



## Stem Cells

A stem cell is an (1) unspecialised cell which has (2) long-term self-renewal capability via mitosis and (3) can differentiate to give rise to specialised cells, comprising tissues and organs.

## POTENCY

<u>Potency</u> is the range of cell types that a stem cell can differentiate into. It is determined by the number of possible developmental pathways the cell possesses.

TOTIPOTENT	PLURIPOTENT	MULTIPOTENT
Can differentiate into all cell types in an organism & any cell in the extra- embryonic membrane	Can differentiate into all cell types in an organism but not any cell in the extra-embryonic membrane (e.g. placental cells)	Can differentiate into a limited number of cell lines and types
e.g. Zygotic Stem Cell (ZSC)	e.g. Embryonic Stem Cell (ESC)	e.g. Adult Stem Cell (ASC)
Within 5 days of fertlisation	Between 5-7 days of fertilisation	More than 7 days after fertilisation
Taken from the zygote	Taken from cells in the inner cell mass (ICM) of the blastocyst	Taken from mature tissue
zygote	blastocyst	tissue



The <u>blastocyst</u> will eventually develop into cells of the three germ layers - mesoderm, endoderm, ectoderm (i.e. all cells in the organism)

- Mesoderm skin and central nervous system cells.
- Endoderm gut, lungs, liver
  Ectoderm brain, epidermis, peripheral nervous system cells



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## ADULT STEM CELLS

<u>ASCs</u> are located in mature tissue and (1) maintain and repair the tissue in which they are located & (2) replace cells that die due to injury or disease.

## e.g. BLOOD STEM CELLS

Blood stem cells (BSCs), aka haemopoietic stem cells (HSCs) and can differentiate into three cellular elements that form blood plasma. The main role of BSCs are to replace blood cells.

1. Red Blood Cells (*erythrocytes*)

- 2. White Blood Cells (*leukocytes* and *lymphocytes*)
- 3. Platelets (megakaryocytes)

BIOETHICS	FOR IPSC	AGAINST IPSC
<ul> <li>There are four principles governing bioethics</li> <li>1. Respect for Persons - Respecting the choice of people</li> <li>2. Maximizing Benefit, Minimizing Harm - Emphasising beneficence and non-maleficence</li> <li>3. Justice - Emphasising fairness</li> <li>4. Care - Respect for relationships between people</li> </ul>	Made with patient cells - lower chance of rejection	Time consuming, Expensive - only available to select few
	Do not have ethical implications of using ESCs from humans	May be tumorigenic - lack of research on iPSCs
have discovered a way to turn somatic cells into induced pluripotent stem cells (iPSCs).	Readily accessible	Difficult to standardize - patient specific