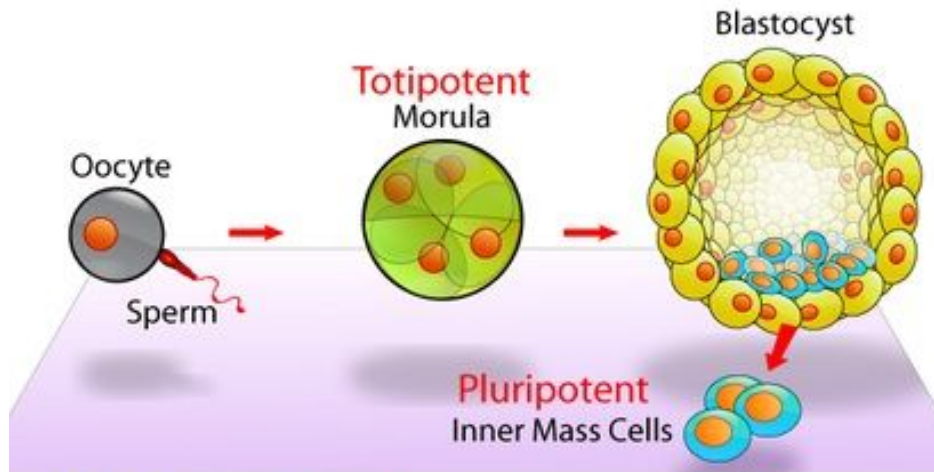


20.2 - Cell specialisation

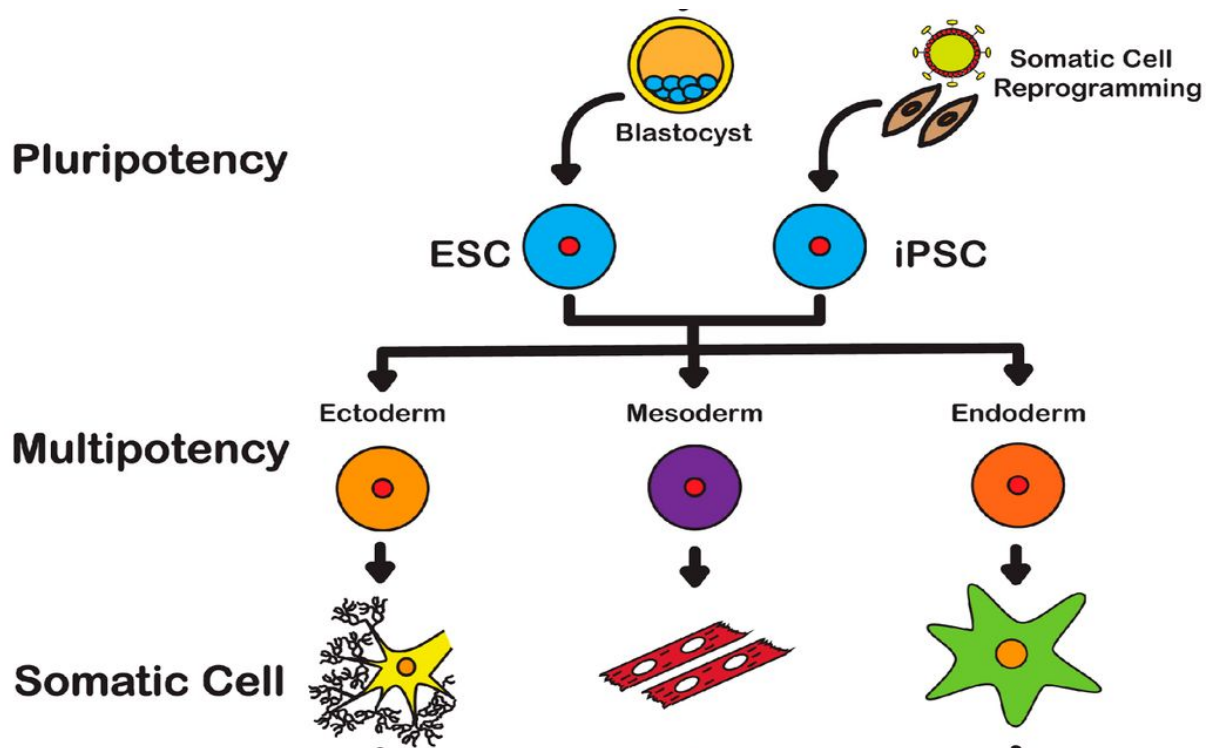


Fertilised egg = zygote

Cells in the zygote are **TOTIPOTENT** - can give rise to any cell type, including extra-embryonic tissue like the placenta

Cells of the zygote divide and form a blastocyst. The inner mass of the blastocyst is made of **Embryonic Stem cells**. These cells are **PLURIPOTENT** - can give rise to any cell type in the body, but not extra-embryonic tissue

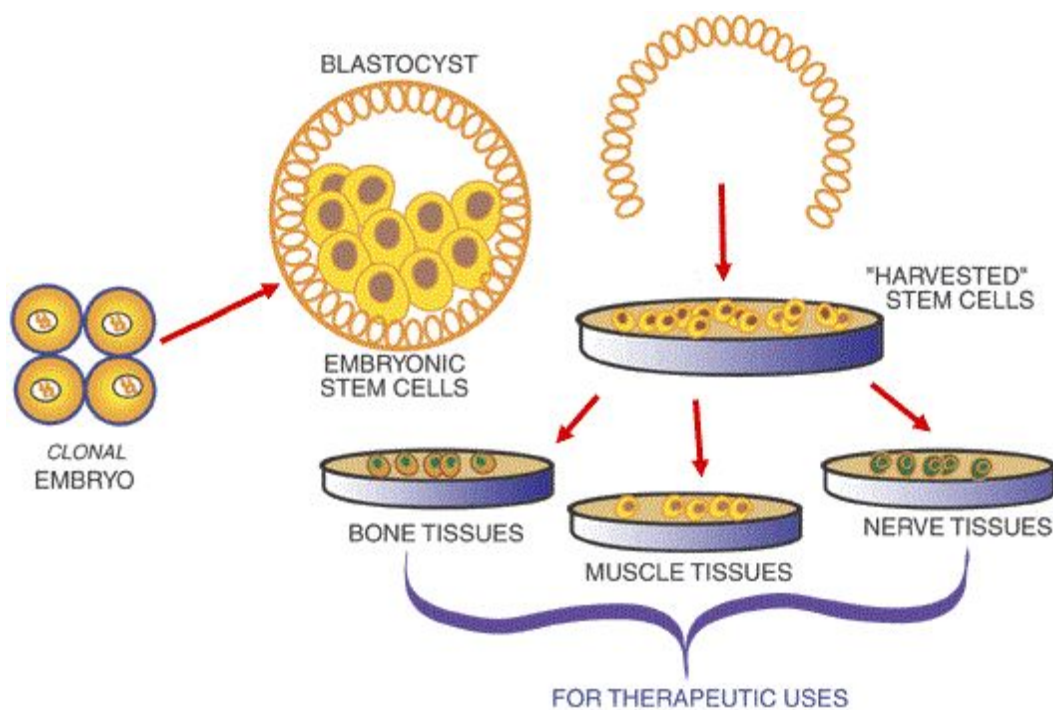
Video: <https://www.youtube.com/watch?v=P1h611sNji8>



Pluripotent cells specialise into **Multipotent Cells** ie. they can now only make certain types of cells = **ADULT STEM CELLS**

Multipotent cells differentiate further into **Unipotent** cells - they can now only divide to give rise to cells of their own type.

Why Stem Cells are Useful (pg 508 - Fig 2)



SCs can be induced to grow into different tissue types by varying the type of growth factor added to the culture medium = used to replace damaged tissue in the body, eg. artificial trachea, artificial heart

More of this will be covered in the 1.15 lessons

Adult Stem Cells vs Embryonic Stem Cells

Embryonic S.C.	Adult S.C.
"Pluripotent" (can become any cell)	"Multipotent" (“can become many but not any”)
Stable. Can undergo many cell divisions.	Less Stable. Capacity for self-renewal is limited.
Easy to obtain but blastocyst is destroyed	Difficult to isolate in adult tissue.
Possibility of rejection??	Host rejection minimized

The use of ESCs is associated with many ethical issues
- will be discussed in the 1.15 lesson

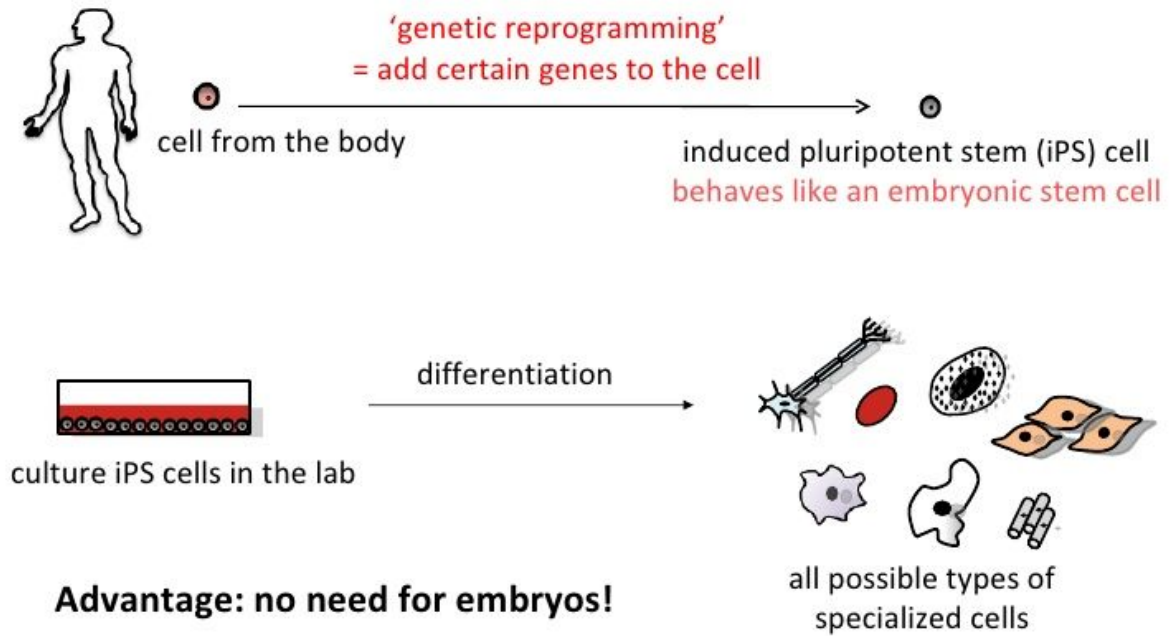
Adult Stem Cells can be found in:

- Umbilical cord
- Placenta
- Bone marrow (Hematopoietic stem cells)
- Brain
- Digestive Tract
- Skin

ASC are often buried deep in the tissue and hard to isolate.

They have a shorter life span than ESCs and are often harder to grow up in the laboratory

Induced Pluripotent Cells - iPS cells (pg 506)



Discovered by Japanese scientist Yamanaka in 2006 - won him the Nobel Prize in 2012

Any cell from the body can be genetically re-programmed to return back to the undifferentiated **pluripotent** state - unlimited supply of cells, without involving embryos

However, takes time and requires expertise - and not 100% identical to ESCs, so cannot be used for basic research

Video:

<https://www.youtube.com/watch?v=uUH5YI5dTOg>