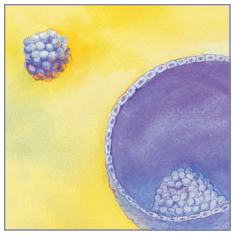
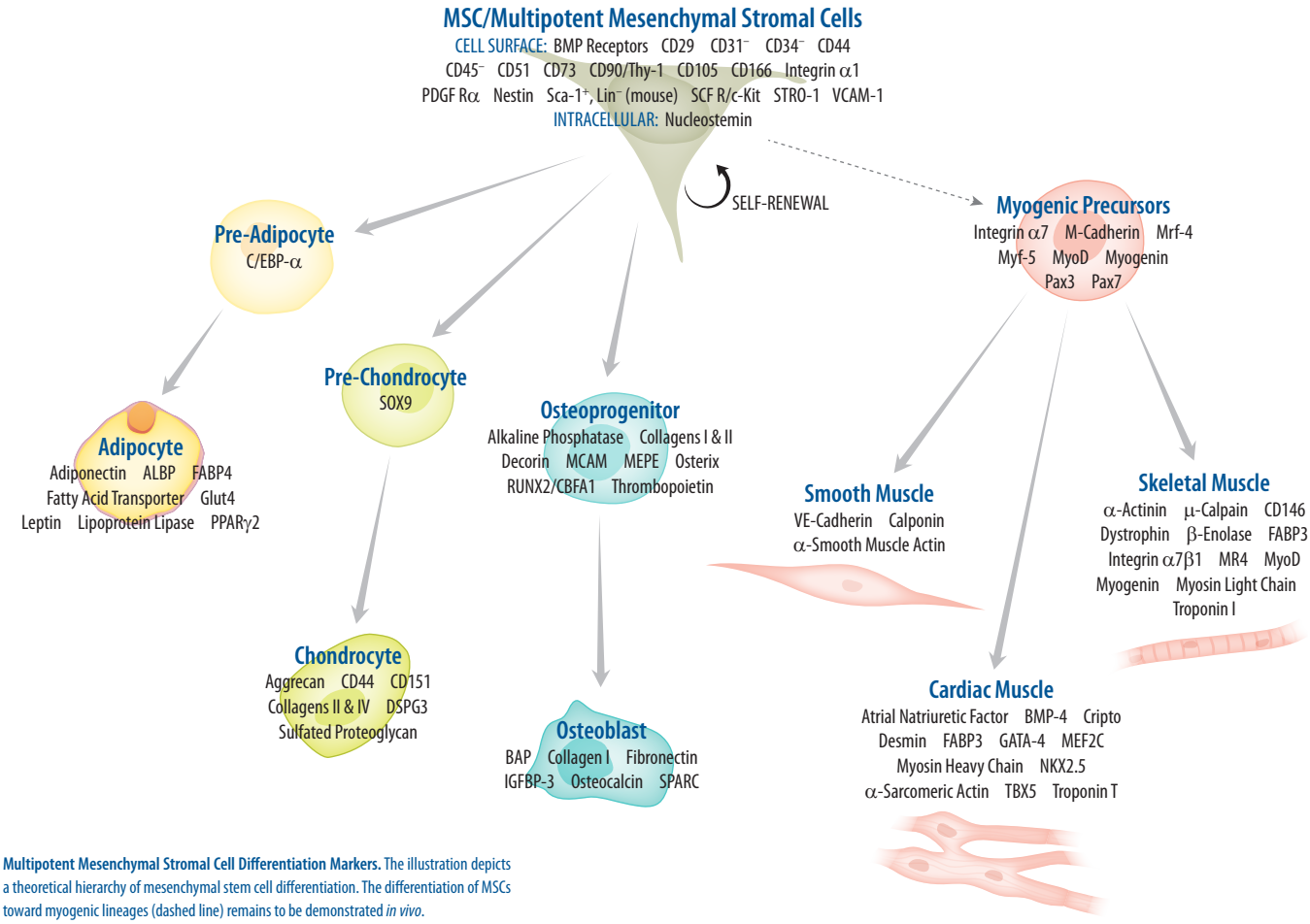


STEM CELL FOCUS: MESENCHYMAL STEM CELLS

Mesenchymal Stem Cell & Differentiation Markers

FEATURED DATA: Aggrecan · CD29/Integrin β1 · CD44 · CD45 · CD90/Thy1 · CD105/Endoglin · CD166/ALCAM · Collagen II · FABP4 Osteocalcin · PDGF Rα · SNF1LK2

The term 'mesenchymal stem cells' (MSCs) is most commonly used to describe multipotent self-renewing cells that can be differentiated *in vitro* to generate adipocytes, chondrocytes, and osteoblasts. However, because these biological properties and hierarchical relationships remain to be clearly demonstrated *in vivo*, the term 'multipotent mesenchymal stromal cells' is often used to distinguish cultured cells from their *in vivo* precursors. Originally discovered in mouse bone marrow, multipotent mesenchymal stromal cells cultured from a variety of species and tissue types, have been shown to differentiate into progeny of additional lineages including, cardiomyocytes, endothelial cells, hepatocytes, and neural cells. Again, the physiological relevance of these findings remains to be determined. Given their rarity, incompletely defined immunophenotype, and localization in multiple organs, studying MSCs *in situ* is a challenging task. To facilitate MSC research, we present tools for the isolation, expansion, differentiation, and verification of MSC/multipotent mesenchymal stromal cells.



Multipotent Mesenchymal Stromal Cell Differentiation Markers. The illustration depicts a theoretical hierarchy of mesenchymal stem cell differentiation. The differentiation of MSCs toward myogenic lineages (dashed line) remains to be demonstrated *in vivo*.

For more information, please visit:
www.RnDSystems.com/MSC

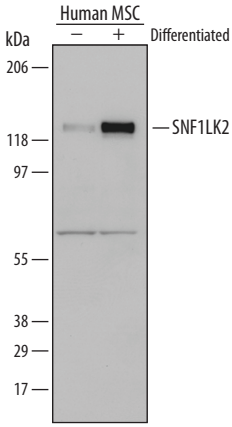
R&D SYSTEMS®

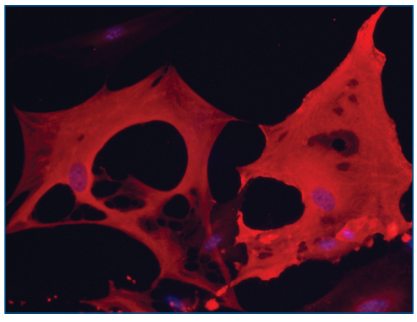
R&D Systems Products for Mesenchymal Stem Cell Differentiation Markers

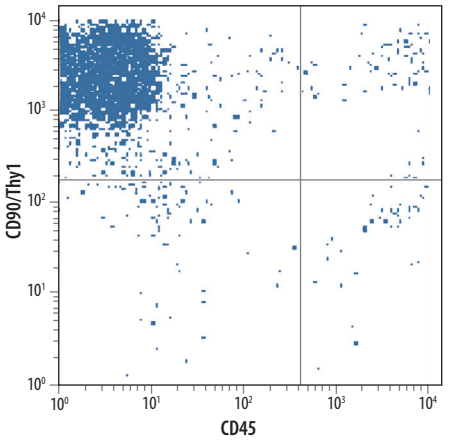
MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
MSC/Multipotent Mesenchymal Stromal Cell Markers			
5'-Nucleotidase/CD73	H M	H (FC, WB) M (FC, IHC, WB)	
ALCAM/CD166	H M	H (B/N, ELISA, FC, WB) M (FC, IHC, WB)	H M
BMPR-IA/ALK-3	H M	H (FC, IHC, WB)	
BMPR-IB/ALK-6	H M	H (FC, IHC, WB) M (WB)	
BMPR-II	H M	H (FC, IHC, WB)	
N-Cadherin	H M	H (FC, IHC, WB) M (FC, IHC, WB) R (FC, IHC, WB)	
CD31	H M P	H (FC, IHC, IP, WB) M (FC, IHC, WB) R (FC) P (FC, WB)	H
CD34		H (FC, IHC) M (FC, WB) R (FC, IHC, WB) Ca (FC, WB) P (WB)	H
CD44	H M R P	H (FC, IHC, IP, WB) M (B/N, FC, IHC, WB) R (B/N, FC, IHC, WB) Ca (FC)	H
CD45	H M	H (FC, IHC) M (FA, FC, IHC, IP, WB)	H H
CD90/Thy1		H (FC, WB) M (WB)	
CD45RO		H (FC)	
CDCP1		H (FC, IHC, IP, WB) M (FC, IHC, WB)	
Endoglin/CD105	H M R P	H (ELISA, FC, IHC, WB) M (ELISA, FC, IHC, WB)	H M H
Fibronectin	H B	H (FC, IHC, IP, WB)	
Integrin α1/CD49a		H (FC, IHC, WB)	
Integrin αV/CD51		H (B/N, FC, IHC, IP, WB)	H
Integrin β1/CD29		H (B/N, FA, FC, IHC, IP, WB) M (FC, IHC, WB)	
NCAM-1/CD56	H M	H (ELISA, FC, IHC, WB) M (WB) R (WB)	H H
Nestin		H (FC, IHC) M (FC, IHC) R (FC, IHC, WB)	H M R
Nucleostemin		H (IHC, WB) M (IHC, WB) R (IHC, WB)	
PDGF Rα	H M	H (B/N, FC, IHC, IP, WB) M (B/N, IHC, WB)	H M
Sca-1/Ly6		M (FC, IHC, WB)	H
SCF R/c-kit	H	H (B/N, ELISA, FC, IHC, WB) M (FC, IHC, WB)	H

MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
SSEA-4		H (FC, IHC) M (FC, IHC)	H
STRO-1		H (FC, IHC)	
VCAM-1/CD106	H M	H (B/N, ELISA, FC, IHC, IP, WB) M (B/N, ELISA, FC, IHC, WB)	H M H
Vimentin	H	H (FC, IHC, WB)	
Adipogenesis Markers			
Adiponectin/Acrp30	H M	H (ELISA, WB) M (ELISA, IHC, WB) R (IHC, WB)	H M
gAdiponectin/gAcrp30	H M		
Clathrin Heavy Chain 2/ CHC22		H (WB)	
FABP4/A-FABP		H (IHC, WB) M (IHC, WB)	
FATP1		H (FC, IHC)	
FATP2		H (FC)	
FATP4		H (FC)	
FATP5		H (FC)	
Glut4		R (AP, IHC, IP, WB)	
Leptin/OB	H M R	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB)	H M
PPARγ/NR1C3		H (EMSA, IHC, IP, WB) M (WB)	
Pref-1/DLK-1/FA1		H (FC, WB)	H
Chondrogenesis Markers			
Aggrecan	H	H (IHC, IP, WB)	H
Annexin A6	H	H (IHC, WB)	
CD44	H M R P	H (FC, IHC, IP, WB) M (B/N, FC, IHC, WB) R (B/N, FC, IHC, WB) Ca (FC)	H
CD151		H (FC) M (FC, IHC)	
Collagen II		M (IHC, WB)	
Collagen IV			
Collagen IV α1		H (IHC, WB)	

Species Key: H Human M Mouse R Rat B Bovine Ca Canine D *Drosophila* F Feline Ms Multispecies P Porcine Z Zebrafish
Application Key: **B/N** Blocking/Neutralization **ChIP** Chromatin Immunoprecipitation **ELISA** ELISA Capture and/or Detection **EMSA** Electrophoretic Mobility Shift Assay **FA** Functional Assay **FC** Flow Cytometry **IHC** Immunohistochemistry **IP** Immunoprecipitation **WB** Western blot







Detection of Human SNF1LK2 by Western Blot. Western blot shows lysates of human mesenchymal stem cells (MSCs) grown in the absence (–) or presence (+) of StemXVivo™ Adipogenic Supplement (Catalog # CCM011). The PVDF membrane was probed with a Goat Anti-Human SNF1LK2 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF5737), followed by a HRP-conjugated Donkey Anti-Goat IgG Secondary Antibody (Catalog # HAF109). SNF1LK2 was detected at approximately 125 kDa (as indicated).

FABP4 in Differentiated Mouse Adipocytes. Fatty acid binding protein-4 (FABP4) was detected in immersion-fixed mouse mesenchymal stem cell-derived adipocytes using a Goat Anti-Mouse FABP4 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF1443). The cells were stained with a NorthernLights™ 557-conjugated Donkey Anti-Goat IgG Secondary Antibody (Catalog # NL001; red) and the nuclei were counterstained with DAPI (blue).

Detection of CD90/Thy1 and CD45 by Flow Cytometry. Primary Rat Mesenchymal Stem Cells (Catalog # PSC003) were stained with an anti-rat RPE-conjugated CD90/Thy1 monoclonal antibody and an anti-rat Alexa Fluor® 687-conjugated CD45 monoclonal antibody. Gate based on control antibodies. After 3 passages, rat MSCs were shown to express high levels of the MSC marker CD90/Thy1 and low levels of CD45, a common hematopoietic lineage marker.

MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
CRTAC1		H (WB)	
DSPG3	H M	H (IHC, WB) M (WB)	
FoxC1		H (WB)	
FoxC2		H (IHC, WB) M (IHC)	
IBSP/Sialoprotein II	H M	H (WB)	
ITM2A		H (WB)	
Matrilin-3	H M	H (B/N, WB) M (WB)	
Matrilin-4	M	H (WB) M (WB)	
MIA		H (IHC, WB)	
OCIL/CLEC2d		H (FC, WB) M (WB)	
Otoraplin/OTOR		H (WB) M (WB)	
SOX9		H (IHC, WB)	
URB	H	H (WB)	
Osteogenesis Markers			
Alkaline Phosphatase/ ALPP/ALPI		H (IP, WB)	
BAP1	H		
BAP31		H (WB)	
Collagen I			
Collagen I α1	H	H (WB)	
Collagen II		M (IHC, WB)	
Decorin	H M	H (ELISA, IHC, WB) M (ELISA, IHC, WB)	H M
Fibronectin	H B	H (FC, IHC, IP, WB)	
IGFBP-3	H M	H (B/N, ELISA, IHC, WB) M (ELISA, WB)	H M
MEPE/OF45	H M	H (B/N, WB) M (WB)	
Osteocalcin		H (FC, IHC)	
RUNX2/CBFA1		H (ChIP, IHC, WB) M (IHC)	H

MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
SPARC	H M	H (FC, IHC, WB) M (FC, IHC, WB)	H
Thrombopoietin/Tpo	H M	H (B/N, ELISA, WB) M (B/N, ELISA, WB)	H M
Myogenesis Markers			
α-Smooth Muscle Actin		H (FC, IHC)	
Atrial Natriuretic Peptide/ ANP	H R P	H (IHC, WB)	
BMP-4	H M Z	H (B/N, ELISA, IHC, WB) Z (WB)	H
Cripto	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, FC, IHC, WB)	H
Desmin		H (IHC, WB) M (IHC)	
FABP3/H-FABP		H (IHC, WB)	H
GATA-4		H (ChIP, IHC, WB)	H
Integrin α7		M (FC)	
Integrin β1/CD29		H (B/N, FA, FC, IHC, IP, WB) M (FC, IHC, WB)	
M-Cadherin/Cadherin-15	H	H (FC, IHC, WB)	
MCAM/CD146		H (FC, IHC, WB) M (IHC, WB) R (FC, WB)	H
MEF2C		H (IHC, WB)	
MYF-5		H (IHC)	
MyoD		H (IHC)	
Myogenin		H (FC, IHC, WB) M (FC, IHC)	
Myosin Heavy Chain		H (FC, IHC)	
NKX2.5		H (IHC, WB)	
Pax3		H (FC, IHC, WB) M (FC, IHC, WB)	
Pax7		H (IHC, WB) M (IHC) R (IHC) Ch (IHC)	
TBX5		H (WB) M (WB)	
Troponin I		H (WB)	
Troponin T		H (IHC)	
VE-Cadherin	H M	H (FC, IHC, WB) M (FC, WB)	H H

Species Key: H Human M Mouse R Rat B Bovine Ca Canine D *Drosophila* F Feline Ms Multispecies P Porcine Z Zebrafish
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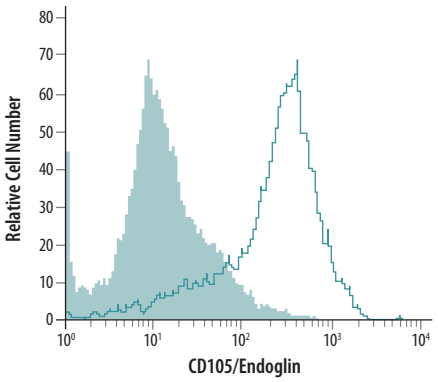
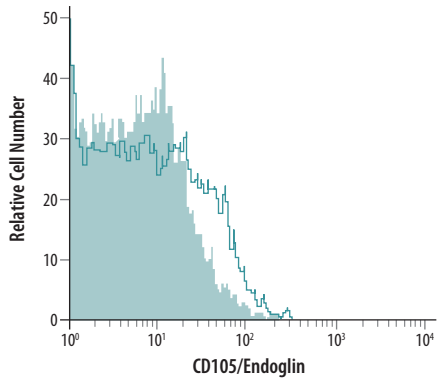
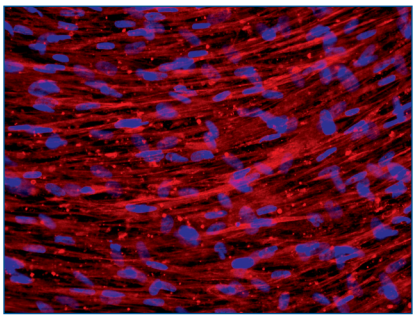
A. UNDIFFERENTIATED



B. OSTEOCYTE-DIFFERENTIATED



Detection of CD105/Endoglin by Flow Cytometry. Human mesenchymal stem cells were stained with the PerCP-conjugated Mouse Anti-Human CD105/Endoglin Monoclonal Antibody provided in the Human Multipotent Mesenchymal Stromal Cell Multi-Color Flow Cytometry Kit* (Catalog # FMC002; open histogram) or a PerCP-conjugated Mouse IgG_1 Isotype Control (Catalog # IC002C; filled histogram). Staining was conducted in undifferentiated (**A**) and 21-day osteocyte-differentiated cells (**B**). Osteocyte-differentiated cells show a characteristic reduction in CD105/Endoglin expression. *This kit also includes CFS-conjugated CD146, APC-conjugated CD90/Thy1, and PE-conjugated CD45 primary antibodies.



Osteocalcin in Differentiated Human Osteocytes. Osteocalcin was detected in immersion-fixed human mesenchymal stem cell-derived osteocytes using a Mouse Anti-Human Osteocalcin Monoclonal Antibody (Catalog # MAB1419). The cells were stained using a NorthernLights 557-conjugated Donkey Anti-Mouse IgG Secondary Antibody (Catalog # NL007; red) and the nuclei were counterstained with DAPI (blue).

R&D Systems Products for Mesenchymal Stem Cell Growth Factors & Receptors

MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
BMP/GDF Family			
BMP-2	H Z	H (B/N, ELISA, IHC, WB) Z (B/N, WB)	H M R
BMP-2/BMP-7 Heterodimer	H	H (WB)	
BMP-2/BMP-4		H (B/N, IHC, WB) Z (WB)	
BMP-2a	Z		
BMP-2/BMP-6 Heterodimer	H		
BMP-3	H	H (IHC, WB)	
BMP-3b/GDF-10	H	H (IHC, WB)	
BMP-4	H M Z	H (B/N, ELISA, IHC, WB) Z (WB)	H
BMP-4/BMP-7 Heterodimer	H		
BMP-5	H M	H (B/N, ELISA, IHC, WB) M (IHC, WB)	
BMP-6	H M	H (B/N, ELISA, IHC, WB) M (IHC, WB)	H
BMP-7	H M	H (B/N, ELISA, IHC, WB)	H
BMP-8		H (IHC, WB)	
BMP-8a	H		
BMP-8b		H (WB) M (WB)	
BMP-9	H M	H (B/N, ELISA, WB) M (B/N, ELISA, WB)	H
BMP-10	H M	H (B/N, WB) M (B/N, IHC, WB)	
BMP-15/GDF-9B	H	H (IHC, WB) M (IHC, WB) R (WB)	
Decapentaplegic/D PP	D	D (WB)	
GDF-1	H	H (WB) M (WB)	
GDF-3	H M	H (IHC, WB) M (IHC, WB)	
GDF-5/BMP-14	M	M (B/N, IHC, WB)	
GDF-6/BMP-13	M	M (IHC)	
GDF-7/BMP-12	M	M (WB)	
GDF-8/Myostatin	H M R	H (B/N, IHC, WB) M (B/N, IHC, WB) R (B/N, IHC, WB)	
GDF-9	M	M (IHC, WB)	
GDF-11/BMP-11	H		
GDF-15	H	H (ELISA, WB) M (IHC)	H
EGF Family			
Amphiregulin	H M	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB)	H M
AMSH/STAMBP		H (WB)	
Betacellulin/BTC	H M	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB)	H M
EGF	H M R	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB) R (B/N, ELISA, WB)	H M R
EGF R/ErbB1	H M	H (ELISA, FC, IHC, IP, WB) M (FC, IHC, WB)	H H
EGF-L6	M		
Epigen	H M	M (ELISA, IHC, WB)	M
Epiregulin	H M	H (B/N, FC, IHC, WB) M (B/N, ELISA, WB)	M
ErbB2/Her2	H	H (B/N, ELISA, FC, IHC, WB) M (FC, IHC, WB)	H H
ErbB3/Her3	H M	H (B/N, ELISA, FC, IHC, WB) M (FC, IHC, WB)	H
ErbB4/Her4	H M	H (FC, WB)	H
HB-EGF	H	H (B/N, ELISA, IHC, WB)	H
LRIG1	M	M (B/N, FC, IHC, WB)	
LRIG3	H	H (WB)	
Neuregulin-1/NRG1	H	H (B/N, ELISA, IHC, WB)	H
NRG1-α/HRG1-α	H	H (B/N, IHC, WB)	
NRG1-β1/HRG1-β1	H	H (B/N, ELISA, IHC, WB)	H
NRG1 Isoform GGF2		H (WB)	
NRG1 Isoform SMDF	H	H (B/N, WB)	
Neuregulin-3/NRG3		M (IHC, WB)	
PI3K-C2β		H (IHC, WB)	
TGF-α	H	H (B/N, ELISA, IHC, WB)	H
TMEFF1/Tomoregulin-1		H (WB) M (IHC, WB)	
TMEFF2/Tomoregulin-2		H (WB)	

Species Key: H Human M Mouse R Rat B Bovine Ca Canine D *Drosophila* F Feline Ms Multispecies P Porcine Z Zebrafish
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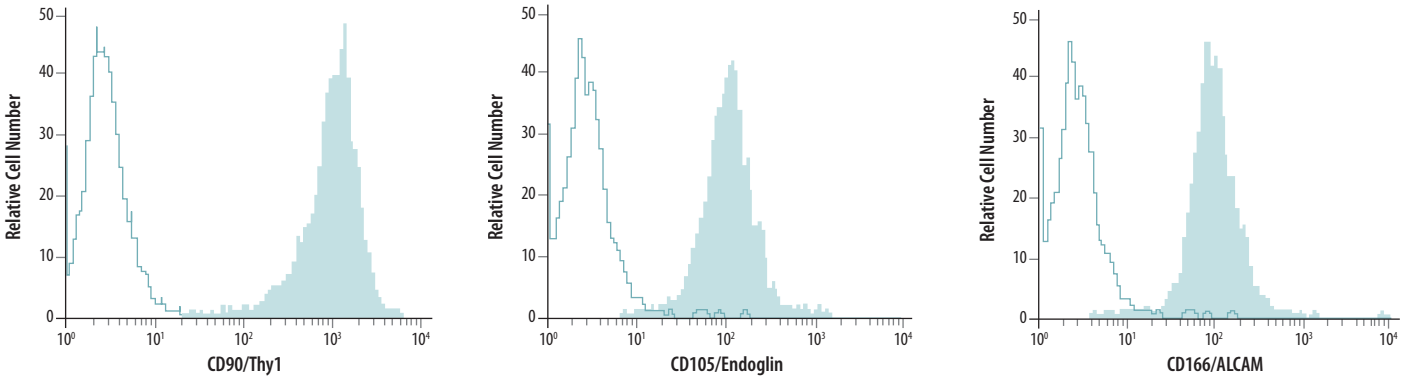
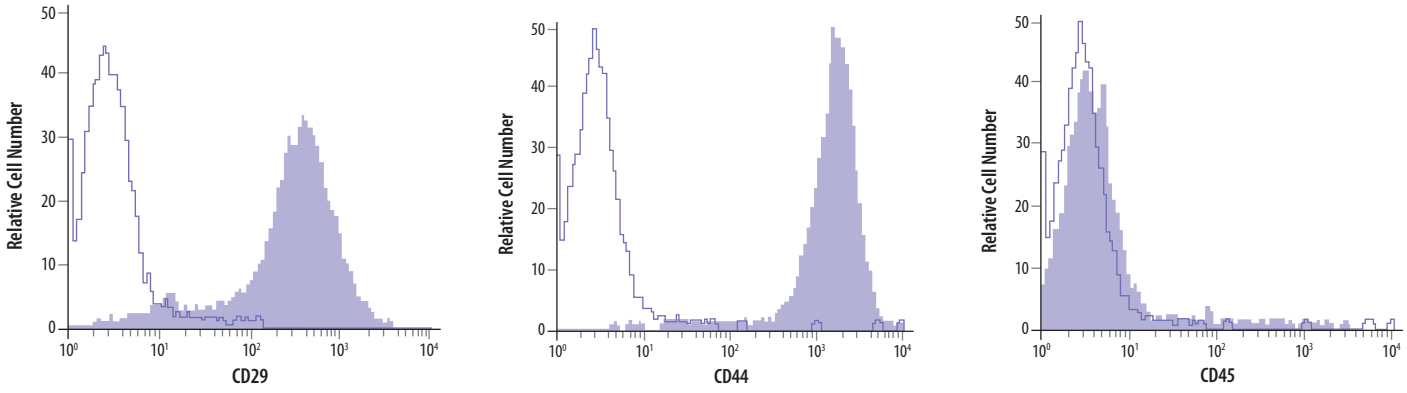


Detection of CD90/Thy1, CD105/Endoglin, and CD166/ALCAM by Flow Cytometry. Undifferentiated human mesenchymal stem cells were incubated with the Mouse Anti-Human CD90/Thy1, CD105/Endoglin, and CD166/ALCAM Monoclonal Antibodies provided in the Human Multipotent Mesenchymal Stromal Cell Marker Antibody Panel* (Catalog # SC017; filled histograms) or a Mouse IgG_1 or IgG_{2A} Isotype Control (Catalog # MAB002 or MAB003, respectively; open histograms). The cells were stained using a PE-conjugated Goat Anti-Mouse Secondary Antibody (Catalog # F0116). *This panel also includes primary antibodies to detect CD19, CD44, CD45, CD106/VCAM-1, and CD146/MCAM.

MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
IGF Family			
ALS		M (WB)	
CILP-1	H	H (WB)	
CTGF/CCN2		H (IHC, WB)	
Cyr61/CCN1	H	H (WB) M (IHC, WB)	
Endocan/ESM-1	H M	H (B/N, WB) M (B/N, ELISA, WB)	M
IGFBP-1	H M	H (B/N, ELISA, WB) M (IHC, WB)	H
IGFBP-2	H M	H (B/N, ELISA, WB) M (B/N, ELISA, WB)	H M
IGFBP-3	H M	H (B/N, ELISA, IHC, WB) M (ELISA, WB)	H M
IGFBP-4	H	H (B/N, ELISA, IHC, WB)	H
IGFBP-5	H M	H (ELISA, IHC, WB) M (ELISA, IHC, WB)	H M
IGFBP-6	H M	H (B/N, ELISA, WB) M (ELISA, IHC, WB)	H M
IGFBP-L1	M	H (WB) M (IHC, WB)	
IGFBP-rp1/IGFBP-7	H M	H (IHC, WB) M (IHC, WB)	
IGFBP-rP10		H (WB) M (WB)	
IGF-I	H M R	H (B/N, ELISA, IHC, WB) M (B/N, ELISA, IHC, WB)	H M R
IGF-I R	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, FC, IHC, WB)	H
IGF-II	H M	H (B/N, IHC, WB) M (B/N, ELISA, IHC, WB)	M
IGF-II R	H	H (B/N, ELISA, FC, IHC, WB)	H
IGFL-3		H (IHC, WB)	
IMP2		H (WB) M (WB) R (WB)	
NOV/CCN3	H M	H (ELISA, IHC, WB) M (ELISA, WB)	H M
WISP-1/CCN4	H M	H (ELISA, IHC, WB) M (IHC, WB)	H
VEGF & PDGF Family			
Neuropilin-1	H M R	H (B/N, FC, IHC, WB) M (B/N, FC, IHC, WB) R (B/N, FC, IHC, WB)	
Neuropilin-2	H R	H (B/N, FC, IHC, WB) R (B/N, FC, WB)	

MOLECULE	RECOMBINANT & NATURAL PROTEINS	ANTIBODIES	ELISAs CELL SELECTION & DETECTION KITS & REAGENTS
PDGF	H P	H (B/N, WB) Ms (B/N, WB)	
PDGF-A		H (ELISA, WB)	
PDGF-AA	H R	H (B/N, ELISA, IHC, WB) R (B/N, IHC, WB) Ms (B/N, WB)	H M
PDGF-AB	H R	H (B/N, ELISA, IHC, WB) Ms (B/N, WB)	H M R
PDGF-B		H (B/N, ELISA, WB) Ms (B/N, WB)	
PDGF-BB	H R	H (B/N, ELISA, WB)	H M R
PDGF-C		H (B/N, IHC, WB) M (B/N, IHC, WB)	
PDGF-CC	H M		
PDGF-D		H (B/N, IHC, WB)	
PDGF-DD	H		H
PDGF Rα	H M	H (B/N, FC, IHC, IP, WB) M (B/N, IHC, WB)	H M
PDGF Rβ	H M	H (B/N, FC, IHC, IP, WB) M (IHC, WB)	H M
PlGF	H	H (ELISA, IHC, WB)	H
PlGF-2	H M	M (B/N, ELISA, WB)	M
VEGF	H M R Ca F Z	H (B/N, ELISA, FC, IF, IHC, WB) M (B/N, ELISA, IHC, WB) R (B/N, ELISA, IHC, WB) Ca (B/N, ELISA, IHC, WB) Z (B/N, WB)	H M R Ca
VEGF/PlGF Heterodimer	H	H (WB)	H
VEGF-B	H M	H (IHC, WB) M (B/N, IHC, WB)	
VEGF-C	H	H (IHC, WB) M (WB) R (WB)	H
VEGF-D	H M	H (B/N, ELISA, IHC, WB) M (ELISA, IHC, WB)	H M
VEGF R1, R2, R3		H (FC)	
VEGF R1/Flt-1	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, ELISA, FC, IHC, WB)	H M
VEGF R2/KDR/Flk-1	H M	H (B/N, ELISA, FC, IHC, WB) M (B/N, ELISA, FC, IHC, WB)	H M H
VEGF R3/Flt-4	H M	H (ELISA, FC, IHC, WB) M (ELISA, FC, WB)	H M

Species Key: H Human M Mouse R Rat B Bovine Ca Canine D *Drosophila* F Feline Ms Multispecies P Porcine Z Zebrafish
Application Key: **B/N** Blocking/Neutralization **ChIP** Chromatin Immunoprecipitation **ELISA** ELISA Capture and/or Detection **EMSA** Electrophorectic Mobility Shift Assay **FA** Functional Assay **FC** Flow Cytometry **IHC** Immunohistochemistry **IP** Immunoprecipitation **WB** Western blot



Detection of CD29, CD44, and CD45 by Flow Cytometry. Conditionally immortalized mouse mesenchymal progenitor cells were incubated with the Rat Anti-Mouse CD29, CD44, and CD45 Monoclonal Antibodies provided in the Mouse Multipotent Mesenchymal Stromal Cell Marker Antibody Panel* (Catalog # SC018; filled histograms) or a Rat IgG_{2A} or IgG_{2B} Isotype Control (Catalog # MAB006 or MAB0061, respectively; open histograms). The cells were stained using a PE-conjugated Goat Anti-Rat Secondary Antibody (Catalog # F0105B). *This panel also includes primary antibodies to detect CD11b/Integrin αM, CD73/5`-Nucleotidase, CD105/Endoglin, CD106/VCAM-1, and Sca-1.

Mesenchymal Stem Cells: Isolation, Expansion, Differentiation, & Verification

R&D Systems offers kits for the maintenance and expansion of MSCs, as well as kits and reagents designed to promote and identify the progression of MSCs into osteogenic, adipogenic, and chondrogenic lineages.

Rat Mesenchymal Stem Cells

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Rat Mesenchymal Stem Cells	Isolated from the bone marrow of F344 rats. 1 vial; containing 1 x 10^6 cells.	PSC003	1 vial

StemXVivo™ Culture Matrix

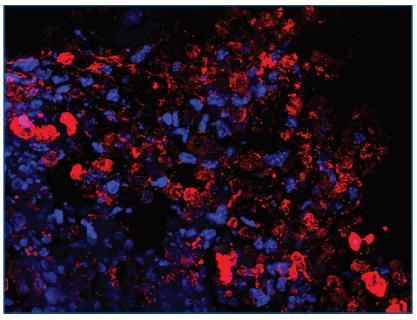
StemXVivo Culture Matrix can be used as a substitute for EHS basement membrane extract (such as Matrigel™) or as a feeder layer in the maintenance and/or differentiation of stem/progenitor cells. The culture matrix is tested for its ability to support attachment and growth of multiple stem/progenitor cell populations.

PRODUCT	DESCRIPTION	CATALOG #	SIZE
StemXVivo Culture Matrix	A defined proprietary mixture of recombinant human adhesion molecules for the culture of stem/progenitor cells. Supplied as a 100X concentrate in PBS.	CCM013	1.0 mL

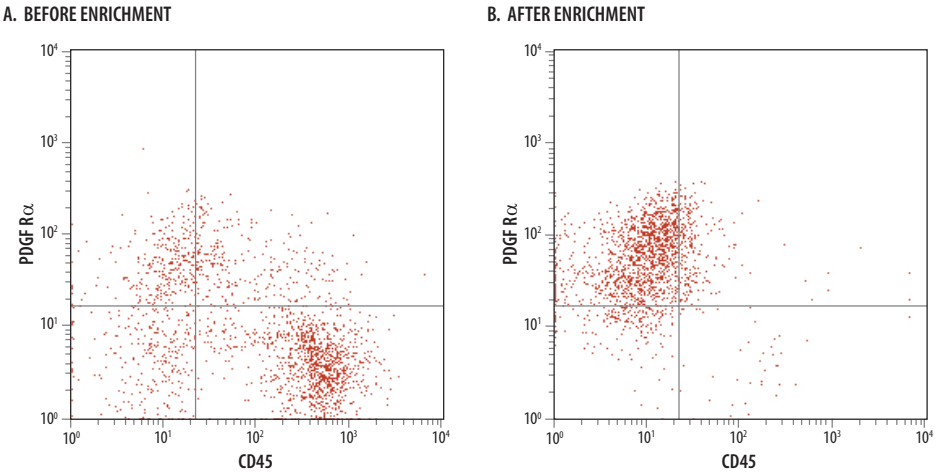
Media & Supplements for Mesenchymal Stem Cell Expansion & Differentiation

StemXVivo MSC Expansion Media is a complete medium for the expansion of mesenchymal stem cells (MSCs). All the components have been selected and optimized for culturing human, rat, and mouse MSCs.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human/Mouse StemXVivo Mesenchymal Stem Cell Expansion Media	Complete media for the expansion of MSCs.	CCM004	250 mL
Human StemXVivo Serum-Free Mesenchymal Stem Cell Expansion Media	Complete serum-free media for the expansion of MSCs.	CCM014	500 mL
Human/Mouse StemXVivo Chondrogenic Base Media	Base media for the differentiation of MSCs into chondrocytes. For use with Chondrogenic Supplement.	CCM005	50 mL
Human/Mouse StemXVivo Osteogenic/Adipogenic Base Media	Base Media that can be used with the appropriate supplement for the differentiation of MSCs into osteocytes or adipocytes. For use with Osteogenic or Adipogenic Supplements.	CCM007	250 mL
Human/Mouse StemXVivo Chondrogenic Supplement	Media supplement for the differentiation of MSCs into chondrocytes. For use with Chondrogenic Base Media.	CCM006	0.5 mL
Human StemXVivo Osteogenic Supplement	Media supplement for the differentiation of human MSCs into osteocytes. For use with Osteogenic/Adipogenic Base Media.	CCM008	12.5 mL
Mouse StemXVivo Osteogenic Supplement	Media supplement for the differentiation of mouse MSCs into osteocytes. For use with Osteogenic/Adipogenic Base Media.	CCM009	12.5 mL
Human/Mouse StemXVivo Adipogenic Supplement	Media supplement for the differentiation of human or mouse MSCs into adipocytes. For use with Osteogenic/Adipogenic Base Media.	CCM011	3.5 mL



Collagen II in Differentiated Mouse Chondrocytes. Collagen II was detected in immersion-fixed mouse mesenchymal stem cell-derived chondrocytes using a Sheep Anti-Mouse Collagen II Antigen Affinity-purified Polyclonal Antibody (Catalog # AF3615). The cells were stained with a NorthernLights 557-conjugated Donkey Anti-Sheep IgG Secondary Antibody (Catalog # NL010; red) and the nuclei were counterstained with DAPI (blue).



Enrichment of Mesenchymal Stem Cells using the MagCellect Mouse Mesenchymal Stem Cell Isolation Kit. Mouse mesenchymal stem cells were enriched from C57/BL6 mouse compact bone using the MagCellect™ Mouse Mesenchymal Stem Cell Isolation Kit (Catalog # MAGM212). Mouse mesenchymal stem cells were stained with an Alexa Fluor®488-conjugated rat anti-mouse PDGF Rα monoclonal antibody and a APC-conjugated Rat Anti-Mouse CD45 Monoclonal Antibody (Catalog # FAB114A), before (**A**) and after (**B**) enrichment. The resulting cell preparation was highly enriched with mesenchymal stem cells.

Mesenchymal Stem Cell Isolation Kit

A kit designed for the isolation of mouse mesenchymal stem cells from a single cell suspension of compact bone or bone marrow cells.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
MagCellect Mouse Mesenchymal Stem Cell Isolation Kit	Mouse mesenchymal stem cell biotinylated antibody cocktail, MagCellect streptavidin ferrofluid, MagCellect Plus buffer. Each kit processes up to 300 x 10^6 cells; up to 12 isolations.	MAGM212	1 Kit

Marker Panels for Mesenchymal Stem Cells

Antibody panels to verify MSC identification by flow cytometry using positive and negative surface markers.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human Multipotent Mesenchymal Stromal Cell Marker Antibody Panel	Contains 25 µg each of antibodies to Stro-1, CD90, CD106, CD105, CD146, CD166, CD44, CD19, and CD45.	SC017	1 Kit
Mouse Multipotent Mesenchymal Stromal Cell Marker Antibody Panel	Contains 25 µg each of antibodies to Sca-1, CD106, CD105, CD73, CD29, CD44, CD11b, and CD45.	SC018	1 Kit

Multi-Color Flow Cytometry Kits for Mesenchymal Stem Cells

Kits to simultaneously verify the expression of MSC markers using four fluorochrome-conjugated antibodies.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human Multipotent Mesenchymal Stromal Cell 4-Color Flow Cytometry Kit	Contains conjugated antibodies to human CD105-PerCP, CD146-Fluorescein, CD90-APC, and CD45-PE.	FMC002	25 Tests
Mouse Multipotent Mesenchymal Stromal Cell 4-Color Flow Cytometry Kit	Contains conjugated antibodies to mouse Sca-1-APC, CD105-Fluorescein, CD29-PE, and CD45-PerCP.	FMC003	25 Tests

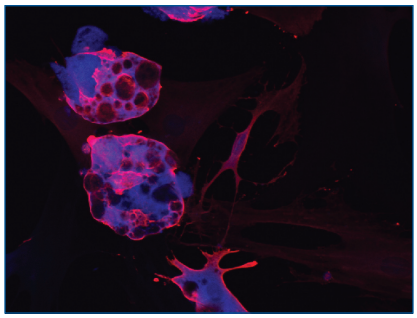
Kits also contain appropriate staining buffers and specific isotype controls.

Mesenchymal Stem Cell Functional Identification Kits

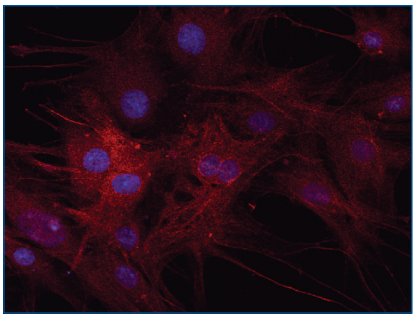
Mesenchymal Stem Cell Functional Identification Kits contain specially formulated Adipogenesis, Chondrogenesis, and Osteogenesis Media Supplements that can be used to verify the ability of MSC populations to differentiate into adipogenic, chondrogenic, or osteogenic lineages. The kits also include a panel of antibodies to identify the mature phenotype of each lineage.

PRODUCT	KIT CONTENTS	CATALOG #	SIZE
Human Mesenchymal Stem Cell Functional Identification Kit	Adipogenic Supplement, Chondrogenic Supplement, Osteogenic Supplement, ITS Supplement, Anti-Aggrecan, Anti-Osteocalcin, Anti-FABP-4.	SC006	1 Kit
Mouse Mesenchymal Stem Cell Functional Identification Kit	Adipogenic Supplement, Chondrogenic Supplement, Osteogenic Supplement, ITS Supplement, Anti-Collagen II, Anti-Osteopontin, Anti-FABP-4.	SC010	1 Kit
Rat Mesenchymal Stem Cell Functional Identification Kit	Adipogenic Supplement, Chondrogenic Supplement, Osteogenic Supplement, ITS Supplement, Anti-Aggrecan, Anti-Osteocalcin, Anti-FABP4.	SC020	1 Kit

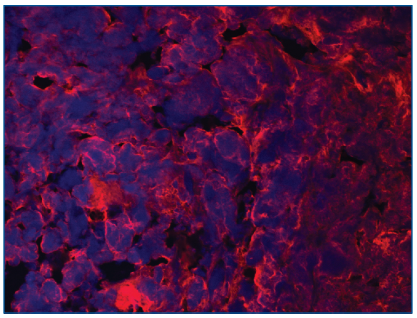
Adipogenic Differentiation Medium
Culture 10-14 Days



Osteogenic Differentiation Medium
Culture 14-21 Days



Chondrogenic Differentiation Medium
Culture 21 Days



Verification of Multipotency using the Rat Mesenchymal Stem Cell Functional Identification Kit. Rat mesenchymal stem cells were cultured in StemXVivo Mesenchymal Stem Cell Expansion Media (Catalog # CCM004) and differentiation was induced as indicated using the media supplements included in the Rat Mesenchymal Stem Cell Functional Identification Kit (Catalog # SC020). Markers of adipocyte, osteocyte, and chondrocyte lineages were detected using a Goat Anti-Mouse FABP4 Antigen Affinity-purified Polyclonal Antibody, a Mouse Anti-Human Osteocalcin Monoclonal Antibody, and a Goat Anti-Human Aggrecan Antigen Affinity-purified Polyclonal Antibody, respectively. All these primary antibodies are included in the Rat Mesenchymal Stem Cell Functional Identification Kit (Catalog # SC020).

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Peer-reviewed References using R&D Systems Mesenchymal Stem Cell-related Products

1. Roobrouk, V. *et al.* (2011) Differentiation potential of human postnatal mesenchymal stem cells, mesoangioblasts, and multipotent adult progenitor cells reflected in their transcriptome and partially influenced by the culture conditions. Stem Cells **29**:871.

   Human Mesenchymal Stem Cell Functional Identification Kit (Catalog # SC006)

   Recombinant Human PDGF-BB (Catalog # 220-BB)

   Recombinant Human FGF-basic (Catalog # 233-FB)

   Sample: Human mesenchymal stem cells
   Application: Differentiation

2. Ninagawa, N. *et al.* (2011) Mesenchymal stem cells originating from ES cells show high telomerase activity and therapeutic benefits. Differentiation **82**:153.

   Rat Anti-Mouse Endoglin/CD105 Monoclonal Antibody (Catalog # MAB1320)

   Sample: Mouse embryoid bodies
   Application: Magnetic cell separation and immunofluorescence

   PE-conjugated Rat Anti-Mouse Endoglin/CD105 Monoclonal Antibody (Catalog # FAB1320P)

   Sample: Mouse embryoid bodies
   Application: Magnetic cell separation

3. Giuliani, M. *et al.* (2011) Long-lasting inhibitory effects of fetal liver mesenchymal stem cells on T-lymphocyte proliferation. PLoS ONE **6**:e19988.

   PE-conjugated Mouse Anti-Human CD90/Thy1 Monoclonal Antibody (Catalog # FAB2067P)

   PE-conjugated Mouse Anti-Human Endgolin/CD105 Monoclonal Antibody (Catalog # FAB10971P)

   PE-conjugated Mouse Anti-Human ALCAM/CD166 Monoclonal Antibody (Catalog # FAB6561P)

   Sample: Human fetal liver-derived and adult bone marrow-derived mesenchymal stem cells
   Application: Flow cytometry

   Human/Mouse StemXVivo Chondrogenic Base Media (Catalog # CCM005)

   Human/Mouse StemXVivo Chondrogenic Supplement (Catalog # CCM006)

   Human/Mouse StemXVivo Osteogenic/Adipogenic Base Media (Catalog # CCM007)

   Human StemXVivo Osteogenic Supplement Catalog # CCM008)

   Human/Mouse StemXVivo Adipogenic Supplement (Catalog # CCM011)

   Sample: Human fetal liver-derived and adult bone marrow-derived mesenchymal stem cells
   Application: Differentiation

4. Chartoff, E. *et al.* (2011) Detection of intranasally delivered bone marrow-derived mesenchymal stromal cells in the lesioned mouse brain: A cautionary report. Stem Cells Int. Article ID:586586.

   Mouse Multipotent Mesenchymal Stromal Cell Marker Antibody Panel (Catalog # SC018)
   Contains antibodies against Sca-1, CD106, CD105, CD73, CD29, CD44, CD11b, and CD45.

   Sample: Mouse EGFP-expressing mesenchymal stromal cells
   Application: Flow cytometry

5. Ball, G. *et al.* (2012) Inhibition of platelet-derived growth factor receptor signaling regulates Oct4 and Nanog expression, cell shape, and mesenchymal stem cell potency. Stem Cells **30**:548.

   Proteome Profiler™ Human Pluripotent Stem Cell Array Kit (Catalog # ARY010)

   Proteome Profiler Human Phospho-RTK Array Kit (Catalog # ARY001)

   Sample: Human mesenchymal stem cell lysates
   Application: Multianalyte profiling

6. Asumda, F. *et al.* (2011) Age-related changes in rat bone-marrow mesenchymal stem cell plasticity. BMC Cell Bio. **12**:44.

   Mouse Anti-Human Osteocalcin Monoclonal Antibody (Catalog # MAB1419)

   Goat Anti-Human Aggrecan G1-IGD-G2 Domains Antigen Affinity-purified Polyclonal Antibody (Catalog # AF1220)

   Goat Anti-Mouse FABP4 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF1443)

   Sample: Rat differentiated bone marrow-derived mesenchymal stem cells
   Application: Immunocytochemistry

   Mouse Mesenchymal Stem Cell Functional Identification Kit (Catalog # SC010)

   Sample: Rat bone marrow-derived mesenchymal stem cells
   Application: Differentiation and lineage detection by immunocytochemistry

   Recombinant Human TGF-β3 (Catalog # 243-B3)

   Recombinant Rat FGF-basic (Catalog # 3339-FB)

   Recombinant Rat IGF-I (Catalog # 4326-RG)

   Recombinant Human BMP-2 (Catalog # 355-BM)

   Sample: Rat bone marrow-derived mesenchymal stem cells
   Application: Differentiation

For more information about MSC-related products, please visit:
www.RnDSystems.com/MSC