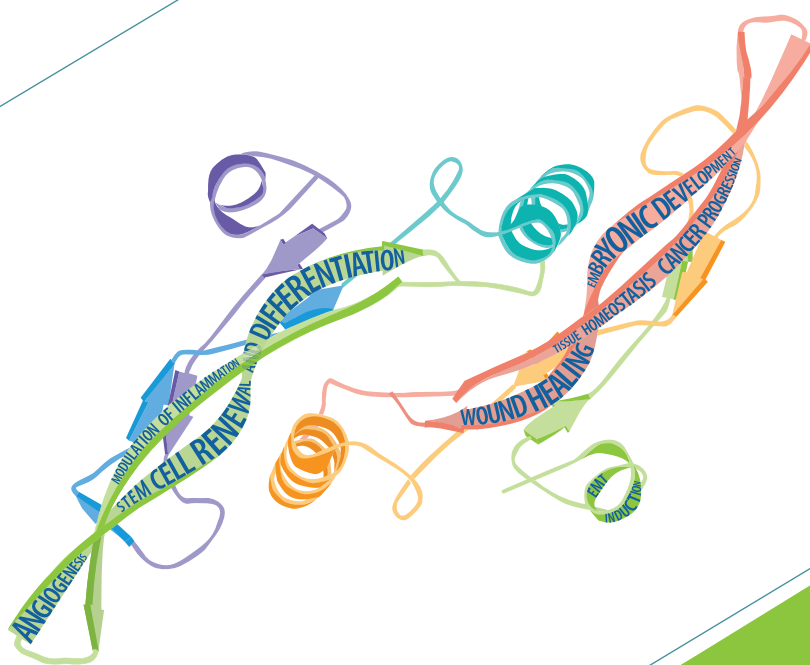


TGF- β Superfamily

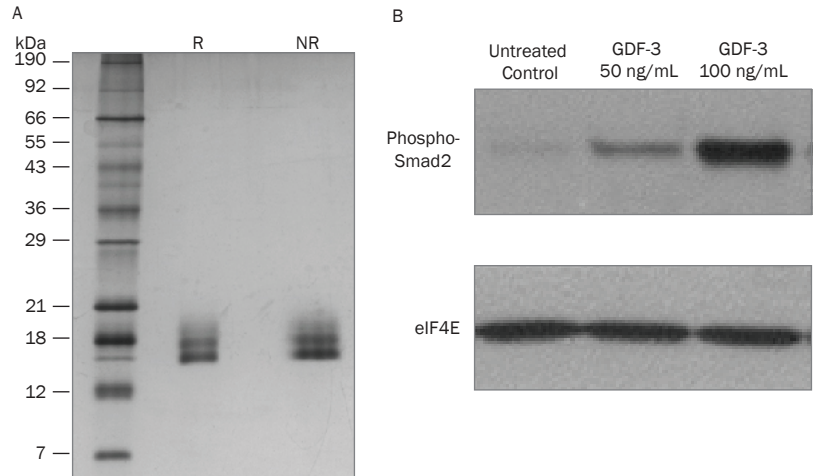


TGF- β Superfamily Proteins

R&D Systems continues to release new and exclusive bioactive TGF- β superfamily ligands and modulators, including new GDF family members, biotinylated BMP proteins, and GMP proteins suitable for cell therapy manufacturing.

New Products for TGF- β Superfamily Research

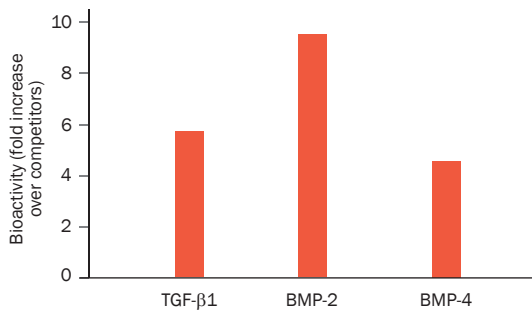
Product	Species	Source	Catalog #
Latent Activin A	Human	CHO	9129-LA
Biotinylated BMP-6 (bioactive)	Human	CHO	BT354
Biotinylated BMP-7 (bioactive)	Human	NSO	BT507
Chordin-like 2	Human	NSO	9127-CH
GDF-3	Mouse	CHO	9009-GD
GDF-11/BMP-11	Human/ Mouse/Rat	<i>E. coli</i>	1958-GMP
GDF-15	Mouse	<i>E. coli</i>	8944-GD
Inhibin A	Human	CHO	8506-AB
PRDC/GREM2	Human	<i>E. coli</i>	8436-PR
TGF- β 1	Equine	CHO	8617-B1
TGF- β 3 GMP/Animal Component-Free	Human	<i>Sf9</i>	243-GMP
USAG-1	Mouse	<i>E. coli</i>	9008-SD



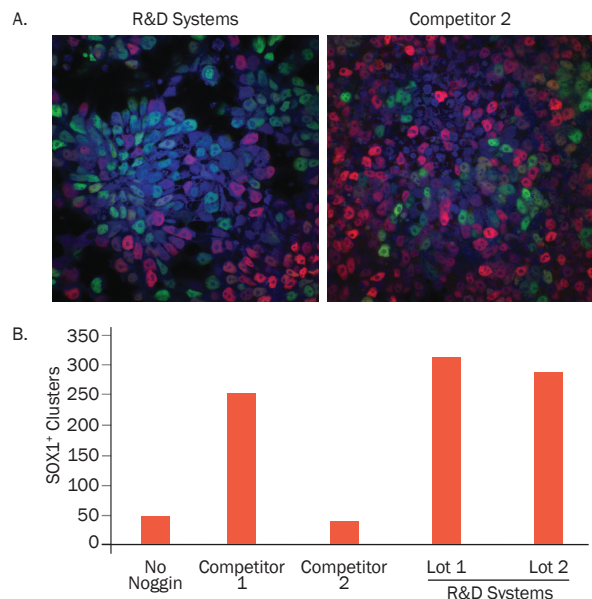
Recombinant Mouse GDF-3 Purity and Activity. **A.** To highlight purity, 1 μ g/lane of Recombinant Mouse GDF-3 (Catalog # 9009-GD) was resolved with SDS-PAGE under reducing (R) and non-reducing (NR) conditions and visualized by silver staining. **B.** Recombinant Mouse GDF-3 induces dose-dependent Smad2 phosphorylation in P19 mouse embryonic carcinoma cells. eIF4E was used as a loading control.

Superior Bioactivity and Reproducibility

R&D Systems is dedicated to producing proteins with industry-leading bioactivity and lot-to-lot consistency. We regularly bring in reagents from competitors for side-by-side testing to ensure that our proteins remain the best in class. In addition, each new lot must meet rigorously defined analytical specifications before reaching the market.



R&D Systems[®] Recombinant TGF- β 1, BMP-2, and BMP-4 Higher Bioactivity Compared to the Competitor. Side-by-side bioassays were performed using R&D Systems proteins and those from another manufacturer. The fold-difference in bioactivity (Competitor ED_{50} /R&D Systems ED_{50}) was determined and plotted.

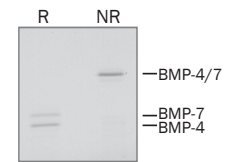


Superior and Consistent Pluripotent Stem Cell Differentiation with R&D Systems[®] Recombinant Human Noggin. BGO1V human embryonic stem cells were cultured in Mouse Embryonic Fibroblast Conditioned Media supplemented with FGF basic (5 ng/mL; Catalog # 233-FB). Stem cells were driven into early cells of the neuroectoderm using a 3 day incubation in recombinant human Noggin (25 μ g/mL) from either R&D Systems (Lot 1, Lot 2; Catalog # 6057-NG) or from two separate competitors (Competitor 1, Competitor 2). Control cells were not incubated in Noggin (No Noggin). The cells were stained for the early ectoderm marker, Otx2, and the neuroectoderm marker, SOX1. **A.** Representative images of SOX1 (green), Otx2 (red), and DAPI (blue) staining in embryonic stem cells differentiated with Noggin. **B.** SOX1⁺ clusters were quantified. Cells treated with R&D Systems[®] Noggin showed an increase in SOX1⁺ cells compared to both untreated and competitor-treated cells. R&D Systems[®] Noggin showed consistent differentiation across the lots tested.

Heterodimeric Proteins Exclusively from R&D Systems

Heterodimers of the TGF- β superfamily may exhibit different biological properties than their respective homodimeric forms. R&D Systems is the only source for these proteins.

Molecule	BMP-2/7	BMP-4/7	BMP-2/6	Activin AC
Species	Human	Human	Human	Human
ED ₅₀	10–40 ng/mL	15–75 ng/mL	4–20 ng/mL	0.8–4 nM
Catalog #	3229-BM	3727-BP	7145-BP	4879-AC

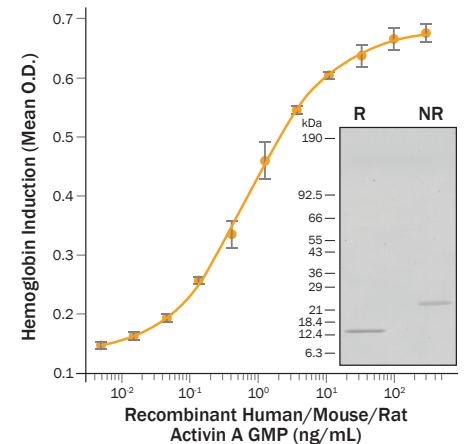


Heterodimer Visualized by SDS-PAGE. BMP-4/7 Heterodimer formation is confirmed with SDS-PAGE. Under reducing (R) conditions the heterodimers separate into monomers.

GMP and Animal-free Proteins for Cell Therapy and Regenerative Medicine

R&D Systems has the largest offering of GMP proteins for use in the manufacture of therapeutics. This includes many members of the TGF- β superfamily, most of which are exclusive to R&D Systems.

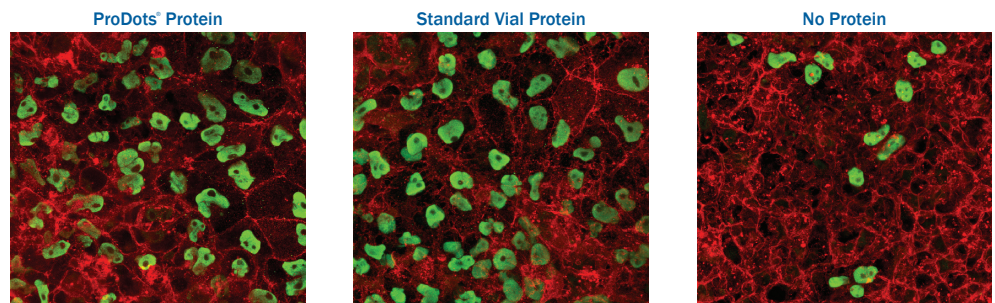
Protein	Species	Source	Grade	Catalog #
Activin A	Human/Mouse/Rat	CHO	GMP	338-GMP
BMP-2	Human	CHO	GMP	355-GMP
BMP-4	Human	NSO	GMP	314-GMP
BMP-7	Human	CHO	GMP	354-GMP
GDF-8/Myostatin	Human/Mouse/Rat	NSO	GMP	788-GMP
Noggin	Human	NSO	GMP	3344-GMP
GDF-11	Human/Mouse/Rat	<i>E. coli</i>	GMP/Animal-Free	1958-GMP
GDNF	Human	NSO	GMP	212-GMP
TGF- β 1	Human	CHO	GMP	240-GMP
TGF- β 3	Human	Sf9	GMP/Animal Component-Free	243-GMP
Activin A	Human/Mouse/Rat	Sf9	Animal Component-Free	ACFP338
TGF- β 1	Human	Sf9	Animal Component-Free	ACFP240
TGF- β 2	Human	Sf9	Animal Component-Free	ACFP302
TGF- β 3	Human	Sf9	Animal Component-Free	ACFP243



GMP Human Activin A Purity and Activity. Recombinant Human/Mouse/Rat Activin A (Catalog # 338-GMP) induces hemoglobin expression in K562 human chronic myelogenous leukemia cells in a dose-dependent manner. The ED₅₀ specification is 0.2–1.2 ng/ml. Purity is highlighted by silver-stained SDS-PAGE (inset).

ProDots® Proteins: No Aliquotting Necessary

ProDots® Proteins are highly bioactive proteins packaged into easy-to-use lyophilized “dots” that take the place of frozen aliquots. Lyophilized dots easily roll out of the vial into a cell culture media bottle and dissolve instantly.



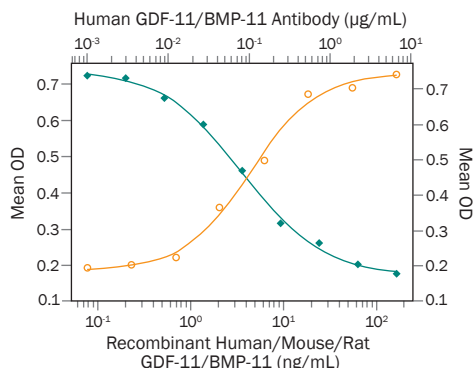
TGF- β Superfamily ProDots® Proteins

Molecule	Catalog #
TGF- β 1	PRD240
Activin A	PRD338
BMP-4	PRD314

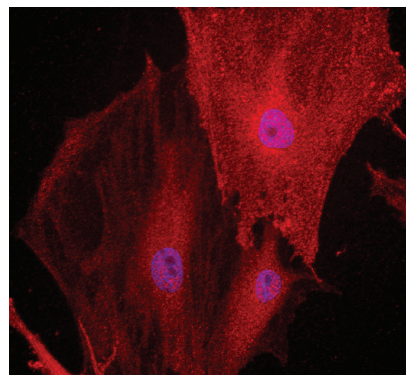
ProDots® Recombinant Human/Mouse/Rat Activin A Promotes the Differentiation of Pluripotent Stem Cells into Endoderm. BG01V human embryonic stem cells were differentiated into endoderm using media supplemented with ProDots® Recombinant Human/Mouse/Rat Activin A (Catalog # PRD338) or with R&D Systems standard retail Recombinant Human/Mouse/Rat Activin A (Catalog # 338-AC). Control cells were cultured in medium without recombinant Activin A. Differentiation into endoderm was confirmed by positive-staining for Claudin-6 (red) and Sox17 (green) using the Mouse Anti-Human Claudin-6 Monoclonal Antibody (Catalog # MAB3656) and the Goat Anti-Human Sox17 Polyclonal Antibody (Catalog # AF1924), respectively.

Antibodies Against TGF- β Superfamily Proteins

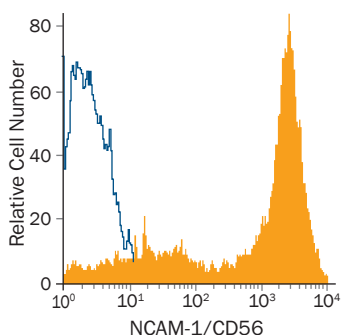
R&D Systems offers a wide selection of antibodies designed for a range of applications including Blocking/Neutralization, Flow Cytometry, ICC and IHC. R&D Systems[®] antibodies are developed, manufactured, and quality tested at our research facility.



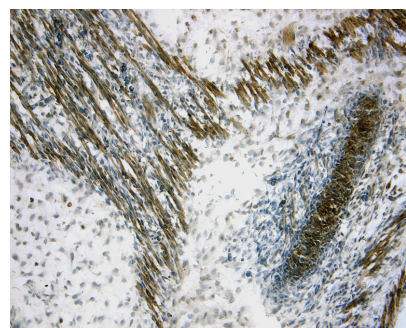
GDF-11/GDF-8 Neutralizing Antibody Blocks GDF-11 Induced Hemoglobin Expression. Recombinant Human/Mouse/Rat GDF-11/BMP-11 (Catalog # 1958-GD) induced hemoglobin expression in the K562 human chronic myelogenous leukemia cell line in a dose-dependent manner (orange line), as measured by the pseudoperoxidase assay. Induction of hemoglobin expression by GDF-11/BMP-11 (25 ng/mL) is neutralized (green line) by increasing concentrations of Mouse Anti-Human GDF-11/GDF-8 Monoclonal Antibody (Catalog # MAB19582). This antibody also neutralizes GDF-8 in a similar bioassay.



Endoglin/CD105 Localized to Plasma Membrane in Rat Mesenchymal Stem Cells. Endoglin/CD105 was detected in immersion fixed undifferentiated rat mesenchymal stem cells using Goat Anti-Rat Endoglin/CD105 Antigen Affinity-purified Polyclonal Antibody (Catalog # AF6440). Cells were stained using the NorthernLights[™] 557-conjugated Anti-Goat IgG Secondary Antibody (red; Catalog # NL001) and counterstained with DAPI (blue).



Detection of NCAM-1/CD56 by Flow Cytometry. The Neuro 2A mouse neuroblastoma cell line was stained for NCAM-1/CD56, a receptor for GDNF, with Rat Anti-Mouse NCAM-1/CD56 APC-conjugated Monoclonal Antibody (filled histogram, Catalog # FAB7820A) or isotype control antibody (open histogram, Catalog # IC006A).

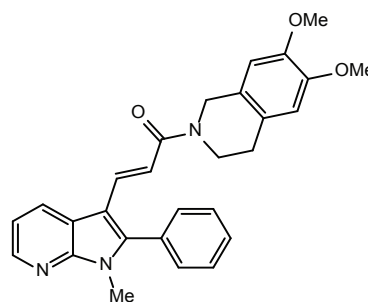


SOST/Sclerostin Expression in Mouse Embryo. SOST/Sclerostin was detected in immersion fixed frozen sections of mouse embryo (15 d.p.c.) using Goat Anti-Mouse SOST/Sclerostin Antigen Affinity-purified Polyclonal Antibody (Catalog # AF1589). Tissue was stained using the Anti-Goat HRP-DAB Cell and Tissue Staining Kit (brown; Catalog # CTS008) and counterstained with hematoxylin (blue). *Relevant citations for SOST/Sclerostin can be viewed on randsystems.com.

Tocris[®] TGF- β Superfamily-Related Small Molecules

Product Name	Catalog #	Product Description
A 83-01	2939	Selective inhibitor of TGF- β RI, ALK-4 and ALK-7
DMH-1	4126	Selective ALK-2 inhibitor
GW 788388	3264	Potent and selective inhibitor of TGF- β RI
ITD1	5068	Selective inhibitor of TGF- β signaling
K 02288	4986	Type 1 BMP receptor inhibitor
LY 364947	2718	Selective inhibitor of TGF- β RI
(5Z)-7-Oxozeaenol	3604	Potent and selective TAK1 MAPKKK inhibitor
N-Acetylpuromycin	5679	Downregulates SnoN and Ski protein expression; promotes TGF- β signaling
R 268712	5288	Potent and selective inhibitor of TGF- β RI
RepSox	3742	Potent and selective inhibitor of TGF- β RI
SB 431542	1614	Potent and selective inhibitor of TGF- β RI, ALK-4 and ALK-7
SB 525334	3211	Selective inhibitor of TGF- β RI
SB 505124	3263	Selective inhibitor of TGF- β RI, ALK-4 and ALK-7

Product Name	Catalog #	Product Description
SD 208	3269	Potent ATP-competitive TGF- β RI inhibitor
SIS3	5291	Selective Smad3 inhibitor; inhibits TGF- β RI signaling



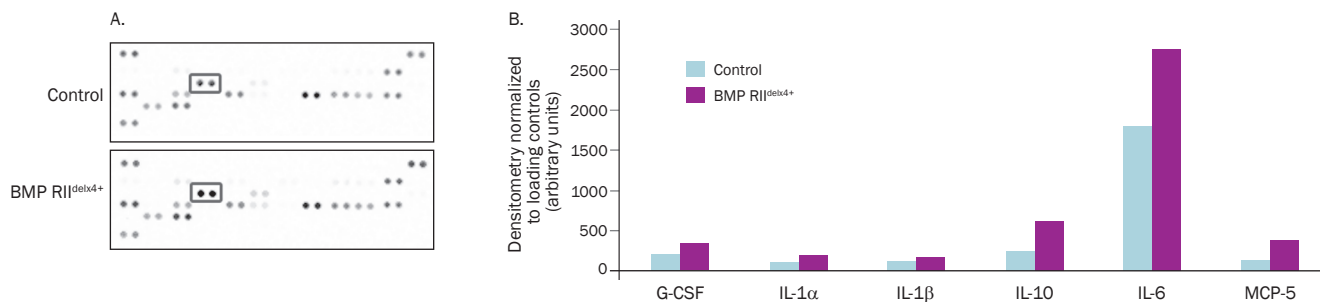
SIS3 (Catalog # 5291)
SIS3 is a selective Smad3 inhibitor, which attenuates TGF- β 1-dependent Smad3 phosphorylation and DNA binding. This compound has no effect on Smad2, p38 MAPK, ERK or PI 3-kinase signaling. SIS3 inhibits TGF- β 1-induced myofibroblast differentiation of dermal fibroblasts. It also inhibits TGF- β 2-induced endothelial cell differentiation in iPSCs.

Multiplex Assays for TGF- β Superfamily Signaling

Proteome Profiler™ Antibody Arrays

- Rapid**—analyze the expression level of dozens of proteins simultaneously
- Economical**—contains 4 membranes—each antibody is spotted in duplicate
- Versatile**—over 25 arrays for both intra- and extracellular factors

Proteome Profiler: Increase Your Potential for Discovery



Proteome Profiler Mouse Cytokine Array Detects Aberrant Cytokine Production in Macrophages from BMP RII^{delx4+} Transgenic Mice. Macrophages isolated from control and BMP RII^{delx4+} mice were activated in culture using lipopolysaccharide. Supernatants were collected after 24 h and assayed using the Proteome Profiler Mouse Cytokine Antibody Array (Catalog # ARY006). (A) Representative arrays of activated Control and BMP RII^{delx4+} macrophage supernatants. The set representing Interleukin (IL)-6 is boxed in gray. (B) Densitometry histograms of selected analytes from activated Control (blue) and BMP RII^{delx4+} (purple) macrophage supernatants. IL-1 α , IL-1 β , IL-6, IL-10, G-CSF, and MCP-5 are increased in BMP RII^{delx4+} mice compared to control. All changes are significant at $p < 0.01$ by ANOVA. Adapted from Talati M., et al. (2014) PLoS ONE 9: e94119.

Investigate the functional effects of TGF- β signaling pathways

Kit	Catalog #		
	Human	Mouse	Rat
Cytokine Array, Panel A	ARY005B	ARY006	ARY008
XL Cytokine Array	ARY022B	ARY028	-
Angiogenesis Array	ARY007	ARY015	-

Investigate non-canonical TGF- β signaling

Array	Catalog #
Human Phospho-Mitogen-activated Protein Kinase (MAPK) Antibody Array	ARY002B
Human Phospho-Kinase Array	ARY003B

Luminex® High Performance Assays

R&D Systems® Luminex® High Performance Assays are designed to maximize assay accuracy and precision while preserving the benefits of multiplexing. Choose analytes from established panels and select “premixed” or “end-user mixed” options.

TGF- β Superfamily-Related Luminex High Performance Assay Panels

	Polystyrene Beads (Catalog #)	Magnetic Beads (Catalog #)
Human High Sensitivity Cytokine Panel A	✓	✓
Human High Sensitivity Cytokine Panel B	-	✓
Human Angiogenesis Panel	✓	✓
Human TGF- β Panel	✓	✓

Products for TGF- β Superfamily Research

Molecules	Molecule	Antibodies	Proteins & Enzymes	ELISAs	Luminex Assays
Activin Family					
Ligands	Activin A	H M R	H M R	H M R	
	Latent Activin A		H		
	Activin AB		H		
	Activin AC Heterodimer		H		
	Activin B	H	H M		
	Activin C	H M	H M		
	Inhibin				H
	Inhibin α	H	H M		
Receptors	Activin RIA/ALK-2	H	H M		
	Activin RIB/ALK-4	H M	H M		
	Activin RIIA	H	H M		
	Activin RIIA/B	H			
Activin RII B	H	H M			
BMP Family					
Ligands	BMP-1/PCP	H H	H H		
	BMP-2	H Z	H M R Z	H M R	H
	BMP-2/BMP-4 Heterodimer	H Z			
	BMP-2/BMP-6 Heterodimer		H		
	BMP-2/BMP-7 Heterodimer	H	H		
	BMP-2a		Z		
	BMP-3	H	H		
	BMP-3b/GDF-10	H	H		
	BMP-4	H M Pr Z	H M Z	H	H
	BMP-4/BMP-7 Heterodimer		H		
	BMP-5	H M	H M	H	
	BMP-6	H M	H M	H	
	BMP-7	H M	H M	H	
	BMP-8	H			
	BMP-8a		H M		
	BMP-8b	H M			
	BMP-9	H M Pr	H M	H M	H
	BMP-10	H M	H M	H M	
	BMP-15/GDF-9B	H M R	H		
	Decapentaplegic/DPP	D	D		
Receptors	BMPR-IA/ALK-3	H	H M		
	BMPR-IB/ALK-6	H M	H M		
	BMPR-II	H	H M		

Molecules	Molecule	Antibodies	Proteins & Enzymes	ELISAs	Luminex Assays	
GDF Family						
Ligands	GDF-1	H M	H			
	GDF-3	H M	H M			
	GDF-5/BMP-14	M	H M	M		
	GDF-6/BMP-13	M	M			
	GDF-7/BMP-12	M	H M			
	GDF-8/Myostatin	H M R	H M R	H Ms		
	GDF-9	H M Ha	H M			
	GDF-11/BMP-11	H M R	H M R	H		
	GDF-11/GDF-8	H M R				
	GDF-15	H M Pr	H M	H M R	H M	
GDNF Family						
Ligands	Artemin	H M	H M	H M		
	GDNF	H R	H R	H	H	
	Neurturin	H M	H M			
	Persephin	H M	H M	H		
Receptors	Gas1	H M	H M	H M		
	GFR α -1/GDNF R α -1	H R	H R			
	GFR α -2/GDNF R α -2	H M	H M			
	GFR α -3/GDNF R α -3	H M	H M			
	GFR α -4/GDNF R α -4	H M				
	GFR α -like	M				
	NCAM-1/CD56	H M R Pr	H M	H	H	
	Ret	H M	H M	H		
Syndecan-3	H M	H M	H			
RGM Family						
Ligands	RGM-A	H M Ch	H M	H M R		
	RGM-B	H M	H M	H		
	RGM-C/Hemojuvelin	H M	H M	H M R		
TGF-β Family						
Ligands	LAP (TGF- β 1)	H M	H	H		
	TGF- β	Ms				
	TGF- β 1	H M Ms	H M P E	H M R P Ca	Ms	
	TGF- β 1, 2, 3	Ms			Ms	
	TGF- β 1.2	Ms	H			
	TGF- β 1/1.2	Ms				
	TGF- β 2	M Ms	H M P	H M R P Ca	Ms	
	TGF- β 2/1.2	Ms				
	TGF- β 3	Ms	H	H	Ms	
	TGF- β 5	Ms	A			
	Receptors	ALK-1	H M	H M	H M	
		ALK-7	H R	R		
		CD109	H M	H		
Cripto		H M Pr	H M	H	H	
Endoglin/CD105		H M R	H M R P	H M	H	
MIS RII		H R	H R	H		
TGF- β RI/ALK-5		H M	H M			
TGF- β RII		H M	H M	H		
TGF- β RIII	H M	H M	H			

Molecules	Molecule	Antibodies	Proteins & Enzymes	ELISAs	Luminex Assays
TGF-β Superfamily					
Modulators	Amnionless	H M	H		
	BAMBI/NMA	H M	H M		
	Caronte	Ch	Ch		
	Cerberus 1	H M	M		
	Chordin	M	M	M	
	Chordin-like 1/ CHRDL1	H	H		
	Chordin-like 2/ CHRDL2	H M	H M		
	COCO	H M	H M	H	
	CRIM1	H	H M		
	Cripto	H M Pr	H M	H	H
	Crossveinless-2/ CV-2	H M	H M		
	Cryptic	H M	H		
	DAN	H M	H M	H M	
	TGF-β Superfamily				
Modulators	Decorin	H M	H M	H M	
	Dermatopontin	H	H M		
	FBXW7/Cdc4	H			
	Follistatin	H M	H M	H	H
	Follistatin-like 4/ FSTL4	H M R	H		
	Follistatin-like 5/ FSTL5		H M		
	Follistatin-related Gene Protein/FLRG	H M	H M	H	H
	GASP-1/WFIKKNRP	H	H	H	
	GASP-2/WFIKKN	H	H	H	
	GFR α -like	M			
	Gremlin	M	H M	M	
	IGSF1				
	Nicalin	H M R			
	Noggin	M	H M		
	NOMO	H			
	PRDC/GREM2	M	H M	M	
	SCUBE3		H		
	SOST/Sclerostin	H M	H M	H M R	H
	TAZ/WWTR1	H			
	Latent TGF- β bp1	H			
	Latent TGF- β bp2/ LTBP-2	H			
	Latent TGF- β bp4	M	H		
	TGIF1	H			
	TMEFF1/Tomoregulin-1	H M			
	TSG	M	H M		
	Tsukushi/TSK	H M	H		
	USAG1	H	H M		
	USP9x		H		

Molecules	Molecule	Antibodies	Proteins & Enzymes	ELISAs	Luminex Assays
Smad Family					
Intracellular Signaling	HIC5/TGFB111	H			
	MAGI2	H M			
	Smad1	H			
	Smad2	H M D			
	Smad2/3	H M			
	Smad3	H M			
	Smad4	H			
	Smad5	H			
	Smad7	H M R			
	Smad8	H			
Smad9	H M				
TGIF1	H				
Others					
Ligands	Vasorin/SLIT-like 2	H	M		
	Lefty	H M			
	Lefty-1	M	M		
	Lefty-2	M			
	Lefty-A	H	H		
	MIS/AMH	H M R	H	H	
Nodal	H M	H M			

R&D SYSTEMS

 **NOVUS**
BIOLOGICALS

TOCRIS

protein  simple

biotechne[®]

Global info@bio-techne.com bio-techne.com/find-us/distributors TEL +1 612 379 2956
North America TEL 800 343 7475 Europe | Middle East | Africa TEL +44 (0)1235 529449
China info.cn@bio-techne.com TEL +86 (21) 52380373

bio-techne.com



BR_TGF beta_10606