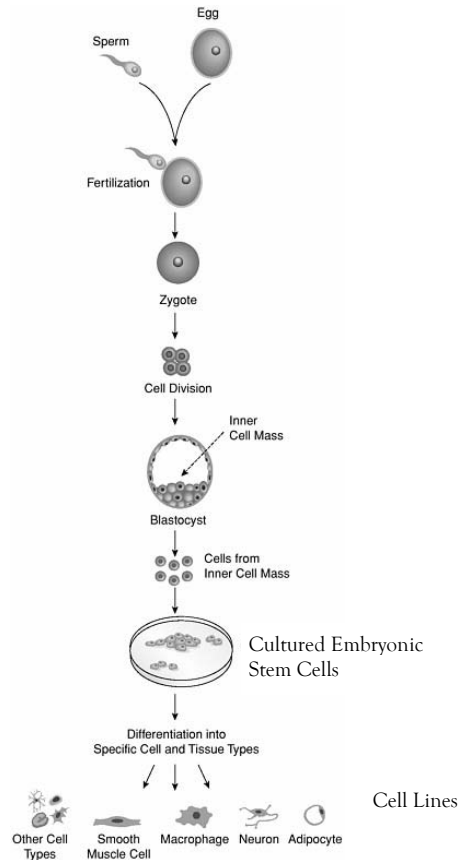


# Making Embryonic Stem Cell (ESC) Lines

## 1. In Vitro Fertilization

Derived from eggs that have been donated for research with the informed consent of the donors. Eggs are fertilized *in vitro* in an IVF clinic or research lab.



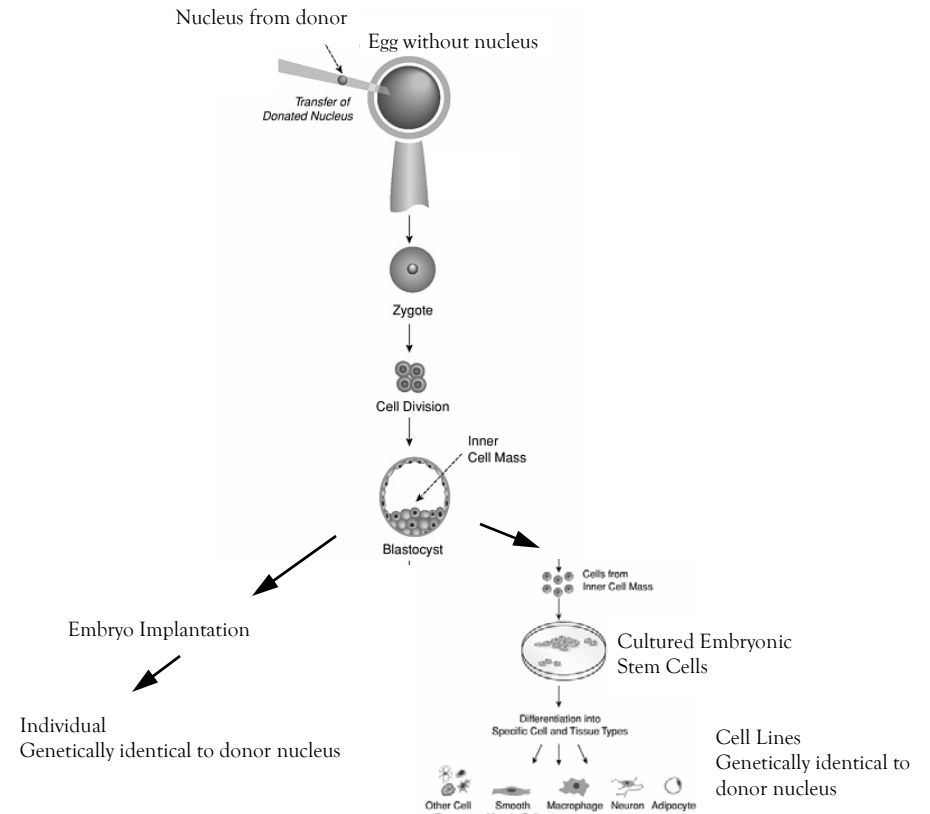
- 1) Remove cells from microscopic inner cell mass of blastocyst.
- 2) Culture cells to become a 'cell line'

There are currently over 400,000 excess embryos from IVF procedures in the US.

Images from: *Stem Cells and the Future of Regenerative Medicine*  
 Online Book, National Academies Press  
<http://www.nap.edu/books/0309076307/html/>

## 2. Somatic Cell Nuclear Transfer

- 1) Remove nucleus from an egg cell
- 2) Remove nucleus from an adult somatic (not egg or sperm) cell
- 3) Transfer nucleus from somatic cell to egg cell
- 4) Provide stimulation to the new cell to grow



### 2a. Reproductive 'Cloning'

- 5) Transplant new cell into uterus and allow to mature

Creates a genetically identical individual to donor of nucleus (Dolly) - although mitochondrial DNA is not the same. Process is *very inefficient* and resulting individuals often have developmental problems.

Does not result in a 'cell line'.

Human reproductive cloning is *not* being pursued by the general scientific community.

### 2b. Therapeutic 'Cloning'

- 5) Remove cells from microscopic inner cell mass of blastocyst.
- 6) Culture cells to become a 'cell line'

Cells are genetically identical to donor of nucleus and could possibly be transplanted back in to donor without immune rejection.

Cell lines that represent certain diseases could also be made from patients.