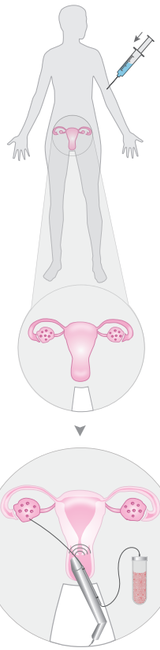
EMBRYO . GENETICALLY MODIFIED EMBRYO .

SCNT . *Somatic Cell Nuclear Transfer*

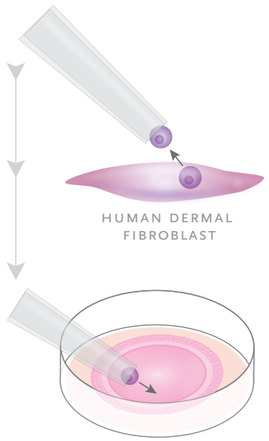
& ANT . *Alternate Nuclear Transfer*

in vitro



OOCYTE PROCUREMENT & TISSUE BIOPSY

For the purposes of stem cell research, hormones are injected to cause the maturation of multiple oocytes (eggs) in the body (*in vivo*), which are then surgically removed. This process poses a risk of ovarian hyperstimulation syndrome (OHSS). Symptoms range from mild to severe and in rare cases can result in death. Additionally, somatic cells (not egg or sperm) are procured via tissue biopsy to serve as the source of nuclear genetic material.

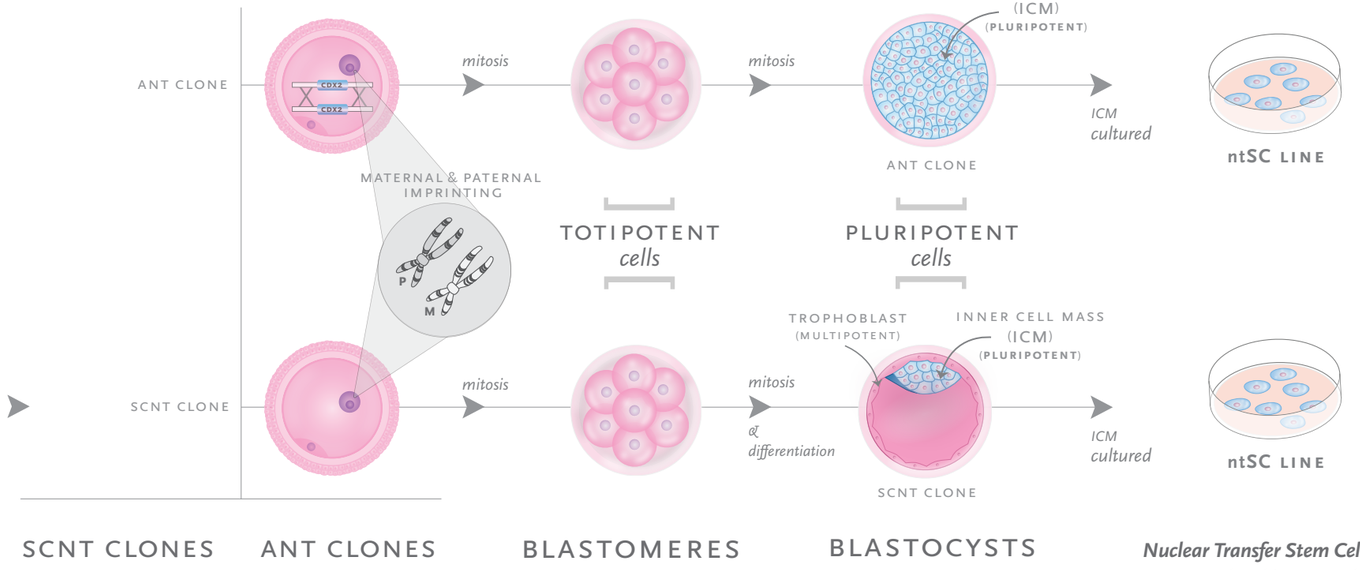


NUCLEAR TRANSFER

The nucleus of the human oocyte is physically removed and replaced with the nucleus of a human adult somatic cell. The cell now has two sets of the nuclear human genome containing the maternal and paternal imprints of the somatic cell donor.

MITOTIC ACTIVATION

Clones are exposed to agents that mimic the calcium gradient waves that accompany sperm entry during fertilization. The electrical gradient triggers mitosis. The SCNT clone has two sets of DNA, representing both maternal and paternal imprints of the nuclear DNA donor.



SCNT CLONES

The adult somatic nuclear DNA is reprogrammed by the cytoplasmic factors of the oocyte. These factors physically alter chromosomes via chemical modification. The specific location of these modifications allows genes involved in pluripotency to be activated. This reprogramming returns the genome to an "embryonic" state.

ANT CLONES

In 2005, the U.S. President's Council on Bioethics asked Jaenisch & Meissner to conduct a proof-of-concept experiment in mice in which they genetically altered a gene essential for trophoblast development (CDX2). Because a placenta cannot form, the ANT clone is incapable of implantation in a uterus, and by some, not considered a potential life.

BLASTOMERES

day 3
8 cells

Clonal Cell Division:
In response to cell culture conditions, the clone undergoes mitotic cell division.

BLASTOCYSTS

day 5
~150 cells

Cell Differentiation:
In response to cell culture conditions and cell signaling, the cells of the SCNT clone begin to specialize, or differentiate. The cells on the outer layer of the blastocyst are referred to as the trophoblast and will support placental development. The cells in the interior of the hollow ball are referred to as the inner cell mass (ICM) and could possibly develop into the fetus.

Nuclear Transfer Stem Cell Lines:
In 2013, Shoukhrat Mitalipov et al. created two patient-specific pluripotent nuclear transfer embryonic stem cell lines (ntESCs) via SCNT. His team used twenty oocytes from two young egg providers and nuclei from fetal/infant somatic donor cells. These oocyte providers were financially compensated, thus due to different state and national laws, some scientists won't be able to use these cells.

SCNT: ***In 1958, Jon Gurdon used SCNT to clone a frog,*** *and in 1996, Ian Wilmut cloned the first mammal, a sheep named Dolly. Dolly was able to reproduce, demonstrating that SCNT does not compromise fertility, though it may affect metabolism. In 2013, Mitalipov et al., used SCNT to create patient-specific embryonic stem cells.*