

You know, when I was a little stem cell,
I didn't know what I wanted to be either

But I'm so confused



Stem Cells

Hank describes Stem Cells

What are Stem Cells?

- Stem Cells- cells with the ability to divide for indefinite periods in culture and to give rise to specialized cells.
 - When it divides, the new cells can either:
 - Stay a stem cell, or
 - Become another type of specialized cell such as: muscle cell, red blood cell, brain, nerve cell, etc.

What are Stem Cells?

- A Stem Cell is cell that is undifferentiated. It has the ability to become differentiated into a specialized cell type.
- [Video: Stem Cells described...](#)

Different kinds of stem cells

- **Totipotent** — the ability of a cell to become any type of cell and has the ability to give rise to a new organism (found just after fertilization/the first few cells of the dividing zygote)
- **Pluripotent**- the ability of a cell to become any cell type but not placental cells-so can't make a new organism (found within the embryo/the first 4-5 days of fertilization)
- **Multipotent**- ability of a stem cell to become specific family of cells (adult stem cells and cord blood stem cells)

What's the fuss?

Pluripotent Cells are:

- **Embryonic stem cells**- found in a 4-5 day old embryo and have not differentiated to become a certain cell yet (*can become any type of cell*)
 - *What is considered a life? So.... Embryonic stem cell research became very controversial.*
 - *To make a stem cell line, embryonic stem cells are more successful and have the ability to become any type of cell compared to adult stem cells*

Multipotent Cells are:

- **Adult or Somatic stem cells**- undifferentiated cell found among differentiated cells (*limited- can only differentiate into the cell types of their tissue origin.*)

There is hope to avoid embryonic cells

- IPSCs- Induced pluripotent stem cells
 - From mice in 2006
 - From humans in 2007
- These are somatic (adult) somatic stem cells that have been reprogrammed to enter an embryonic stem cell like state
- Used for drug development/modeling of diseases/hopes for transplantation medicine

(induced pluripotent stem cells)

- “iPSC are derived from skin or blood cells that have been reprogrammed back into an embryonic-like pluripotent state that enables the development of an unlimited source of any type of human cell needed for therapeutic purposes. For example, iPSC can be prodded into becoming beta islet cells to treat diabetes, blood cells to create new blood free of cancer cells for a leukemia patient, or neurons to treat neurological disorders.”
- Credit: <https://www.stemcell.ucla.edu/induced-pluripotent-stem-cells>

Legal Issues

- “The stem cell debate has risen to the highest level of courts in several countries. Production of embryonic stem cell lines is illegal in Austria, Denmark, France, Germany, and Ireland, but permitted in Finland, Greece, the Netherlands, Sweden, and the UK. **In the United States, it is not illegal to work with or create embryonic stem cell lines. However, the debate in the US is about funding, and it is in fact illegal for federal funds to be used to research stem cell lines that were created after August 2001.**”
- Credit:
http://www.medicalnewstoday.com/info/stem_cell

Somatic Cell Nuclear Transfer

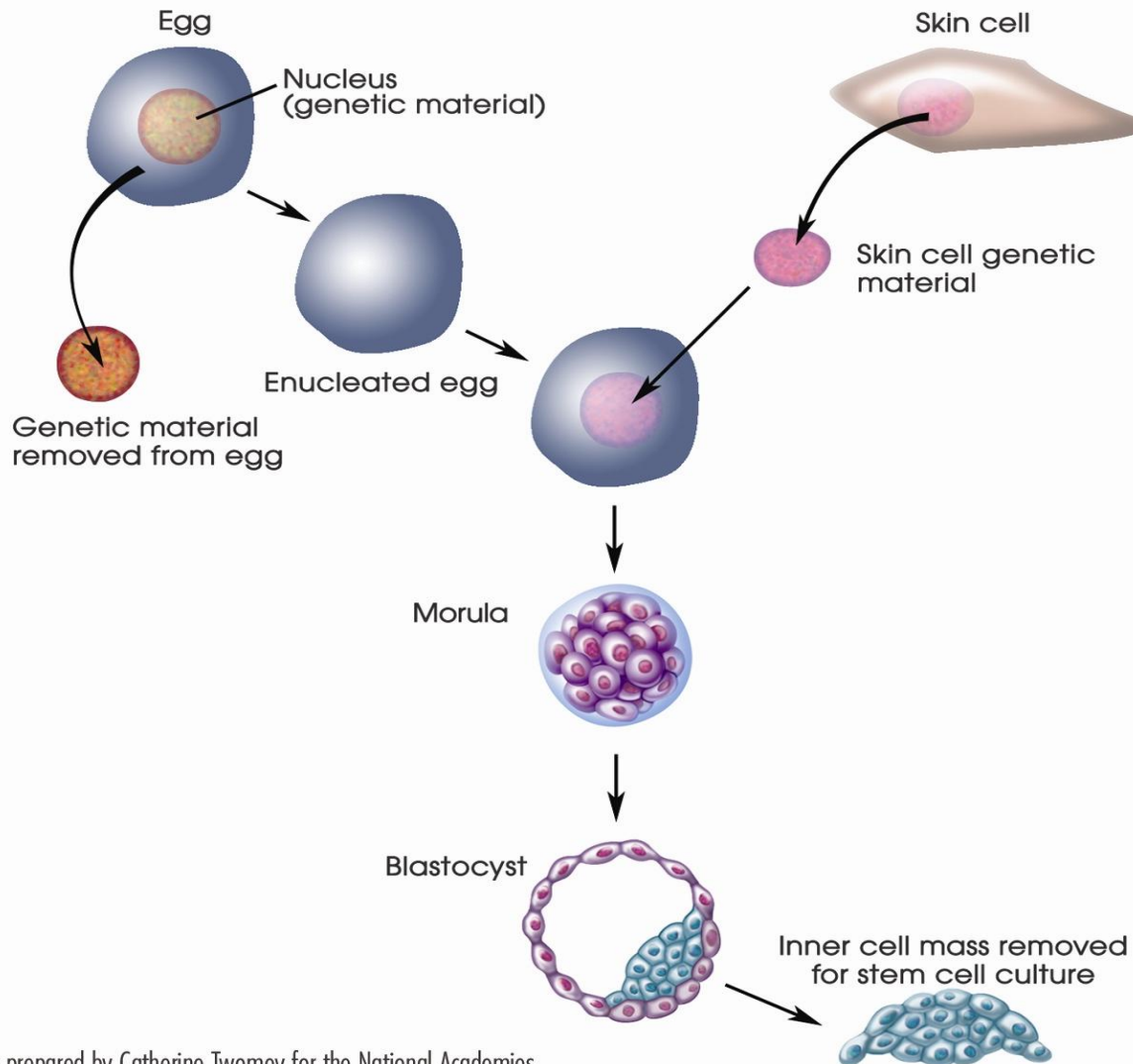


Image prepared by Catherine Twomey for the National Academies, *Understanding Stem Cells: An Overview of the Science and Issues* from the National Academies, <http://www.nationalacademies.org/stemcells>. Academic noncommercial use is permitted.

Documentary Time!

- Terra Incognita- Mapping Stem Cell Research

Helpful Links:

- General Info on Stem Cells:
http://www.medicalnewstoday.com/info/stem_cell
- Article on the use of stem cell therapies:
<https://www.sciencedaily.com/releases/2016/08/160818131144.htm>
- Info on iPSCs:
<http://stemcells.nih.gov/info/RegenerativeMedicine/2006Chapter10.htm>