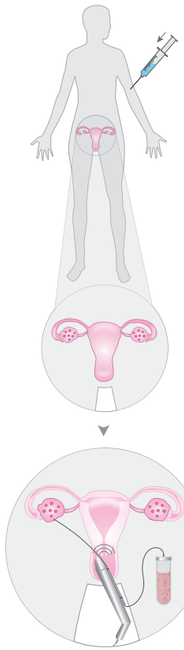
EMBRYO . IVF . PGD . *Preimplantation Genetic Diagnosis*

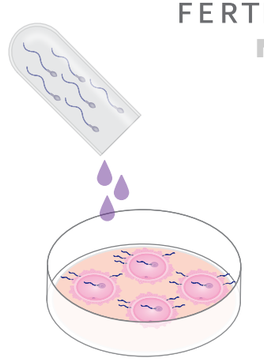
in vitro



OOCYTE PROCUREMENT

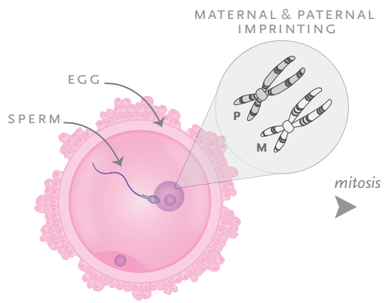
Hormones are injected into a person with ovaries to mature multiple oocytes (eggs) *in vivo*, which are then surgically removed. This process poses a risk of ovarian hyperstimulation syndrome (OHSS), with symptoms ranging from mild to severe and in rare cases can result in death. Long-term health consequences are unknown.

IN VITRO FERTILIZATION



OOCYTES & SPERM

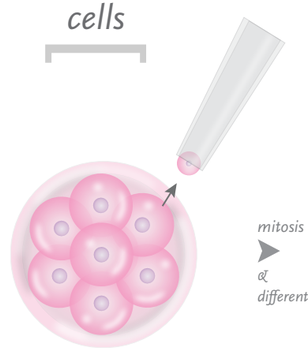
In Vitro Fertilization (IVF):
IVF is an assisted reproductive technology that involves creating embryos in a Petri dish. Sperm that have been screened for viral infection and washed are introduced to mature oocytes.



ZYGOTES *day 0*

Nuclear Fusion:
Fusion of egg and sperm provides a complete human genome (two sets of nuclear DNA). Upon fertilization, calcium ions flood the egg cytoplasm and trigger fusion of egg and sperm nuclei. The zygote (fused sperm and egg) is cultured in a Petri dish with growth factors and placed in an incubator that mimics the uterine environment.

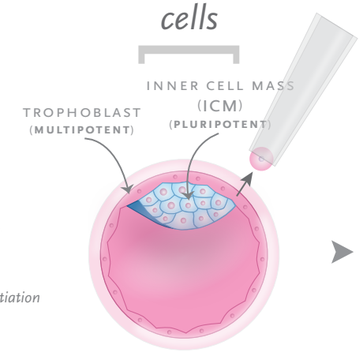
TOTIPOTENT *cells*



BLASTOMERES *day 3 8 cells*

mitosis & differentiation

PLURIPOTENT & MULTIPOTENT *cells*



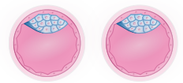
BLASTOCYSTS *day 5 ~150 cells*

Embryo Development, Screening, and Genetic Testing:
In response to cell culture conditions, the zygote undergoes mitotic cell division and at day 5 begins to differentiate. Embryos are graded as they develop and parents with a family history of disease may opt for PGD. Embryos can be screened prior to uterine transfer for gene variants that confer risk of disease and/or disability. 1-3 cells are removed from graded blastomeres, or blastocysts, and genetically tested to identify large DNA changes at the chromosomal level via Fluorescent In Situ Hybridization (FISH), small DNA changes at the DNA sequence level via Polymerase Chain Reaction (PCR), or both types of DNA changes using Array Chromosomal Genomic Hybridization (aCGH). PGD can be used to detect genetic risk for > 100 diseases/disabilities.


FISH

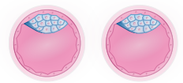

PCR


aCGH

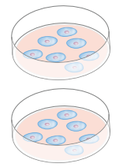

blastocysts without disease risk variant

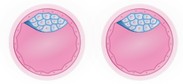
uterine transfer


BABY (ASC)
FOR PREGNANCY

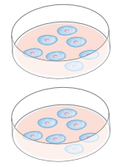

blastocysts without disease risk variant

ICM cultured


hESC LINE
FOR CELL THERAPIES


blastocysts with disease risk variant

ICM cultured


hESC LINE
FOR MODELING DISEASES

Stem Cell Lines:
If PGD is successful, embryos that test negative for a specific disease/disability risk are transferred into the uterus for reproduction. Extranumerary embryos are used to create pluripotent human embryonic stem cell lines (hESCs). Those without disease/disability risk can be used for cell transplant therapy and those with disease/disability risk are used to model disease progression *in vitro* and to develop potential treatments.

➤ **PGD *allows potential parents to screen their IVF embryos*** *for genetic variants that increase risk of disease or influence physical/cognitive development. PGD can be used to create "savior siblings" whose bone marrow or cord blood stem cells match siblings living with disease. PGD is seen by some as promoting reproductive choice, but by others as a technique that is discriminatory to people living with disease/disability.*