

# Successful extraction of Stem Cells from Cord Blood Samples in Cairo University Hospitals

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# Medical Revolution I

## PENICILLIN

- Discovered in **1928** by bacteriologist **Alexander Fleming** working at St. Mary's Hospital in London.
- Noticed that it killed adjacent bacterial colonies
- He published his results in **1929**.

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*Originally noticed by a French medical student, **Ernest Duchesne**, in 1896*

# Medical Revolution II

**STEM CELL THERAPY**

**WE ARE LIVING IT TODAY!!!**

# What are Stem Cells?

- **Stem cells are the repair units of the body**
- They have the remarkable potential to develop into many different cell types in the body.

# History of Stem Cells (SC)

>20 yrs. ago → Mouse embryos → mouse embryonic SC

## EMBRYONIC STEM CELLS

1998 → Human embryos → human embryonic SC

# Why Stem Cells?

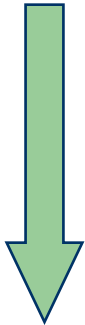
- Today, donated organs are often used to replace failing or destroyed tissue; such as liver, kidneys, lungs, ..etc.
- But these days the **demand** surpasses the **supply**.

# Properties of Embryonic Stem Cells

- ..have three general properties:
  - 1-they are capable of ***dividing*** and ***renewing*** themselves for long periods.
  - 2-they are ***unspecialised***.
  - 3-they can give rise to ***specialised cell types (differentiation)***.

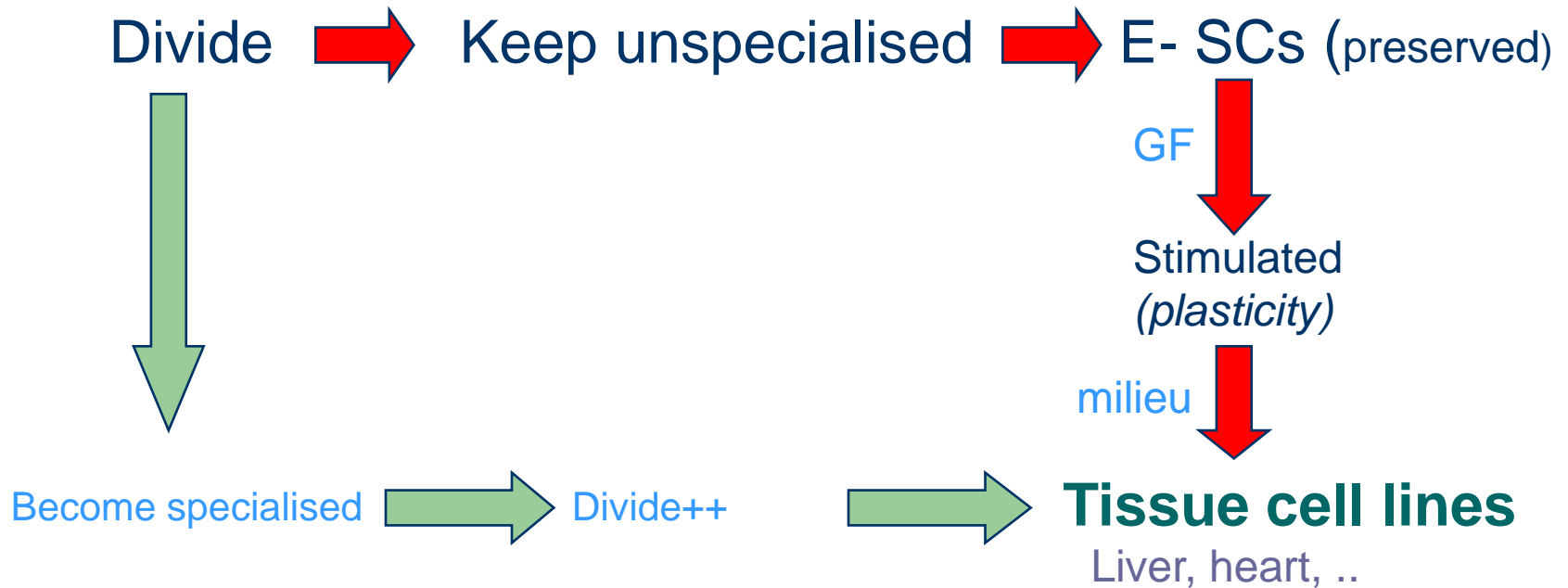
# Properties of Embryonic Stem Cells

Divide → Keep unspecialised → E- SCs (preserved)




Become specialised → Divide++ → Tissue cell lines  
Liver, heart, ..

# Properties of Embryonic Stem Cells

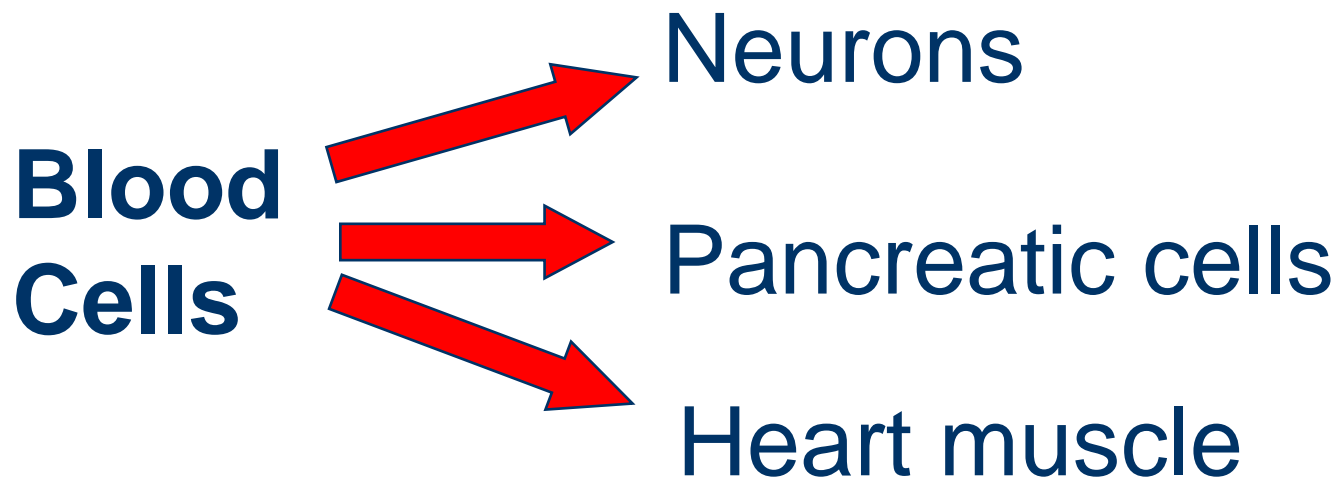


# Plasticity

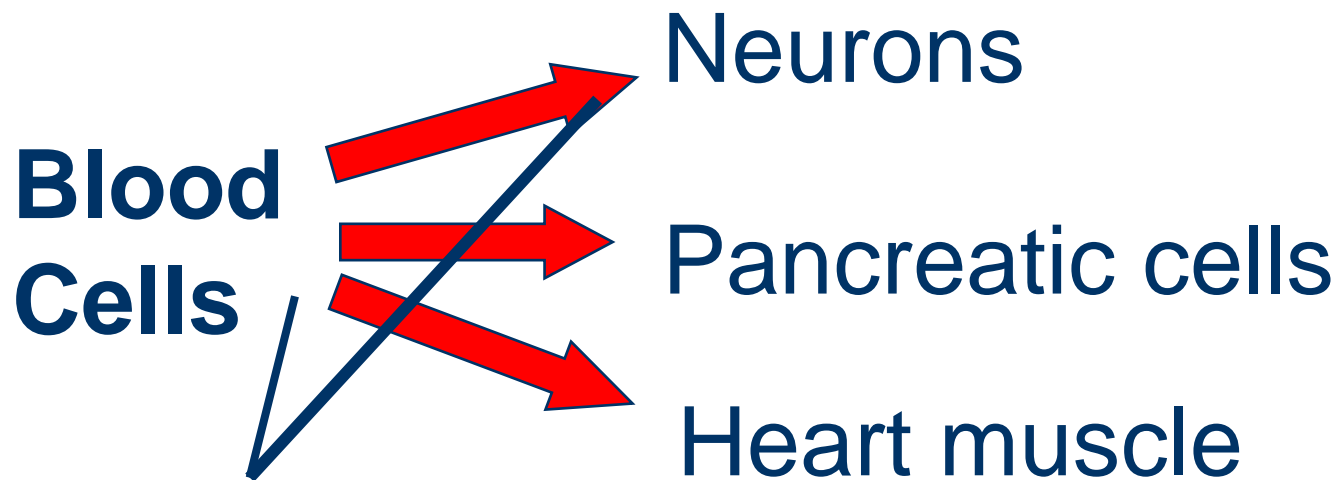
*The ability of stem cells of one tissue to trans-differentiate into cell types of another tissue.*

**Haematological**  **Somatic**

# So does this mean that ...?

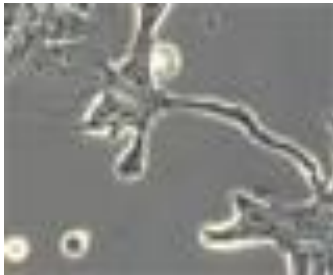


**Experiments**  **Successful**

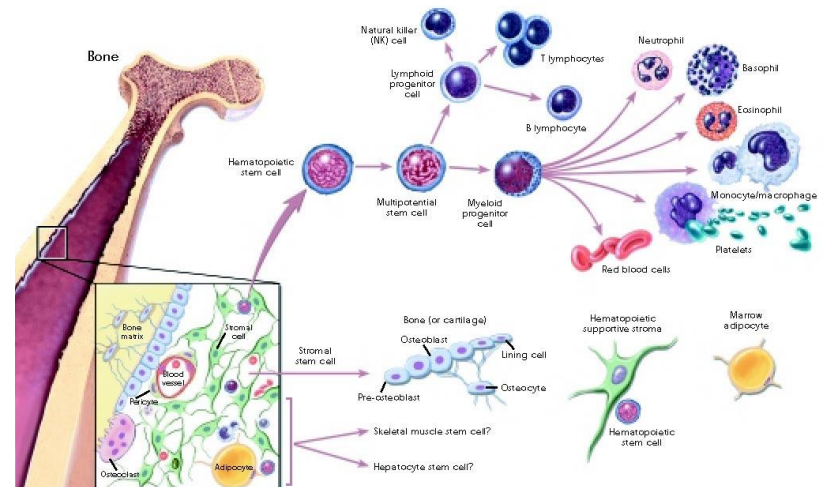


# Types of Stem Cells

- Scientists primarily work with two kinds of stem cells from animals and humans:

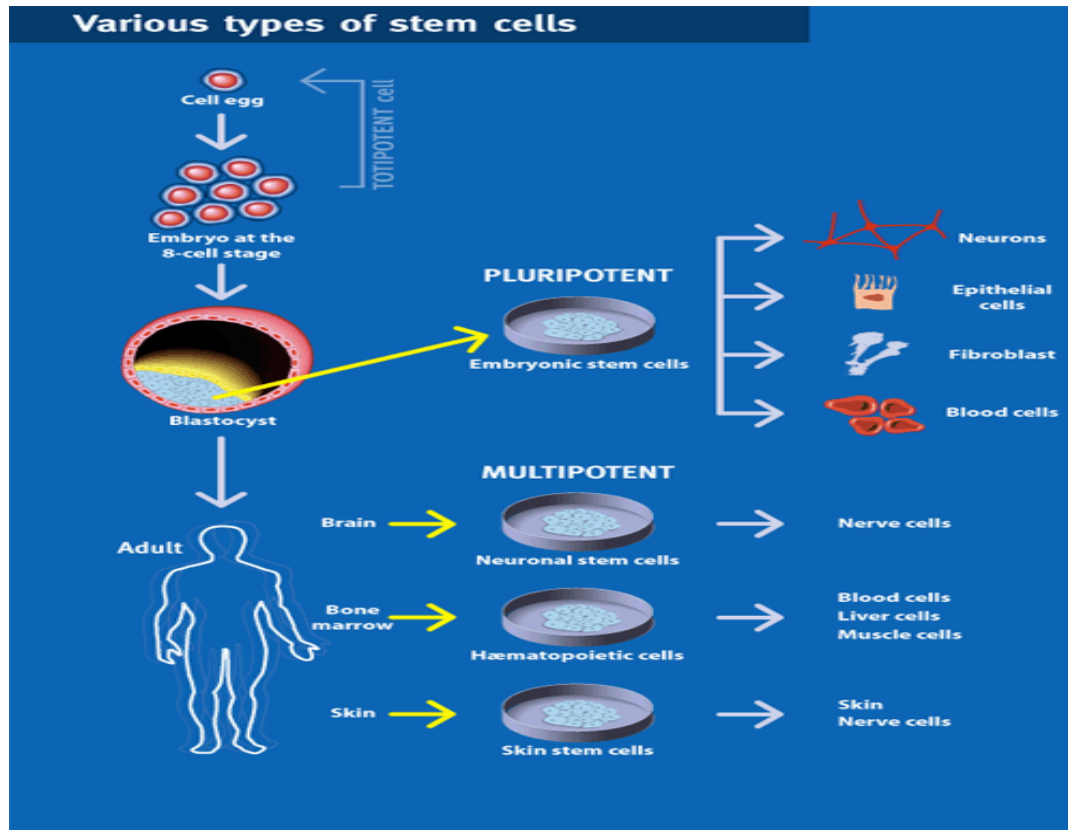


embryonic stem cells



adult stem cells

# The Power of Stem Cells



# Where to get embryonic SC?

New

Amniotic  
Fluid

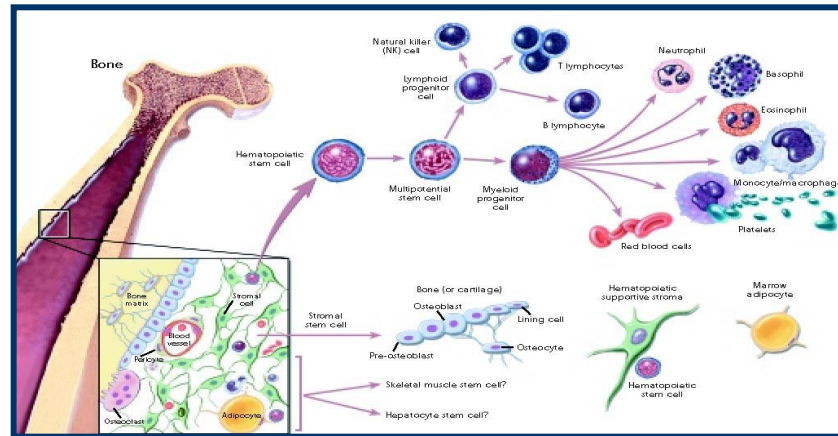
Aborted  
embryos

Blastocysts developed from  
surplus embryos in IVF labs

- Meets a lot of ethical debates, ethics in IVF centers.
- The “Bush Presidential Ban” banned U.S government funding for the study of embryonic stem cell lines created after August 9, 2001. A second hearing last Thursday 11, 2007

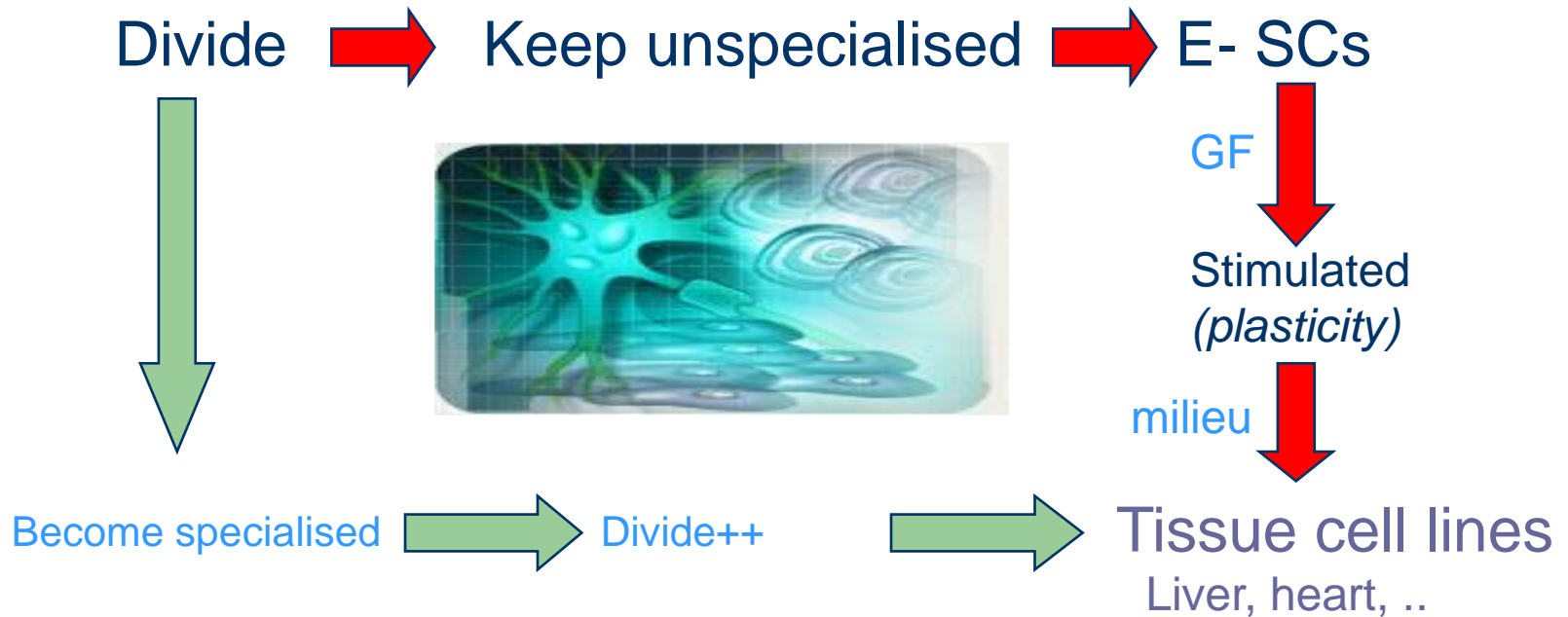


# Adult stem cells

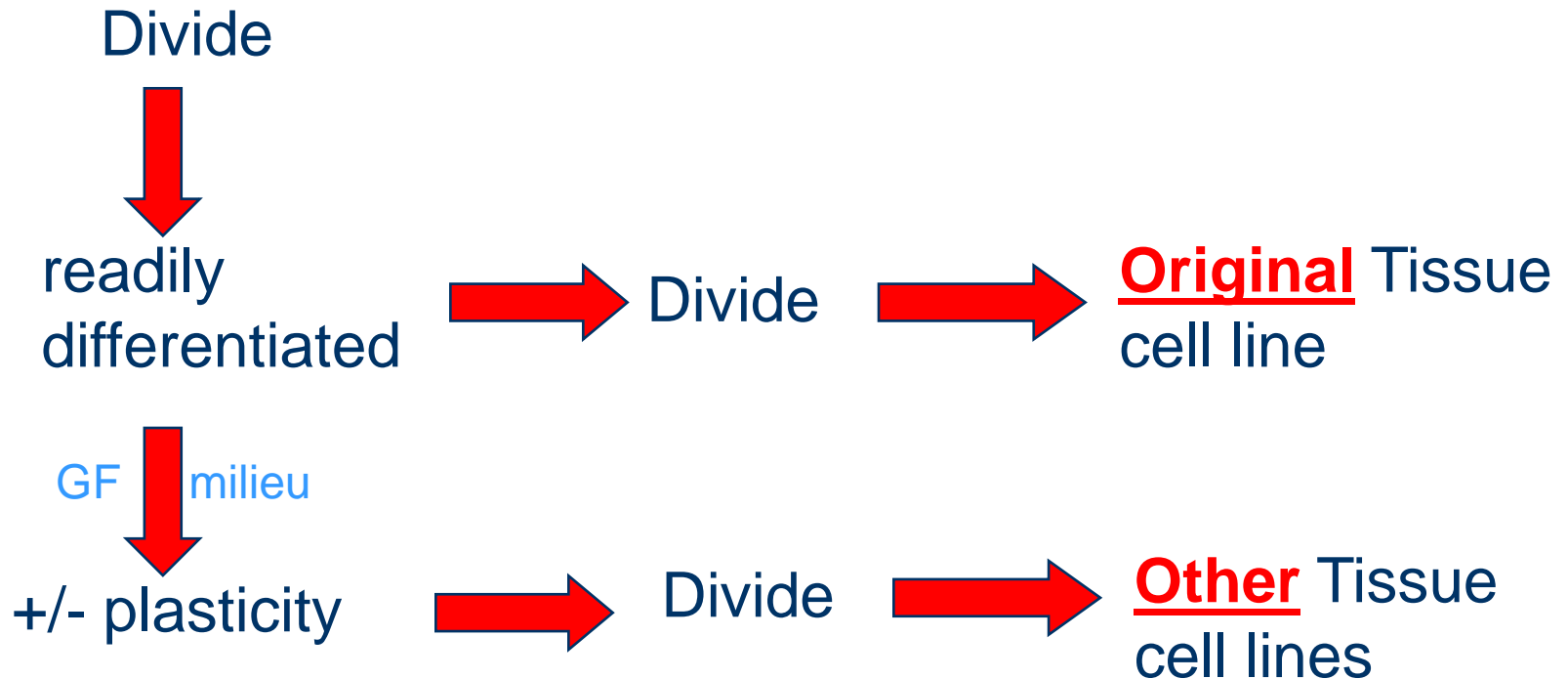


- These are derived from blood, bone marrow
- They are specialised (HLA tagged)
- They may have some *plasticity* to develop into other tissue lines under certain circumstances
- They divide to form more cell of origin and not undifferentiated stem cells

# Properties of Embryonic Stem Cells



# Properties of **Adult** Stem Cells

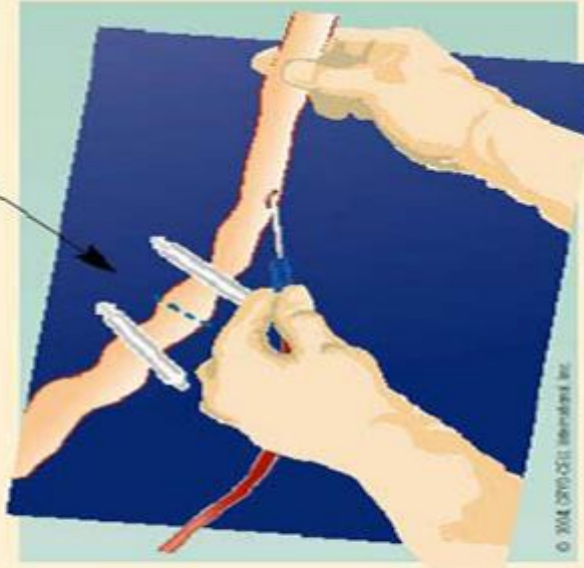


# Umbilical Cord Blood

- Is a rich source of **adult** stem cells (*mainly*) .
- Those cells are undifferentiated
- They carry high plasticity
- It is readily available
- Easy to collect, transport and process.
- Collected after clamping of the cord

# Cord Blood Collection

1. Double-clamp and cut the umbilical cord.
2. Snap the blue plastic DonorCare needle guard around the collection tubing. *It's critical that the arrow on the outside of the guard is pointing toward the end of the needle.*



# Umbilical Cord Blood

- Painless and risk free
- No harm to the mother or baby.
- Immediately after birth of the baby
- Will otherwise be discarded
- Cells will be stored for 20 years+
- May save the baby, the parents and grand parents and sisters and brothers
- Compatible from 50-100%



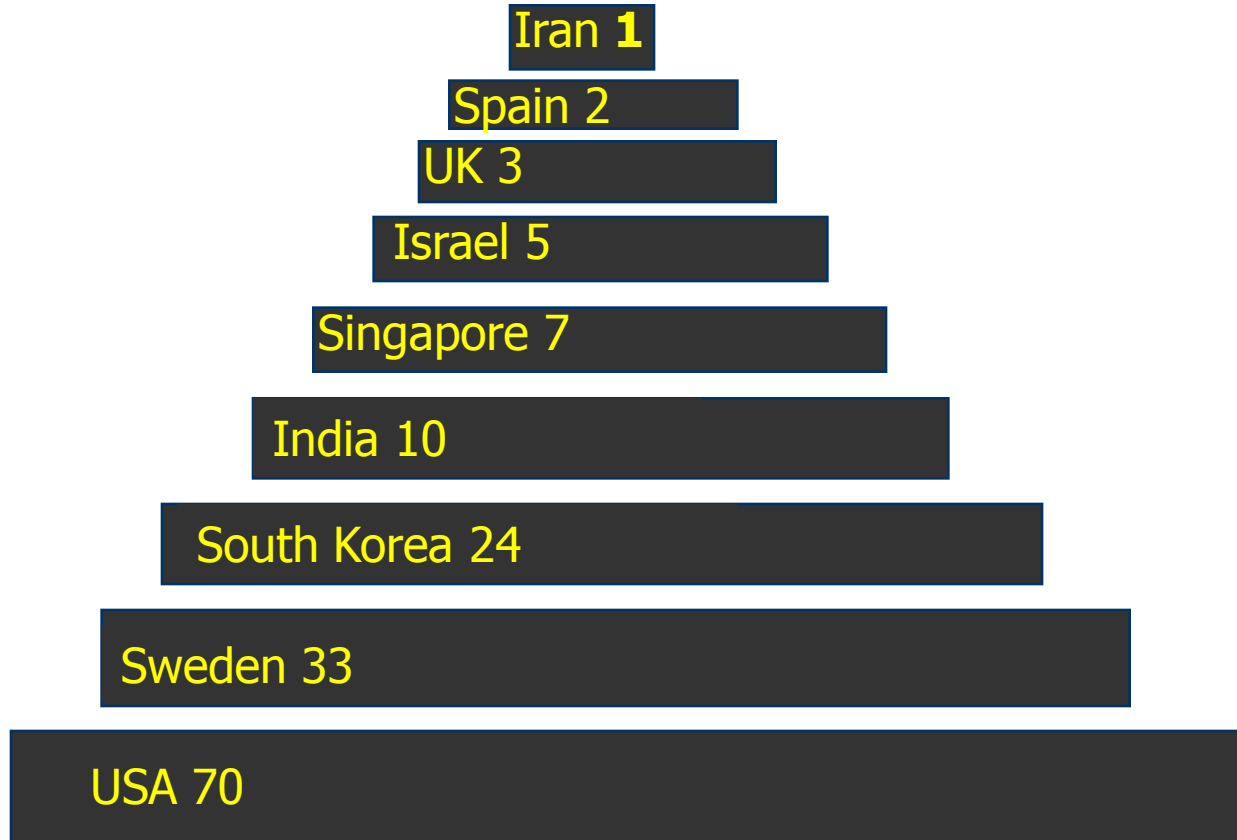
# Islamic Code (Fatwa)

*It is lawful to acquire and cultivate stem cells and to use them for the purpose of treatment or for conducting permissible research, if their sources are **legitimate**.*

# Islamic Code (Fatwa)

- *Cord blood with the permission of the parents.*
- *A fetus aborted spontaneously or for a therapeutic reason allowed by Islamic law with the permission of the parents.*
- *Surplus zygotes in a test-tube baby procedure, if there are many and they are donated by the parents.*

# Where to get embryonic SCs?



# Stem Cell Therapy

- Therefore, exploring the possibility of using stem cells for **cell-based therapies** has become a very active area of investigation by researchers.

**AND THIS IS THE REVOLUTION!!**

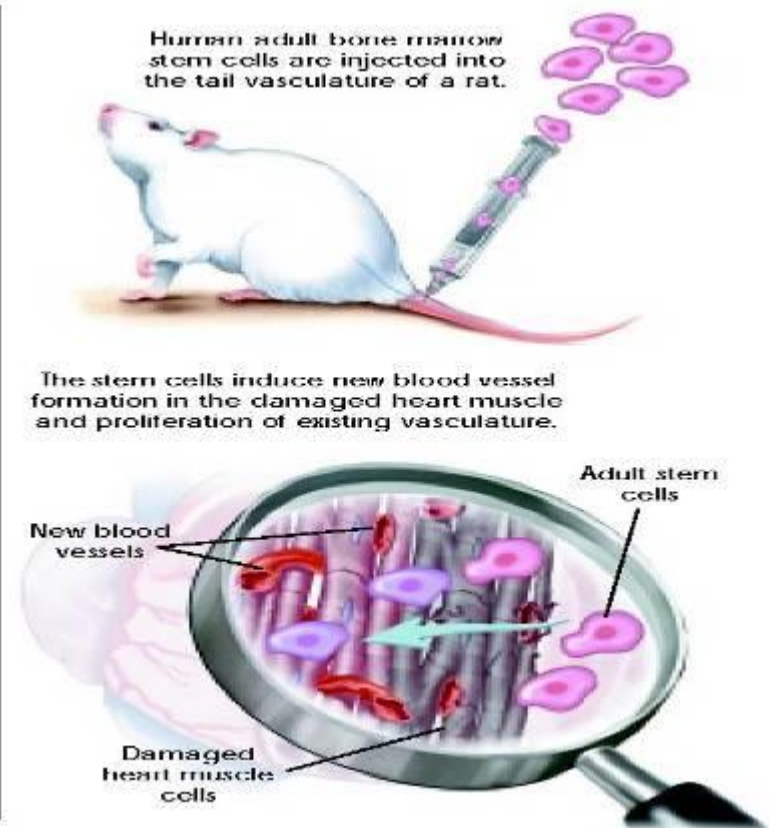
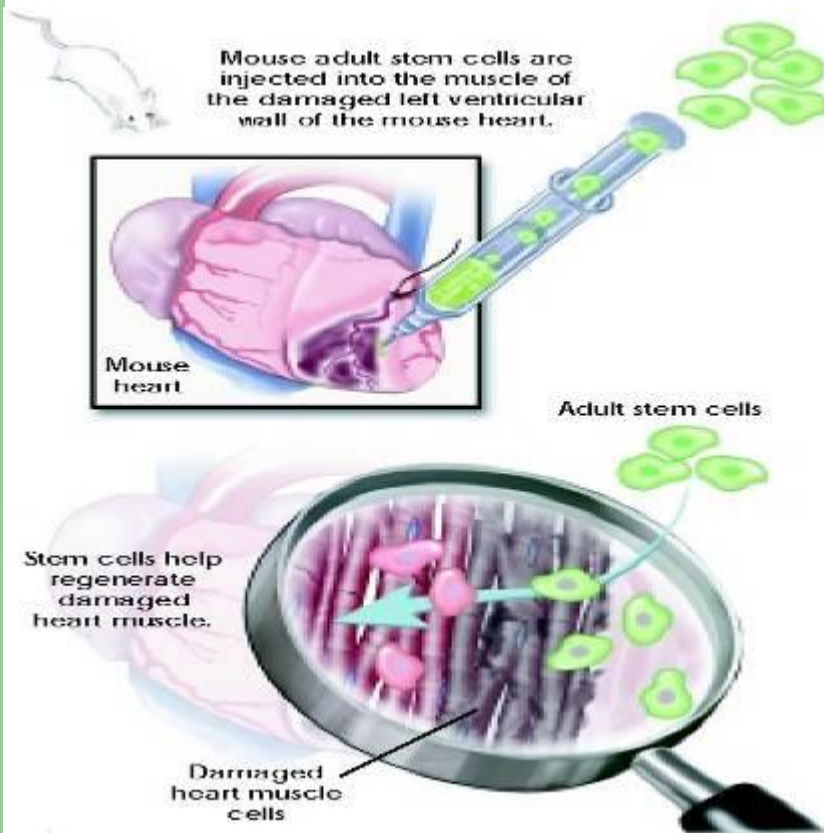
**Cell-based therapies** — *treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged tissues.*

# Stem Cell Therapy

Stem cells are now designed to treat diseases including:

- **Parkinson's and Alzheimer's diseases,**
- **Spinal cord injury**
- **Stroke**
- **Burns**
- **Heart disease**
- **Diabetes**
- **Osteoarthritis, and rheumatoid arthritis.**

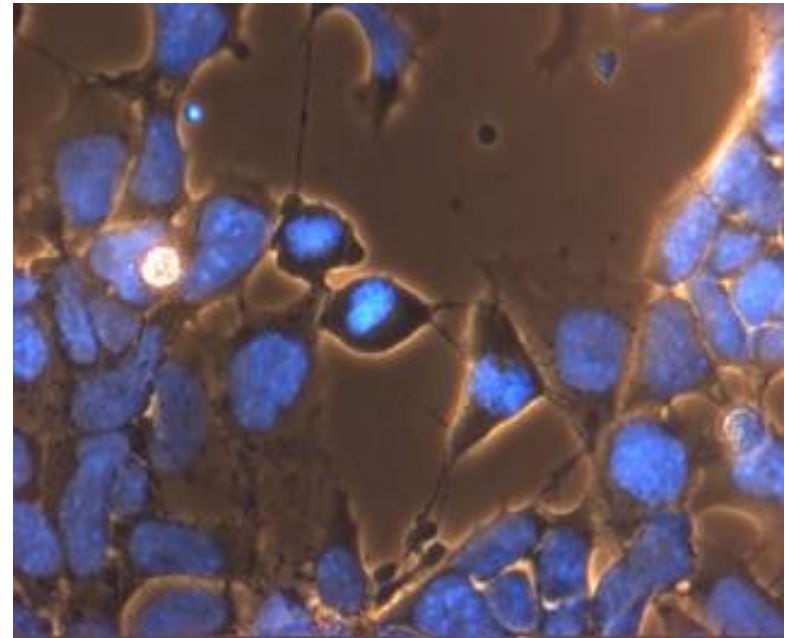
# Stem Cell Therapy (Heart)



# Stem Cell Therapy

- It is also possible to direct the differentiation of human embryonic stem cells in cell culture to form insulin-producing cells that eventually may be used in transplantation therapy for

**Type I Diabetes**



**Breaking News !!!**

## Scientists grow artificial liver

1.10.2006

**New Castle University. UK**

**Scientists have grown miniature (1p coin size) liver from stem cells which will be used for **drug testing** and may reduce the need for animal experiments**

**They have used, for the first time, cord blood adult stem cells.**

**Breaking News !!!**

## Human stem cells found in Amniotic Fluid

REUTERS 

07.01.2007

**Embryonic stem cells can be found in the amniotic fluid**

**They would provide a non-controversial source of these cells**

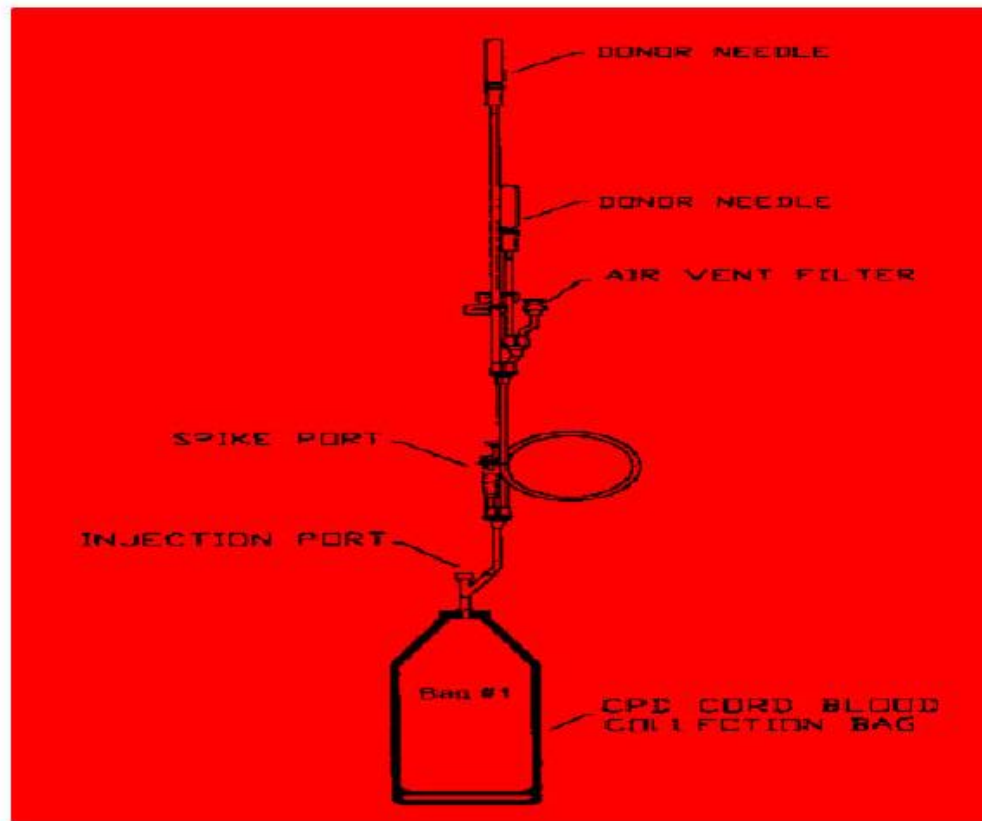
*“Embryonic cells are considered the most malleable of the various types of stem cells, but these amniotic fluid-derived cells are a close second”,*

**said Dr. Anthony Atala, of the Institute for Regenerative Medicine at Wake Forest University School of Medicine, who led the study.**



**Those cells can turn into several tissue types, but don't yet seem as flexible as embryonic ones.**

# Cord Blood Collection



# Cairo University

## Kasr Al-Aini School of Medicine

- First collected 5 cord blood samples (March 2006)
- Sent to the bone marrow transplant unit
- Processed and stem cells were separated and cryopreserved

# Cairo University

## Kasr Al-Aini School of Medicine

- Later collected 8 more cord blood samples (Sept 2006)
- A total of 13 samples
- Processed in the BMT unit as well and stem cells were separated and cryopreserved

# Cairo University-Kasr Al-Aini School of Medicine – THE TEAM

## –Obstetrics Department

- Prof. Dr. Abdel-Maguid Ramzy

## –Bone Marrow Transplant Unit

- Prof. Dr Farouk Haggag
- Dr Neemat Kassem
- Dr Heba and Dr Rania

## -Lifeforce Immune System Plc. Bank

- Andy Neal- Chief Technical Officer
- Emyr Harries

## -Gambro BCT



# Count

Cord #	Pre Vol/ml	Pre WBC	Post Vol ml	CD34+ yield/l
• 1	67	6.2	8	0.061x10 <sup>9</sup>
• 2	77.5	2.5	5.3	0.0053x10 <sup>9</sup>
• 3	111.5	13.7	5.2	0.33x10 <sup>9</sup>
• 4	107.5	7.9	5.2	0.21x10 <sup>9</sup>
• 5	80.3	8.0	5.7	0.038x10 <sup>9</sup>

# A Baby ready to face the World!!



