

Supporting Information

Lanthanum Breaks the Balance between Osteogenesis and Adipogenesis of Mesenchymal Stem Cells through Phosphorylation of Smad1/5/8

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Table S1. The positions of 84 genes in supper array.

Gene	1	2	3	4	5	6	7	8	9	10	11	12
A	Abcb1a	Alcam	Anpep	Anxa5	Bdnf	Bglap1	Bmp2	Bmp4	Bmp6	Bmp7	Casp3	Cd44
B	Col1a1	Csf2	Csf3	Ctnnb1	Egf	Eng	Erb2	Fgf10	Fgf2	Fut1	Fut4	Fzd9
C	Gdf15	Gdf5	Gdf6	Gdf7	Gtf3a	Hat1	Hdac1	Hgf	Hnf1a	Icam1	Ifng	Igf1
D	Il10	Il1b	Il6	Ins2	Itga6	Itgav	Itgax	Itgb1	Jag1	Kdr	Kitl	Lif
E	Mcam	Mitf	Mmp2	Nes	Ngfr	Notch1	Nt5e	Nudt6	Kat2b	Pdgfrb	Pigs	Pou5f1
F	Pparg	Prom1	Ptk2	Ptprc	Rhoa	Runx2	Slc17a5	Smad4	Smurf1	Smurf2	Sox2	Sox9
G	Tbx5	Tert	Tgfb1	Tgfb3	Thy1	Tnf	Vcam1	Vegfa	Vim	Vwf	Wnt3a	Zfp42
H	Gusb	Hprt1	Hsp90ab1	Gapdh	Actb	MGDC	RTC	RTC	RTC	PPC	PPC	PPC

Table S2. Genes involved in TGF β /BMP signaling pathway are up-regulated in osteogenic differentiation of MSCs upon their interactions with 0.0001 μ M La.

Functional	GeneBank	Gene Symbol	Description	Fold Change
Osteogenesis Markers	NM_007553	Bmp2	Bone morphogenetic protein 2	10.4
	NM_007556	Bmp6	Bone morphogenetic protein 6	13.0
	NM_008002	Fgf10	Fibroblast growth factor 10	1.4
	NM_008228	Hdac1	Histone deacetylase 1	25.3
	NM_009327	Hnf1a	HNF1 homeobox A	0.2
	NP_002244	Kdr	Kinase insert domain receptor	0.6
	NM_007982	Ptk2	PTK2 protein tyrosine kinase 2	1.8
	NM_009820	Runx2	Runt related transcription factor 2	3.3
	NM_029438	Smurf1	SMAD specific E3 ubiquitin protein ligase 1	0.6
	NM_025481	Smurf2	SMAD specific E3 ubiquitin protein ligase 2	0.4
NM_011537	Tbx5	T-box 5	2.1	
Adipogenesis Markers	NM_011146	Pparg	Peroxisome proliferator activated receptor gamma	0.1
	NM_016802	Rhoa	Ras homolog gene family, member A	0.1
Chondrogenesis Markers	NM_011076	Abcb1a	ATP-binding cassette, sub-family B (MDR/TAP), member 1A	0.5
	NM_007553	Bmp2	Bone morphogenetic protein 2	10.4
	NM_007554	Bmp4	Bone morphogenetic protein 4	8.1
	NM_007556	Bmp6	Bone morphogenetic protein 6	13.0
	NM_008109	Gdf5	Growth differentiation factor 5	0.2
	NM_013526	Gdf6	Growth differentiation factor 6	0.3
	NM_013527	Gdf7	Growth differentiation factor 7	0.0
	NM_026115	Hat1	Histone aminotransferase 1	0.1
	NM_021334	Itgax	Integrin alpha X	0.1
	NM_011448	Sox9	SRY-box containing gene 9	6.4
NM_011577	Tgfb1	Transforming growth factor, beta 1	0.8	
Myogenesis Markers	NM_013822	Jag1	Jagged 1	0.1
	NM_008714	Notch1	Notch gene homolog 1 (Drosophila)	0.5

Tenogenesis Markers	NM_007553	Bmp2	Bone morphogenetic protein 2	10.4
	NM_011819	Gdf15	Growth differentiation factor 15	0.9
	NM_008540	Smad4	MAD homolog 4 (Drosophila)	13.1
	NM_011577	Tgfb1	Transforming growth factor, beta 1	0.8
Stemness Markers	NM_008006	Fgf2	Fibroblast growth factor 2	1.3
	NM_008387	Ins2	Insulin II	0.1
	NM_008501	Lif	Leukemia inhibitory factor	0.2
	NM_013633	Pou5f1	POU domain, class 5, transcription factor 1	0.4
	NM_011443	Sox2	SRY-box containing gene 2	0.0
	NM_009354	Tert	Telomerase reverse transcriptase	3.8
	NM_009522	Wnt3a	Wingless-related MMTV integration site 3A	0.0
	NM_009556	Zfp42	Zinc finger protein 42	3.8
MSC-Specific Markers	NM_009655	Alcam	Activated leukocyte cell adhesion molecule	0.4
	NM_008486	Anpep	Alanyl (membrane) aminopeptidase	0.8
	NM_009810	Casp3	Caspase 3	6.2
	NM_009851	Cd44	CD44 antigen	0.8
	NM_007932	Eng	Endoglin	1.6
	NM_0010038 17	ErbB2	V-erb-b2 erythroblastic leukemia viral oncogene homolog 2, neuro/glioblastoma derived oncogene homolog (avian)	0.9
	NM_010242	Fut4	Fucosyltransferase 4	0.0
	XM_284144	Fzd9	Frizzled homolog 9 (Drosophila)	3.1
	NM_008397	Itga6	Integrin alpha 6	0.6
	NM_008402	Itgav	Integrin alpha V	0.7
	NM_023061	Mcam	Melanoma cell adhesion molecule	34.4
	NM_033217	Ngfr	Nerve growth factor receptor (TNFR superfamily, member 16)	0.3
	NM_011851	Nt5e	5' nucleotidase, ecto	0.5
	NM_008809	Pdgfrb	Platelet derived growth factor receptor, beta polypeptide	0.9
	NM_008935	Prom1	Prominin 1	3.9
	NM_009382	Thy1	Thymus cell antigen 1, theta	1.7
	NM_011693	Vcam1	Vascular cell adhesion molecule 1	0.2
	NM_009673	Anxa5	Annexin A5	0.4
	NM_007540	Bdnf	Brain derived neurotrophic factor	7.8
	NM_007541	Bglap1	Bone gamma carboxyglutamate protein 1	0.7
	NM_007557	Bmp7	Bone morphogenetic protein 7	3.8
	NM_007742	Col1a1	Collagen, type I, alpha 1	2.3
	NM_009969	Csf2	Colony stimulating factor 2 (granulocyte-macrophage)	0.0
	NM_009971	Csf3	Colony stimulating factor 3 (granulocyte)	0.0
	NM_007614	Ctnnb1	Catenin (cadherin associated protein), beta 1	0.8
	NM_010113	Egf	Epidermal growth factor	0.6
	NM_008051	Fut1	Fucosyltransferase 1	0.1
	NM_025652	Gtf3a	General transcription factor III A	1.5
	NM_010427	Hgf	Hepatocyte growth factor	5.2
	NM_010493	Icam1	Intercellular adhesion molecule 1	4.9

MSCAssociated Genes	NM_008337	lfng	Interferon gamma	3.8
	NM_010512	Igf1	Insulin-like growth factor 1	1.2
	NM_010548	IL10	Interleukin 10	0.1
	NM_008361	IL1b	Interleukin 1 beta	9.6
	NM_031168	IL6	Interleukin 6	0.8
	NM_010578	Itgb1	Integrin beta 1 (fibronectin receptor beta)	0.1
	NM_008601	Mitf	Microphthalmia-associated transcription factor	0.2
	Mmp2	Mmp2	Matrix metalloproteinase 2	0.1
	NM_016701	Nes	Nestin	0.3
	NM_153561	Nudt6	Nudix (nucleoside diphosphate linked moiety X)-type motif 6	0.4
	NM_201406	Pigs	Phosphatidylinositol glycan anchor biosynthesis, class S	4.6
	NM_011210	Ptprc	Protein tyrosine phosphatase, receptor type, C	7.5
	NM_172773	Slc7a5	Solute carrier family 7 (anion/sugar transporter), member 5	0.8
	NM_009368	Tgfb3	Transforming growth factor, beta 3	2.0
	NM_013693	Tnf	Tumor necrosis factor	1.7
	NM_009505	Vegfa	Vascular endothelial growth factor A	0.2
	NM_011701	Vim	Vimentin	1.2
	NM_011708	Vwf	Von Willebrand factor homolog	0.2

Table S3. Genes involved in TGF β /BMP signaling pathway are down-regulated in adipogenic differentiation of MSCs upon their interactions with 0.0001 μ M La.

Functional	GeneBank	Gene Symbol	Description	Fold Change
Osteogenesis Markers	NM_007553	Bmp2	Bone morphogenetic protein 2	1.4
	NM_007556	Bmp6	Bone morphogenetic protein 6	0.4
	NM_008002	Fgf10	Fibroblast growth factor 10	3.0
	NM_008228	Hadc1	Histone deacetylase 1	0.1
	NM_009327	Hnf1a	HNF1 homeobox A	0.7
	NP_002244	Kdr	Kinase insert domain receptor	1.4
	NM_007982	Ptk2	PTK2 protein tyrosine kinase 2	0.6
	NM_009820	Runx2	Runt related transcription factor 2	0.3
	NM_029438	Smurf1	SMAD specific E3 ubiquitin protein ligase 1	1.7
	NM_025481	Smurf2	SMAD specific E3 ubiquitin protein ligase 2	0.4
	NM_011537	Tbx5	T-box 5	2.3
Adipogenesis Markers	NM_011146	Pparg	Peroxisome proliferator activated receptor gamma	1.8
	NM_016802	Rhoa	Ras homolog gene family, member A	0.9
Chondrogenesi	NM_011076	Abcb1a	ATP-binding cassette, sub-family B (MDR/TAP), member 1A	1.6
	NM_007553	Bmp2	Bone morphogenetic protein 2	1.4
	NM_007554	Bmp4	Bone morphogenetic protein 4	0.1
	NM_007556	Bmp6	Bone morphogenetic protein 6	0.4
	NM_008109	Gdf5	Growth differentiation factor 5	3.4
	NM_013526	Gdf6	Growth differentiation factor 6	0.6

s Markers	NM_013527	Gdf7	Growth differentiation factor 7	0.7
	NM_026115	Hat1	Histone aminotransferase 1	1.0
	NM_021334	Itgax	Integrin alpha X	1.4
	NM_011448	Sox9	SRY-box containing gene 9	1.8
	NM_011577	Tgfb1	Transforming growth factor, beta 1	0.7
Myogenesis Markers	NM_013822	Jag1	Jagged 1	0.8
	NM_008714	Notch1	Notch gene homolog 1 (Drosophila)	0.6
Tenogenesis Markers	NM_007553	Bmp2	Bone morphogenetic protein 2	1.4
	NM_011819	Gdf15	Growth differentiation factor 15	1.8
	NM_008540	Smad4	MAD homolog 4 (Drosophila)	0.7
	NM_011577	Tgfb1	Transforming growth factor, beta 1	0.5
Stemness Markers	NM_008006	Fgf2	Fibroblast growth factor 2	0.4
	NM_008387	Ins2	Insulin II	0.9
	NM_008501	Lif	Leukemia inhibitory factor	1.5
	NM_013633	Pou5f1	POU domain, class 5, transcription factor 1	4.0
	NM_011443	Sox2	SRY-box containing gene 2	1.5
	NM_009354	Tert	Telomerase reverse transcriptase	2.2
	NM_009522	Wnt3a	Wingless-related MMTV integration site 3A	1.1
	NM_009556	Zfp42	Zinc finger protein 42	1.0
MSC-Specific Markers	NM_009655	Alcam	Activated leukocyte cell adhesion molecule	1.8
	NM_008486	Anpep	Alanyl (membrane) aminopeptidase	1.2
	NM_009810	Casp3	Caspase 3	1.2
	NM_009851	Cd44	CD44 antigen	1.2
	NM_007932	Eng	Endoglin	0.4
	NM_0010038 17	ErbB2	V-erb-b2 erythroblastic leukemia viral oncogene homolog 2, neuro/glioblastoma derived oncogene homolog (avian)	0.7
	NM_010242	Fut4	Fucosyltransferase 4	0.6
	XM_284144	Fzd9	Frizzled homolog 9 (Drosophila)	1.4
	NM_008397	Itga6	Integrin alpha 6	0.6
	NM_008402	Itgav	Integrin alpha V	0.9
	NM_023061	Mcam	Melanoma cell adhesion molecule	0.3
	NM_033217	Ngfr	Nerve growth factor receptor (TNFR superfamily, member 16)	2.6
	NM_011851	Nt5e	5' nucleotidase, ecto	0.3
	NM_008809	Pdgfrb	Platelet derived growth factor receptor, beta polypeptide	0.8
	NM_008935	Prom1	Prominin 1	0.2
	NM_009382	Thy1	Thymus cell antigen 1, theta	0.9
	NM_011693	Vcam1	Vascular cell adhesion molecule 1	0.4
	NM_009673	Anxa5	Annexin A5	1.5
	NM_007540	Bdnf	Brain derived neurotrophic factor	1.7
	NM_007541	Bglap1	Bone gamma carboxyglutamate protein 1	0.0
	NM_007557	Bmp7	Bone morphogenetic protein 7	6.1
	NM_007742	Col1a1	Collagen, type I, alpha 1	0.1
	NM_009969	Csf2	Colony stimulating factor 2 (granulocyte-macrophage)	0.8

MSCAssociated Genes	NM_009971	Csf3	Colony stimulating factor 3 (granulocyte)	0.5
	NM_007614	Ctnnb1	Catenin (cadherin associated protein), beta 1	1.0
	NM_010113	Egf	Epidermal growth factor	1.5
	NM_008051	Fut1	Fucosyltransferase 1	2.4
	NM_025652	Gtf3a	General transcription factor III A	0.9
	NM_010427	Hgf	Hepatocyte growth factor	1.9
	NM_010493	Icam1	Intercellular adhesion molecule 1	0.7
	NM_008337	Iifng	Interferon gamma	1.3
	NM_010512	Igf1	Insulin-like growth factor 1	0.9
	NM_010548	IL10	Interleukin 10	0.1
	NM_008361	IL1b	Interleukin 1 beta	0.0
	NM_031168	IL6	Interleukin 6	0.4
	NM_010578	Itgb1	Integrin beta 1 (fibronectin receptor beta)	0.5
	NM_008601	Mitf	Microphthalmia-associated transcription factor	0.8
	Mmp2	Mmp2	Matrix metalloproteinase 2	1.0
	NM_016701	Nes	Nestin	1.0
	NM_153561	Nudt6	Nudix (nucleoside diphosphate linked moiety X)-type motif 6	0.5
	NM_201406	Pigs	Phosphatidylinositol glycan anchor biosynthesis, class S	0.7
	NM_011210	Ptprc	Protein tyrosine phosphatase, receptor type, C	0.5
	NM_172773	Slc7a5	Solute carrier family 17 (anion/sugar transporter), member 5	1.3
	NM_009368	Tgfb3	Transforming growth factor, beta 3	0.4
	NM_013693	Tnf	Tumor necrosis factor	0.5
	NM_009505	Vegfa	Vascular endothelial growth factor A	0.5
	NM_011701	Vim	Vimentin	4.0
	NM_011708	Vwf	Von Willebrand factor homolog	0.2