

A woman in teal medical scrubs is pointing at a large digital screen. The screen displays a microscopic image of cells, with a hand visible on the left side of the frame. The woman is holding a clipboard and has an ID badge around her neck. The background is a dimly lit room with blinds.

# MESENCHYMAL STEM CELLS

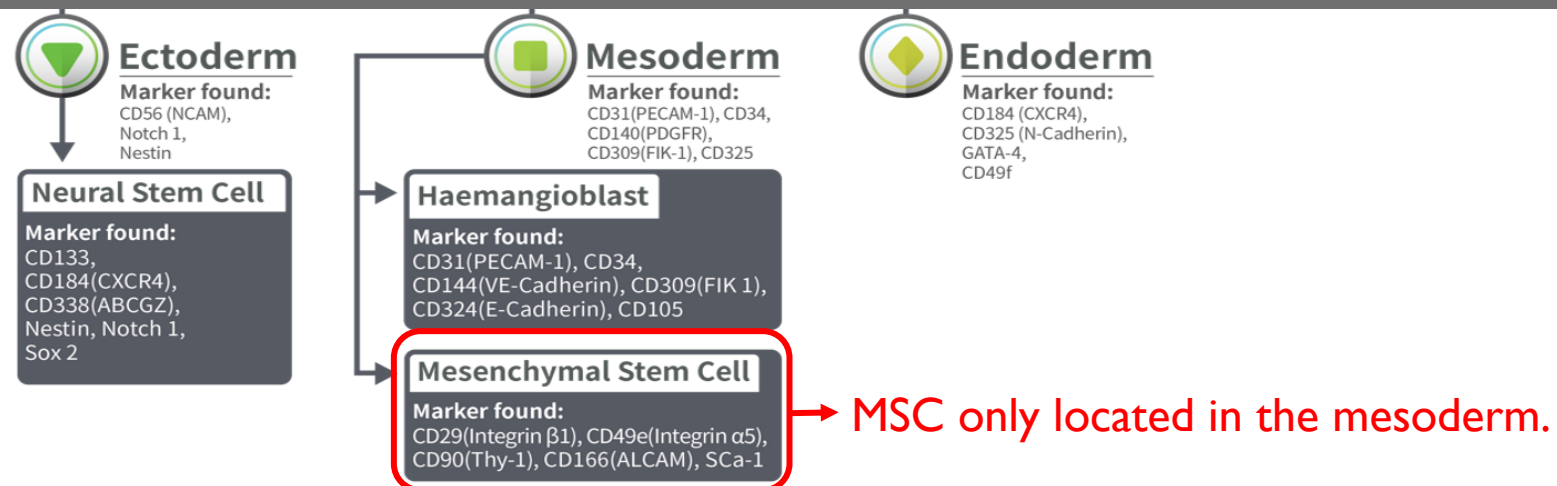
# MESENCHYMAL STEM CELLS (MSCS)

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- MSCs are multifunctional stem cells, located in the mesoderm.
- Have high self-proliferation and multidirectional differentiation ability.
- Able to differentiate into nerve cells, bone cells, fat cells, liver cells, etc.
- The largest source is from the placenta, umbilical cord, and Wharton's jelly.  
Other sources include baby teeth, fat, and bone marrow.
- Be used as a new way to repair skin injury, promote anti-inflammation and the healing of skin wounds.

# MSCS MECHANISM

MSCs secrete bioactive factors and exosomes, contributing to generate cytokines, growth factors, antioxidants, and angiogenesis factors. MSCs also stimulate cell proliferation and angiogenesis molecules. Through both local regulation and systemic inflammation to improve the responses of the immune system to repair damaged, aged tissues and suppress body pressure while the damaged cell death.



# MSCS CHARACTERISTICS

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- Limited Homing Effect
- Anti-inflammatory Effect
- Good Cytokine Secretion
- Promote Angiogenesis



# MSCS CHARACTERISTICS

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## Limited Homing Effect

Homing effect stimulates dormant mesenchymal stem cells whenever a specific body tissue is damaged or aged. These stem cells home to the damaged tissue to differentiate and replace the damaged cells. MSC can control the migration of stem cells to some tissues (such as skin, bone, cartilage, etc.) through different signals to repair damaged and aging tissues and organs in the human body.

## Anti-inflammatory Effect

MSC has the advantage of having innate immunogenic properties, which can suppress the immune system rejection. MSC also secretes soluble factors to activate on immune cells through direct contact. This effect results to regulate the immune system, contributing to target inflammations and improving anti-inflammatory effect.

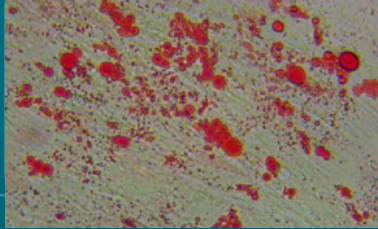
## Good Cytokine Secretion

MSC has strong abilities of migration and differentiation. It can secrete a variety of high-quality cytokines in a short term, which can stimulate the immunosuppressive function of MSC and improve the viability of damaged cells.

## Promote Angiogenesis

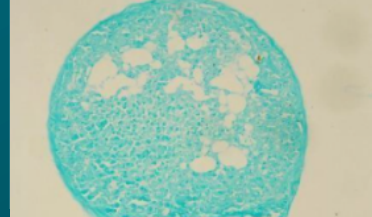
Blood vessels are generated under the regulation of various pro-angiogenic factors and anti-angiogenic factors. MSC can induce and promote angiogenesis whilst also regulating blood stem cells.

# MSC DIFFERENTIATION CULTURE



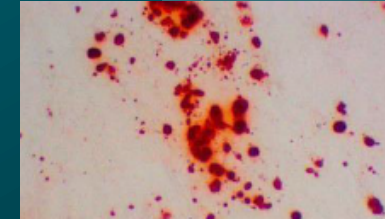
## Adipogenesis

- Through the oil-red-O staining agent, MSC culture differentiated into two main types of human fat: adipocytes and neutrophils. These were mainly distributed in the subcutaneous, pancreas and kidney.



## Cartilage Formation

- Alcian Blue is a cationic dye, and the main components of cartilage are glycosaminoglycan and hyaluronic acid. When reflected with the dye, the cartilage appears blue-green, indicating cartilage formation.



## Bone Formation

- The identification method of osteoblasts is to use Alizarin Red dye, which will appear orange after combining with calcium ions and is used to detect calcium deposition or calcification of cells.

The background of the slide features two histological images. On the left, a dark, low-contrast image shows a cross-section of tissue with a central cavity. On the right, a high-contrast, pink-stained image shows a similar tissue section with more detail, including cellular structures and a central cavity. The text is overlaid on a dark teal rectangular area on the left side of the slide.

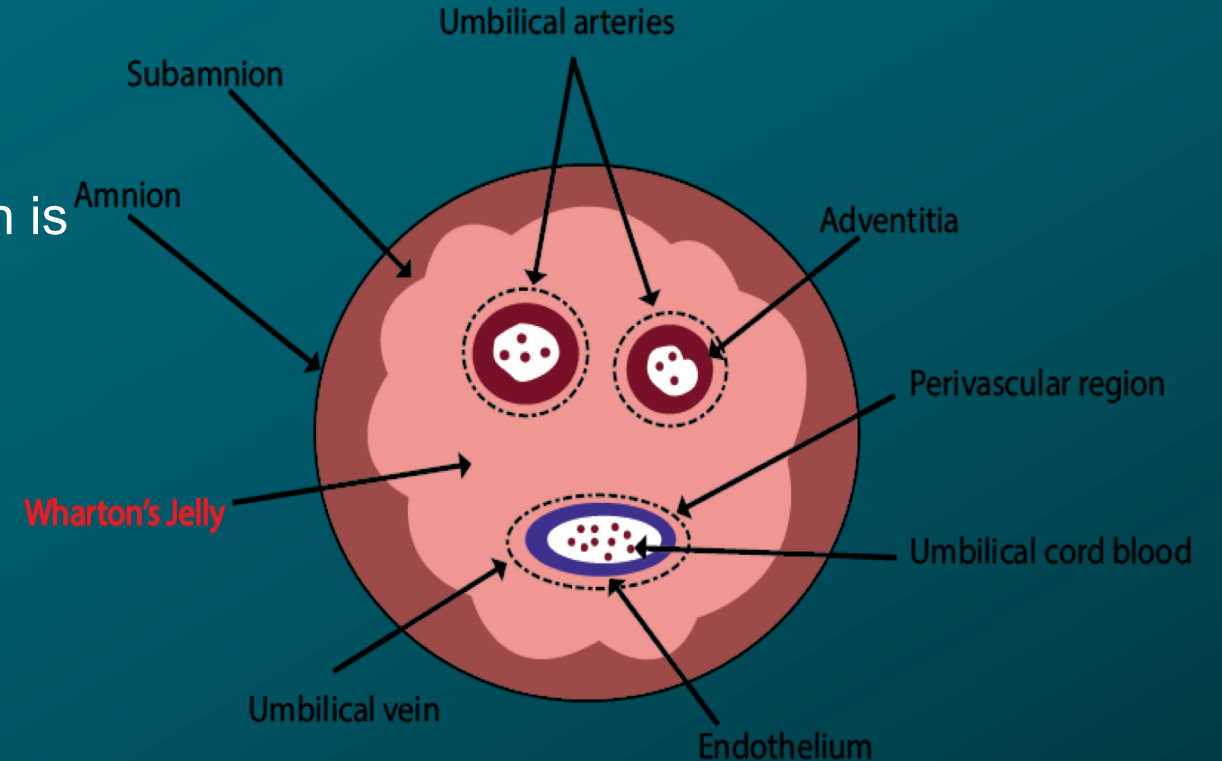
# WHARTON'S JELLY

Source of MSCs



# WHARTON'S JELLY

- Wharton's jelly is the is a primordial mucous connective tissue of the umbilical cord, which is made up of mucopolysaccharides and also contains fibroblasts and macrophages.
- Mucopolysaccharides is a type of mucosal tissue, which has the characteristics of stem cells, and also known as umbilical cord mesenchymal stem cells.





# STRENGTHS

## WHARTON'S JELLY

- Wharton's Jelly is rich in MSC and has all the functions of MSC.
- MSC, from Wharton's jelly has high purity, activity and differentiation potential.
- Easy to obtain without ethical questions.
- No pairing or rejection problem, because there is no genetic factor in Wharton's Jelly.
- The number of available MSC is large and the value-added ability is better than that of MSC in bone marrow.

### Number of MSCs per 200 million (Nucleated cells)

Umbilical cord blood

1 unit

Bone marrow

2,000 unites

Wharton's Jelly

666,000 units

# AGELESS

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MSCs for Anti-aging

# ANTI-AGING



- **MSC has the ability to differentiate skin cells:**  
Under specific culture conditions, MSC can induce differentiated cells into fibrocytic, melanocytes, skin sacs, sebaceous glands, migrate to the skin surface, differentiate into skin cells for cell replacement, and produce an anti-aging effect.
- **Stimulate skin cell proliferation and collagen synthesis:**  
MSC can combine and secrete a variety of dermal cell holding matrix components and cytokines. These include the vascular endothelial growth factor and platelet-derived growth factor, which contribute to tissue regenerative repair; TGF-B1 secreted by MSC can promote hyaluronic acid and collagen synthesis in dermal fibroblasts.
- **Inhibit the decay and death of skin cells:**  
microRNA (miRNA), after entering the dermis, exerts biological effects to repair skin and delay skin aging through direct or transfer effects.



# MSC PRODUCTION FLOW

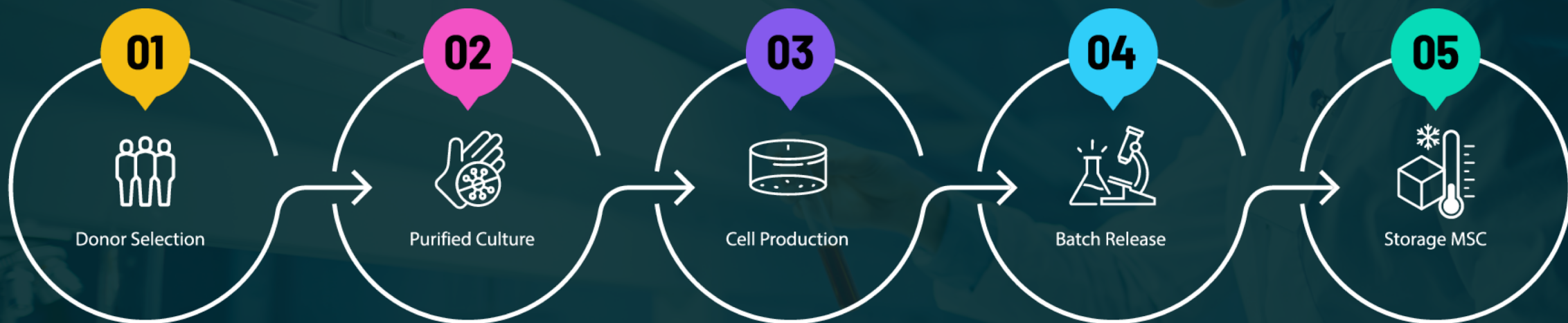
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Five Steps



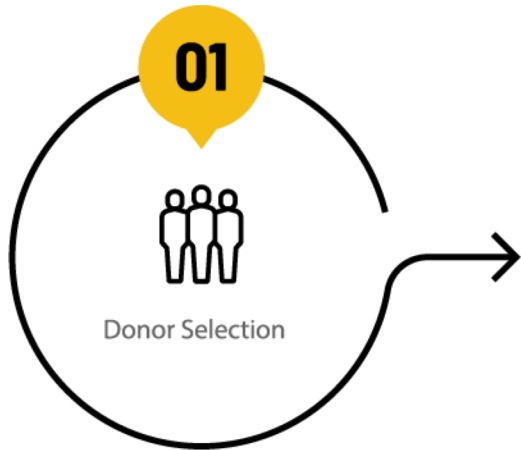


# STEPS OF MSC PRODUCTION FLOW



# STEP I

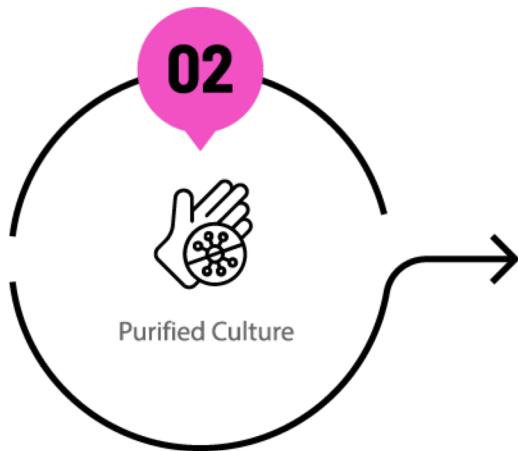
## Donor Selection



- I. Rigorous screening of high-quality donors who demonstrate the highest compatibility with general populations.
- II. Donors must meet eligibility criteria with negative tests for infectious diseases including HIV, Hepatitis B and C, and syphilis.

# STEP 2

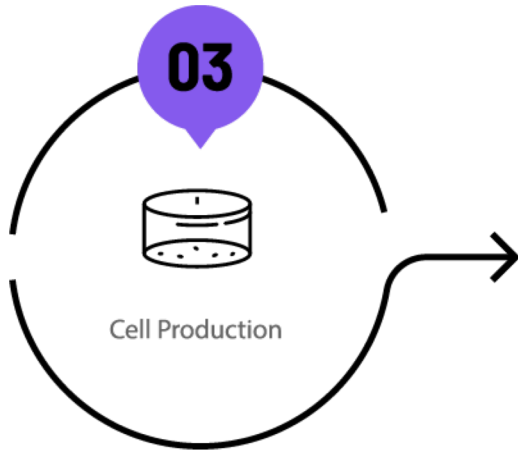
## Purified Culture



Isolation and collection MSCs within sterile environment.

# STEP 3

## Cell Production



### A. Cell Separation plus biosafety testing

- Cell separation maintained at 5°C
- Utilises patented technology for MSC extraction process that targets for CD19 positive cell selection.
- Flow cytometric analysis to verify isolated cell populations using the appropriate marker dyes
- Washing of verified cell populations with phosphate buffered saline solution
- Biological testing for cellular viability and integrity

### B. Cell preservation technology \*I

- Lowering and maintaining temperature of product receptacle at -80°C
- Extract and replace suspension fluid with CellMate (cell preservation solution)
- Gradual raising of temperature to 6°C
- Biological testing for cellular viability and integrity

**C. Quality Control:** Flow cytometric analysis of cell markers to verify cell populations

**D. Packing and Biosafety testing:** Sterile packaging system to ensure sample safety



# STEP 4

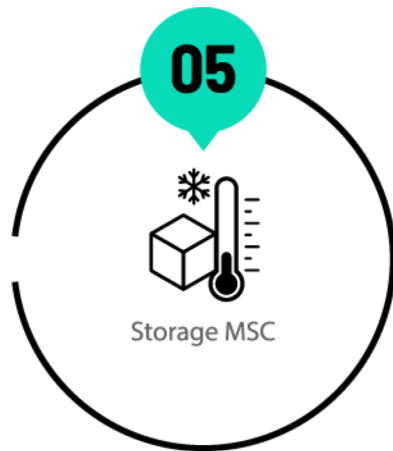
## Batch Release



Quality assurance ensures all samples meet minimum concentration.

# STEP 5

## Storage MSCs



Product stored between 4°C to 10°C for up to 90 days.

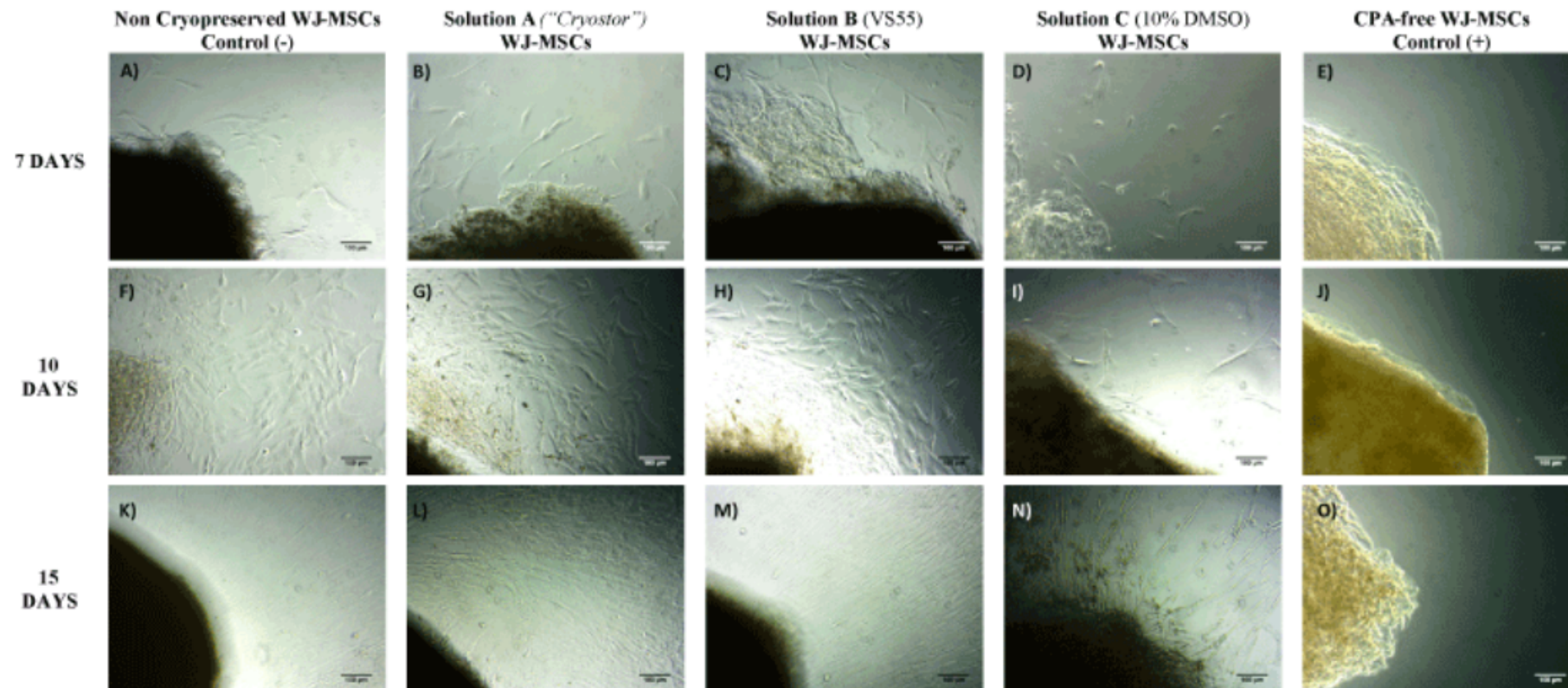


# SCIENTIFIC STUDY

MSCs

# MSC DIFFERENTIATED CULTURE

## Culture of Mesenchymal Stem Cells





# MSC MARKERS

Antigens[1][2][3][4]

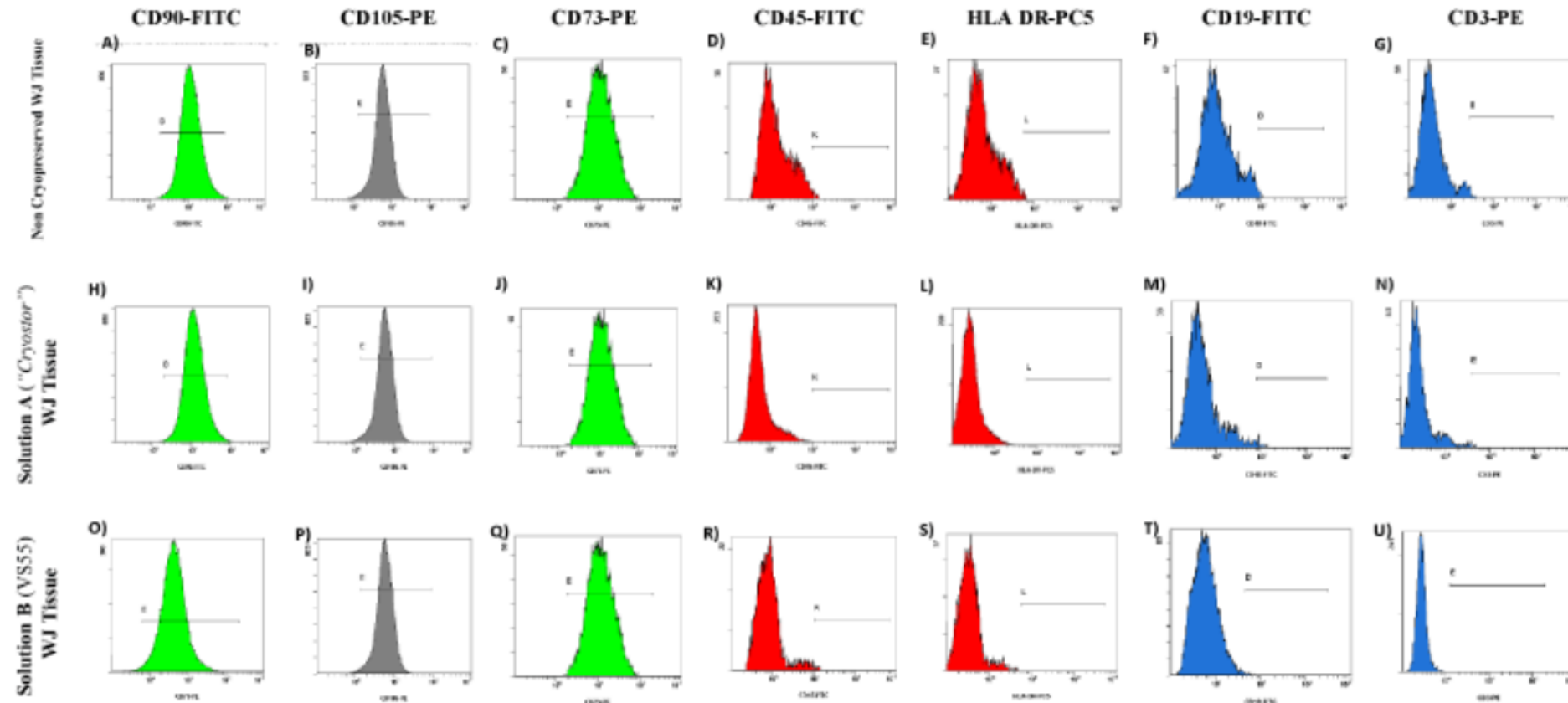
Positive Antigens		Negative Antigens
CD9	CD99	CD11b
CD13	CD105	CD14
CD29	CD106	CD19
CD44	CD146	CD31
CD49e	CD155	CD34
CD54	CD166	CD45
CD61	CD276	CD62E
CD63	CD304	CD62I
CD71	HLA-A, B, C	CD62P
CD73		CD79a
CD90		CD133
CD97		HLA-DR
CD98		

## References

- [1] Calloni, R. et al. Reviewing and updating the major molecular markers for stem cells. Stem cells and development 22, doi:10.1089/scd.2012.0637 (2013)
- [2] Nery A. et al. Human mesenchymal stem cells: from immunophenotyping by flow cytometry to clinical applications. Cytometry A. 83A:48-61. doi: 10.1002/cyto.a.22205 (2013).
- [3] Uzielienė I. et al. Different phenotypes and chondrogenic responses of human menstrual blood and bone marrow mesenchymal stem cells to activin A and TGF- $\beta$ 3. Stem cell research and therapy 12:251, doi:10.1186/s13287-021-02286-w (2021).
- [4] Abbasi K. et al. More to Explore; The Mesenchymal Stem Cells (MSCs) Major Tissue Sources, Known Surface Markers, and Its Immunomodulation properties. American Journal of Pure and Applied Biosciences, 3(4), 85-97. doi:10.34104/ajpab.021.085097 (2021).

# SCIENTIFIC STUDY

Immune system cell - related responses of umbilical cord mesenchymal stem cells after culture.

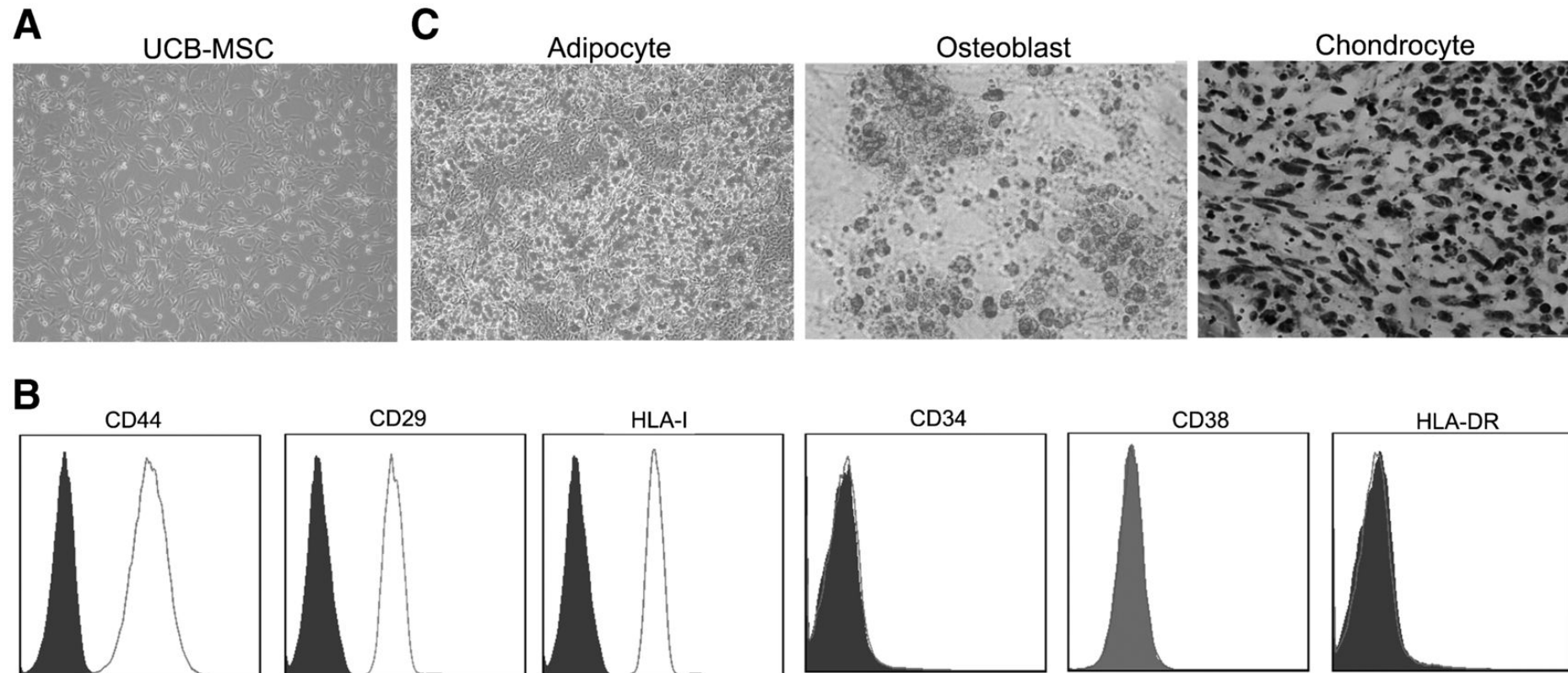


# SCIENTIFIC STUDY

A. Umbilical cord mesenchymal stem cells were cultured to show fibroblast-like morphology.

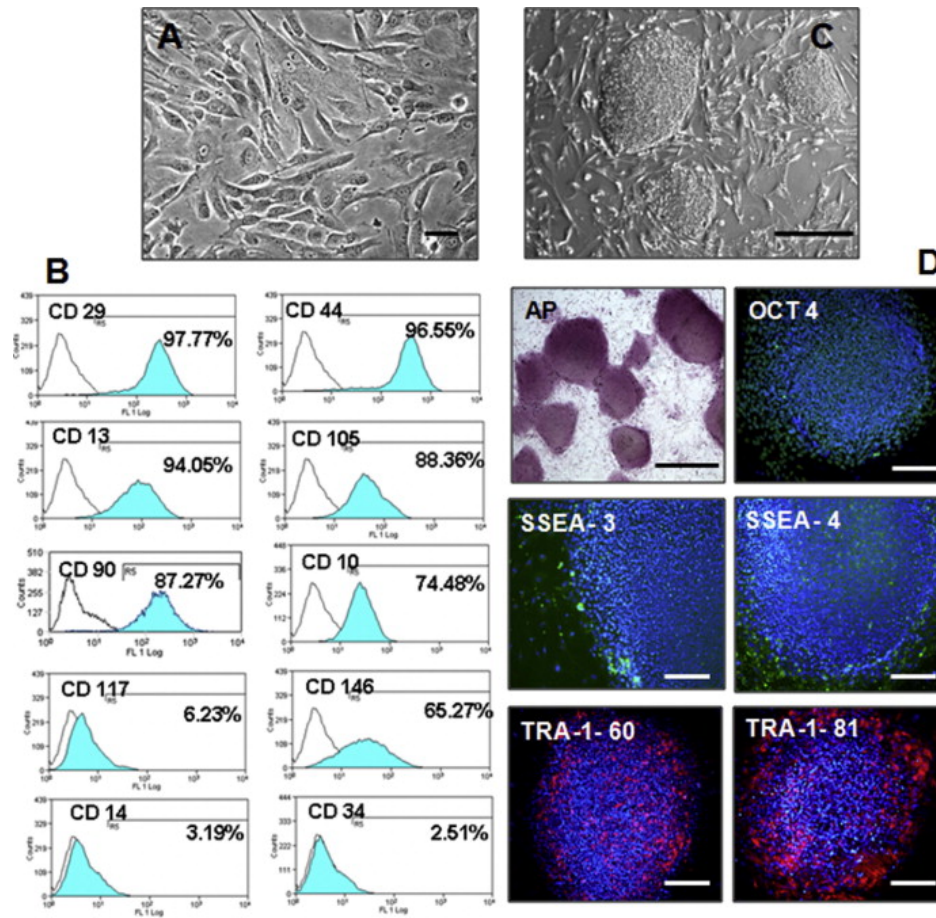
B. Immuno-map of umbilical cord mesenchymal stem cells.

C. By oil-red-O, alcian blue, alizarin-Red-S, the abilities of adipocytes, chondrocytes and osteoblasts were detected.



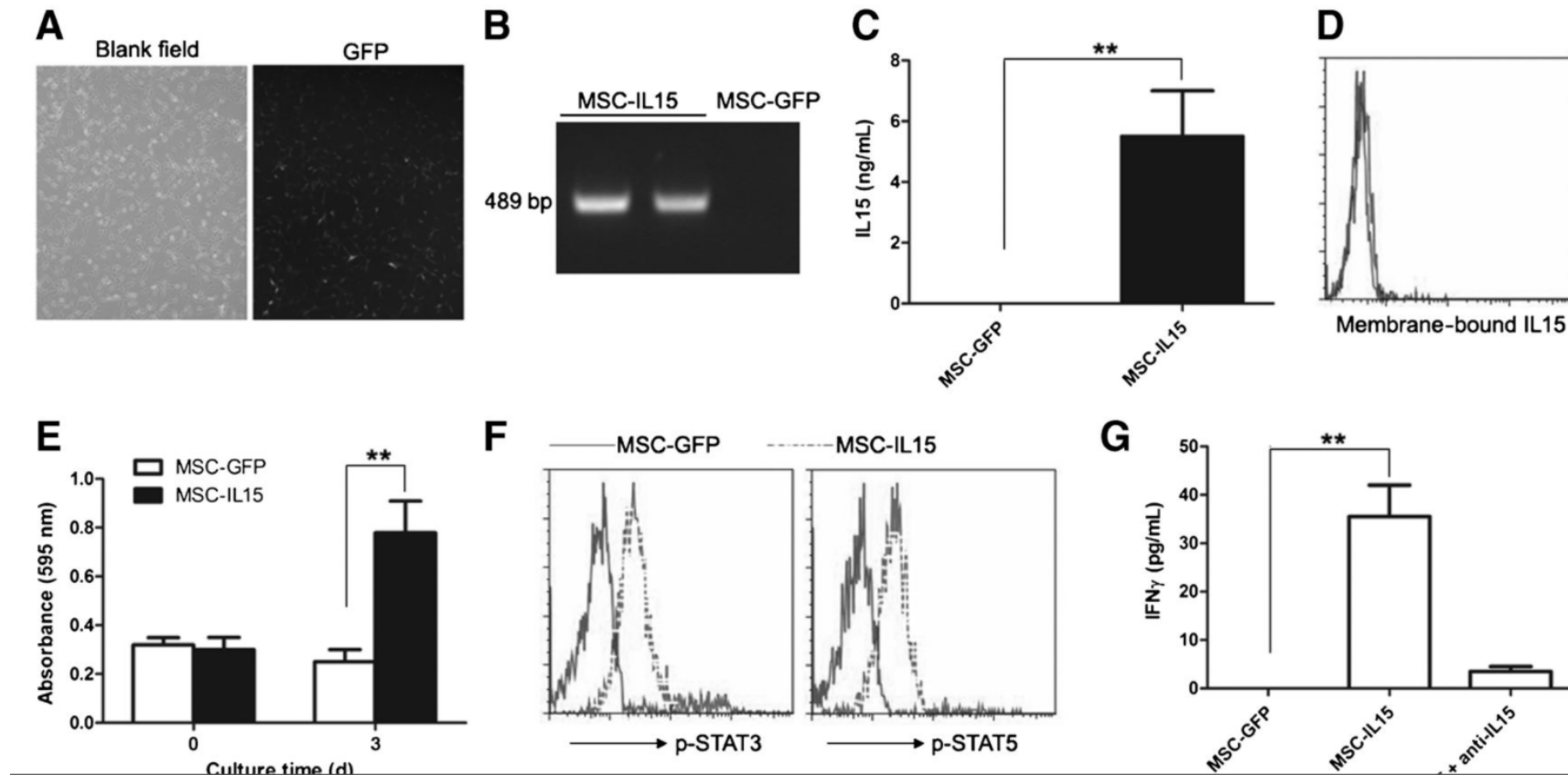
# SCIENTIFIC STUDY

Do not mediate cancer genes



# SCIENTIFIC STUDY

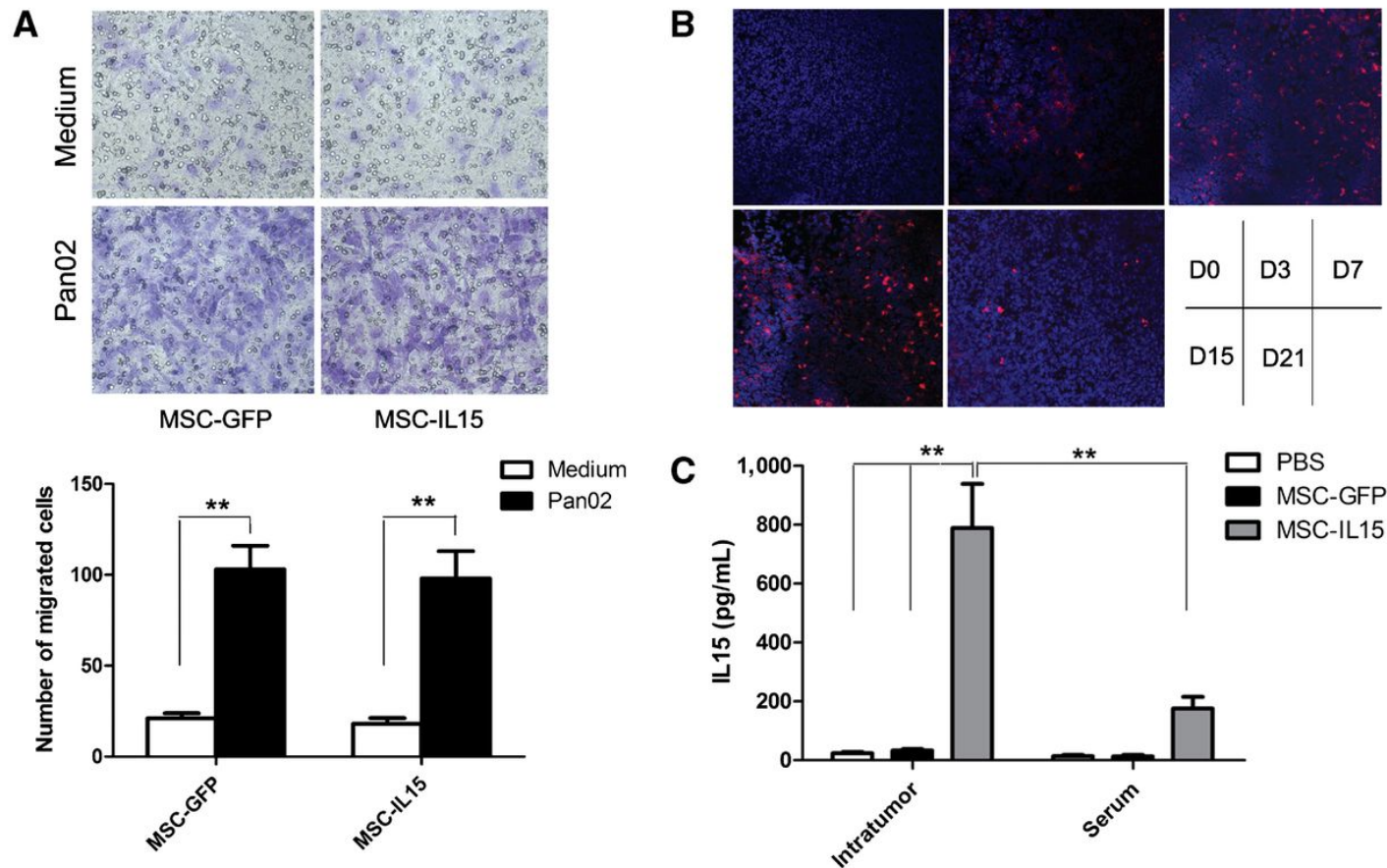
Successfully released functional IL15, which plays a role in signalling, activating and regulating immune cells; activating, proliferating and differentiating T and B cells, and playing an anti-inflammatory role in inflammatory responses.





# SCIENTIFIC STUDY

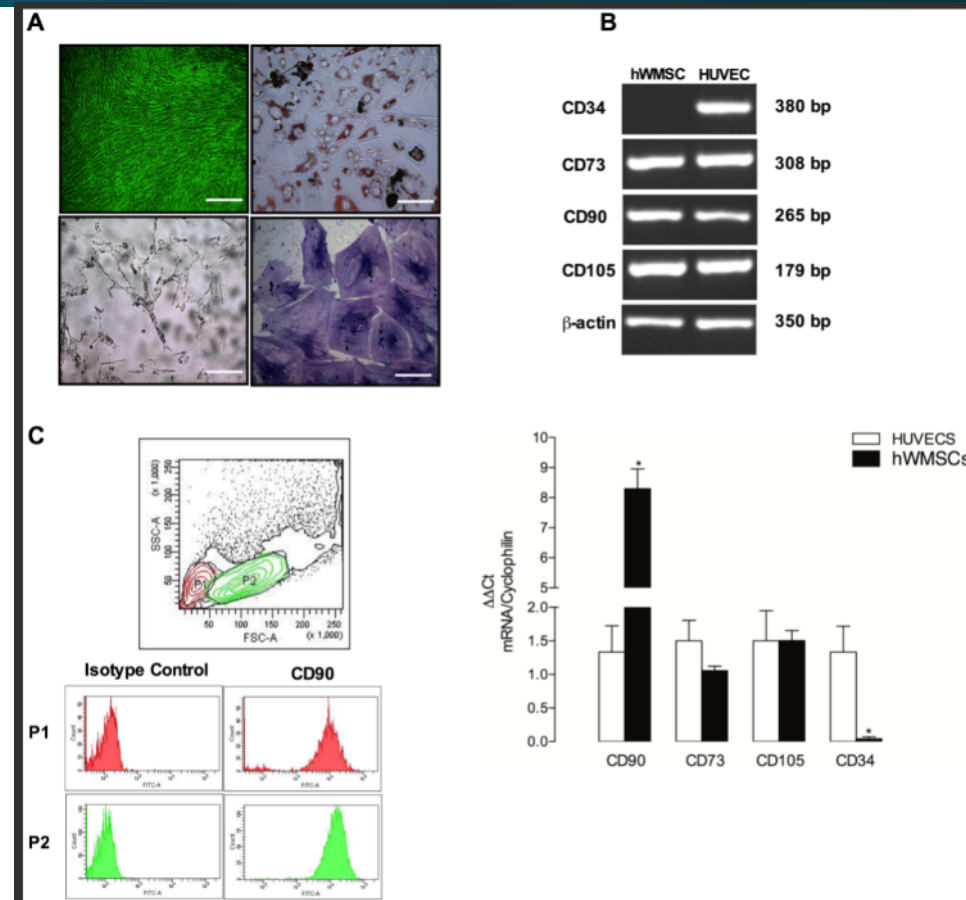
SIL15 is directed to the inflamed site by MSCs homing property.



# SCIENTIFIC STUDY

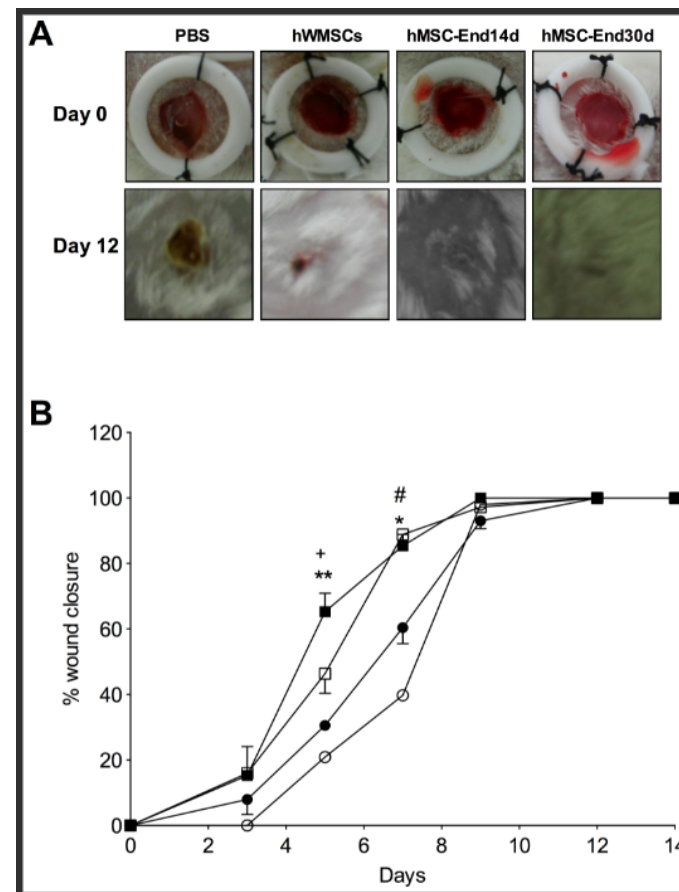
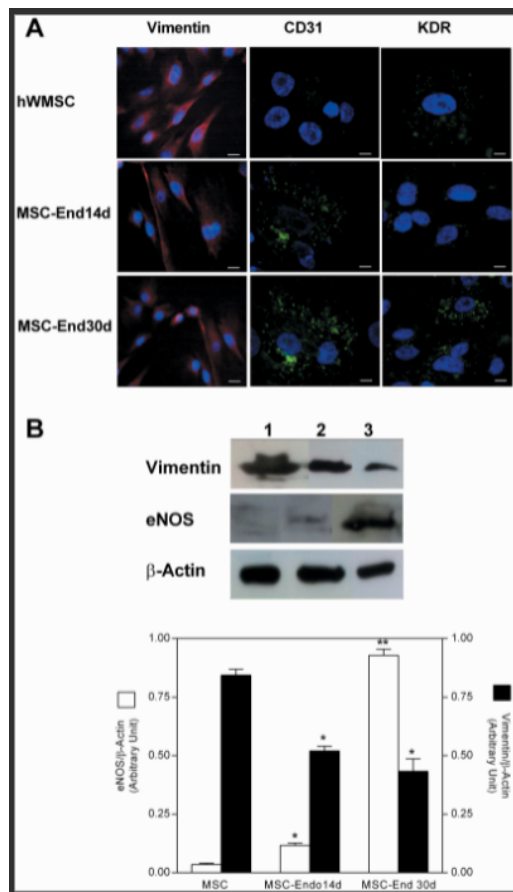
Endothelial differentiation promotes tissue repair and regeneration factor production.

Cyclophilin	Sense
	Antisense
CD90	Sense
	Antisense
CD105	Sense
	Antisense
CD73	Sense
	Antisense
CD31	Sense
	Antisense
CD34	Sense
	Antisense
eNOS	Sense
	Antisense
KDR	Sense
	Antisense



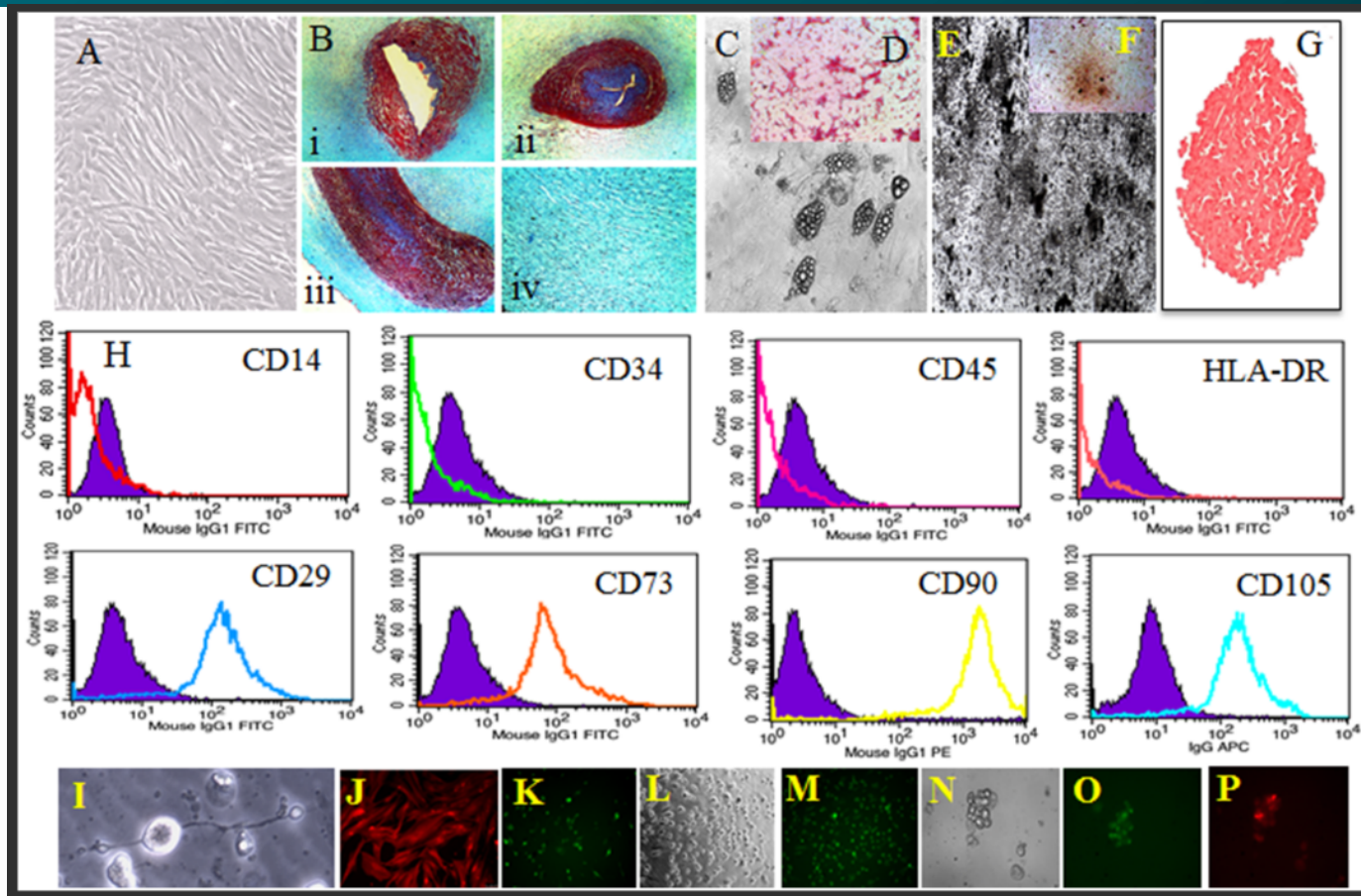
# SCIENTIFIC STUDY

Endothelial differentiation promotes tissue repair and regeneration factor production.



# SCIENTIFIC STUDY

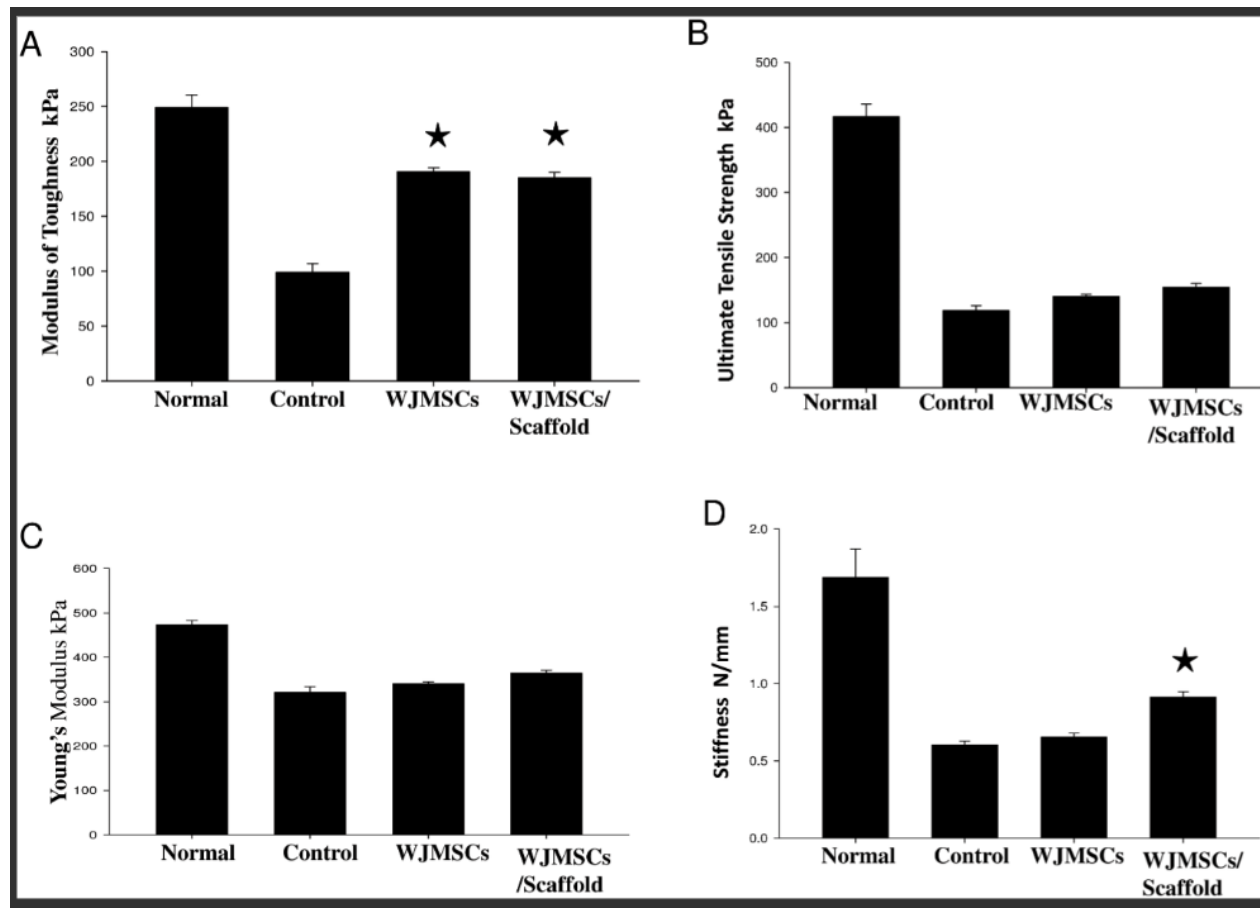
Subcutaneous tissue repair is associated with cellular response.





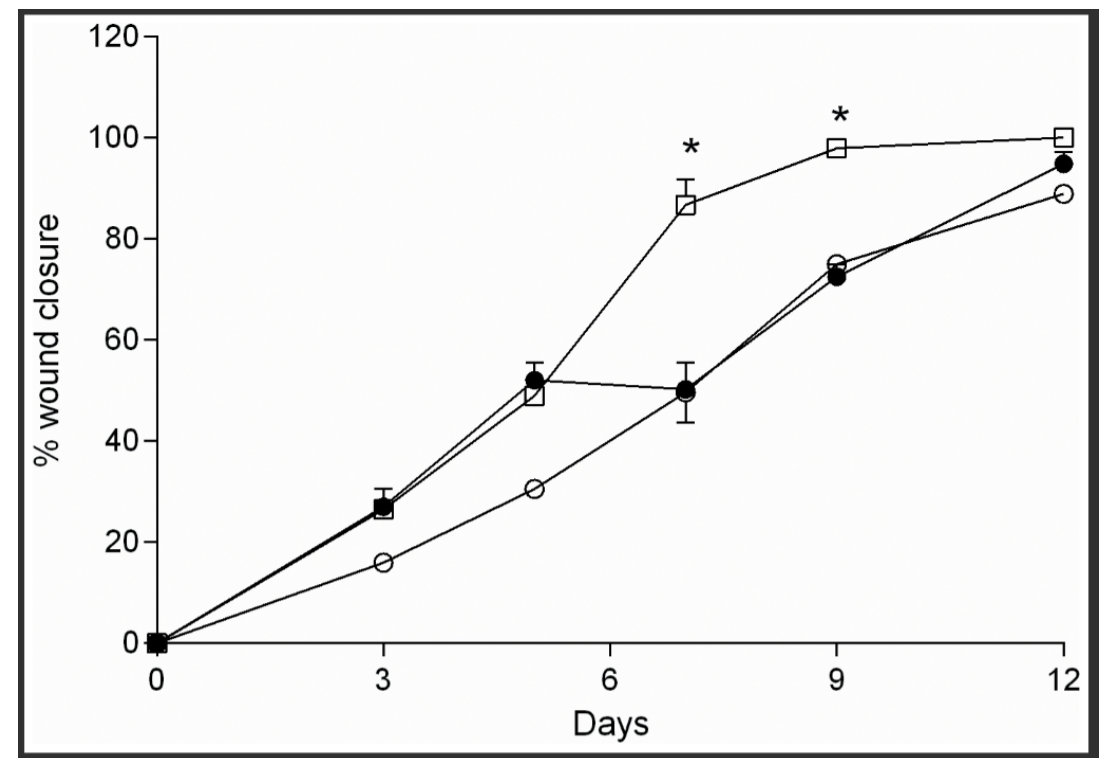
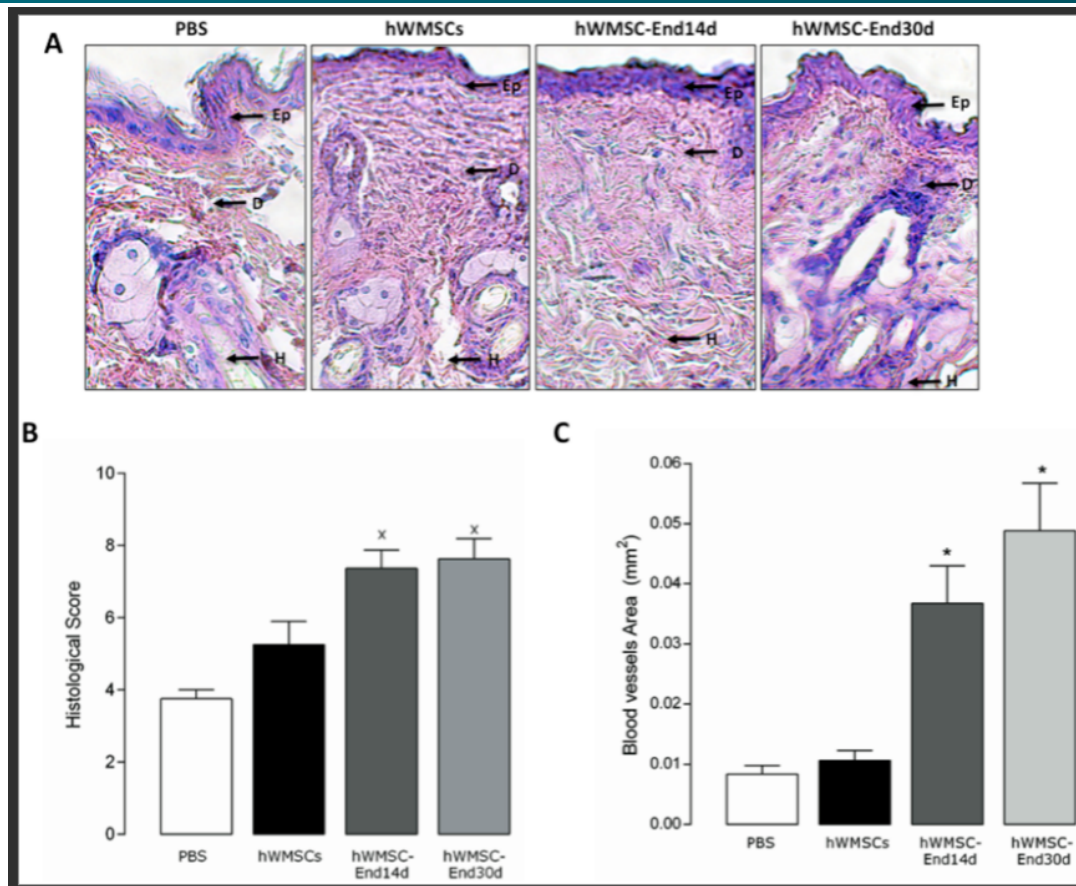
# SCIENTIFIC STUDY

## Effects of subcutaneous tissue



# SCIENTIFIC STUDY

## Repair of subcutaneous vascular tissue



**THANK  
YOU**

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