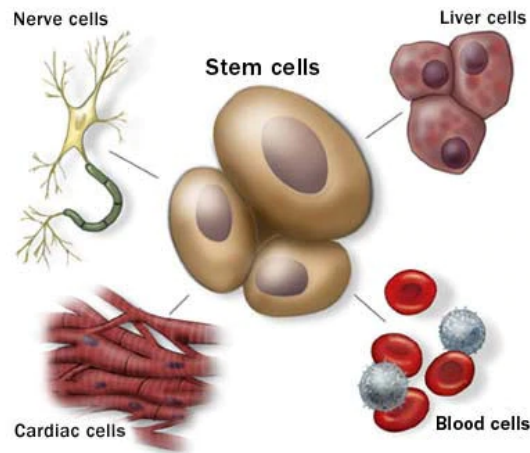


Stem Cells

1. Stem Cells

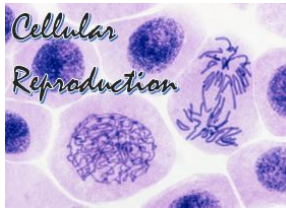
- a. Unspecialized cells that can become various types
 - i. There are different types of stem cells
- b. Come in three basic types
 - i. Embryonic; fetal tissues and the development into an embryo
 1. Have a lack of specificity toward any particular type of cell
 2. Useful for scientific research
 - ii. Progenitor; partially specialized cells and are found in fetal and adult tissue
 1. Undifferentiated cells within tissues
 - iii. Adult; unspecialized cells that can regenerate and replace damaged tissue
 1. i.e. bone marrow cells



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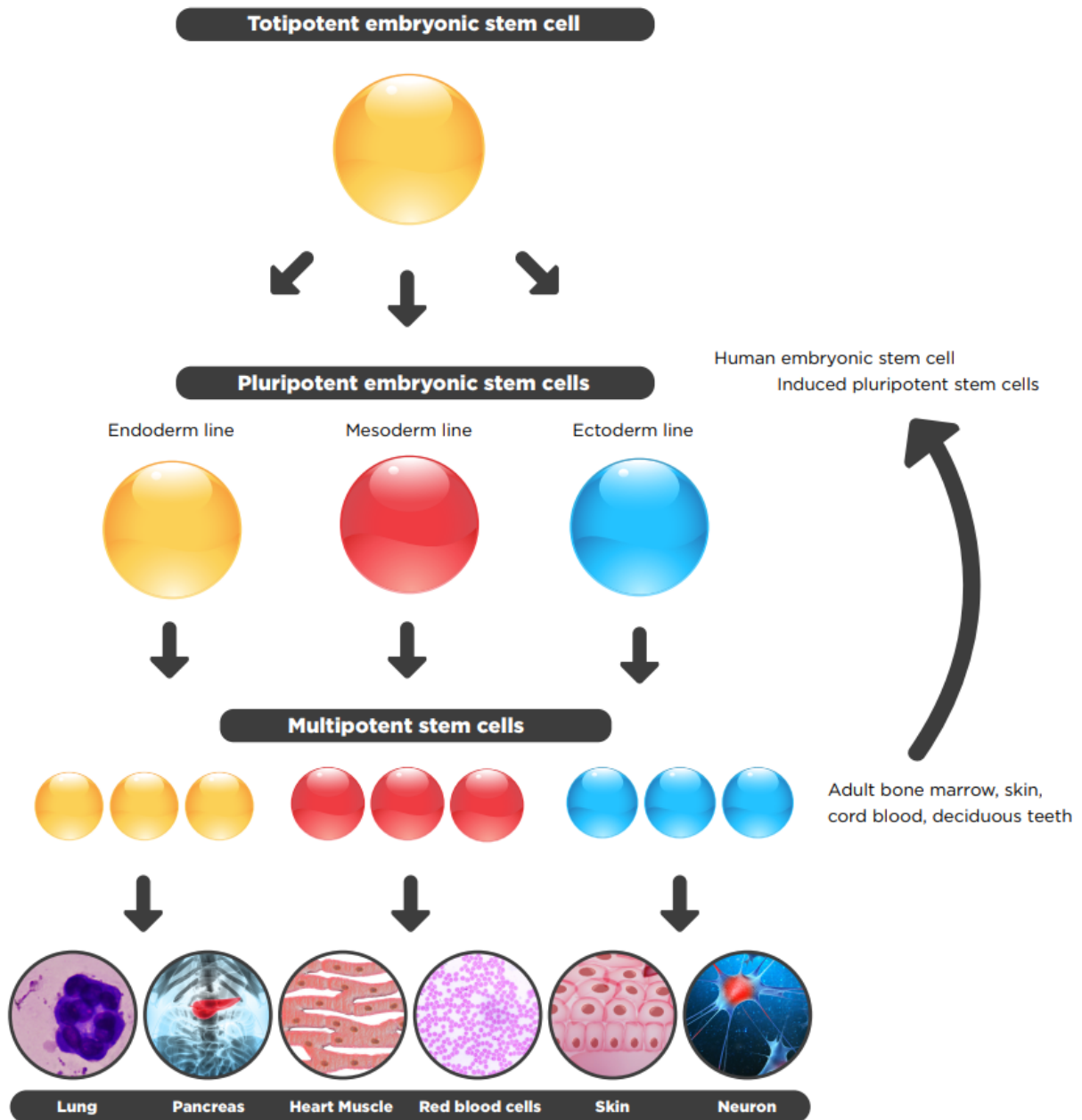
From: <https://www.mayoclinic.org/tests-procedures/bone-marrow-transplant/in-depth/stem-cells/art-20048117>

- c. Potency or ability to specialize
 - i. Totipotent; infinite potential and the possibility to become any cell in the body or support a growing fetus
 1. Fertilized eggs
 - ii. Pluripotent; can become any cell in the body, ut are not capable of creating placental tissue
 1. During blastocyst



Stem Cells

2. Outer cells become placenta to support embryo
3. Inner cells differentiate to become the cells of the embryo
- iii. Multipotent; much less versatile and can only become a few types of cells in a particular lineage
 1. i.e. a brain cell can become a neuron or astrocyte but never a blood cell





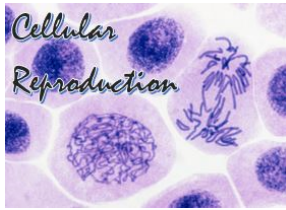
Stem Cells

Accessed: <https://www.technologynetworks.com/cell-science/articles/cell-potency-totipotent-vs-pluripotent-vs-multipotent-stem-cells-303218>

Totipotent vs Pluripotent vs Multipotent Comparison Chart

	Totipotent	Pluripotent	Multipotent
Relative potency	High	Medium	Low
Cell types capable of generating	Differentiate into any cell type	Differentiate into cells from any of the three germ layers	Differentiate into a limited range of cell types
Terminology	Toti = Whole	Pluri = Many	Multi = Several
Examples	Zygote, early morula	Embryonic stem cells, Induced pluripotent stem cells	Haematopoietic stem cells, neural stem cells, mesenchymal stem cells
Found	Early cells of fertilised egg	Inner mass cells of the blastocyst	In many tissues
Expression of pluripotency genes	+++	++	+
Expression of lineage-specific genes	+	++	+++
Pros of use in research	Easy to isolate and grow	Easy to isolate and grow	Less ethical issues, less chance of immune rejection if taken from same patient
Cons of use in research	Ethical issues	Ethical issues, teratoma formation	Hard to isolate, limited differentiation, scarce

Accessed: <https://www.technologynetworks.com/cell-science/articles/cell-potency-totipotent-vs-pluripotent-vs-multipotent-stem-cells-303218>



Stem Cells

- d. Uses:
 - i. Regenerate damaged cells and tissues
 - ii. Divide infinitely and could keep organisms living for long periods of time
 - iii. Driving research into human disease and the use of stem cells in medicine
 - 1. Sources of stem cells
 - a. Excess embryos from IVF
 - b. Created in a lab from donated sperm and egg
 - c. Embryos from somatic cell nuclear transfer (used in cloning)
 - d. Embryos from aborted fetuses
 - e. Umbilical cords
- e. Ethics
 - i. Using aborted fetuses for stem cell research is politically and morally divisive
 - ii. Most research lines come from unused fertilized eggs from IVF
 - iii. Highly regulated by the federal government
 - 1. Guidelines dictate the type of research and the source of the cells