

S4 Table. Enriched GO terms associated with Wnt3a targets

GO terms associated with up-regulated genes			
GO ID	Enriched Biological Process	No. genes	FDR
GO:0042127	regulation of cell proliferation	74	8.32E-16
GO:0048729	tissue morphogenesis	48	4.25E-15
GO:0048646	anatomical structure formation involved in morphogenesis	62	1.81E-14
GO:0001944	vasculature development	44	2.48E-14
GO:0007167	enzyme linked receptor protein signaling pathway	53	9.46E-14
GO:0051094	positive regulation of developmental process	61	1.03E-13
GO:0001525	angiogenesis	35	3.59E-13
GO:0009719	response to endogenous stimulus	70	3.59E-13
GO:0060485	mesenchyme development	27	4.59E-13
GO:0023057	negative regulation of signaling	58	2.73E-12
GO:0048585	negative regulation of response to stimulus	63	2.73E-12
GO:0051270	regulation of cellular component movement	46	2.75E-12
GO:0048762	mesenchymal cell differentiation	23	3.58E-12
GO:0040007	growth	52	3.58E-12
GO:0010648	negative regulation of cell communication	58	3.58E-12
GO:0030334	regulation of cell migration	42	5.47E-12
GO:0007267	cell-cell signaling	55	7.67E-12
GO:0048863	stem cell differentiation	27	8.20E-12
GO:2000145	regulation of cell motility	43	9.86E-12
GO:0040012	regulation of locomotion	45	1.01E-11
GO:0016477	cell migration	56	1.50E-11
GO:0009968	negative regulation of signal transduction	53	1.52E-11
GO:0090130	tissue migration	24	1.95E-11
GO:0071363	cellular response to growth factor stimulus	38	1.95E-11
GO:0009967	positive regulation of signal transduction	60	2.51E-11
GO:0070848	response to growth factor	38	6.73E-11
GO:0006928	movement of cell or subcellular component	68	7.07E-11
GO:0045597	positive regulation of cell differentiation	46	8.75E-11
GO:0051674	localization of cell	57	1.42E-10
GO:0048870	cell motility	57	1.42E-10
GO:0051093	negative regulation of developmental process	44	1.78E-10
GO:0000904	cell morphogenesis involved in differentiation	42	1.78E-10
GO:0008284	positive regulation of cell proliferation	44	2.45E-10
GO:0014031	mesenchymal cell development	20	3.04E-10
GO:0008285	negative regulation of cell proliferation	38	3.33E-10
GO:0040011	locomotion	63	3.88E-10
GO:0045595	regulation of cell differentiation	62	4.71E-10
GO:0048864	stem cell development	20	4.92E-10
GO:0023056	positive regulation of signaling	61	5.54E-10
GO:0010647	positive regulation of cell communication	61	9.31E-10
GO:0030335	positive regulation of cell migration	29	1.07E-09
GO:0040017	positive regulation of locomotion	30	1.11E-09

GO:0010941	<i>regulation of cell death</i>	60	1.15E-09
GO:2000147	<i>positive regulation of cell motility</i>	29	1.99E-09
GO:0022610	<i>biological adhesion</i>	57	2.12E-09
GO:0007178	<i>transmembrane receptor protein serine/threonine kinase signaling pathway</i>	25	2.46E-09
GO:0051272	<i>positive regulation of cellular component movement</i>	29	3.41E-09
GO:0042981	<i>regulation of apoptotic process</i>	56	3.41E-09
GO:0060393	<i>regulation of pathway-restricted SMAD protein phosphorylation</i>	12	4.01E-09
GO:0007155	<i>cell adhesion</i>	56	4.38E-09
GO:0043067	<i>regulation of programmed cell death</i>	56	4.97E-09
GO:0012501	<i>programmed cell death</i>	65	4.97E-09
GO:0001932	<i>regulation of protein phosphorylation</i>	53	4.97E-09
GO:0060389	<i>pathway-restricted SMAD protein phosphorylation</i>	12	6.73E-09
GO:0006915	<i>apoptotic process</i>	64	7.15E-09
GO:0042325	<i>regulation of phosphorylation</i>	55	7.40E-09
GO:0001763	<i>morphogenesis of a branching structure</i>	20	1.56E-08
GO:0040008	<i>regulation of growth</i>	35	1.86E-08
GO:0014070	<i>response to organic cyclic compound</i>	43	2.61E-08
GO:0090092	<i>regulation of transmembrane receptor protein serine/threonine kinase signaling pathway</i>	19	3.08E-08
GO:0006468	<i>protein phosphorylation</i>	63	3.08E-08
GO:0002040	<i>sprouting angiogenesis</i>	12	3.25E-08
GO:0030178	<i>negative regulation of Wnt signaling pathway</i>	18	4.64E-08
GO:0090287	<i>regulation of cellular response to growth factor stimulus</i>	20	4.94E-08
GO:0009725	<i>response to hormone</i>	42	5.31E-08
GO:0010720	<i>positive regulation of cell development</i>	30	5.31E-08
GO:0051130	<i>positive regulation of cellular component organization</i>	47	8.21E-08
GO:0030111	<i>regulation of Wnt signaling pathway</i>	22	8.37E-08
GO:0007169	<i>transmembrane receptor protein tyrosine kinase signaling pathway</i>	33	1.01E-07
GO:0031399	<i>regulation of protein modification process</i>	59	1.34E-07
GO:0007389	<i>pattern specification process</i>	27	1.47E-07
GO:0051247	<i>positive regulation of protein metabolic process</i>	54	1.53E-07
GO:0030324	<i>lung development</i>	18	1.53E-07
GO:0019220	<i>regulation of phosphate metabolic process</i>	57	1.61E-07
GO:0032989	<i>cellular component morphogenesis</i>	50	1.61E-07
GO:0051216	<i>cartilage development</i>	17	1.69E-07
GO:0042327	<i>positive regulation of phosphorylation</i>	40	1.96E-07
GO:0023014	<i>signal transduction by protein phosphorylation</i>	39	1.96E-07
GO:0030029	<i>actin filament-based process</i>	32	1.96E-07
GO:0051174	<i>regulation of phosphorus metabolic process</i>	57	1.96E-07
GO:0043065	<i>positive regulation of apoptotic process</i>	31	2.04E-07
GO:0043068	<i>positive regulation of programmed cell death</i>	31	2.47E-07
GO:0031401	<i>positive regulation of protein modification process</i>	45	2.55E-07
GO:0010942	<i>positive regulation of cell death</i>	32	2.63E-07
GO:0048705	<i>skeletal system morphogenesis</i>	18	2.67E-07

GO:0030278	<i>regulation of ossification</i>	17	2.94E-07
GO:1904035	<i>regulation of epithelial cell apoptotic process</i>	11	3.01E-07
GO:0060284	<i>regulation of cell development</i>	39	3.43E-07
GO:0000902	<i>cell morphogenesis</i>	47	3.72E-07
GO:0060688	<i>regulation of morphogenesis of a branching structure</i>	10	3.82E-07
GO:0061448	<i>connective tissue development</i>	19	4.02E-07
GO:0045765	<i>regulation of angiogenesis</i>	18	4.30E-07
GO:0071772	<i>response to BMP</i>	15	5.37E-07
GO:0071773	<i>cellular response to BMP stimulus</i>	15	5.37E-07
GO:1902531	<i>regulation of intracellular signal transduction</i>	56	5.72E-07
GO:0072132	<i>mesenchyme morphogenesis</i>	9	6.57E-07
GO:0006935	<i>chemotaxis</i>	28	6.83E-07
GO:0042330	<i>taxis</i>	28	7.31E-07
GO:0003002	<i>regionalization</i>	22	7.41E-07
GO:0032270	<i>positive regulation of cellular protein metabolic process</i>	50	7.77E-07
GO:0001503	<i>ossification</i>	23	7.77E-07
GO:0061061	<i>muscle structure development</i>	30	8.47E-07
GO:0010769	<i>regulation of cell morphogenesis involved in differentiation</i>	22	8.75E-07
GO:0030855	<i>epithelial cell differentiation</i>	30	9.90E-07
GO:0061035	<i>regulation of cartilage development</i>	10	1.06E-06
GO:0030155	<i>regulation of cell adhesion</i>	31	1.09E-06
GO:0048608	<i>reproductive structure development</i>	25	1.18E-06
GO:0010562	<i>positive regulation of phosphorus metabolic process</i>	41	1.25E-06
GO:0045937	<i>positive regulation of phosphate metabolic process</i>	41	1.25E-06
GO:0061458	<i>reproductive system development</i>	25	1.35E-06
GO:0071407	<i>cellular response to organic cyclic compound</i>	27	1.44E-06
GO:0016049	<i>cell growth</i>	27	1.48E-06
GO:0043627	<i>response to estrogen</i>	17	1.62E-06
GO:0001501	<i>skeletal system development</i>	26	1.73E-06
GO:0003156	<i>regulation of animal organ formation</i>	8	2.04E-06
GO:0045926	<i>negative regulation of growth</i>	18	2.25E-06
GO:0033993	<i>response to lipid</i>	38	2.37E-06
GO:0048545	<i>response to steroid hormone</i>	27	2.43E-06
GO:0090090	<i>negative regulation of canonical Wnt signaling pathway</i>	14	3.48E-06
GO:0030036	<i>actin cytoskeleton organization</i>	27	3.78E-06
GO:0010594	<i>regulation of endothelial cell migration</i>	12	4.17E-06
GO:0072089	<i>stem cell proliferation</i>	14	4.23E-06
GO:0048589	<i>developmental growth</i>	29	4.30E-06
GO:0060537	<i>muscle tissue development</i>	22	4.58E-06
GO:0072078	<i>nephron tubule morphogenesis</i>	10	5.21E-06
GO:0045667	<i>regulation of osteoblast differentiation</i>	12	5.76E-06
GO:0030198	<i>extracellular matrix organization</i>	20	6.05E-06
GO:0031589	<i>cell-substrate adhesion</i>	19	6.25E-06
GO:0043062	<i>extracellular structure organization</i>	20	6.26E-06
GO:0048666	<i>neuron development</i>	39	6.50E-06
GO:0051384	<i>response to glucocorticoid</i>	14	7.51E-06
GO:0045859	<i>regulation of protein kinase activity</i>	31	7.51E-06

GO:0032355	<i>response to estradiol</i>	13	8.08E-06
GO:0090100	<i>positive regulation of transmembrane receptor protein serine/threonine kinase signaling pathway</i>	11	8.57E-06

GO terms associated with down-regulated genes			
GO ID	Enriched Biological Process	No. genes	FDR
GO:0022610	<i>biological adhesion</i>	93	1.44E-14
GO:0007155	<i>cell adhesion</i>	89	4.36E-13
GO:0030198	<i>extracellular matrix organization</i>	39	6.86E-13
GO:0043062	<i>extracellular structure organization</i>	39	6.86E-13
GO:0048514	<i>blood vessel morphogenesis</i>	48	2.09E-12
GO:0001525	<i>angiogenesis</i>	42	3.05E-11
GO:1903034	<i>regulation of response to wounding</i>	42	4.66E-11
GO:0001568	<i>blood vessel development</i>	50	4.66E-11
GO:0001944	<i>vasculature development</i>	51	4.85E-11
GO:0040011	<i>locomotion</i>	90	5.57E-11
GO:0032101	<i>regulation of response to external stimulus</i>	64	7.75E-11
GO:0051241	<i>negative regulation of multicellular organismal process</i>	68	9.4E-11
GO:0016477	<i>cell migration</i>	74	1.15E-10
GO:0006952	<i>defense response</i>	86	1.15E-10
GO:0080134	<i>regulation of response to stress</i>	83	1.87E-10
GO:0051674	<i>localization of cell</i>	77	3.87E-10
GO:0048870	<i>cell motility</i>	77	3.87E-10
GO:0030334	<i>regulation of cell migration</i>	51	7.26E-10
GO:0009611	<i>response to wounding</i>	59	1.67E-09
GO:0006928	<i>movement of cell or subcellular component</i>	90	2.47E-09
GO:0048585	<i>negative regulation of response to stimulus</i>	78	2.49E-09
GO:2000145	<i>regulation of cell motility</i>	51	6.98E-09
GO:0031347	<i>regulation of defense response</i>	52	6.98E-09
GO:0002682	<i>regulation of immune system process</i>	76	9.78E-09
GO:0040012	<i>regulation of locomotion</i>	53	1.49E-08
GO:0045087	<i>innate immune response</i>	52	1.9E-08
GO:0043207	<i>response to external biotic stimulus</i>	57	2.19E-08
GO:0051270	<i>regulation of cellular component movement</i>	52	3.1E-08
GO:0009607	<i>response to biotic stimulus</i>	58	3.43E-08
GO:0002237	<i>response to molecule of bacterial origin</i>	31	4.29E-08
GO:0001503	<i>ossification</i>	33	4.97E-08
GO:0006955	<i>immune response</i>	76	5.41E-08
GO:0009967	<i>positive regulation of signal transduction</i>	73	6.6E-08
GO:0010647	<i>positive regulation of cell communication</i>	79	8.59E-08
GO:0023056	<i>positive regulation of signaling</i>	78	1.08E-07
GO:0048589	<i>developmental growth</i>	43	2E-07
GO:0006935	<i>chemotaxis</i>	39	2.24E-07
GO:0030155	<i>regulation of cell adhesion</i>	44	2.36E-07

GO:0042330	<i>taxis</i>	39	2.36E-07
GO:0051240	<i>positive regulation of multicellular organismal process</i>	75	3.03E-07
GO:0006954	<i>inflammatory response</i>	44	3.03E-07
GO:0009617	<i>response to bacterium</i>	39	4.13E-07
GO:0001816	<i>cytokine production</i>	43	5.56E-07
GO:0040007	<i>growth</i>	57	5.92E-07
GO:0050727	<i>regulation of inflammatory response</i>	28	7.12E-07
GO:1902533	<i>positive regulation of intracellular signal transduction</i>	52	8.16E-07
GO:0032722	<i>positive regulation of chemokine production</i>	12	8.31E-07
GO:0032103	<i>positive regulation of response to external stimulus</i>	27	1.2E-06
GO:0051093	<i>negative regulation of developmental process</i>	50	1.2E-06
GO:0030335	<i>positive regulation of cell migration</i>	32	1.31E-06
GO:0002684	<i>positive regulation of immune system process</i>	52	1.31E-06
GO:0009968	<i>negative regulation of signal transduction</i>	59	1.31E-06
GO:0040017	<i>positive regulation of locomotion</i>	33	1.82E-06
GO:0001817	<i>regulation of cytokine production</i>	39	1.98E-06
GO:0001501	<i>skeletal system development</i>	35	2.09E-06
GO:2000147	<i>positive regulation of cell motility</i>	32	2.27E-06
GO:0032496	<i>response to lipopolysaccharide</i>	27	2.35E-06
GO:0031589	<i>cell-substrate adhesion</i>	26	2.67E-06
GO:0050678	<i>regulation of epithelial cell proliferation</i>	26	2.8E-06
GO:0032642	<i>regulation of chemokine production</i>	13	3.51E-06
GO:0002687	<i>positive regulation of leukocyte migration</i>	16	3.58E-06
GO:0051272	<i>positive regulation of cellular component movement</i>	32	3.69E-06
GO:0001818	<i>negative regulation of cytokine production</i>	22	3.74E-06
GO:0045088	<i>regulation of innate immune response</i>	28	3.74E-06
GO:0042127	<i>regulation of cell proliferation</i>	73	3.93E-06
GO:0031349	<i>positive regulation of defense response</i>	30	4.57E-06
GO:0033993	<i>response to lipid</i>	52	4.57E-06
GO:0045824	<i>negative regulation of innate immune response</i>	10	4.94E-06
GO:1901700	<i>response to oxygen-containing compound</i>	71	4.94E-06
GO:1903036	<i>positive regulation of response to wounding</i>	19	4.94E-06
GO:0070374	<i>positive regulation of ERK1 and ERK2 cascade</i>	19	5.78E-06
GO:0045596	<i>negative regulation of cell differentiation</i>	40	6.42E-06
GO:0023057	<i>negative regulation of signaling</i>	61	6.66E-06
GO:0032602	<i>chemokine production</i>	13	6.78E-06
GO:0050776	<i>regulation of immune response</i>	47	8.32E-06
GO:0071346	<i>cellular response to interferon-gamma</i>	16	9.16E-06
GO:0002526	<i>acute inflammatory response</i>	17	9.84E-06
GO:0010648	<i>negative regulation of cell communication</i>	61	9.86E-06
GO:0048646	<i>anatomical structure formation involved in morphogenesis</i>	60	1.03E-05
GO:0060349	<i>bone morphogenesis</i>	13	1.07E-05
GO:0050920	<i>regulation of chemotaxis</i>	19	1.07E-05
GO:0010721	<i>negative regulation of cell development</i>	26	1.24E-05
GO:0044236	<i>multicellular organism metabolic process</i>	16	1.26E-05
GO:0034341	<i>response to interferon-gamma</i>	17	1.31E-05
GO:0044259	<i>multicellular organismal macromolecule metabolic process</i>	15	1.32E-05

GO:0048608	<i>reproductive structure development</i>	31	1.65E-05
GO:0030278	<i>regulation of ossification</i>	19	1.71E-05
GO:0050900	<i>leukocyte migration</i>	27	1.79E-05
GO:0061458	<i>reproductive system development</i>	31	1.89E-05
GO:0050729	<i>positive regulation of inflammatory response</i>	15	2.07E-05
GO:0048729	<i>tissue morphogenesis</i>	41	2.22E-05
GO:0002697	<i>regulation of immune effector process</i>	30	2.25E-05
GO:0048699	<i>generation of neurons</i>	66	2.29E-05
GO:0002252	<i>immune effector process</i>	44	2.37E-05
GO:0043410	<i>positive regulation of MAPK cascade</i>	32	2.65E-05
GO:0001763	<i>morphogenesis of a branching structure</i>	20	3.21E-05
GO:0002685	<i>regulation of leukocyte migration</i>	17	3.42E-05
GO:0046903	<i>secretion</i>	56	3.45E-05
GO:0008284	<i>positive regulation of cell proliferation</i>	46	3.53E-05
GO:0045765	<i>regulation of angiogenesis</i>	20	3.54E-05
GO:0050730	<i>regulation of peptidyl-tyrosine phosphorylation</i>	20	3.74E-05
GO:0032963	<i>collagen metabolic process</i>	14	3.94E-05
GO:1901342	<i>regulation of vasculature development</i>	21	4.11E-05
GO:0044093	<i>positive regulation of molecular function</i>	76	4.21E-05
GO:0060828	<i>regulation of canonical Wnt signaling pathway</i>	20	4.57E-05
GO:0001649	<i>osteoblast differentiation</i>	19	4.73E-05
GO:0045595	<i>regulation of cell differentiation</i>	70	4.78E-05
GO:0010810	<i>regulation of cell-substrate adhesion</i>	17	5.65E-05
GO:0071345	<i>cellular response to cytokine stimulus</i>	38	6.26E-05
GO:0033002	<i>muscle cell proliferation</i>	17	0.000069
GO:0002683	<i>negative regulation of immune system process</i>	27	7.24E-05
GO:0030111	<i>regulation of Wnt signaling pathway</i>	23	7.38E-05
GO:0050921	<i>positive regulation of chemotaxis</i>	14	7.67E-05
GO:0001101	<i>response to acid chemical</i>	25	7.78E-05
GO:0045785	<i>positive regulation of cell adhesion</i>	27	8.59E-05
GO:0023014	<i>signal transduction by protein phosphorylation</i>	46	8.73E-05
GO:0048659	<i>smooth muscle cell proliferation</i>	14	9.56E-05
GO:0032940	<i>secretion by cell</i>	50	9.8E-05
GO:0070371	<i>ERK1 and ERK2 cascade</i>	21	0.000112
GO:1902531	<i>regulation of intracellular signal transduction</i>	71	0.000113
GO:0043408	<i>regulation of MAPK cascade</i>	38	0.000114
GO:0050679	<i>positive regulation of epithelial cell proliferation</i>	16	0.000115
GO:0010941	<i>regulation of cell death</i>	67	0.000119
GO:0051094	<i>positive regulation of developmental process</i>	57	0.000123
GO:0018108	<i>peptidyl-tyrosine phosphorylation</i>	25	0.000129
GO:0050731	<i>positive regulation of peptidyl-tyrosine phosphorylation</i>	16	0.00013
GO:0071396	<i>cellular response to lipid</i>	32	0.000137
GO:0018212	<i>peptidyl-tyrosine modification</i>	25	0.000139
GO:0060350	<i>endochondral bone morphogenesis</i>	9	0.000151
GO:2000027	<i>regulation of organ morphogenesis</i>	20	0.000154
GO:0032490	<i>detection of molecule of bacterial origin</i>	5	0.000157
GO:0070372	<i>regulation of ERK1 and ERK2 cascade</i>	20	0.000161

GO:0001934	<i>positive regulation of protein phosphorylation</i>	45	0.000163
GO:0048771	<i>tissue remodeling</i>	16	0.000163
GO:0002009	<i>morphogenesis of an epithelium</i>	33	0.000178
GO:0031214	<i>biomineral tissue development</i>	14	0.000179
GO:0032680	<i>regulation of tumor necrosis factor production</i>	13	0.000179
GO:0045667	<i>regulation of osteoblast differentiation</i>	13	0.000179
GO:0030199	<i>collagen fibril organization</i>	8	0.00018
GO:0003006	<i>developmental process involved in reproduction</i>	37	0.000198
GO:0050778	<i>positive regulation of immune response</i>	35	0.000203
GO:0042327	<i>positive regulation of phosphorylation</i>	46	0.000215
GO:0042981	<i>regulation of apoptotic process</i>	62	0.000215
GO:1903555	<i>regulation of tumor necrosis factor superfamily cytokine production</i>	13	0.000223
GO:0048705	<i>skeletal system morphogenesis</i>	18	0.00023
GO:0044243	<i>multicellular organismal catabolic process</i>	10	0.000233
GO:0034097	<i>response to cytokine</i>	40	0.00024
GO:0050918	<i>positive chemotaxis</i>	9	0.000241
GO:0030282	<i>bone mineralization</i>	12	0.00025
GO:0098609	<i>cell-cell adhesion</i>	45	0.000252
GO:0042592	<i>homeostatic process</i>	69	0.000259
GO:0071295	<i>cellular response to vitamin</i>	7	0.000259
GO:1900046	<i>regulation of hemostasis</i>	11	0.000261
GO:0045089	<i>positive regulation of innate immune response</i>	21	0.000264
GO:0048660	<i>regulation of smooth muscle cell proliferation</i>	13	0.000268
GO:0071706	<i>tumor necrosis factor superfamily cytokine production</i>	13	0.000268
GO:0032757	<i>positive regulation of interleukin-8 production</i>	8	0.000269
GO:0043067	<i>regulation of programmed cell death</i>	62	0.000278
GO:0014066	<i>regulation of phosphatidylinositol 3-kinase signaling</i>	14	0.000292
GO:0003416	<i>endochondral bone growth</i>	6	0.000308
GO:0060348	<i>bone development</i>	16	0.000311
GO:0042325	<i>regulation of phosphorylation</i>	61	0.000315
GO:0051336	<i>regulation of hydrolase activity</i>	57	0.000325
GO:0050663	<i>cytokine secretion</i>	16	0.000325
GO:0032677	<i>regulation of interleukin-8 production</i>	9	0.000329
GO:0006915	<i>apoptotic process</i>	73	0.00033
GO:0010628	<i>positive regulation of gene expression</i>	72	0.000337
GO:0042116	<i>macrophage activation</i>	9	0.000363
GO:0010562	<i>positive regulation of phosphorus metabolic process</i>	49	0.000363
GO:0045937	<i>positive regulation of phosphate metabolic process</i>	49	0.000363
GO:0043085	<i>positive regulation of catalytic activity</i>	63	0.000368
GO:1901701	<i>cellular response to oxygen-containing compound</i>	45	0.000373
GO:0006024	<i>glycosaminoglycan biosynthetic process</i>	12	0.000373