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Mesenchymal Stem Cell Therapy for Knee Osteoarthritis: 5 years Follow- Up of Three Patients

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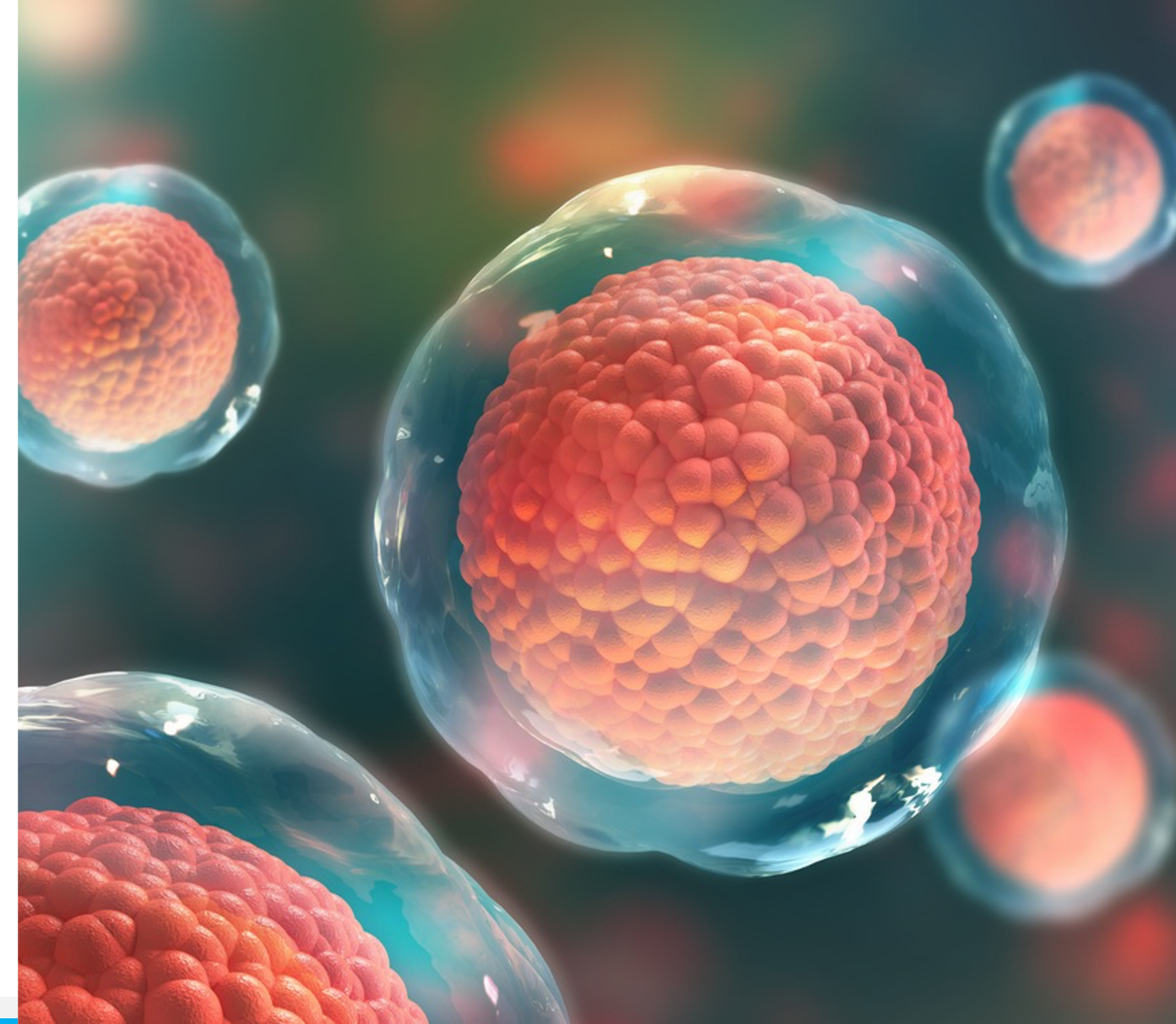
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Mesenchymal stem cell therapy for knee

osteoarthritis:
5 years follow-
up of three
patients

Shay Musa



Background

- Osteoarthritis is the degeneration of articular cartilage and is clinically identified by pain that persists as well as stiffness and disability.
 - Patients with osteoarthritis have very few options for effective long-term treatment.
 - Treatments such as pain medications, anti-inflammatories such as nonsteroidal anti-inflammatory drugs (NSAIDs), lubrication, and surgery can only prolong but not cure osteoarthritis.

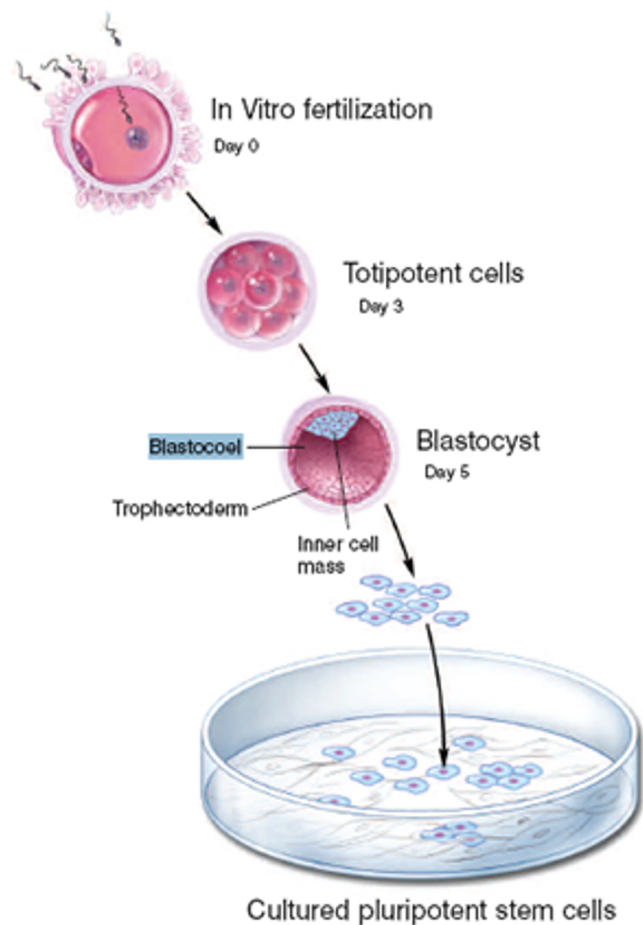
Embryonic Stem Cells

- Pluripotent- differentiate into all the cell types that make up a body
- The process is very long and not cost-efficient
- Many regulations put in place by the government on research conducted using embryonically derived stem cells so that pregnancy is not purposely terminated to provide stem cells
- Most versatile type of stem cells

Mesenchymal Stem Cells

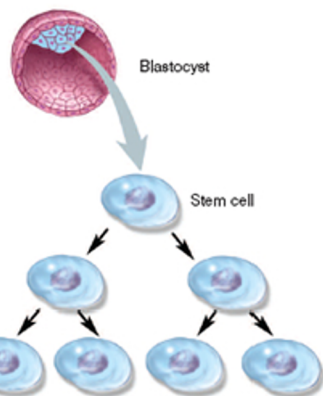
- Adult- derived stem cells
 - Can be derived from Adipose Tissue, bone marrow, etc.
- Exhibit pluripotent properties
 - Useful alternative
- Easy and cost-efficient to derive from an adult host

How Human Embryonic Stem Cells Are Derived



Characteristics of Embryonic Stem Cells

1. Origin:
Derived from pre-implantation or peri-implantation embryo



2. Self-Renewal:
The cells can divide to make copies of themselves for a prolonged period of time without differentiating.

3. Pluripotency:
Embryonic stem cells can give rise to cells from all three embryonic germ layers even after being grown in culture for a long time.

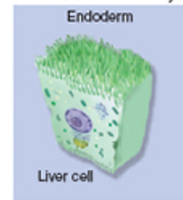
The three germ layers and one example of a cell type derived from each layer:



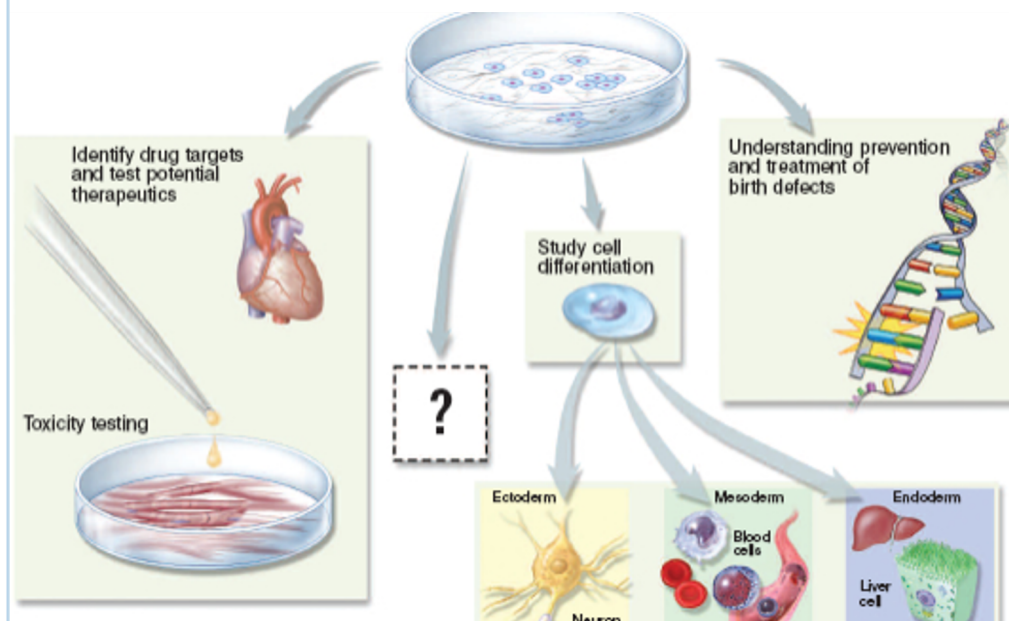
Ectoderm gives rise to: brain, spinal cord, nerve cells, hair, skin, teeth, sensory cells of eyes, ears, nose, and mouth, and pigment cells.



Mesoderm gives rise to: muscles, blood, blood vessels, connective tissues, and the heart.



Endoderm gives rise to: the gut (pancreas, stomach, liver, etc.), lungs, bladder, and germ cells (eggs or sperm).



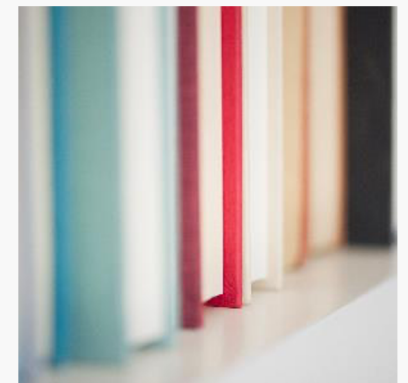
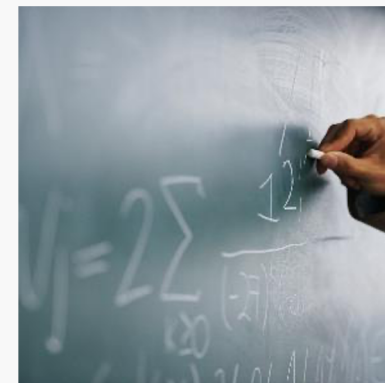
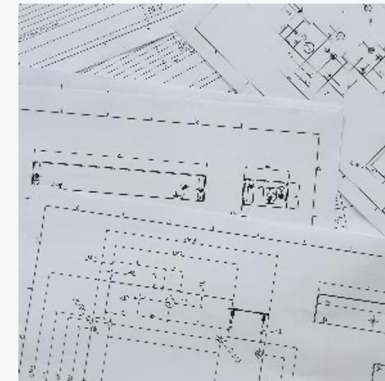
Methods

- Stem cells derived from bone marrow from the same individual were obtained and expanded.
- A safety test was then conducted on the stem cells that were derived from the bone marrow prior to injection.
- All drugs were stopped 3-4 weeks prior to injection as a control and a baseline was measured. Stem cells were then injected into the more severely damaged knee.
- The Research Committee and the Ethical Committee of the Tehran University of Medical Sciences reviewed this study for the inclusion of human subjects and approved it based on the guidelines of the Helsinki Declaration
- Results were collected after 6 months and a follow-up study was conducted after 5 years



Results

- Six months after the injection of stem cells, range of motion and flexion of the knee showed significant improvement across all four patients.
- However, five years after the injection the range of motion decreased in comparison to six months after the treatment, but still remained above the baseline.
- This is the second experiment ever done on human subjects, the first was conducted by Centeno in 2008 and there was an improvement in range of motion at 6 months but started to decline again at 12 months.
 - There was also no long term follow up done after a few years to track progression.
- Neither experiment caused any adverse side effects and showed an overall improvement in the knee compared to the baseline.
 - However, there are very few test subjects and multiple confounding variables that could potentially affect the validity of this data as there are too many regulations required to remain within the ethical guidelines.



Discussion Questions

- How do you think stem cell research will change/ evolve in the future?
- Will scientists use embryonic stem cells and mesenchymal stem cells in the future? Which do you think?
- Do you think mesenchymal stem cells will work as an alternative to embryonic stem cells?
- Should regulations on embryonic stem cells should be lifted? Are they justified?





Questions?



Links

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- https://vcu-alma-primo.hosted.exlibrisgroup.com/primo-explore/fulldisplay?docid=TN_wj10.1111%2F1756-185X.12670&context=PC&vid=VCUL&lang=en_US&search_scope=all_scope&adaptor=primo_central_multiple_fe&tab=all&query=any,contains,Mesenchymal%20stem%20cell%20therapy%20for%20knee%20osteoarthritis:%205%20years%20follow-up%20of%20three%20patients

More information on embryonic stem cells

- https://stemcells.nih.gov/info/Regenerative_Medicine/2006Chapter1.htm