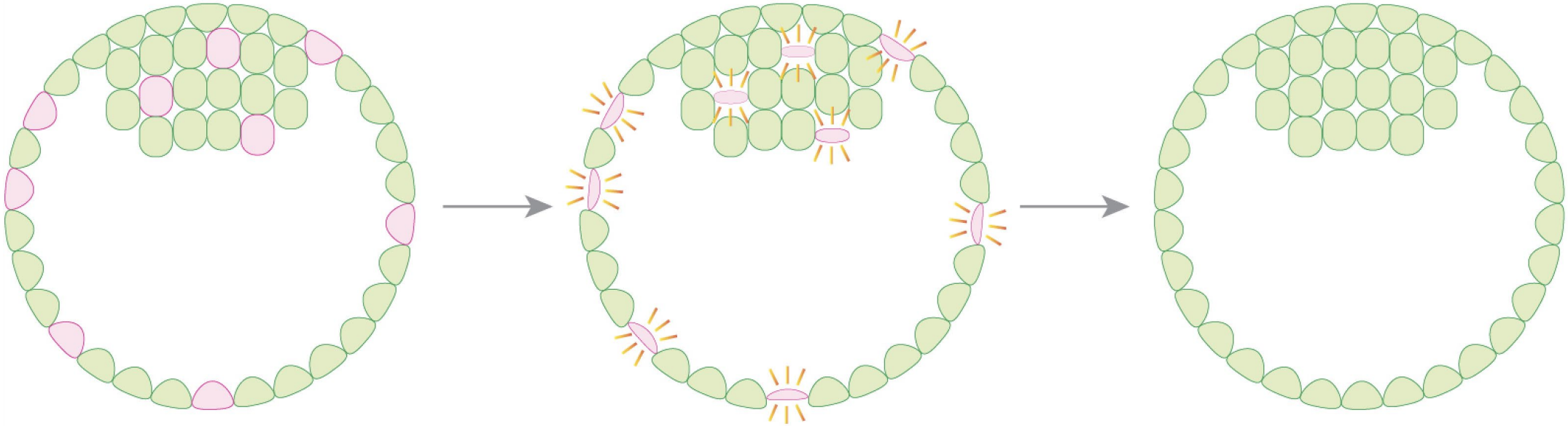


Mosaic embryo transfer





Mosaic embryo transfer: Self correction



Trends in Genetics

Supports open access

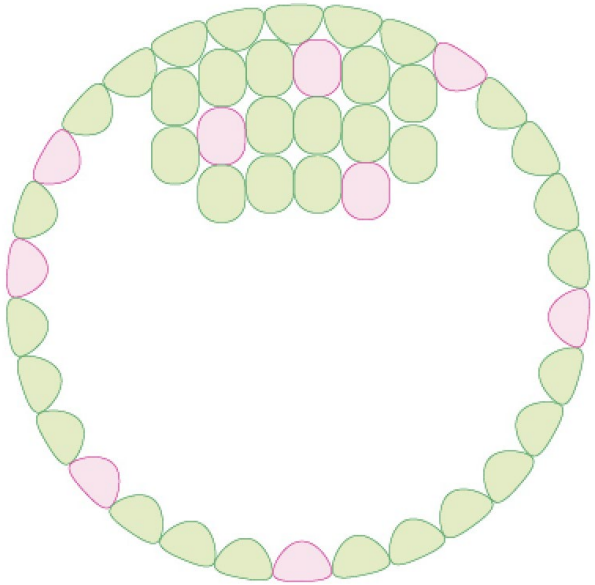
REVIEW | VOLUME 27, ISSUE 11, P446-453, NOVEMBER 2011

The aneuploidy paradox: costs and benefits of an incorrect karyotype

Jason M. Sheltzer • Angelika Amon

Published: August 29, 2011 • DOI: https://doi.org/10.1016/j.tig.2011.07.003

Mosaic embryo transfer: Self correction



nature COMMUNICATIONS

ARTICLE

Received 10 Jun 2015 | Accepted 26 Feb 2016 | Published 29 Mar 2016 DOI: 10.1038/ncomms11165 OPEN

Mouse model of chromosome mosaicism reveals lineage-specific depletion of aneuploid cells and normal developmental potential

Helen Bolton[1], Sarah J.L. Graham[1], Niels Van der Aa[2], Parveen Kumar[2], Koen Theunis[2], Elia Fernandez Gallardo[2], Thierry Voet[2,3] & Magdalena Zernicka-Goetz[1]

nature COMMUNICATIONS

ARTICLE

https://doi.org/10.1038/s41467-020-16796-3 OPEN

Autophagy-mediated apoptosis eliminates aneuploid cells in a mouse model of chromosome mosaicism

Shruti Singla[1], Lisa K. Iwamoto-Stohl[1], Meng Zhu[1] & Magdalena Zernicka-Goetz[1,2]✉

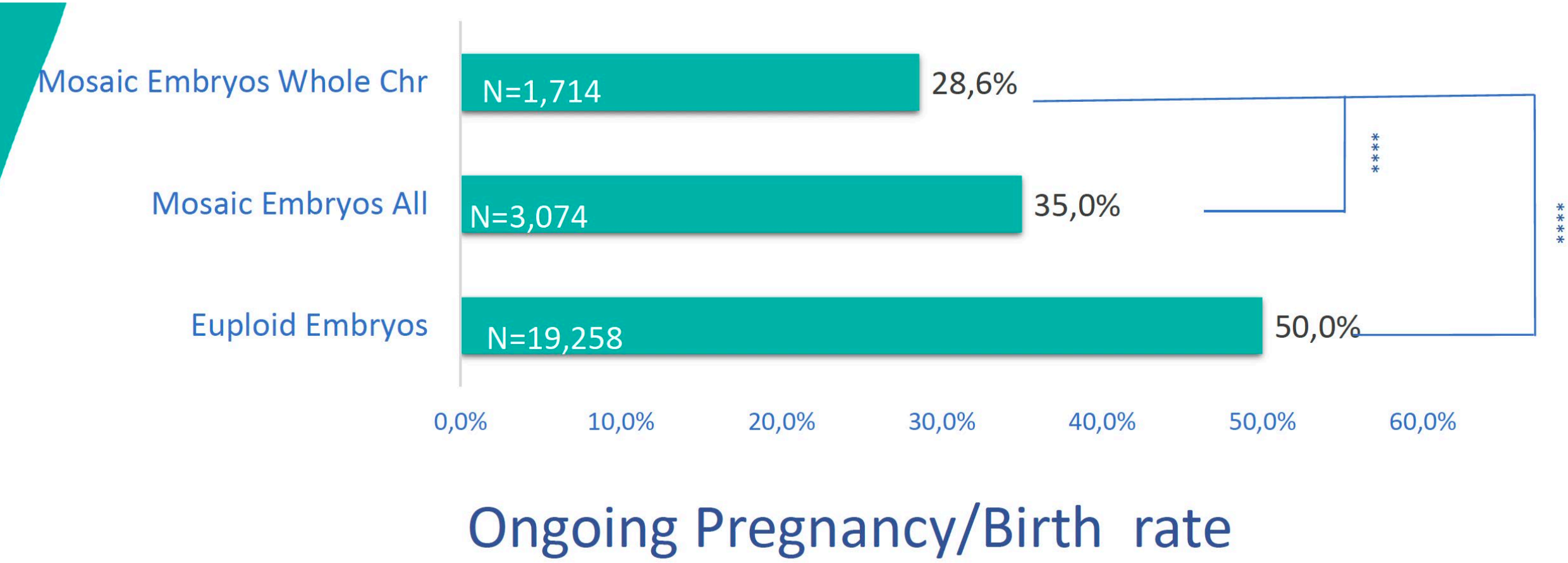
In mixed euploid-aneuploid embryos:

- aneuploid cells undergo preferential cell death or attenuated proliferation
- euploid cells compensate by increasing proliferation
- if the initial load of aneuploid cells is too high, embryo dies

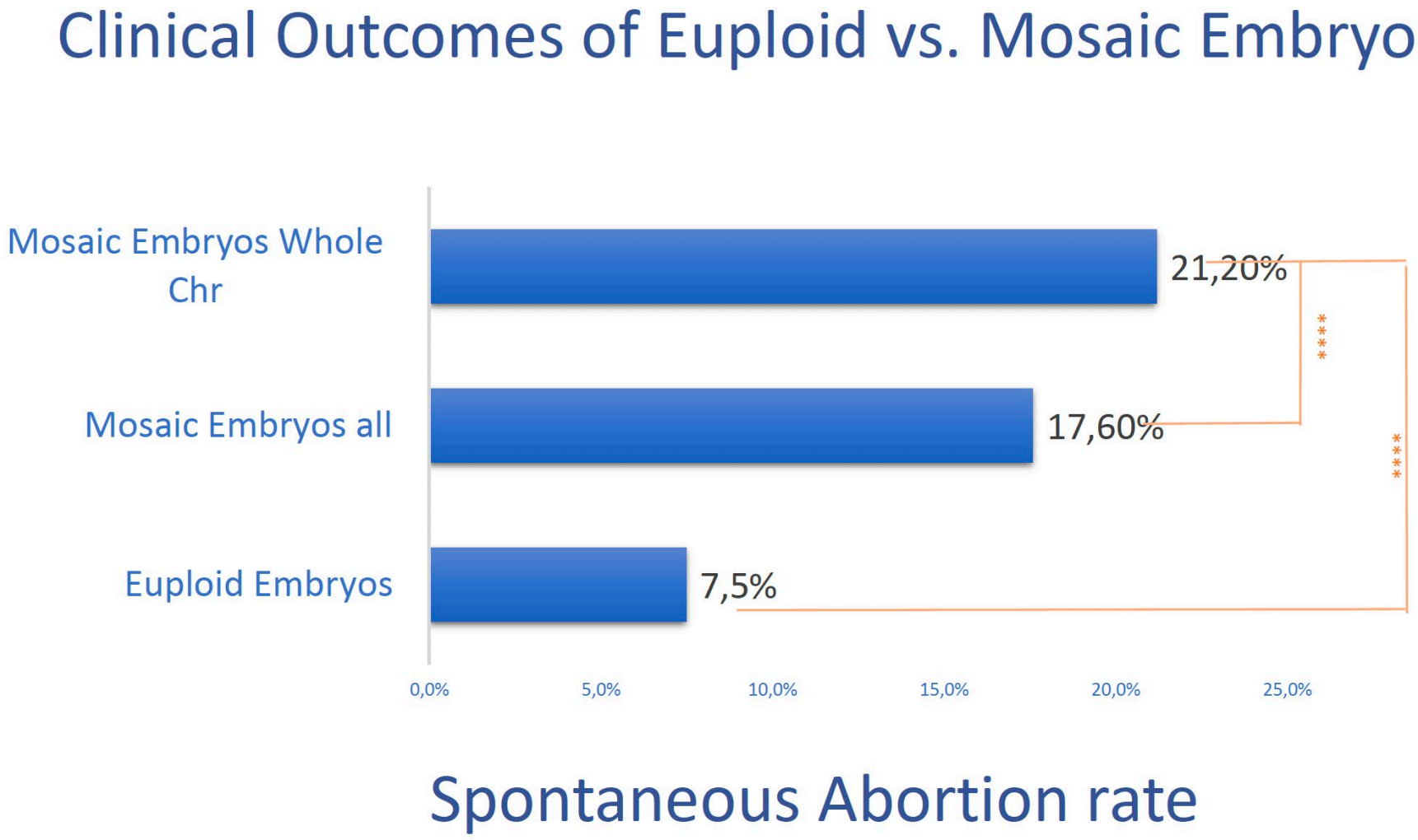
Mosaic embryo transfer: Outcomes

Updated data from
IRMET (**I**nternational **R**egistry of **M**osaic **E**mbryo **T**ransfers)

Mosaic embryo transfer: Outcomes



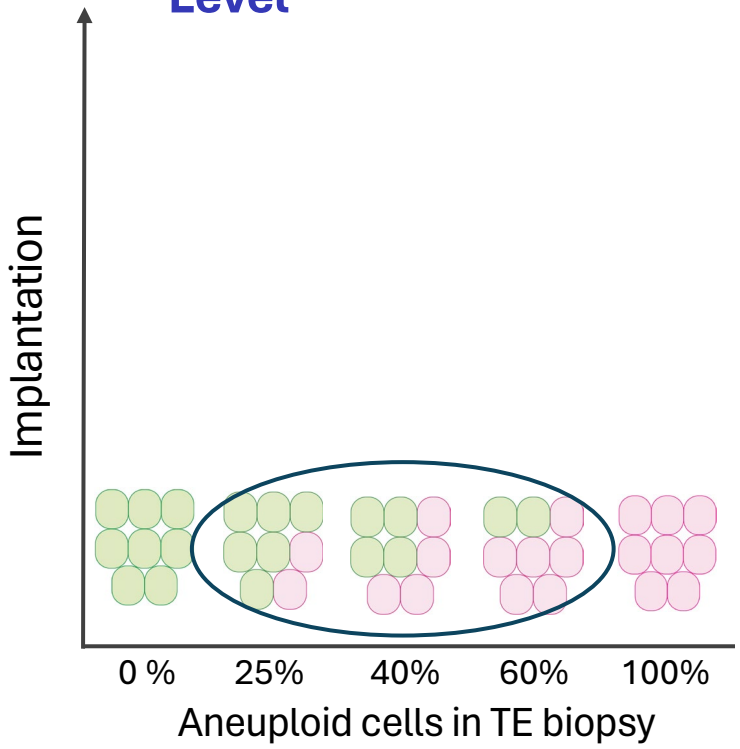
Mosaic embryo transfer: Outcomes



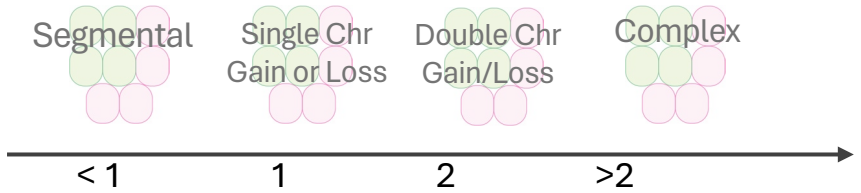
Mosaic embryo transfer: Outcomes

Mosaic Features

Mosaic Level



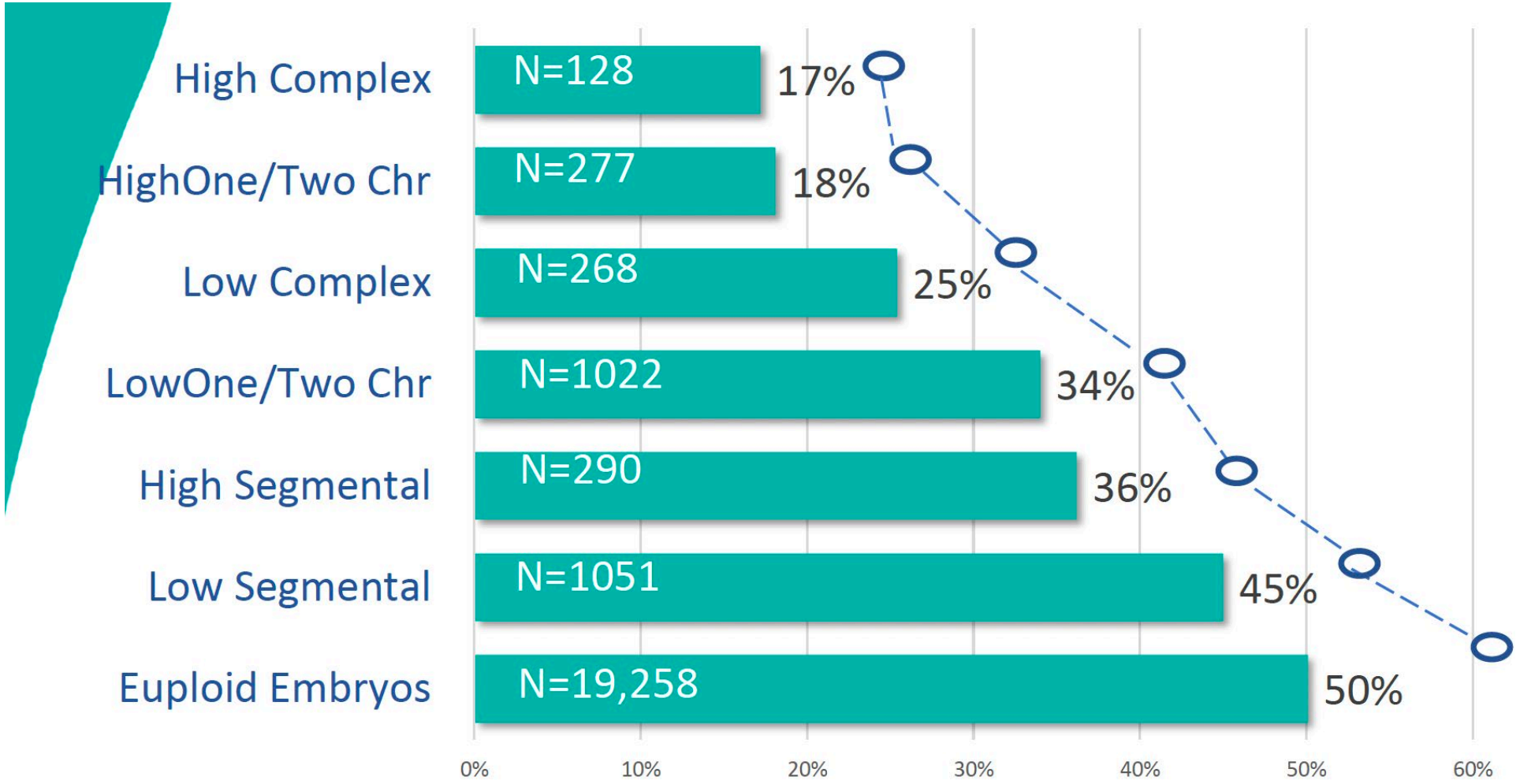
Mosaic Type



Mosaic embryo transfer: Outcomes

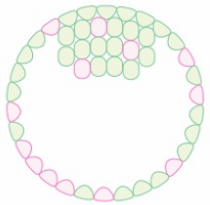
Mosaic Level
Low is <50%
High is ≥50%

Mosaic Type
Segmental
One Whole Chromosome
Two Whole Chromosomes
Complex (>2 Chr)



Ongoing Pregnancy rate

Mosaic embryo transfer: Persistent Mosaicism



Mosaic Embryo Transfers ~3000

?

→

Persistence of Mosaicism

human reproduction

CASE REPORT *Reproductive genetics*

The birth of a baby with mosaicism resulting from a known mosaic embryo transfer: a case report

Semra Kahraman*, Murat Cetinkaya, Beril Yuksel, Mesut Yesil, and Caroline Pirkevi Cetinkaya

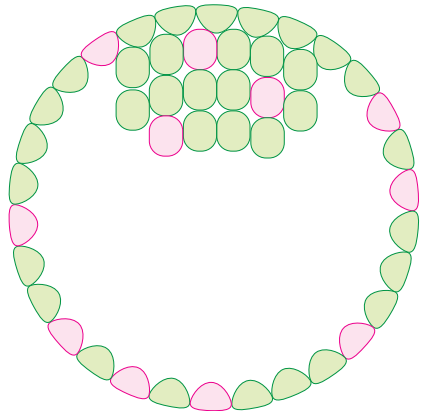
Istanbul Memorial Hospital, Assisted Reproductive Technologies and Reproductive Genetics Center, Piyale Pasa Bulvari 34385, Sisli, Istanbul, Turkey

*Correspondence address. Istanbul Memorial Hospital, Assisted Reproductive Technologies and Reproductive Genetics Center, Piyale Pasa Bulvari 34385, Sisli, Istanbul, Turkey. E-mail: semkahraman@gmail.com

Submitted on November 25, 2019; resubmitted on December 18, 2019; editorial decision on December 29, 2019

ABSTRACT: Mosaic embryos have the potential to implant and develop into healthy babies. The transfer of mosaic embryos is now considered to be a possible option for women undergoing ART with preimplantation genetic testing for aneuploidies and in the absence of euploid embryos, particularly those with diminished ovarian reserve and/or advanced maternal age. It can aid in avoiding the discard of potentially viable embryos, which might otherwise result in healthy babies. In over 500 studies on mosaicism, there have been no reports of mosaicism in babies born following the transfer of mosaic embryos. Here, we present a case report of a 39-year-old woman with diminished ovarian reserve with only one blastocyst available for trophectoderm biopsy. The transfer of the embryo, which showed 35% mosaicism of monosomy 2, resulted in pregnancy. Amniocentesis revealed a mosaic trisomic mos46,XX(98)/47,XX,+2(2) karyotype. There were no pathological findings in detailed ultrasonography, and the fetus showed a normal fetal growth with no evidence of intrauterine growth retardation. A healthy female baby was born at Week 37. The peripheral blood chromosome analysis validated with fluorescence *in situ* hybridization showed 2% mosaic monosomy 2 [mos45,XX,-2(2)/46,XX(98)]. This is the first reported case of true fetal mosaicism resulting in a live birth following the transfer of a known mosaic embryo. Worldwide, prenatal diagnosis has shown the depletion of mosaicism in embryos transferred after they have been reported as mosaics. Our case demonstrates the need for close prenatal monitoring and diagnosis by early amniocentesis, preferably at >14 weeks gestation.

Review



THANK YOU

PACIFIC COAST REPRODUCTIVE SOCIETY

Andrea Victor
avictor@rmaliivf.com