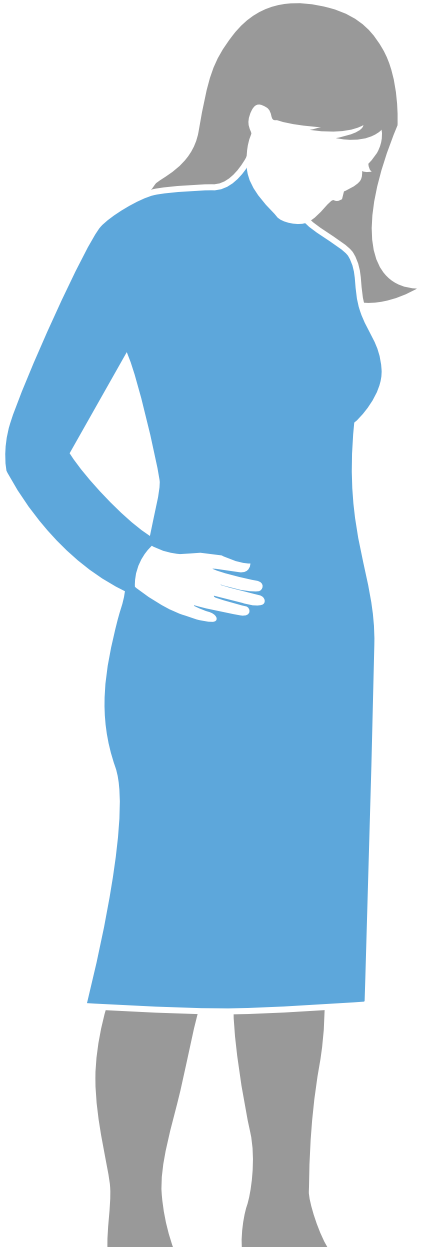
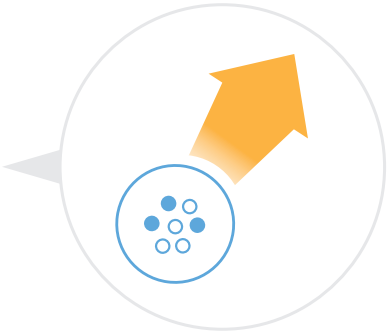
illumina®

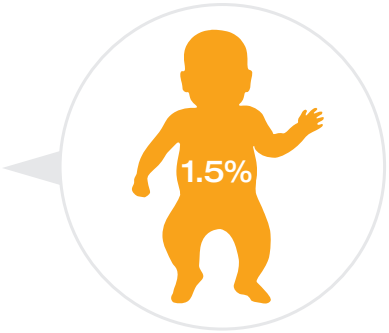
Improving IVF success rates with preimplantation genetic screening (PGS).

The current use of ART.





The use of Assisted Reproductive Technology (ART) has doubled over the past decade.[1]



Approximately 1.5% of all babies in the US are born as a result of ART.[1]

Less than 1/3 of ART-related cycles* resulted in live births in 2013.[2]

*Performed with the intent to transfer at least one embryo.

illumina®

The current use of ART.

- The use of ART has doubled over the past decade.[1]
- *In vitro* fertilization (IVF) is used approximately 99% of the time in ART.[2]
- Women may require several attempts of IVF to have a baby.[3]
- Less than 1/3 of IVF cycles* resulted in a live birth in 2013.[2]

*Performed with the intent to transfer at least one embryo.

illumina®

Chromosomes and DNA.

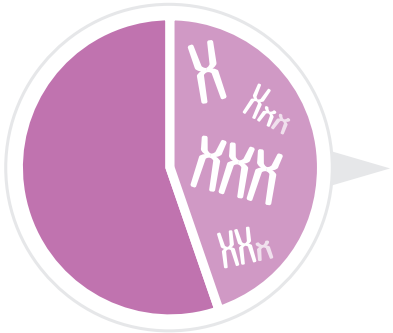
illumina®

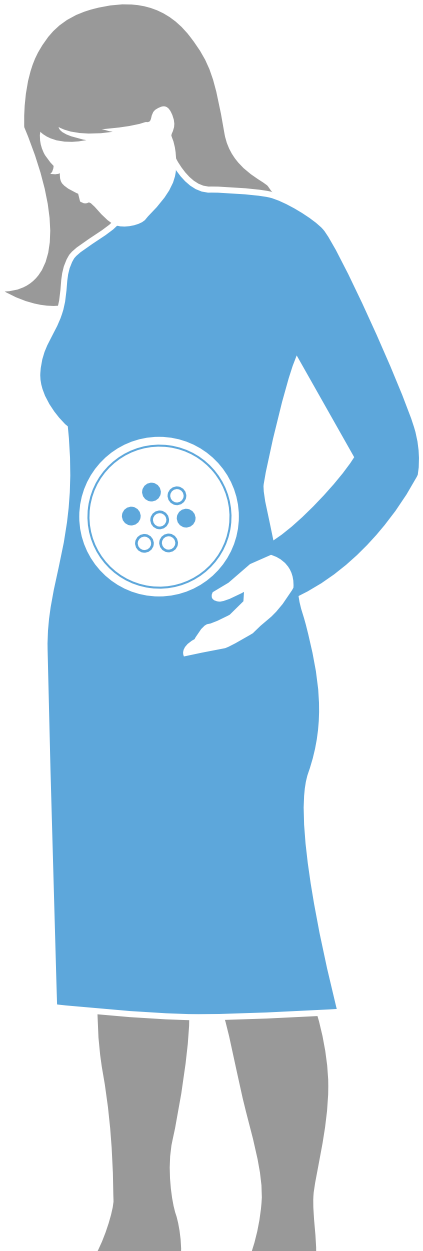
Chromosomes and DNA.

- Chromosomes are the structures in our bodies that carry our genetic information or DNA.
- There are 46 chromosomes arranged into 23 pairs numbered 1-22. The final pair are the sex chromosomes (X and Y).
- The sex chromosomes determine if a baby is male or female.
  - Females usually have two X chromosomes and males usually have an X and a Y.
- One copy of each chromosome is inherited from the mother's egg cell, and the other copy is from the father's sperm cell.

Conventional IVF provides limited success.

Nearly 1/2 of *in vitro* fertilized embryos have chromosomal abnormalities.[4-6]



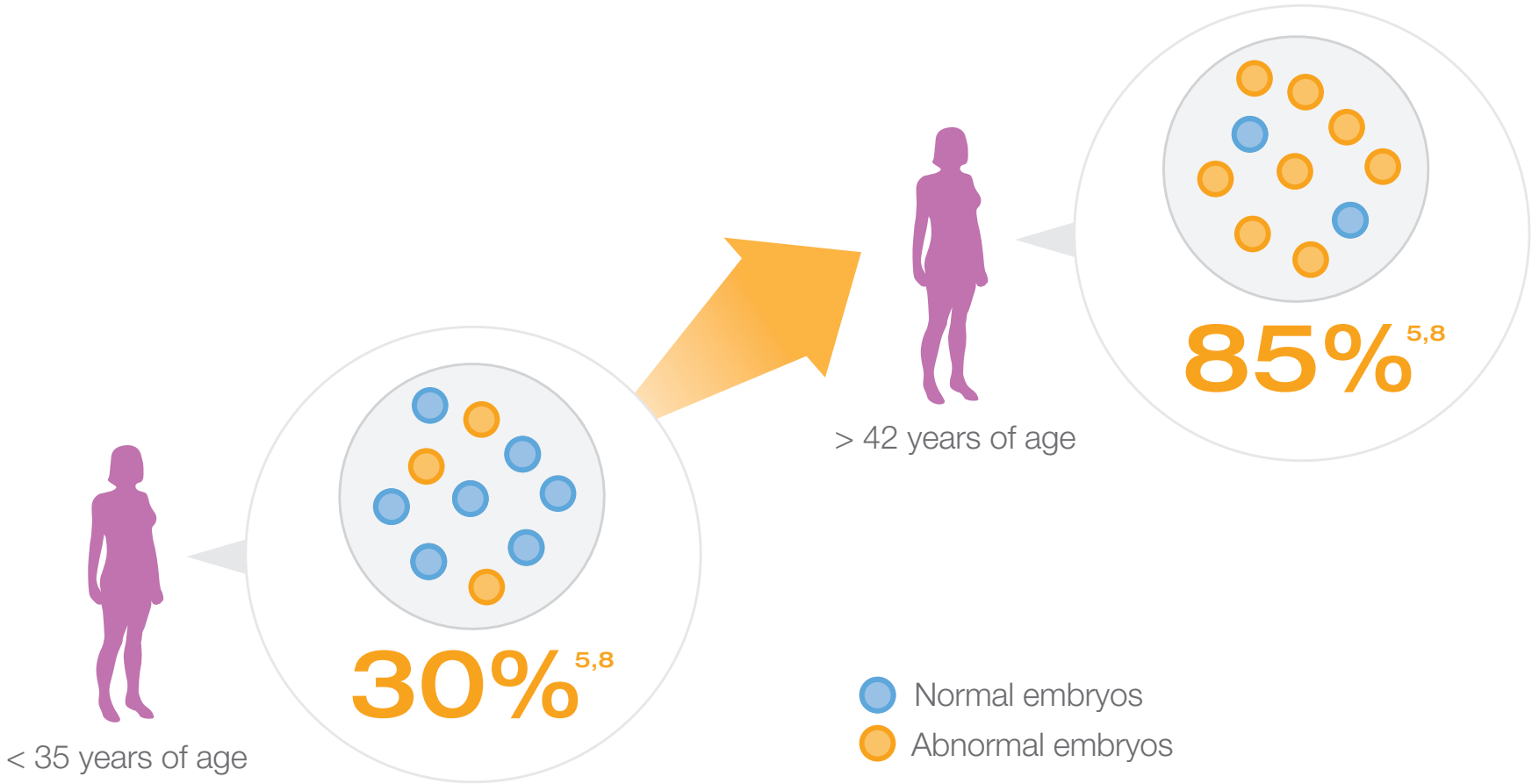


illumina®

Conventional IVF provides limited success.

- It is believed that chromosomal abnormalities (aneuploidy) are a major cause of infertility and IVF failure.[6]
  - The aneuploid embryo may not implant or is likely to miscarry early due to its inability to develop properly.
- Nearly half of all IVF embryos are aneuploid, even in first-time IVF patients.[4]
- It is also estimated that at least 50% of first trimester miscarriages are associated with aneuploidy.[7]
- A few aneuploidies are compatible with life; however, most of these are associated with disease.

Aneuploidy incidence increases with age.



illumina®

Aneuploidy incidence increases with age.

- Aneuploidy results in an abnormal amount of genetic material, which impacts the development of the pregnancy and can result in miscarriage.
- Aneuploidy can occur in women of all ages; however, the chances are greater with increasing maternal age.
  - As a result, infertility rates may increase.
- The rate of aneuploidy in embryos increases with maternal age from approximately 30% at a maternal age under 35 to approximately 85% at a maternal age over 42.[5,8]
- Most chromosome abnormalities are not likely to implant or result in a live birth.[9,11]
- Most chromosomal abnormalities are not compatible with life; however, some can result in a live birth, for example, Down syndrome (trisomy 21).[5-6]

Preimplantation genetic screening (PGS).

Ongoing pregnancy rates have been reported to be 69.1% with PGS* vs 41.7% without PGS.[†,4]

* Embryos were selected on the basis of morphology and comprehensive chromosomal screening.

† In the control group, embryos were assessed by morphology only.

illumina®

Preimplantation genetic screening (PGS).

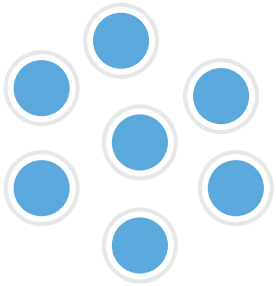
- PGS is a procedure used to determine the chromosomal status of an IVF embryo by screening all 23 chromosomes pairs.
- PGS is used to screen embryos so that only those with a normal number of chromosomes (euploid) are considered for transfer.
- PGS helps to improve IVF success rates, as euploid embryos are more likely to implant and result in a live birth.[4,9,10]
- PGS may result in:
  - Improved implantation rates[9,11]
  - Reduced spontaneous abortion and miscarriage[9,10]
  - Increased rate of ongoing pregnancy and number of live births[4,9,10]
- Ongoing pregnancy rates: 69.1% with PGS* vs. 41.7% without PGS.[†,4]

* Embryos were selected on the basis of morphology and comprehensive chromosomal screening.

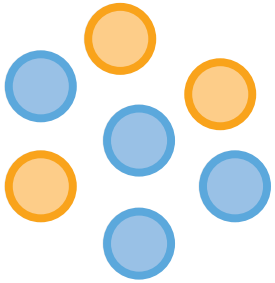
† In the control group, embryos were assessed by morphology only.

illumina®

How PGS works.

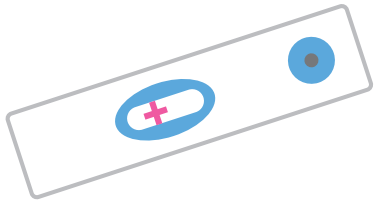


Cells are removed from the embryo.



Cells are screened to detect any chromosomal abnormalities.

Viable embryos are transferred to the uterus.



The chance of successful pregnancy is improved.[4,9,10]

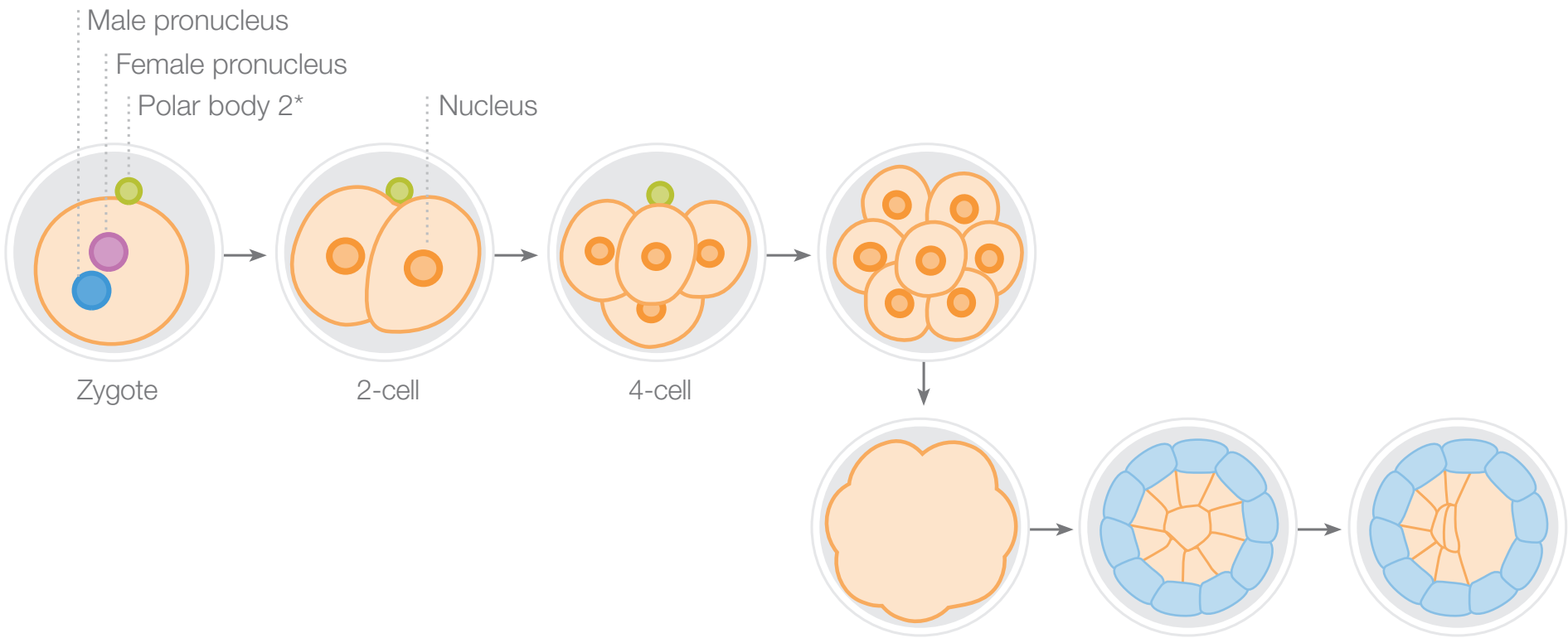
illumina®

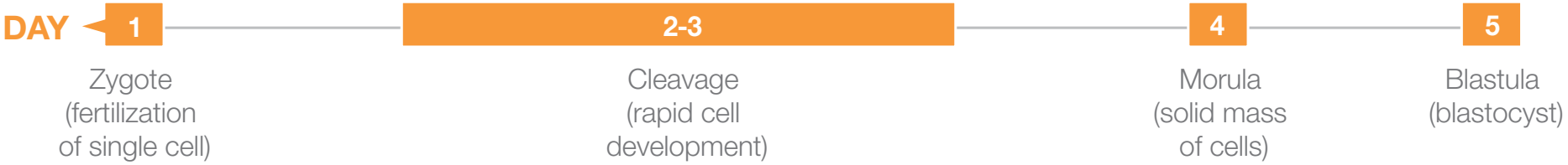
How PGS works.

- Following fertilization, cells are removed from each embryo.
- Cells are screened to identify which embryos are chromosomally normal (euploid).
- Selected euploid embryos are either transferred to the uterus or frozen for future use.

illumina®

The stages of embryo development.





*Polar body 1 is released at an earlier stage of development, during the maturation of the maternal egg cell.[1]

illumina®

The stages of embryo development.

PGS can be used at various stages to screen cells of a developing embryo. The stages are:

- **First and second polar bodies—**Polar bodies are produced as byproducts of egg maturation and fertilization. These can be collected and tested. However testing polar bodies provides information on maternal contribution only.
- **Cleavage stage—**1 or 2 cells can be removed and analyzed when the embryo reaches day 3 of its development.
- **Blastocyst stage—**Cells can be removed and analyzed when the embryo reaches day 5 of its development.

The PGS timeline.

1. Stimulation and egg removal
2. Cells collected
3. PGS performed
4. PGS results gathered
5. Embryo transferred

illumina®

The PGS process.

PGS can fit seamlessly into your routine IVF treatment.

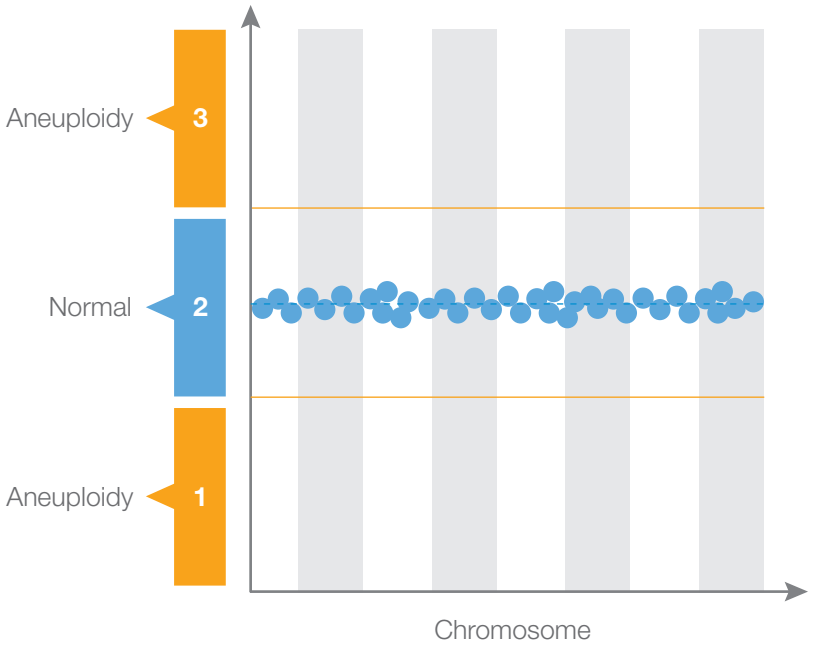
1. The cycle starts with the stimulation of the ovaries followed by egg retrieval and fertilization
2. One or a few cells can then be taken from the embryos for testing.
3. PGS testing is performed to determine the number of chromosomes of each embryo.
4. Results can be visualized and reported.
5. Euploid embryo(s) are identified and can either be transferred into the uterus or frozen for future use.

illumina®

Getting your results.

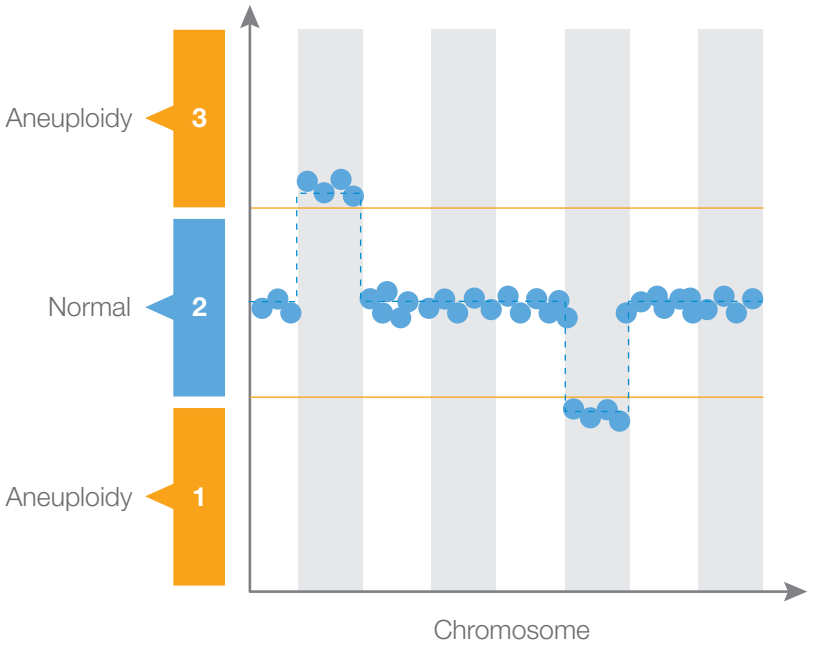
Normal profile

Chromosome copy number



Abnormal profile

Chromosome copy number



illumina®

Getting your results.

- Samples can be tested at the clinic or sent to an outside laboratory.
- Results are visualized to identify the number of chromosomes in each embryo. A report is sent back to the clinician identifying which embryos are euploid.
- Based on these results, an embryo can then be considered for transfer to the uterus.

illumina®

References

1. Centers for Disease Control and Prevention. http://www.cdc.gov/art/reports/index.html. Accessed September 15, 2015.
2. Centers for Disease Control and Prevention. Assisted Reproductive Technology: Fertility Clinic Success Rates Report. http://www.cdc.gov/art/pdf/2013-report/art-2013-fertility-clinic-report.pdf. Accessed September 15, 2015.
3. Society for Assisted Reproductive Technology. Success Rates. http://www.sart.org/SART_Success_Rates/. Accessed January 22, 2015
4. Yang Z, Liu J, Collins GS, et al. Selection of single blastocysts for fresh transfer via standard morphology assessment alone and with array CGH for good prognosis IVF patients: Results from a randomized pilot study. *Mol Cytogenet*. 2012;5(1):24.
5. Ata B, Kaplan B, Danzer H, et al. Array CGH analysis shows that aneuploidy is not related to the number of embryos generated. *Reprod Biomed Online*. 2012;24:614-620.
6. Liu J, Wang W, Sun X, et al. DNA microarray reveals that high proportions of human blastocysts from women of advanced maternal age are aneuploid and mosaic. *Biol Reprod*. 2012;87(6):148.
7. Simpson JL. Causes of fetal wastage. *Clin Obstet Gynecol*. 2007;50(1):10-30.
8. Harton GL, Munné S, Surrey M, et al. Diminished effect of maternal age on implantation after preimplantation genetic diagnosis with array comparative genomic hybridization. *Fertil Steril*. 2013;100(6):1695-1703.
9. Grifo JA, Hodes-Wertz B, Lee HL, et al. Single thawed euploid embryo transfer improves IVF pregnancy, miscarriage, and multiple gestation outcomes and has similar implantation rates as egg donation. *J Assist Reprod Genet*. 2013;30(2):259-264.
10. Forman EJ, Hong KH, Ferry KM, et al. *In vitro* fertilization with single euploid blastocyst transfer: a randomized controlled trial. *Fertil Steril*. *2013;*100(1):100-107.
11. Scott RT Jr, Upham KM, Forman EJ, et al. Blastocyst biopsy with comprehensive chromosome screening and fresh embryo transfer significantly increases in vitro fertilization implantation and delivery rates: a randomized controlled trial. *Fertil Steril*. 2013;100(3):697-703.

www.illumina.com/thevalueofPGS Pub. No. 1576-2015-025

illumina®