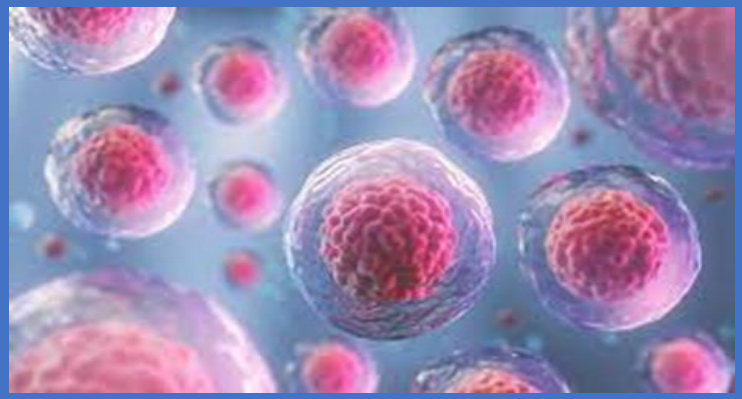
Block CSF-103
Cell Structure and Function



STEM CELLS

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Intended Learning Outcomes

By the end of this lecture, the student should be able to :

- **Define and recognize the different characteristics of stem cells.**
- **Identify the types of stem cells.**
- **Interpret the stem cells' applications, role, and tissue banking considerations**

STEM CELLS

Definition

Undifferentiated Cells have the ability to continuously divide and differentiate (develop) into various other kind(s) of cells/tissues

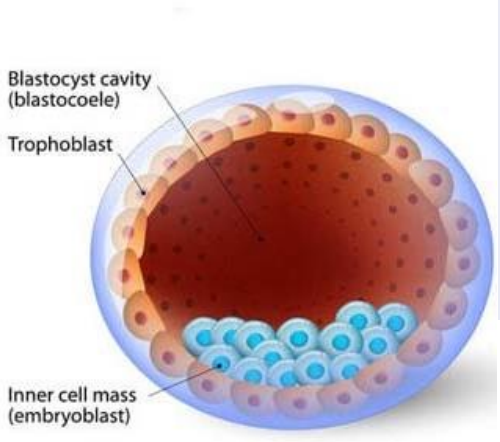
Stem cells characteristics

Types of stem cells according to differentiation capability

Stem cell type	Description	Examples
Totipotent 	Each cell can develop into a new individual (embryo , fetal membranes and placenta	Fertilized egg, Cells from early embryos (1-3 days)

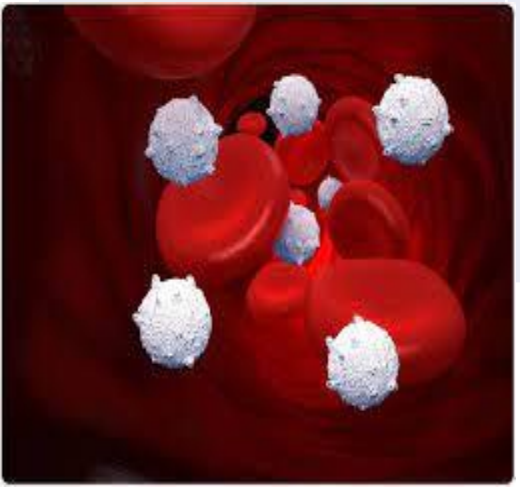
Types of stem cells according to differentiation capability

Stem cell type	Description	Examples
Pluripotent	Form (embryo only)	cells of inner cell mass of the blastocyst (5 to 7 days)



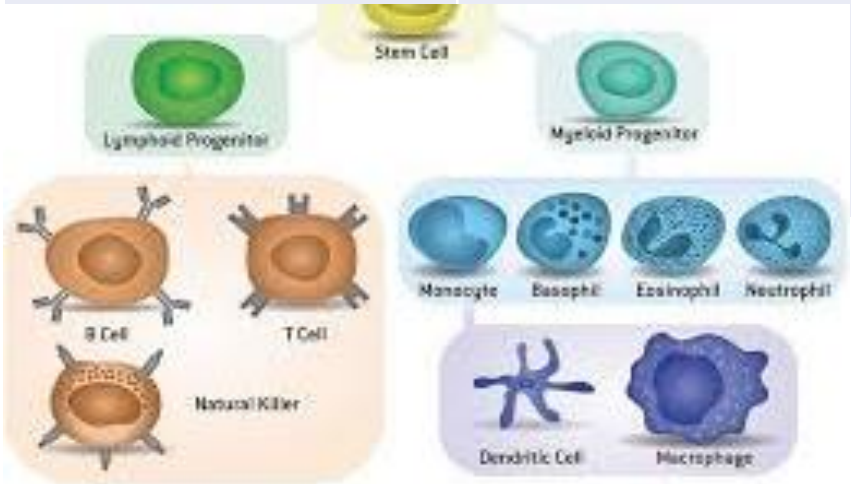
Types of stem cells according to differentiation capability

Stem cell type	Description	Examples
Multipotent	can generate different cell types for the specific tissue or organ	blood-forming (hematopoietic) stem cells in the bone marrow



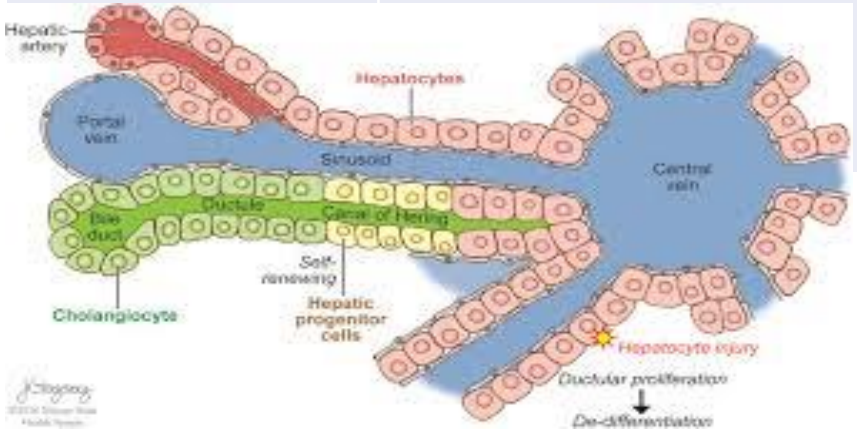
Types of stem cells according to differentiation capability

Stem cell type	Description	Examples
Oligopotent	differentiate into a few cells.	lymphoid or myeloid blood forming cells in bone marrow

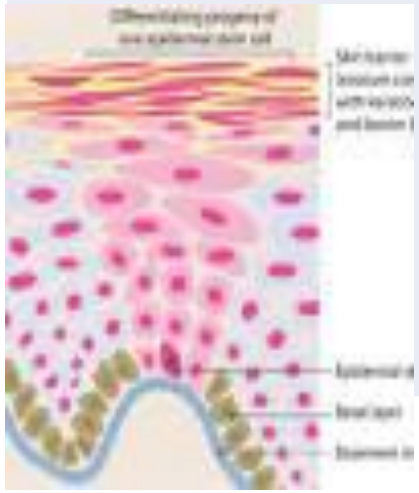


Types of stem cells according to differentiation capability

Stem cell type	Description	Examples
bipotent	Into two types; biliary, hepatocyte	Hepatic progenitor cells

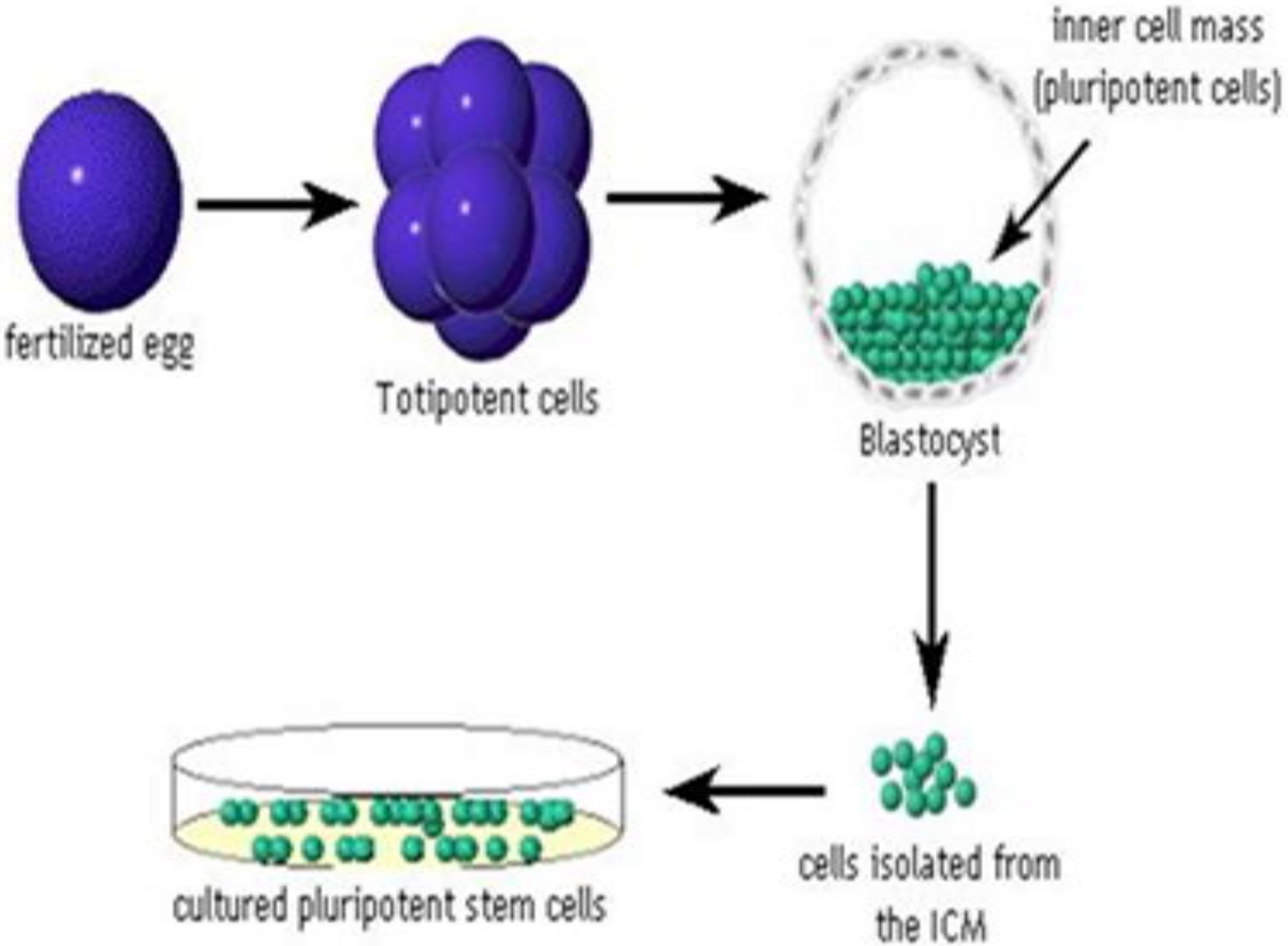


Types of stem cells according to differentiation capability

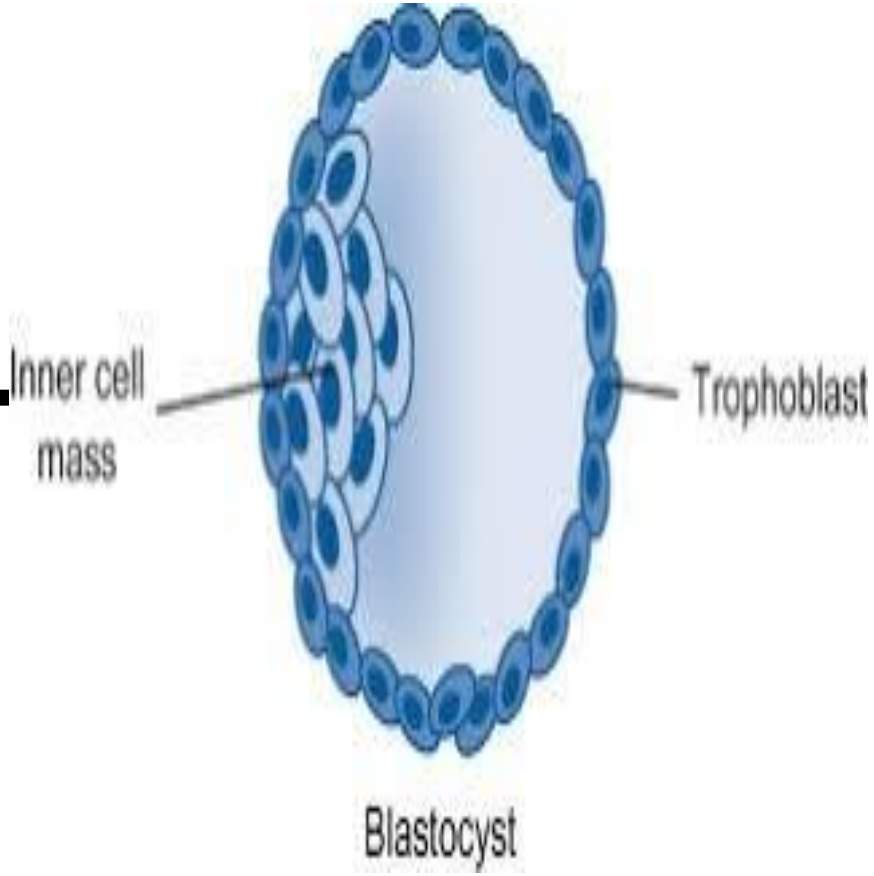
Stem cell type	Description	Examples
unipotent 	only produce cells of their own type, but have the property of self-renewal required	Epidermal stem cells. Muscle stem cell

Types of stem cells according to source
1-Embryonic stem cells

- ✓ Derived from the inner cell mass of blastocysts.
- ✓ following informed consent.
- ✓ have the potential to become almost any cell type.


inner cell mass
(pluripotent cells)
fertilized egg
Totipotent cells
Blastocyst
cells isolated from
the ICM
cultured pluripotent stem cells

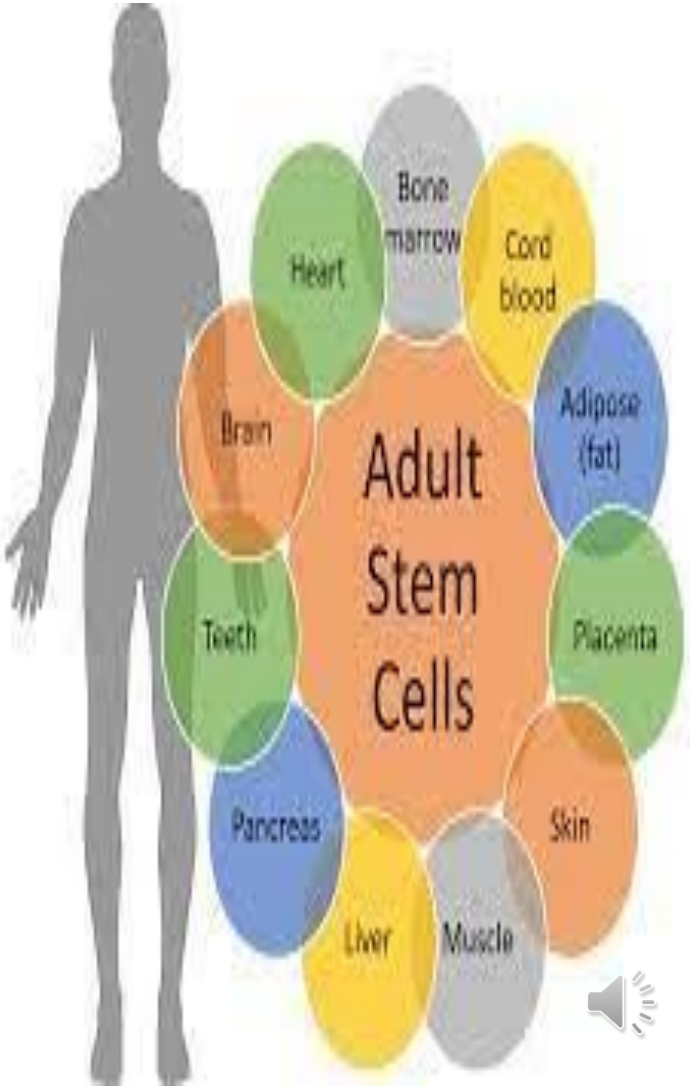
Frozen blastocysts



Types of stem cells according to source
2-Adult stem cells

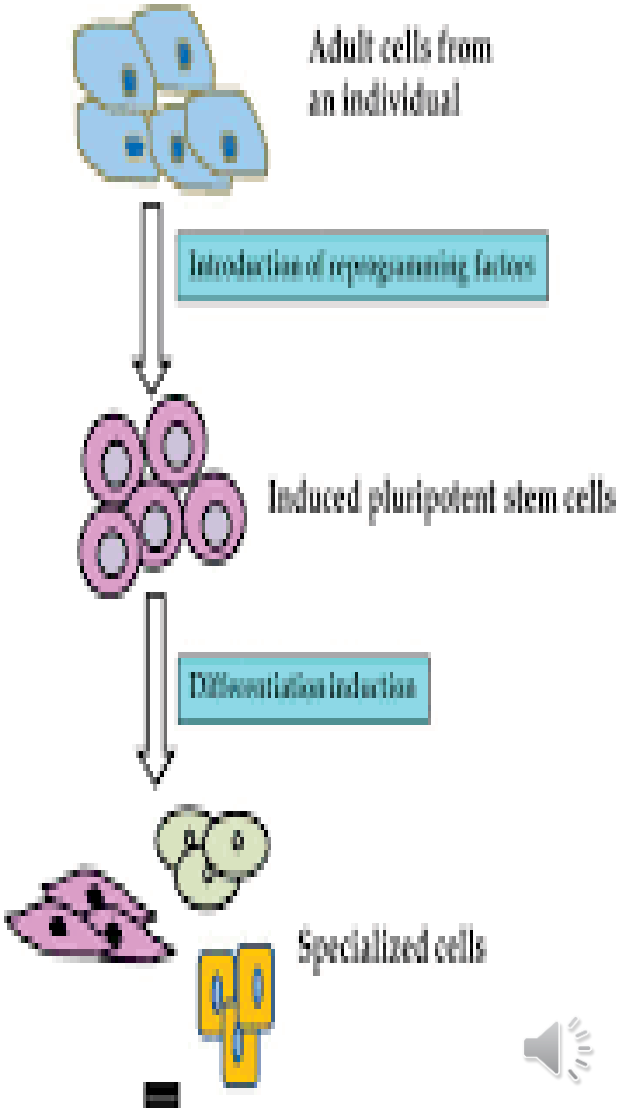
Tissue-specific stem cells:

- ✓ **bone Marrow.**
- ✓ **Adipose tissue-derived stem cells (ADSCs), Umbilical cord stem cells**
- ✓ **Human amniotic fluid.**



Types of stem cells according to source
3-Induced pluripotent stem cells (iPPSCs)

created through the introduction of embryonic genes into a somatic cell that causes it to revert back to a “stem cell-like” state, a process called genetic reprogramming.



Stem Cell Applications in Medicine

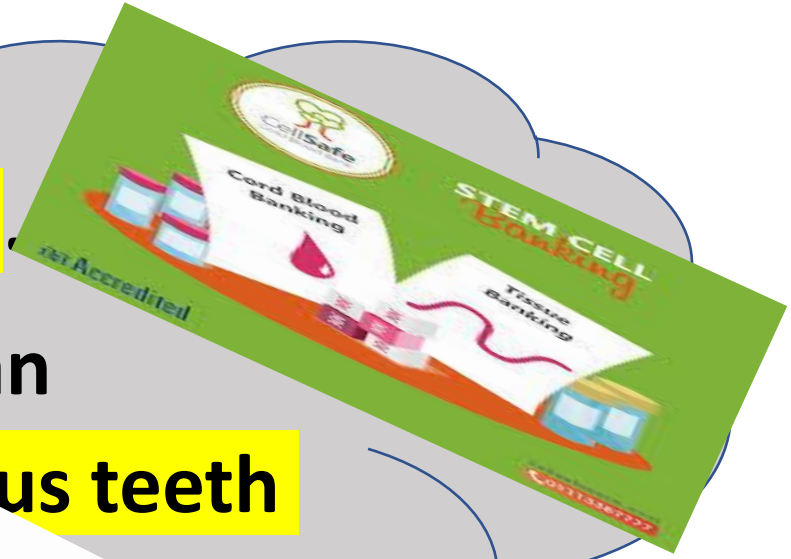
Theoretically and under research, stem cell therapies could be applied in regenerative medicine.

Clinical trials

Currently, the only stem cell-based treatment approved by the FDA is hematopoietic stem cell (HSCs) transplantation, used to treat blood and immune system disorders.

Stem cells and tissue banks

- The **umbilical cord** .
- Stem cells of human exfoliated **deciduous teeth** (SHED).



Cell Renewal

It occurs in all our lives through tissue-specific stem cells for the repair of damaged tissue

- ✓Skin epidermis.
- ✓ Intestinal epithelium.
- ✓ Spermatogenesis.

Intended Learning Outcomes

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QUIZ!

1- What is a stem cell?

a. A cell that can make copies of itself and make more specialized types of cells.
b. A cell that helps to fight against infections.
c. a specialized cell.
d. A cell that can produce all the cell types of the body.

a

2- Embryonic stem cells can differentiate into which types of cells?

a. Only brain stem cells and specialized brain cells.
b. All types of specialized cells in the body.
c. Only cells that can produce insulin.
d. Only cells that can produce artificial skin.

b

3- A blastocyst is…

a. A very early-stage embryo.
b. A type of stem cell.
c. Part of the blood system.
d. A type of brain cell.

a

4- What are the roles of stem cells in our bodies?

a) We are not sure what roles stem cells play in the body.
b) They produce new specialized cells to replace cells that die or are used up.
c)They fight against infections.
d)They perform specialized roles in the body (e.g. produce insulin, transmit signals in the nervous system, …).

b

Answer the following short questions:

1-Enumerate stem cell types according to their differentiation capability, and give an example for each one.

2-Define stem cells.

3-Enumerate stem cell types according to their source.

4-What is meant by tissue bank?

What are the applications of stem cells in medicine?

5-What is the physiological role of stem cells?


Thank You!