

Bone Growth & Remodeling



Tools for Cell Biology Research™

R&D
SYSTEMS®

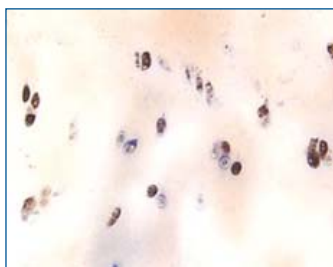


Bone Growth and Remodeling

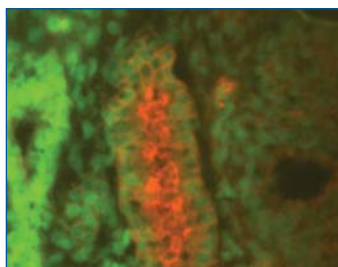
The skeletal system provides a structural framework for the body, facilitating movement and protecting internal organs, as well as serving as a reservoir for inorganic salts and cells of the immune system. Many cell types and signaling pathways impact bone growth and remodeling: chondrocytes and osteoblasts derived from bone marrow mesenchymal stem cells, osteoclasts of hematopoietic origins, and hormones and other neuromodulators that help regulate the balance of osteoblastic bone formation and osteoclastic bone resorp-

tion. The dynamic processes of bone deposition and resorption continuously remodel bones, and this balance is crucial for maintenance of bone size, shape, and integrity. Disruptions of bone homeostasis accompany disorders that include osteoporosis, arthritis, and many heritable skeletal diseases.

R&D Systems offers an array of tools for the study of skeletal biology, including proteins, antibodies, and ELISAs, along with kits for cell selection and apoptosis. Visit www.RnDSystems.com/go/Bone



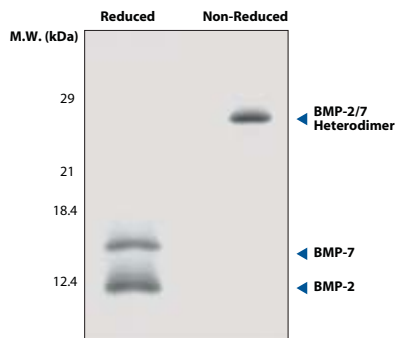
Aggrecan Expression in Human Cartilage. Aggrecan was detected in paraffin-embedded human cartilage tissue sections using anti-human aggrecan polyclonal antibody (Catalog # AF1220). Tissues were stained using R&D Systems anti-goat HRP-DAB Cell and Tissue Staining Kit (Catalog # CTS008; brown) and counterstained with hematoxylin (blue).



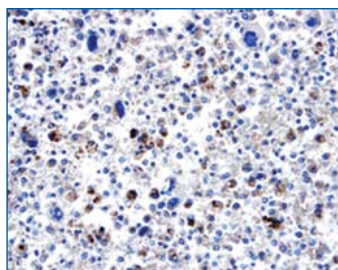
Alkaline Phosphatase Expression in Human Kidney. Alkaline phosphatase was detected in human kidney sections using anti-alkaline phosphatase monoclonal antibody (Catalog # MAB1448). Sections were stained using Rhodamine Red™-conjugated anti-mouse secondary antibody (red) and counterstained using FluoroNissl™ (green).



Bone Growth & Remodeling Products offered by R&D Systems				
Molecule	Antibodies	Proteins	ELISAs & Kits	
Activin A	H M R	H M R	H	✓
Activin RIA/ALK-2	H	H		
Activin RIB/ALK-4	H M	H M		
Activin RIIA, B	H	H		
Activin RIIB	H	H M		
Aggrecan	H	H		
Akt1	H M R	H	H M R	✓
ALK-1	H M	H M		✓
ALK-7	R	R		
Alkaline Phosphatase	H M R	H M		
Angiopoietin-1	H	H	H	✓
Annexin A2	H M R			✓
Annexin V	H	H		
AP-1/c-jun	H			
APC	H			
Apoptosis-related Products, see www.RnDSystems.com/go/Apoptosis for a complete listing				
Axin-1	H M R			
Bcl-2	H M	H	H	✓
β-Catenin	H M R X		H	
Biglycan	H	H		✓
BMP-2	H Z	H Z	H M R	
BMP-2/BMP-7 heterodimer		H		
BMP-3	H	H		
BMP-3b/GDF-10	H	H		
BMP-4	H Z	H Z	H	
BMP-5	H	H	H	
BMP-6	H	H	H	
BMP-7	H	H	H	
BMP-8	H	H		
BMP-9	H	H		
BMP-10	H	H		
BMP-15/GDF-9B	H			
BMPR-IA/ALK-3	H	H M		
BMPR-IB/ALK-6	H M	H M		



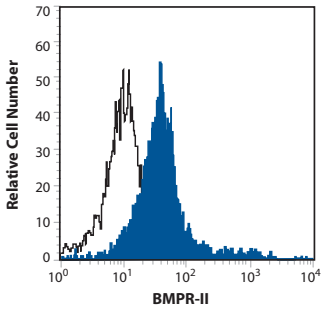
Recombinant BMP Heterodimer. R&D Systems recombinant human BMP-2/BMP-7 protein (Catalog # 3229-BM) is a refolded disulfide-linked heterodimer. Under reducing conditions the heterodimer separates into monomers as revealed by SDS-PAGE.



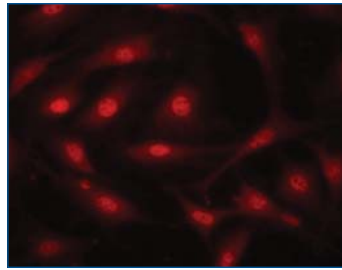
BMP-8 Expression in Human Osteosarcoma. BMP-8 was detected in paraffin-embedded human osteosarcoma tissue sections using anti-human BMP-8 polyclonal antibody (Catalog # AF1073). Tissues were stained using R&D Systems anti-goat HRP-DAB Cell and Tissue Staining Kit (Catalog # CTS008; brown) and counterstained with hematoxylin (blue).

Bone Growth & Remodeling Products offered by R&D Systems

Molecule	Antibodies	Proteins	ELISAs & Kits
BMPR-II	H	H	
BMP inhibitors, see the table on page 15			
cAMP	Ms		Ms
Cannabinoid R1	H		
CART	H		
N-Cadherin	H	H	
Cadherin-6	H	H	
Cadherin-11	H	H	
Calcineurin		H	
Calcitonin R		H	
Carbonic Anhydrase II	H	H	
Cathepsin 5	H	H	H
CBFA1/RUNX2	H		
CCL6/C10	M	M	
CCL8/MCP-2	H M	H	H
CCL12/MCP-5	M	M	M
CD44/OPN Receptor	H	H	
CNP	H		
Collagen I		R B	Ms

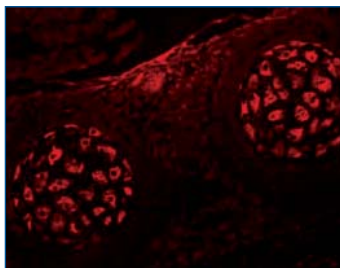


Detection of BMPR-II in MG-63 cells using Flow Cytometry. MG-63 osteosarcoma cells were stained with anti-human BMPR-II polyclonal antibody (Catalog # AF811, filled histogram) or goat IgG control (Catalog # AB108, open histogram) followed by APC-conjugated anti-goat secondary antibody (Catalog # F0108).

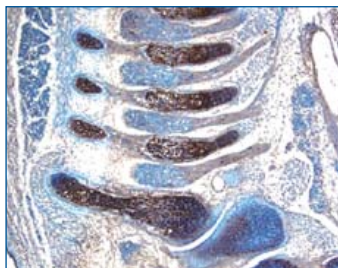


CBFA1/RUNX2 Expression in MC-3T3 cells. CBFA1/RUNX2 was detected in MC-3T3 pre-osteoblast cells using anti-human CBFA1/RUNX2 polyclonal antibody (Catalog # AF2006). Cells were stained using Rhodamine Red-conjugated anti-goat secondary antibody.

Bone Growth & Remodeling Products offered by R&D Systems			
Molecule	Antibodies	Proteins	ELISAs & Kits
Collagen II	M		
COMP/Thrombospondin-5	H	H	✓
Connexin 43	H M R Pr		
COX-1	H		
COX-2	H M		
CTGF/CCN2	H		✓
CXCL8/IL-8	H Ca F P	H P Ca F	H P Ca ✓
CXCL12/SDF-1	H M	H M F Pr	H M
CXCR4	H M F		✓
Decapentaplegic	D	D	
Decorin	H M	H M	H M
Dishevelled	H		
Dkk-1	H M	H M R	H M ✓
Dkk-2	M	M	
DMP-1	M	H	
DSPG3	H M		✓
EGF	H M R	H M R	H M ✓
EGFR	H M	H M	H ✓
Endoglin/CD105	H M	H M	H



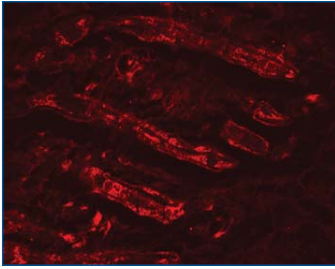
EphA4 Expression in Rat Cartilage. EphA4 was detected in a cross-section of rib cartilage primordia in E15 rat embryos using anti-mouse EphA4 polyclonal antibody (Catalog # AF641). Tissue was stained using Cy™3-conjugated anti-goat secondary antibody.



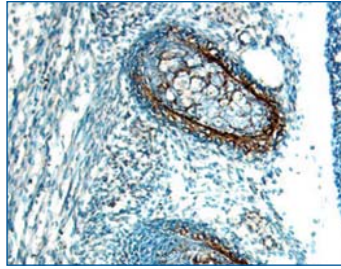
Galectin-3 Expression in Embryonic Mouse Ribs. Galectin-3 was detected in a cryostat tissue section of mouse embryonic (15 d.p.c.) ribs using anti-mouse Galectin-3 polyclonal antibody (Catalog # AF1197). Tissues were stained using the anti-goat HRP-DAB Cell and Tissue Staining Kit (Catalog # CTS008; brown) and counterstained with hematoxylin (blue).

Bone Growth & Remodeling Products offered by R&D Systems

Molecule	Antibodies	Proteins	ELISAs & Kits	
Endorepellin/Perlecan	H M			
Endothelin-1	H		H	
EphA4	M	M		✓
EphB4	H M	H M	H	✓
Ephrin-B1	M	M		✓
ERK	H M R	H	H M R	✓
E-Selectin	H M R	H M R	H M	✓
Estrogen R	H			✓
Exostosin-like (EXT)	H M			
Extracellular Matrix Components, see www.RnDSystems.com/go/ECM for a complete listing				
Fas Ligand	H M R	H M R	H M	
FGF acidic	H B	H B	H	✓
FGF basic	H B	H M R B	H	
FGF-7/KGF	H Ca	H Ca	H	
FGF-9	H	H	H	
FGF-23	H M	H		
FGF R1	H	H		
FGF R2	H M	H M	H	
FGF R3	H M	H M	H	



EphB1 Expression in Rat Cartilage. EphB1 was detected in cartilage primordium of phalangeal bones in rat embryos using anti-rat EphB1 polyclonal antibody (Catalog # AF542). Tissue was stained using Cy3-conjugated anti-goat secondary antibody.



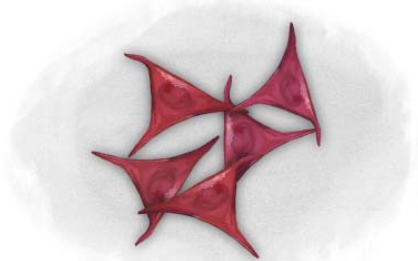
Gremlin Expression in Embryonic Mouse Ribs. Gremlin was detected in a cryostat cross-section of mouse embryonic (15 d.p.c.) ribs using anti-mouse Gremlin polyclonal antibody (Catalog # AF956). Tissues were stained using R&D Systems anti-goat HRP-DAB Cell and Tissue Staining Kit (Catalog # CTS008; brown) and counterstained with hematoxylin (blue). See *BMP Inhibitors table, page 15 for a product listing.*

Bone Growth & Remodeling Products offered by R&D Systems

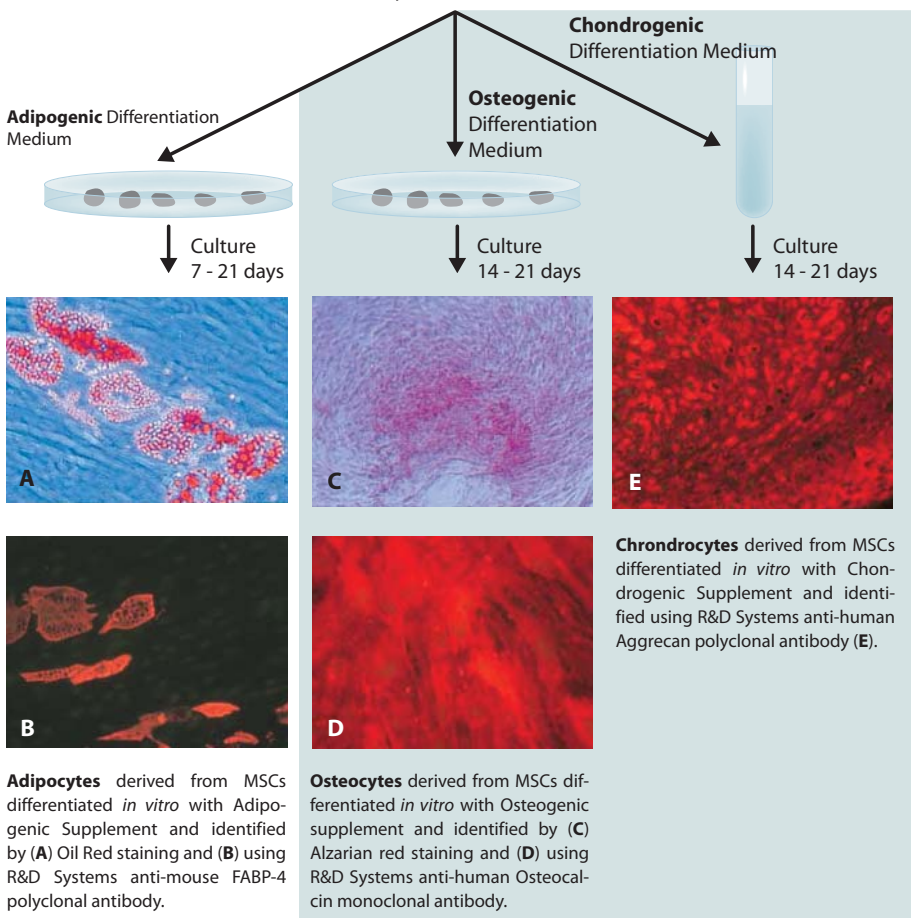
Molecule	Antibodies	Proteins	ELISAs & Kits
FGF R4	H M	H	
Fibronectin	H	H B	
Frizzled-1	H M	M	✓
Galectin-3	H M	H M	M ✓
G-CSF	H M	H M	H M
G-CSF R α	H	H	
GDF-5	M	M	✓
GDF-6		M	
GDF-7	M	M	
GDF-9	M		
GLI-1	H M		✓
Glypican-3	H	H	✓
GM-CSF	H M R Ca F P	H M R Ca F P	H M R F
GM-CSF R α	H		
gp130/OSM R	H M	H M	H
Growth Hormone	H R	H	H
Growth Hormone R	H M R	H M R	
GSK-3	H M R	H	H M R ✓
HIF-1 α	H M R		H M ✓



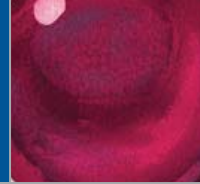
Human Mesenchymal Stem Cell Functional Identification Kit



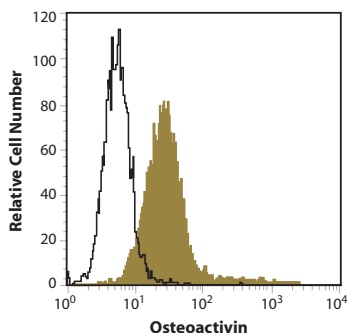
Mesenchymal Stem Cells (MSCs)



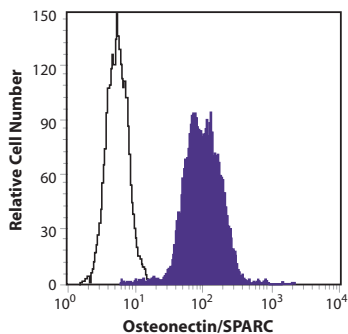
Supplements for the differentiation media as well as these antibodies are included in the kit (Catalog # SC006).



Bone Growth & Remodeling Products offered by R&D Systems			
Molecule	Antibodies	Proteins	ELISAs & Kits
Hyaluronan		Ms	Ms
IBSP/Sialoprotein II		H	
ICAM-1/CD54	H M R	H M R	H M R
IFN- α/β R1	H M	M	
IFN- α/β R2	H M	H	
IFN- β	H M R	H M R	H M
IFN- γ	H M R B Ca CRE F P Pr	H M R B Ca CRE F P Pr	H M R Ca CR F P Pr
IGF-I	H M	H M R	H M
IGF-II	H M	H M	M
IGF-I R	H	H	H
IGF-II R	H	H	
IGFBP-5	H M	H M	H M
I κ B- β	H R		
IL-1 α /IL-1F1	H M R CR P	H M R CR P	H M R
IL-1 β /IL-1F2	H M R Ca CRE F P	H M R Ca CRE F P Pr	H M R F P
IL-4	H M R B Ca CRE F P	H M R B Ca CRE F P Pr	H M R Ca CR F P
IL-6	H M R Ca CRE F P	H M R Ca CRE F P	H M R Ca F P
IL-11	H M	H M	H M
IL-17	H M	H M	H M
Indian Hedgehog	M	M	
Insulin	H M B		
Insulin R/CD220	H	H	
Integrin α 2	H M		
Integrin α V	H		
Integrin α V β 3	H		
Integrin β 2	H M		
Integrin β 3	H		
IRF2	H M		
Jagged	H R	R	
JAK1	H M R		
JNK1	H M R	M	H M R
Kremen	H M	H M	M
Leptin	H M	H M R	H M



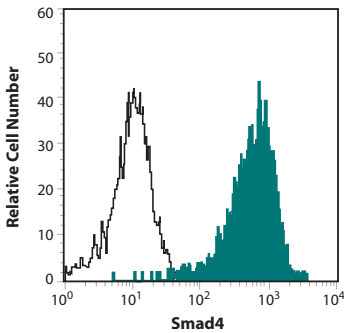
Detection of Osteoactivin in MG-63 cells using Flow Cytometry. MG-63 osteosarcoma cells were stained with anti-human Osteoactivin monoclonal antibody (Catalog # MAB25501, filled histogram) or mouse IgG_{2b} isotype control (Catalog # MAB0041, open histogram) followed by PE-conjugated anti-mouse secondary antibody (Catalog # F0102B).



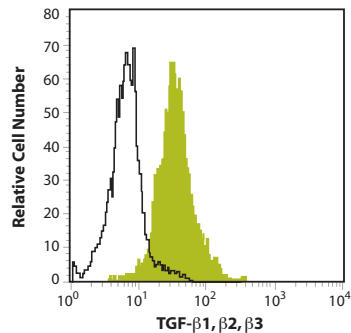
Detection of Osteonectin/SPARC in HT-1080 cells using Flow Cytometry. Intracellular staining of human HT-1080 fibrosarcoma cells with PE-conjugated anti-human Osteonectin/SPARC monoclonal antibody (Catalog # IC941P, filled histogram) or PE-conjugated mouse IgG, isotype control (Catalog # IC002P, open histogram).

Bone Growth & Remodeling Products offered by R&D Systems

Molecule	Antibodies	Proteins	ELISAs & Kits	
Leptin R	H M	H M	H M	
LIF	H M		H M	
LIF R	H	H		
LRP-6	H M	H M		✓
LTBP-1	H			✓
Matrilin-3	H M	H M		✓
Matrilin-4	H M	M		
M-CSF	H M	H M	H M	
M-CSF R	H M	H M	H	
MEK1	H M R			✓
MEPE	H	H		
Mimectan/Osteoglycin	H M	M		
MMP-1	H	H	H	✓
MMP-2	H M R	H M R	H M R	
MMP-8	H R	H M R	H	
MMP-9/NGAL	H M	H M	H M	
MMP-12	H M	H M	H	
MMP-13	H	H	H	
MMP-14	H	H		



Detection of Smad4 in HeLa cells using Flow Cytometry. Intracellular staining of HeLa cells with anti-human Smad4 monoclonal antibody (Catalog # MAB2097, filled histogram) or mouse IgG_{2b} isotype control (Catalog # MAB004, open histogram) followed by APC-conjugated anti-mouse secondary antibody (Catalog # F0101B).

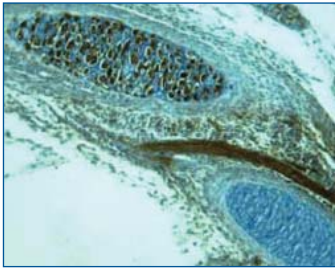


Detection of TGF- β in PC-3 cells using Flow Cytometry. Intracellular staining of human PC-3 prostate cancer cells with APC-conjugated anti-human TGF- β 1, - β 2, - β 3 monoclonal antibody (Catalog # IC1835A, filled histogram) or APC-conjugated mouse IgG₁ isotype control (Catalog # IC002A, open histogram).

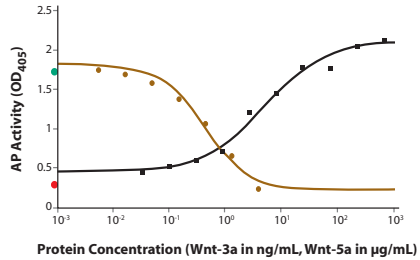
Bone Growth & Remodeling Products offered by R&D Systems

Molecule	Antibodies	Proteins	ELISAs & Kits	
NCAM-1	H	H	H	✓
NF κ B1	H M			✓
Notch-1	H R	H R		✓
NOV/CCN3	H M	H M		✓
OCIL/CLEC2d	H M			✓
Oncostatin M (OSM)	H M	H M	H	
OSM R β	M	M		
OSCAR	H			
OSF-2/Periostin	H	H	H	
Osteoactivin	H M	M		
Osteoadherin	H M	H M		
Osteocalcin	H			
Osteocrin	H M			
Osteonectin/SPARC	H M	M		
Osteopontin (OPN)	H M	H M B	H M	
Osteoprotegerin (OPG)	H M	H M	H M	
p38	H M R		H M	✓
p70 S6 kinase	H M R	H	H M R	✓
Patched	M			

Bone Growth & Remodeling Products offered by R&D Systems				
Molecule	Antibodies	Proteins	ELISAs & Kits	
PDGF-AA	H R Ms	H R	H M	✓
PDGF-AB	H Ms	H R	H M R	
PDGF-BB	H Ms	H R	H M R	
PDGF R α	H M	H M	H	✓
PDGF R β	H M	H M	H	
PGE2			Ms	✓
PKA C	H M R			
PKA R	H M R			
PI 3-Kinase p85 α	H M R			✓
PPAR γ /NR1C3	H			✓
Pref-1/DLK-1	H		H	
Prolactin	H M	H M	H M	
Prolactin R	H M R	H R	H	
PTEN	H M R	H	H M R	
RANK/TNFRSF11A	H M	H M	H	✓
RANK L/TRANCE	H M	H M	M	
RAR α /NR1B1	H			✓
RAR β /NR1B2	H			
Serpin F1	H M			✓
Smad1	H			
Smad2	H M			
Smad3	H M			
Smad4	H			
Smad5	H			
Smad7	H M R			
Smad8	H			
Sonic Hedgehog	H M	H M	M	✓
SOST/Sclerostin	H M	H M		
SOX9	H			✓
Src	H M R	V	H	
STAT1	H M		H M	✓
STAT3	H M		H M	
STRO-1	H			
Syndecan-1	H M			✓



Wnt-5a Expression in Embryonic Rat Rib. Wnt-5a was detected in a paraffin-embedded tissue section of rat embryo (15 d.p.c.) using anti-mouse Wnt-5a polyclonal antibody (Catalog # AF645). Tissues were stained using the anti-goat HRP-DAB Cell and Tissue Staining Kit (Catalog # CTS008; brown) and counterstained with hematoxylin (blue).



Effects of Wnt-3a and Wnt-5a on Differentiation of MC3T3-E1 Pre-osteoblasts. Recombinant mouse Wnt-3a (Catalog # 1324-WN) induces alkaline phosphatase (AP) production in a dose-dependent manner (black curve). The differentiation elicited by 20 ng/mL of Wnt-3a (green point) is suppressed by increasing concentrations of recombinant mouse (Catalog # 645-WN; brown curve) Wnt-5a. The baseline level of AP production in this cell line is denoted on the graph (red point).

Bone Growth & Remodeling Products offered by R&D Systems

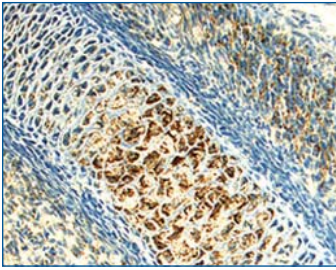
Molecule	Antibodies	Proteins	ELISAs & Kits
Syndecan-3	H M		
TBX3	H		
Tenascin-C	H M		✓
TGF- α	H	H	H
TGF- β 1	Ms	H P	H M R P Ca ✓
TGF- β 2	Ms	H P	H
TGF- β 3	Ms	H	H
TGF- β 1 (LAP)	H	H	
Latent TGF- β 1		H	H ✓
TGF- β RI/ALK-5	H M	M	
TGF- β RII	H M	H M	
TGF- β RIII/betaglycan	H	H	
TGF-β Superfamily products, please see www.RnDSystems.com/go/TGFbeta for a complete listing			
Thrombopoietin	H M	H M	H M
Thrombospondin-2	H	H	H ✓
TIMP-1	H M R	H M R	H M R ✓
TIMP-3	H	H	
TMEFF1/Tomoregulin-1	H M		✓
TNF- α	H M R B Ca C R E P Pr	H M R B Ca C R E F P Pr	H M R Ca E F P Pr ✓



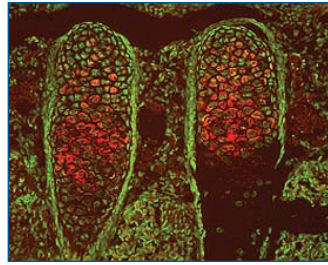
Bone Growth & Remodeling Products offered by R&D Systems				
Molecule	Antibodies	Proteins	ELISAs & Kits	
TNF-β	H M	H M	H	
TNF RI	H M	H M Ca	H M	✓
TNF RII	H M	H M	H M	✓
TOR	H M R		H	
Thyroid Receptor α	H			✓
TRACP/PAP/ACP5	H	H		
TRAF-6	H			✓
TRAIL	H M	H M	H	
TRAIL R1	H	H		✓
TSH β	R			
UPA/Urokinase	H			
URB	H	H		
VCAM-1	H M	H M	H M	✓
VDR/NR111	H			
VEGF	H M R Ca Z	H M R Ca Z	H M R Ca	✓
VEGF-B	H M	H M		
VEGF-C	H	H	H	
VEGF-D	H M	H M	H M	
VEGF R1/Flt-1	H M	H M	H M	
VEGF R2/KDR/Flk-1	H M	H M	H M	
VEGF R3/Flt-4	H M	H M	H M	
Vitamin D BP	H			
Vitronectin	H M	B H		✓
WIF	H M	H		
Wnt-3a	M	M		✓
Wnt-5a	M	M		
Wnt-7a	H	H		
Wnt-7b	H			



For further information on all R&D Systems Bone Growth & Remodeling products, please visit our website at www.RnDSystems.com/go/Bone



Chordin-like Expression 2 in Embryonic Mouse Cartilage. Detection of Chordin-like 2 in a cryostat section of mouse embryonic (15 d.p.c.) bone using anti-mouse Chordin-like 2 monoclonal antibody (Catalog # MAB2520). Tissues were stained using anti-rat HRP-DAB Cell and Tissue Staining Kit (Catalog # CTS017; brown) and counterstained with hematoxylin (blue).



Twisted Gastrulation (TSG) Expression in Embryonic Mouse Ribs. Detection of TSG in a cryostat tissue section of mouse embryonic (15 d.p.c.) rib cartilage primordium using anti-mouse TSG polyclonal antibody (Catalog # AF756). Tissues were stained using donkey anti-goat Rhodamine Red™ X-conjugated secondary antibody (red) and counterstained with FluoroNissl Green (green).

BMP Inhibitors

BMP Inhibitor Products offered by R&D Systems

Molecule	Antibodies	Proteins	ELISAs & Related Products
BAMBI/NMA	H M		
Caronte	Ch	Ch	
Cerberus	H M		
Chordin	M	M	M
Chordin-Like 1	H	H	
Chordin-Like 2	H M	M	
COCO	H M	H M	
Crossveinless-2	H M	H M	
DAN	H M	H M	H
FLRG	H M	H M	H
Follistatin	H	H M	H
Gremlin	M	M	
Noggin	M	H M	
PRDC	M	M	
SOST/Sclerostin	H M	H M	
TSG	M	M	M





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