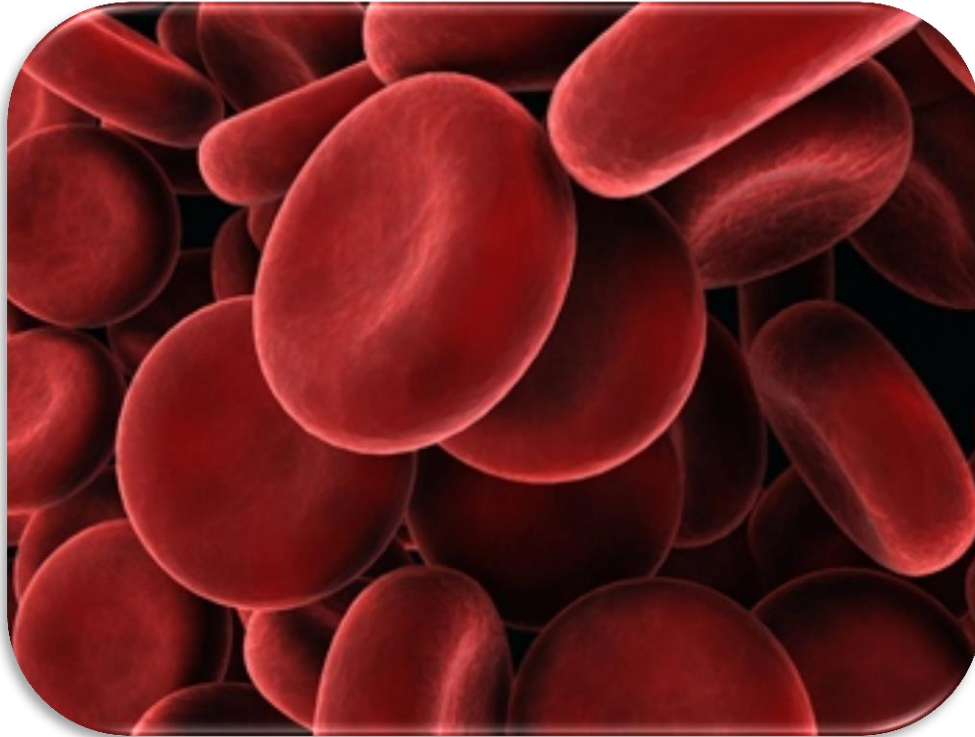




Hematology



Lecture: Introduction to pluripotent stem cells

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Reviewed by: Eman AlBediea

[If there is any mistake or suggestions please feel free to contact us:](#)

Anatomyteam32@gmail.com

Both - Black

Male Notes - BLUE

Female Notes - GREEN

Explanation and additional notes - ORANGE

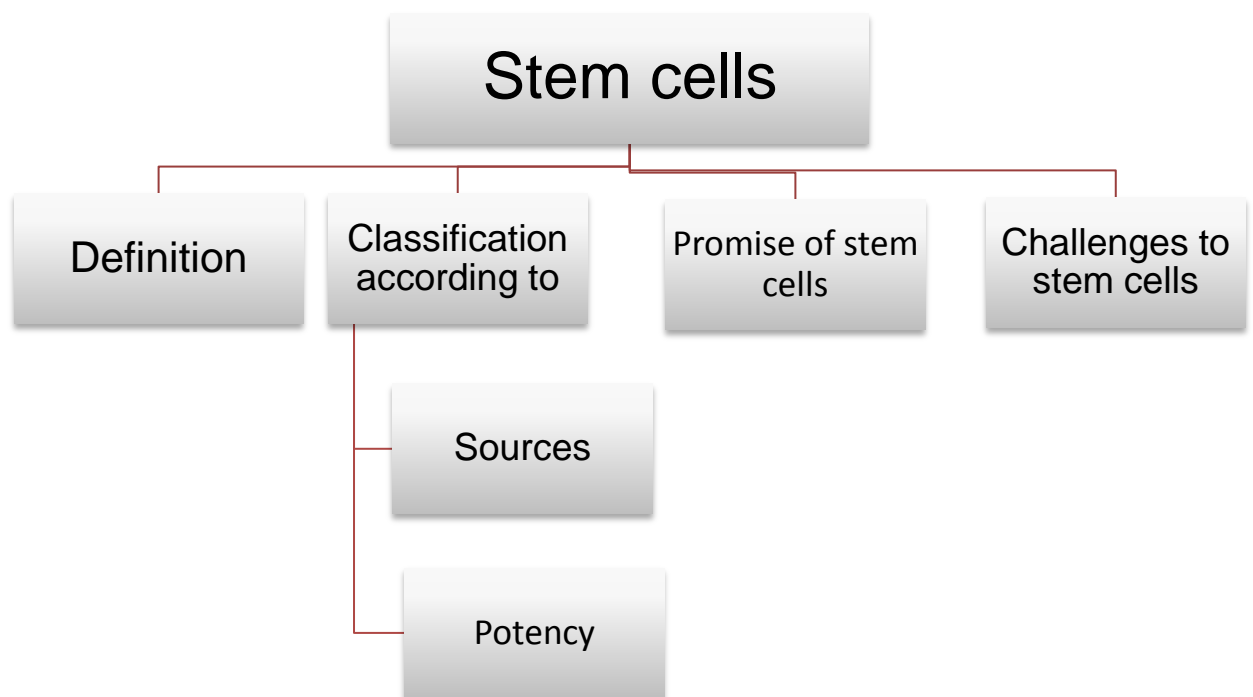
Very Important note - Red



Objectives:

Not Given

Mind Map





Definition of stem cells

Which type of cells we can consider it as stem cell?

- The cell that has the ability to **continuously divide** and **differentiate** into various other kinds of cells/tissues.

Classification

What are the sources of stem cells?

- It comes from all tissues and all stages.
 - From fertilization to the implantation (embryonic stem cell) lasts for 7 days
 - From 2nd trimester to the end of life (adult stem cell)

- **According to the source:**

- 1- **Embryonic stem cells (ESC) :**

The source of it is the **blastocysts** (inner cell mass) and it is the method which was followed to clone ((The Dolly Sheep))*

- **We can isolate blastocyst by:**
 - a- **In vitro fertilization (IVF):** is a process by which an egg is fertilized by sperm outside the body then it injected into the host.
 - b- **Somatic cell nuclear transfer (SCNT):** is a laboratory technique for creating a cloned embryo with a donor somatic nucleus. EX: (dolly Sheep)

Why it is the most used source?

- 1- Because it gives all types of tissues and more potent.
- 2- Because it is very active and it has longer life span.

* **Dolly Sheep:** a female sheep, and the first mammal to be cloned from an adult somatic cell, using the process of nuclear transfer.



2- Adult (tissue specific):

Which is taken from mature organ that means it can be taken from (fetus liver) despite he is not adult yet..!

(From 2nd trimester to the end of life).

Found in specific mature body tissues as well as the umbilical cord and placenta after birth also they can be isolated of developing embryos' different tissues.

2- Induced Pluripotent stem cells (iPSCs):

Which was discovered by Yamanka and he got noble prize.

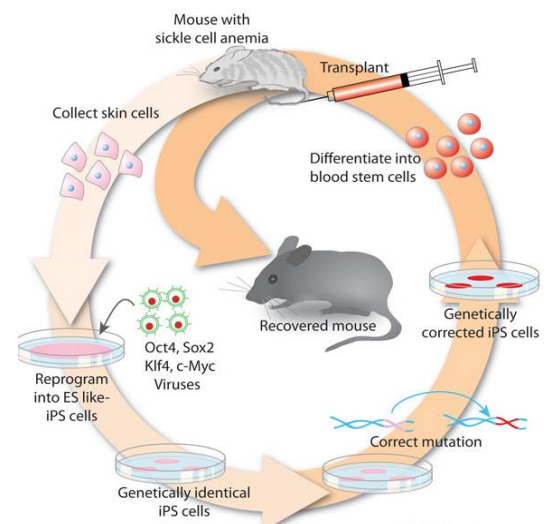
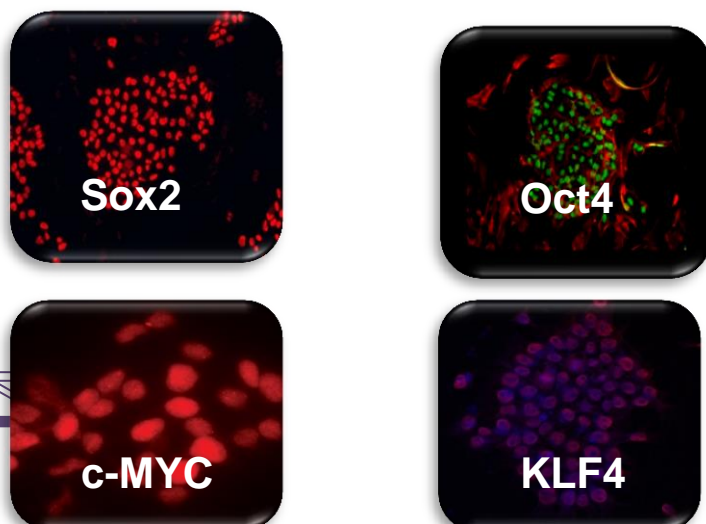
What he did?

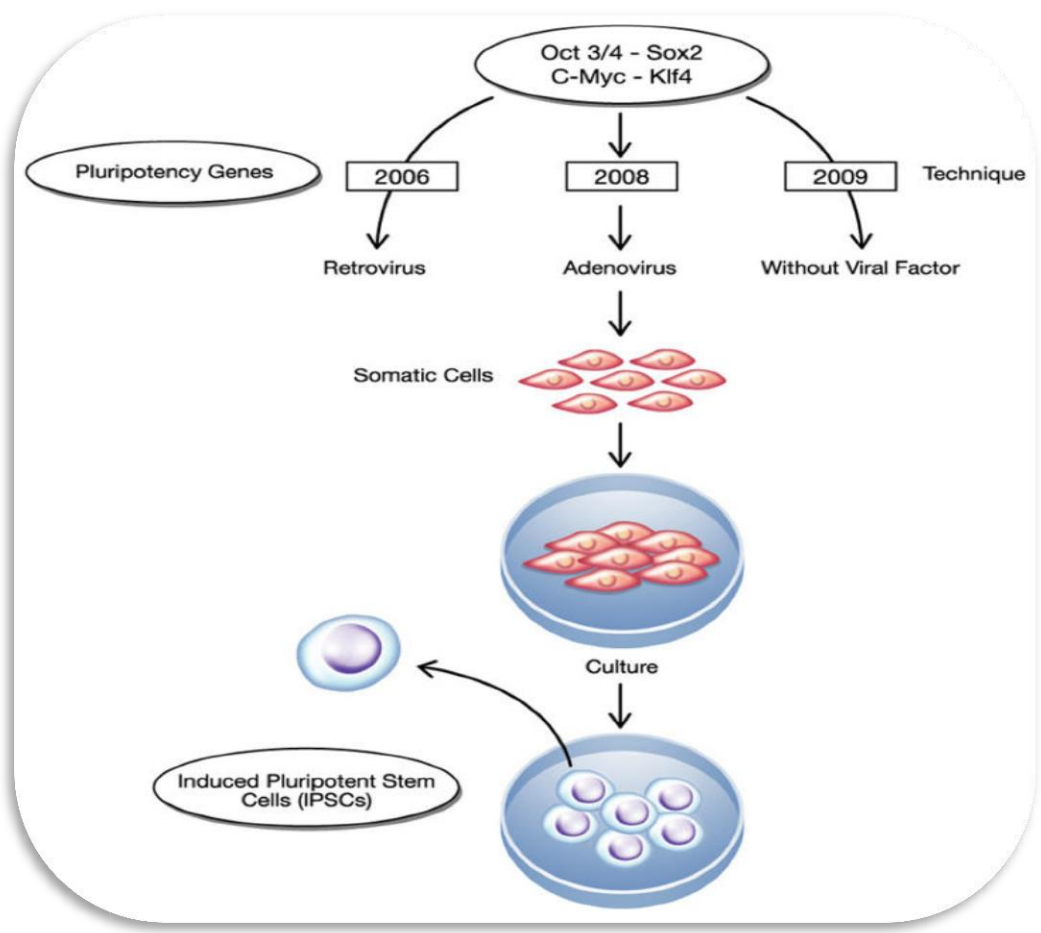
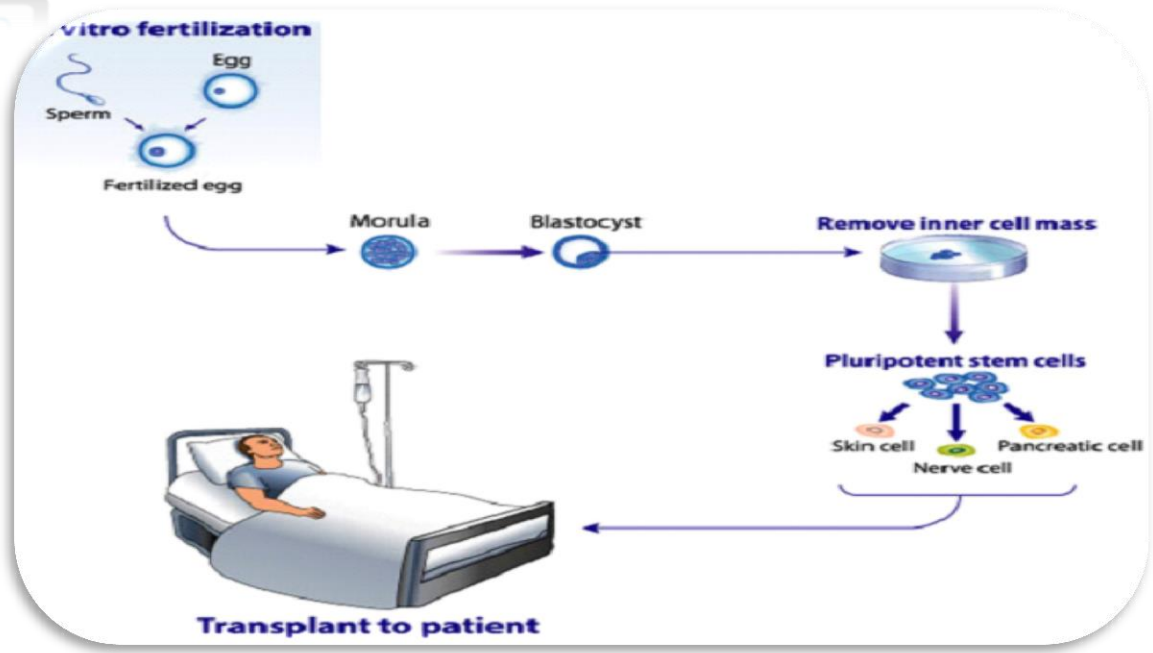
He returned the somatic cell (mature cell) which was taken from mouse to pluripotent (three germ cells) which is the embryonic stem cell state.

This protocol has been applied to mouse cells and human somatic cells.

How he did it?

He added four transcription factors to skin cell of sickle cell mouse (Oct3/4, Sox2, KLF4 and c-MYC) and the cells were differentiated into hematopoietic cells, the produced cells were transfused back into the sick mouse, then the mouse recovered.







How transcription factors can go inside nucleus of somatic cell?

By carrying it on virus (herpes virus mainly) that goes inside the nucleus, but it is the obstacle that we can't apply it on human because **Herpes virus is not curable.**

How can we detect pluripotent cells?

- 1- By staining and detecting the transcription factors.
- 2- By injecting the cell into the kidney, if it formed (Teratoma) that means it is pluripotent cell.

•According to the potency:

Potency	Description
Totipotent	1-3 days, differentiate into embryonic and extraembryonic cell types
Pluripotent	Descendants of totipotent cells and differentiate into cells of 3 germ layers
Multipotent	of)Produce cells of a closely related family cells (e.g. hematopoietic stem cells
Oligopotent	Differentiate into ONLY a few cells, such as lymphoid or myeloid stem cells
Unipotent	Produce ONLY one cell type (e.g. muscle stem cells)
Nullipotent	The terminal cell

Very Important

- Totipotent: fertilized egg and it is the most potent.
- **Decreasing the potency of totipotent lead to pluripotent** (blastocyte or inner cell mass)
- Multipotent (tissue specific)



The Promise of Stem Cells Technique

- Replacement of tissues/organs
- Repair of defective cell types.
- Study cell differentiation
- Toxicity testing.
- Understanding prevention and treatment of birth defects.
- Study of development and gene control.
- Study of drugs therapeutic potential

Challenges to Stem Cells Research

- Stem cells need to be differentiated to the appropriate cell types before they can be used clinically.
- Recently, abnormalities in chromosome number and structure were found in three human ESC lines.
- Stem cell development or proliferation must be controlled once placed into patients.
- Possibility of rejection of stem cell transplants as foreign tissues is very high.
- The use of mouse “feeder” cells to grow ESC could result in problems due to xenotransplantation.

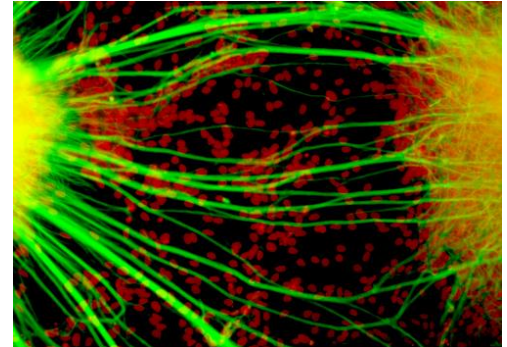
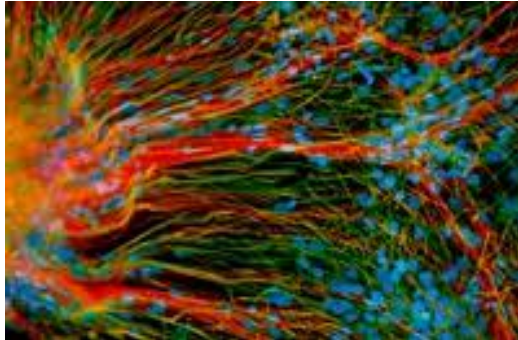


Development/Plasticity/Repair

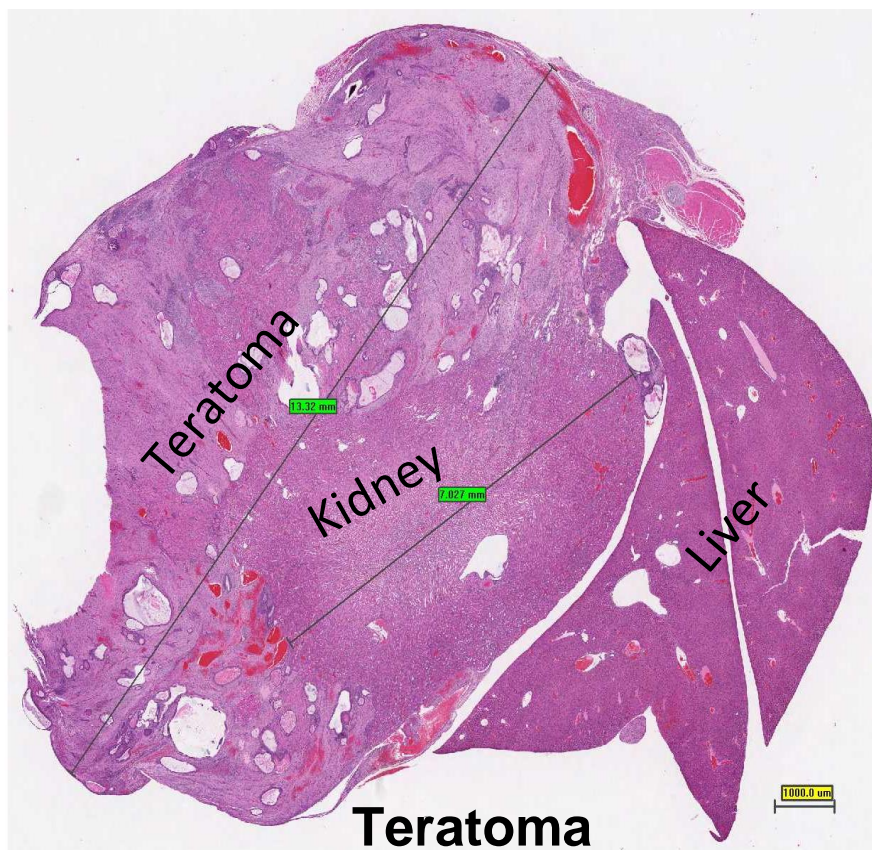
Human Embryonic Stem Cell-Derived Oligodendrocyte Progenitor Cell Transplants Remyelinate and Restore Locomotion after Spinal Cord Injury

Hans S. Keirstead,¹ Gabriel Nistor,¹ Giovanna Bernal,¹ Minodora Totoiu,¹ Frank Cloutier,¹ Kelly Sharp,¹ and Oswald Steward^{1,2,3}

Departments of ¹Anatomy and Neurobiology, ²Neurobiology and Behavior, and ³Neurosurgery, Reeve-Irvine Research Center, College of Medicine, University of California at Irvine, Irvine, California 92697-4292



But no person cured from Spinal cord injury





Questions:

1- Which of the following is the source of embryonic stem cell:

- a- Fertilized egg.
- b- Inner cell mass
- c- Mature organ
- d- Somatic cell

2- In vitro fertilization method is used to isolate :

- a- Fertilized egg.
- b- Inner cell mass
- c- Mature organ
- d- Somatic cell

3- Which of the following stages will have tissue specific stem cells:

- a- Fertilized egg
- b- Inner cell mass
- c- 10th week of fetal life
- d- 18th week of fetal life

4- Which of the following transcription factors is not used in induced pluripotent stem cells :

- a- Sox2
- b- Oct3/4
- c- HSF1
- d- KLF4



5- Which of the following stem cells can give extraembryonic cell type:

- a- Totipotent stem cells
- b- Pluripotent stem cells
- c- Multipotent stem cells
- d- Oligopotent stem cells

Q	Answers
1	B
2	B
3	D
4	C
5	A

GOOD LUCK

Anatomy Team Leaders:

Fahad AlShayhan & Eman AL-Bedica