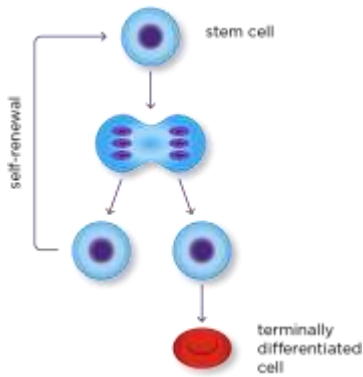


STEM CELL 101: Adapted from text by the UW Institute for Stem Cell and Regenerative Medicine

What are Stem Cells?

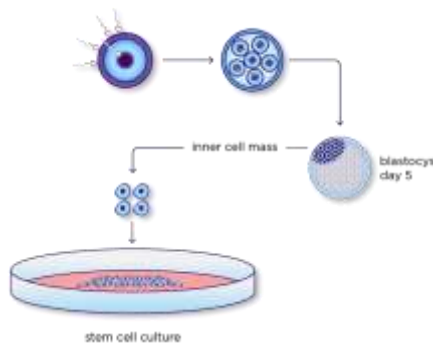


Stem cells are simple-looking cells with specialized functions found in nearly all tissues in the body. They can make copies of themselves and “self-renew.” They have remarkable ability to differentiate many different kinds of cells.

1. What is differentiation?

What are Embryonic Stem Cells?

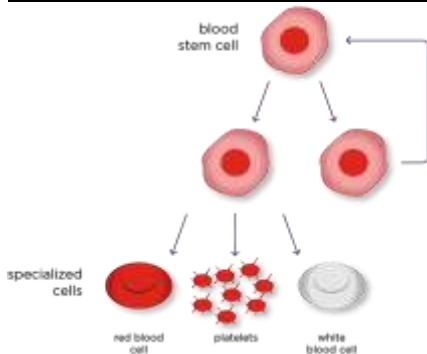
It all begins with fertilization. Embryonic stem cells appear at the blastocyst stage of the embryo. They are **pluripotent** (able to mature into any of the 200+ different cell types in the body). They are immortal (capable of reproducing indefinitely), and can be grown in large quantities in the laboratory.



2. What kind of stem cells do embryos have?

3. Define this word.

What are Adult Stem Cells?



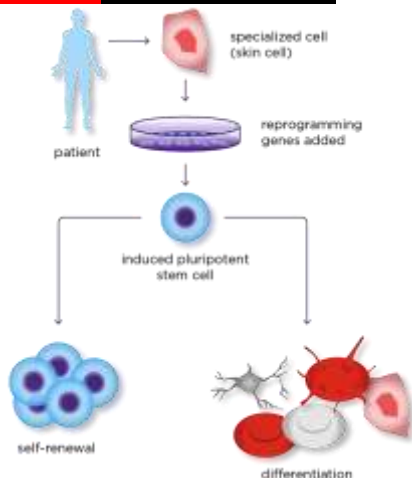
Adult stem cells are **multipotent** (they can mature into a few cell types). They have the capacity to divide long-term, but they are not immortal. These cells make up organ systems in the body — like skin, blood, and gut.

4. What kind of stem cells do adults have?

5. Define this word.

What are Induced Pluripotent Stem Cells?

Induced pluripotent stem cells are derived from adult cells (from skin, blood, urine, etc.) that have been “reprogrammed” in the lab. They have been taken back to an embryonic stem cell-like state, and can then be differentiated into any cell type in the body.



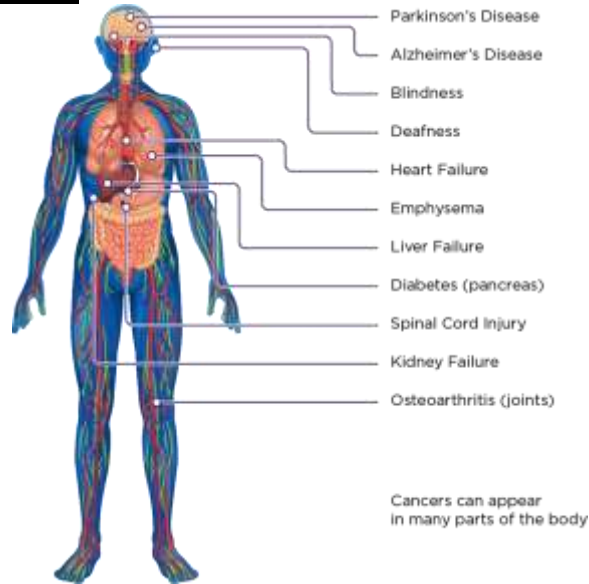
6. What kind of cells can bioengineers reprogram into stem cells?

7. What kind of stem cells do these become?

8. Why would the ability to make stem cells be important?

Keeping Our Cells in Balance

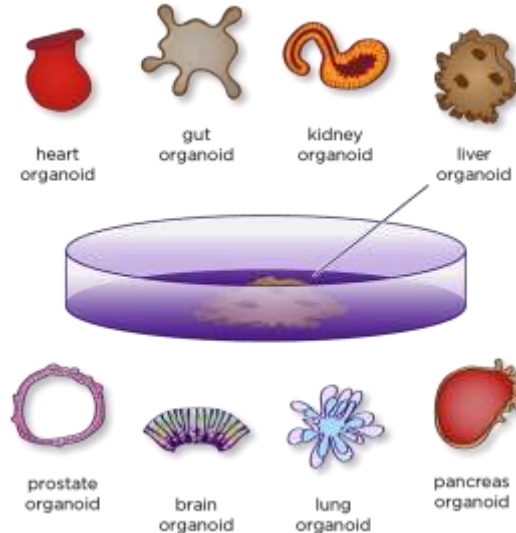
Many degenerative diseases result from **cell deficiency**. Stem cells give us a way to replenish the cells that are lost or dysfunctional. On the other hand, cancer is a disease of **cellular excess** caused by mutated genes in adult stem cells that multiply uncontrollably and can affect many parts of the body. Precision medicine targets each cancer to find its "Achilles heel."



9. Would stem cells be more useful in treating cell deficiency diseases, or cell excess diseases? WHY?

Using Stem Cells to Build New Tissue

Researchers can now engineer new tissue from stem cell-derived cells. "Organoids" are miniaturized and simplified versions of organs, built from this tissue to mimic actual human organs. These lab-generated tissue organoids are used for drug screening and disease modeling.



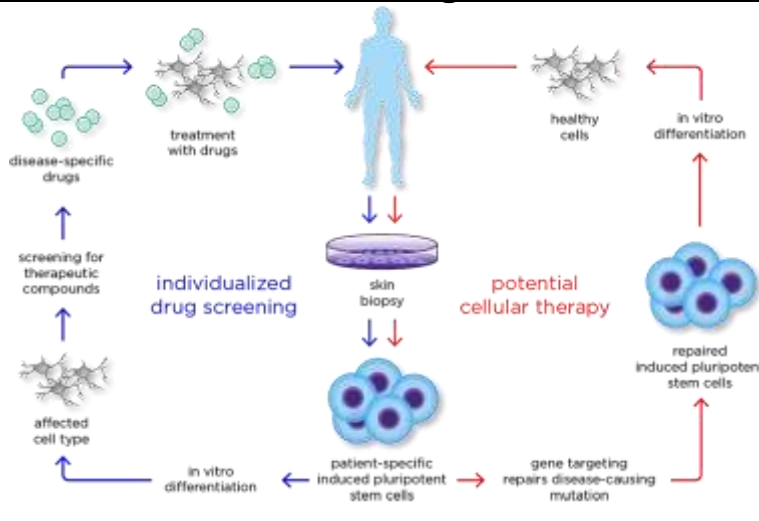
10. What are organoids?

11. Why are organoids useful?

12. In the future how could organoids be used medically?

Creating Patient-Specific Stem Cells to Target Disease Precisely

Disease modeling allows researchers to discover the deficiency in the patient's unhealthy cells. This allows doctors to identify medications or additional therapies that can improve the function of these cells. Genetically repaired cells taken from a patient can potentially be used to treat the patient without rejection.



13. Why might genetically repaired cells be a better treatment option that traditional medicine or therapies?