

TGF-β Family

Name	Synonyms	Main Function	Natural Antagonists / Binding Proteins
TGF-β ₁	Differentiation inhibiting factor, cartilage-inducing factor	Regulates cell proliferation, growth, differentiation and motility. Involved in adipogenesis, chondrogenesis, embryogenesis, tissue remodeling, wound healing and tumour formation.	Follistatin, Follistatin-like related gene (FLRG), Decorin, alpha-2 macroglobulin
TGF-β ₂	Glioblastoma-derived T-cell suppressor factor, BSC-1, Cetermin, Polyergin	Regulates cell proliferation, growth, differentiation and motility. Involved in adipogenesis, chondrogenesis, embryogenesis, tissue remodeling, wound healing and tumour formation.	Decorin, alpha-2 macroglobulin
TGF-β ₃	None	Regulates cell proliferation, growth, differentiation and motility. Involved in adipogenesis, chondrogenesis, embryogenesis, tissue remodeling, wound healing and tumour formation.	
TGF-β ₄	Endometrial bleeding associated factor beta-4 (EBAF), Lefty preproprotein, LEFTA	Essential for left-right (L-R) asymmetry determination of organ systems. Possible role in endometrial bleeding.	
Inhibin A	Inhibin alpha & beta A	Inhibits secretion of follitropin by the pituitary gland, regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	
Inhibin B	Inhibin alpha & beta B	Inhibits secretion of follitropin by the pituitary gland, regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	
Activin A	Activin beta-A, Inhibin beta-1, FRP, (Follicle-stimulating hormone-releasing protein), FSH-releasing protein, FSH-releasing factor, EDF (Erythroid differentiation factor)	Regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	Follistatin, Follistatin-like related gene (FLRG), GASP-1, Cerberus, alpha2 macroglobulin, DAN
Activin AB	Activin beta A & beta B	Regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	
Activin B	Activin beta-B, Inhibin beta-2	Regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	
Activin C	Activin beta-C, Inhibin beta-C, blastocyst B1	Regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	
Activin E	Activin beta-E, Inhibin beta-E	Regulates embryogenesis, osteogenesis, hematopoiesis, reproductive physiology and hormone secretion from the hypothalamic, pituitary and gonadal glands.	
BMP-2	BMP-2A	Induces cartilage and bone formation, plays a role in cardiac morphogenesis.	Noggin, Chordin, Follistatin, Follistatin-like related gene (FLRG), GASPH, DAN, Cerberus, Gremlin
BMP-3	Osteogenin, BMP-3A	Induces cartilage and bone formation.	
BMP-3B	GDF-10	Biological function unknown, but may play a role in differentiation of osteoblasts, augmenting BMP-2 activity.	
BMP-4	BMP2B (BMP2B1, BMP2B2, Bmp2-rs1), DVR4	Induces cartilage and bone formation, involved in mesoderm induction, tooth development, limb formation and fracture repair.	Noggin, Chordin, Chordin-like/ Neuralin/Ventroptin, Follistatin, DAN, Cerberus, Gremlin
BMP-5	None	Induces cartilage and bone formation.	Noggin, Chordin-like/Neuralin/Ventroptin, Sclerostin/SOST
BMP-6	VGR, Vg-1-related protein	Induces cartilage and bone formation.	Noggin, Chordin-like/Neuralin/Ventroptin, Follistatin, Follistatin-like related gene, Sclerostin/SOST
BMP-7	OP-1 (Osteogenic Protein-1)	Induces cartilage and bone formation, involved in calcium regulation and bone homeostasis. May act as an osteoinductive factor responsible for epithelial osteogenesis.	Noggin, Chordin, Follistatin-like related gene (FLRG), DAN, Cerberus, Sclerostin/SOST
BMP-8	BMP-8a, OP-2 (Osteogenic Protein-2)	Induces cartilage and bone formation, involved in calcium regulation and bone homeostasis. May act as an osteoinductive factor responsible for epithelial osteogenesis.	
BMP-8b	OP-2 (Osteogenic Protein-2)	Stimulates cartilage and bone formation, implicated in calcium regulation and bone homeostasis.	
BMP-9	GDF-2	May be involved in bone formation, regulates blood glucose homeostasis, potential autocrine/paracrine mediator in the hepatic reticuloendothelial system, involved in chondrogenesis.	
BMP-10	None	Plays a crucial role in trabeculation of the embryonic heart.	
BMP-11	GDF-11	Involved in the patterning of both mesodermal and neural tissues and in establishing the skeletal muscle. Acts globally to specific positional identity along the anterior/posterior axis.	Follistatin, Follistatin-like related gene (FLRG), GASP-1
BMP-12	GDF-7, CDMP-3	Induces the formation of tendon and ligament tissues.	
BMP-13	GDF-6, CDMP-2	Plays a role in cartilage homeostasis, involved in embryonic skeletal development, and formation of tendon-like tissue.	Noggin
BMP-14	GDF-5, CDMP-1	Essential for limb cartilage and limb-joint formation in developing mice. Involved in embryonic skeletal development.	Noggin, DAN
BMP-15	GDF-9B	An oocyte-specific factor that regulates granulosa cell proliferation and differentiation, and is essential for normal follicular growth.	
GDF-1	Embryonic growth/differentiation factor	May be involved in mediating cell differentiation events during embryonic development.	
GDF-2	BMP-9	Implicated in bone formation.	
GDF-3	Vgr-2, UNQ2222/PRO248	Embryonal carcinoma stem cell-associated marker <i>in vitro</i> and <i>in vivo</i> .	
GDF-5	CDMP-1, BMP-14	Essential for limb cartilage and limb-joint formation in developing mice. Involved in embryonic skeletal development.	Noggin, DAN
GDF-6	BMP-13, CDMP-2	Plays a role in cartilage homeostasis, involved in embryonic skeletal development, and formation of tendon-like tissue.	Noggin
GDF-7	BMP-12, CDMP-3	Induces the formation of tendon and ligament tissues.	
GDF-8	Myostatin	Regulates skeletal muscle mass.	Follistatin, Follistatin-like related gene (FLRG), GASP-1
GDF-9	None	Essential for normal follicular growth.	
GDF-10	BMP-3B, BIP (Bone Inducing Protein)	Biological function unknown, but may play a role in differentiation of osteoblasts, augmenting BMP-2 activity.	
GDF-11	BMP-11	Involved in the patterning of both mesodermal and neural tissues and in establishing the skeletal muscle. Acts globally to specific positional identity along the anterior/posterior axis.	Follistatin, Follistatin-like related gene (FLRG), GASP-1
GDF-15	PLAB, Placental TGFβ, Prostate Differentiation Factor (PDF), NRG-1, MIC-1 (Macrophage Inhibitory Cytokine 1)	Possible mediator of placental control of embryonic development, may act as an autocrine regulatory molecule.	
GDNF	ATF (Astrocyte-Derived Trophic Factor)	Promotes dopamine uptake and survival and morphological differentiation of midbrain neurons.	
Artemin	ART, ARTN, Enovin, Neublastin	Supports the survival of all peripheral ganglia such as sympathetic, neural crest and placodally-derived sensory neurons, and dopaminergic midbrain neurons.	
Neurturin	NTN, NRTN	Promotes the development and survival of sympathetic and sensory neurons.	
Persephin	PSP, PSPN	Promotes the survival of ventral midbrain dopaminergic neurons and motor neurons, and promotes ureteric bud branching.	
LEFTY-1	LEFTYB, Protein Lefty B	Essential for left-right (L-R) asymmetry of organ systems.	
LEFTY-2	LEFTYA, TGF-β4, Protein Lefty A	Essential for left-right (L-R) asymmetry of organ systems.	
AMH (<i>anti-Muellerian hormone</i>)	MIS, Muellerian inhibiting substance	Causes regression of the Muellerian duct, inhibits the growth of tumours derived from tissues of Muellerian duct origin.	
Dorsalin (<i>chick</i>)	Dorsalin-1, DSL-1	Regulates cell differentiation within neural tube.	
NODAL	None	Essential for mesoderm formation and subsequent organization of axial structures.	Cerberus